

# **REVIEW OF CHEMICAL STORAGE FACILITIES AT P B GELATINS, TREFOREST INDUSTRIAL ESTATE, PONTYPRIDD FOR COMPLIANCE WITH CIRIA 736**

21/11/2014

J-5016-CIE



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GELATINS, TREFOREST INDUSTRIAL ESTATE,  
PONTYPRIDD FOR COMPLIANCE WITH CIRIA C736**

| Report No. | Issue Detail    | Originator | Date     | Checked By | Date     |
|------------|-----------------|------------|----------|------------|----------|
| J-5016-CIE | Client Issue    | JP         | 14/11/14 |            |          |
| J-5016-CIE | Client Issue 02 | JP         | 21/11/14 | TPS        | 21/11/14 |

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**Job No:** J-5016-CIE  
**Date:** November 2014  
**Edition:** 02

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## 1.0 INTRODUCTION

PB Gelatins UK Limited (PB Gelatins) at Treforest Industrial Estate, Pontypridd, Rhondda Cynon Taff have recently applied for and have been granted an Environmental Permit by Natural Resources Wales. The permit governs the industrial production of Gelatin from oessin (bones) at their manufacturing facilities.

The permit has been granted with a number of 'Improvement programme requirements' which are detailed in Table S1.3 of the permit. Requirement is:

*'The Operator shall submit a report to Natural Resources Wales detailing a review of all the tank storage and associated bunding and drainage on site and assess against the requirements of "Containment systems for the prevention of pollution" CIRIA C736 published 2014. Where differences are identified the Operator shall include within the report a timetabled plan for upgrading the tank storage areas on site. The plan shall be implemented by the Operator in line with the written approval from Natural Resources Wales.'*

Nijhuis H2OK Ltd have been appointed by PB Gelatins to review the chemical (inventory) storage arrangements on site, in order to satisfy this requirement. This report details the findings of the review.

## 2.0 STORED INVENTORY

PB Gelatins have identified the following chemical inventories for review in this study:

| ID No | System                 | Area         | Tank Description           | Contents              | Working Volume Stored |
|-------|------------------------|--------------|----------------------------|-----------------------|-----------------------|
| BC 01 | A18 Phosphoric         | A18          | Bulk Phosphoric Acid       | Phosphoric Acid 75%   | 19.1 m <sup>3</sup>   |
| BC 11 | A18 Sulphuric          | A18          | Bulk Sulphuric Acid        | Sulphuric Acid 77%    | 21.0 m <sup>3</sup>   |
| BC 02 | W Works Truefloc TAC40 | Water works  | Bulk Truefloc TAC40        | Truefloc TAC40        | 16.7 m <sup>3</sup>   |
| BC 03 | A21 caustic            | Water works  | Bulk Caustic Soda          | Caustic Soda 20%      | 76.4 m <sup>3</sup>   |
| BC 04 | A21 caustic day tank   | Water works  | Bulk Caustic Soda          | Caustic Soda 20%      | 70.0 m <sup>3</sup>   |
| BC 06 | A21 Deioniser effluent | Rear A21     | Bulk Acid Effluent storage | Acidic water          | 55.7 m <sup>3</sup>   |
| BC 05 | A21 HCL                | Rear A21     | Bulk Hydrochloric Acid     | Hydrochloric Acid 32% | 33.4 m <sup>3</sup>   |
| BC 08 | A21 Hydrogen peroxide  | Rear A21     | Bulk Hydrogen Peroxide     | Hydrogen Peroxide 35% | 9.6 m <sup>3</sup>    |
| BC 10 | A21 Acetic Acid        | Rear A21     | Bulk Acetic Acid           | Acetic Acid 80%       | 5.5 m <sup>3</sup>    |
| BC 07 | A21 Phosphoric         | Rear A21     | Bulk Phosphoric Acid       | Phosphoric Acid 75%   | 14.4 m <sup>3</sup>   |
| BC 09 | Hydrated lime          | A18 Building | Concrete vessel            | Lime (hydrated)       | 166.3m <sup>3</sup>   |

**Table 2.1.1: Chemical Inventories Identified for Review**

The full bulk chemical storage asset register provided by PB Gelatins which contains additional information on the primary and secondary containment provided, as well as the controls and information held on each asset, is included in **Appendix A**.

Drawing J-4777-CIE-1000-A included in **Appendix B** shows the location in which these substances are stored within the PB Gelatins site.

### 3.0 DETERMINATION OF INVENTORY CLASSIFICATIONS

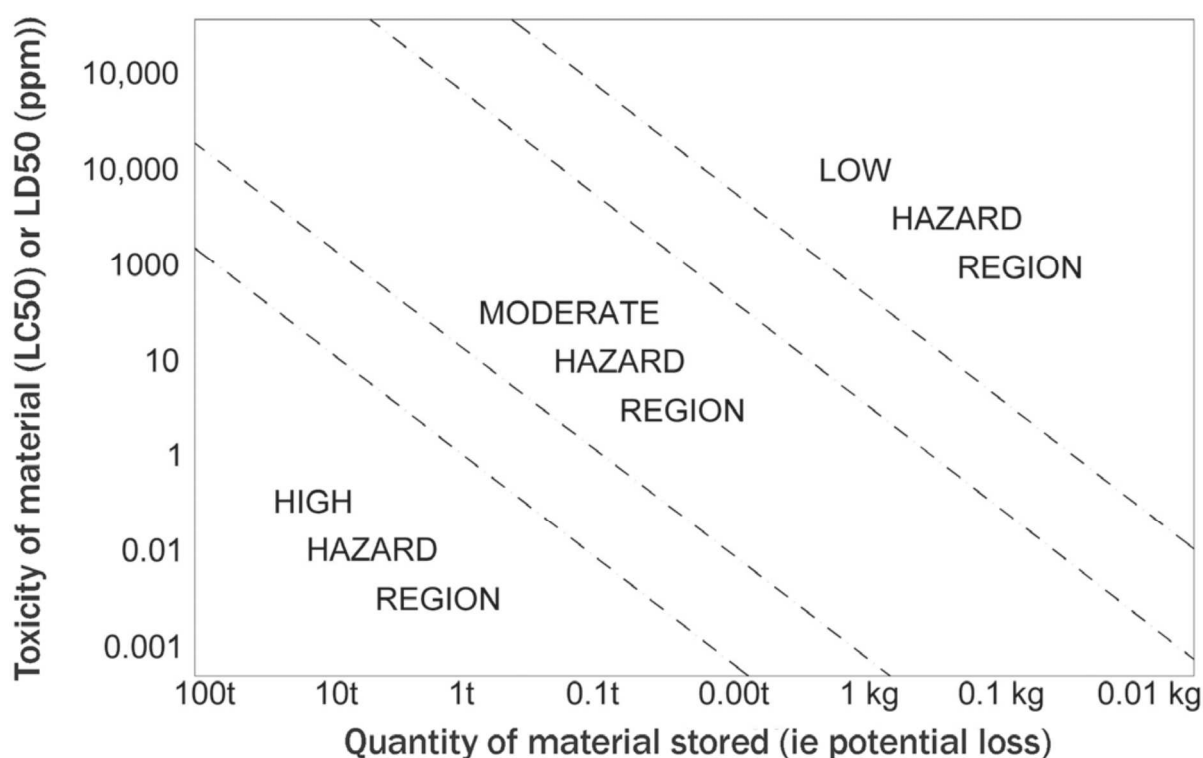
The determination of the classification (Class 1, 2 or 3) of each of the inventories has been carried out in accordance with the principles set out in CIRIA C736, using a Source, Pathway Receptor risk assessment methodology. The guidance provided in CIRIA C736 is not prescriptive, and as such the start of the following sections provide detail of how the methodology has been applied.

#### 3.1 Source Hazard Ratings

A source hazard rating of High (H), Moderate (M), or Low (L) has been assigned to each of the inventories. The ratings have been assigned based upon a relationship between the quantity of material stored and its toxicity, using the relationship defined in Figure 3.1 below, as extracted from CIRIA 736.

Quantities of stored materials are based upon working quantities of materials as provided in the asset register and as validated by measurements taken on site by NH2OK.

The toxicity of a substance has been based upon its LC50 ratings for fish as detailed in the Material Safety Data Sheets (MSDS), provided by PB Gelatins, and included in **Appendix C**.



**Figure 3.1.1: Relationship between quantity of material stored, toxicity and hazard rating**

Figure 3.2.1 below shows the source hazard ratings derived for each of the inventories, and the parameters used to determine these ratings:

| Inventory              | Working Volume Stored (m <sup>3</sup> ) | Specific gravity (t/m <sup>3</sup> ) | Weight of stored material (t) | LC50 fish 1 (mg/l) | Hazard region defined by Figure 3.1 |
|------------------------|-----------------------------------------|--------------------------------------|-------------------------------|--------------------|-------------------------------------|
| A18 phosphoric         | 19.1                                    | 1.33                                 | 25.4                          | 3.0 - 3.25         | HIGH                                |
| A18 Sulphuric          | 21                                      | 1.84                                 | 38.6                          | 42                 | HIGH                                |
| W Works Truefloc TAC40 | 16.7                                    | 1.23                                 | 20.5                          | 1.0 - 10.0         | HIGH                                |

|                        |       |      |       |             |      |
|------------------------|-------|------|-------|-------------|------|
| A21 caustic            | 76.4  | 1.7  | 129.9 | 125-145     | HIGH |
| A21 caustic day tank   | 70    | 1.7  | 119.0 | 125-145     | HIGH |
| A21 Deioniser effluent | 55.7  | 1.15 | 64.1  | 25          | HIGH |
| A21 HCL                | 33.4  | 1.15 | 38.4  | 25          | HIGH |
| A21 Hydrogen peroxide  | 9.6   | 1.13 | 10.8  | 22.0 - 33.0 | HIGH |
| A21 Acetic Acid        | 5.5   | 1.07 | 5.9   | >300.8      | HIGH |
| A21 Phosphoric         | 14.4  | 1.33 | 19.2  | 3-3.25      | HIGH |
| A21 Hydrated Lime      | 151.3 | 2.24 | 338.9 | 50.6        | HIGH |

**Figure 3.2.1: Source Hazard Ratings**

### 3.2 Pathway Hazard Ratings

The pathways and receptors have been identified during the site survey, using various internet mapping services and drainage plans provided by PB Gelatins and Dwr Cymru (Welsh Water).

The pathways identified in the immediate area of the storage facilities are: runoff across the ground; infiltration through the ground; conveyance through surface water sewers; conveyance through foul water sewers including treatment through the Dwr Cymru municipal waste water treatment works (WWTW); conveyance through industrial effluent sewers including treatment through the PB Gelatins DAF treatment plant; and flooding from the nearby River Taff.

In determining the hazard rating the following has been considered:

- The length of the pathway and likely time that the pathway would take to convey the inventory
- Site layout (including topography), and any tertiary containment features such as kerbs, walls or drainage features.
- Geographical, geological and hydrogeological features that could either impede or facilitate escape of inventory from the site. In addition building foundations may impede or alter sub-surface drainage paths.
- Climatic conditions and expected variability.
- The scale of potential incidents (larger incidents and firewater generally have greater potential for mobilisation in the environment than smaller spills).

In the same fashion as the Source Hazard Ratings, pathways have been assigned a hazard rating of H, M or L based upon the following judgement criteria.

H – The pathway would almost certainly convey the majority of a spillage to the receptor in its original form

M – The pathway could conceivably convey part or all of a spillage to the receptor with some mitigation i.e. dilution or neutralisation

L – The pathway is unlikely to convey any of a spillage to the receptor, or high levels of mitigation will be provided along the pathway i.e. treatment

As the nature of the pathway differs for each of the inventories, Pathway Hazard Ratings have been assessed individually for each of the inventories.

The PB Gelatins Drainage plan, Dwr Cymru Drainage Plan, and a copy of the Environment Agency's indicative flood map are included in **Appendix D**.

Assessment sheets used to determine the individual pathway hazard ratings for each of the inventories is included in **Appendix E**. A summary of the hazard ratings derived is included below.

| Pathways                                                                                                       | A18 Phosphoric |                      | A18 Sulphuric |                      | Truefloc TAC40 |                      | A21 Caustic |                      | A21 Caustic day tank |                      | A21 Deioniser effluent |                      | A21 Hydrochloric Acid |                      | A21 Hydrogen Peroxide |                      | A21 Acetic Acid |                      | A21 Phosphoric |                      | Lime (hydrated) |                      |
|----------------------------------------------------------------------------------------------------------------|----------------|----------------------|---------------|----------------------|----------------|----------------------|-------------|----------------------|----------------------|----------------------|------------------------|----------------------|-----------------------|----------------------|-----------------------|----------------------|-----------------|----------------------|----------------|----------------------|-----------------|----------------------|
|                                                                                                                | River Taff     | Soils + ground water | River Taff    | Soils + ground water | River Taff     | Soils + ground water | River Taff  | Soils + ground water | River Taff           | Soils + ground water | River Taff             | Soils + ground water | River Taff            | Soils + ground water | River Taff            | Soils + ground water | River Taff      | Soils + ground water | River Taff     | Soils + ground water | River Taff      | Soils + ground water |
| Direct runoff                                                                                                  | L              | L                    | L             | L                    | L              | H                    | L           | H                    | L                    | H                    | L                      | M                    | L                     | M                    | L                     | M                    | L               | M                    | L              | M                    | L               | M                    |
| Infiltration                                                                                                   | L              | L                    | L             | L                    | L              | H                    | L           | H                    | L                    | H                    | L                      | M                    | L                     | M                    | L                     | M                    | L               | M                    | L              | M                    | L               | M                    |
| Surface water drainage                                                                                         | M              | L                    | M             | L                    | H              | L                    | H           | L                    | H                    | L                    | M                      | L                    | M                     | L                    | M                     | L                    | M               | L                    | M              | L                    | M               | L                    |
| Foul water drainage including treatment through the public treatment works                                     | L              | N/A                  | L             | N/A                  | L              | N/A                  | L           | N/A                  | L                    | N/A                  | L                      | N/A                  | L                     | N/A                  | L                     | N/A                  | L               | N/A                  | L              | N/A                  | L               | N/A                  |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | L              | N/A                  | L             | N/A                  | L              | N/A                  | L           | N/A                  | L                    | N/A                  | L                      | N/A                  | L                     | M                    | L                     | N/A                  | L               | N/A                  | L              | N/A                  | L               | N/A                  |
| Flooding                                                                                                       | M              | L                    | M             | L                    | M              | L                    | M           | L                    | M                    | L                    | M                      | L                    | M                     | L                    | M                     | L                    | M               | L                    | M              | L                    | M               | L                    |

**Figure 3.3.1: Pathway Hazard Ratings**

### 3.3 Receptor Hazard Ratings

The search area for receptors has been defined by the pathways identified in the locality of the storage facilities and the distance that these pathways would likely carry the potential pollutants. The significant receptors identified in the search area include: The River Taff and its associated watercourses; and soils/aquifers and groundwater.

In assessing the hazard rating of the receptors, mapping which identifies the location of the following have been accessed:

- Sites of Special Scientific Interest (SSSI's) ([www.magic.gov.uk](http://www.magic.gov.uk))
- Special Areas of Conservation (SAC's) ([www.magic.gov.uk](http://www.magic.gov.uk))
- Special Protection Areas (SPA's) ([www.magic.gov.uk](http://www.magic.gov.uk))
- Groundwater Source Protection Zones (<http://maps.environment-agency.gov.uk>)
- Aquifer Maps – Superficial Deposits Designation (<http://maps.environment-agency.gov.uk>)
- Aquifer Maps – Bedrock Designation (<http://maps.environment-agency.gov.uk>)
- Drinking Water Safeguard Zones (<http://maps.environment-agency.gov.uk>)
- Nitrate Vulnerability Zones (<http://maps.environment-agency.gov.uk>)
- Water Framework Directive – River Basin Management Plans – 2015 Predicted Chemical Quality (<http://maps.environment-agency.gov.uk>)
- Water Framework Directive – River Basin Management Plans – 2015 Predicted Ecological Quality (<http://maps.environment-agency.gov.uk>)

Using this information the receptors have been assigned hazard ratings based upon the following judgment criteria.

H – Receptor highlighted as a nationally important natural resource as defined by high protection levels or designation

M – Receptor has moderate protection or designation level or is a locally important natural resource due to its potential uses or its ability to support natural life

L – Environment has low or no designation, is unlikely to be a locally useful resource, and supports limited or no natural life

Figure 3.4.1 below shows that the receptors identified are not within an area designated a SSSI, SAC or SPA.



Figure 3.4.1: Map identifying SSSI's, SAC's and SPA's ([www.magic.gov.uk](http://www.magic.gov.uk))

Figure 3.4.2 below shows that the receptors are not within an area identified as a 'Groundwater Source Protection Zone'.

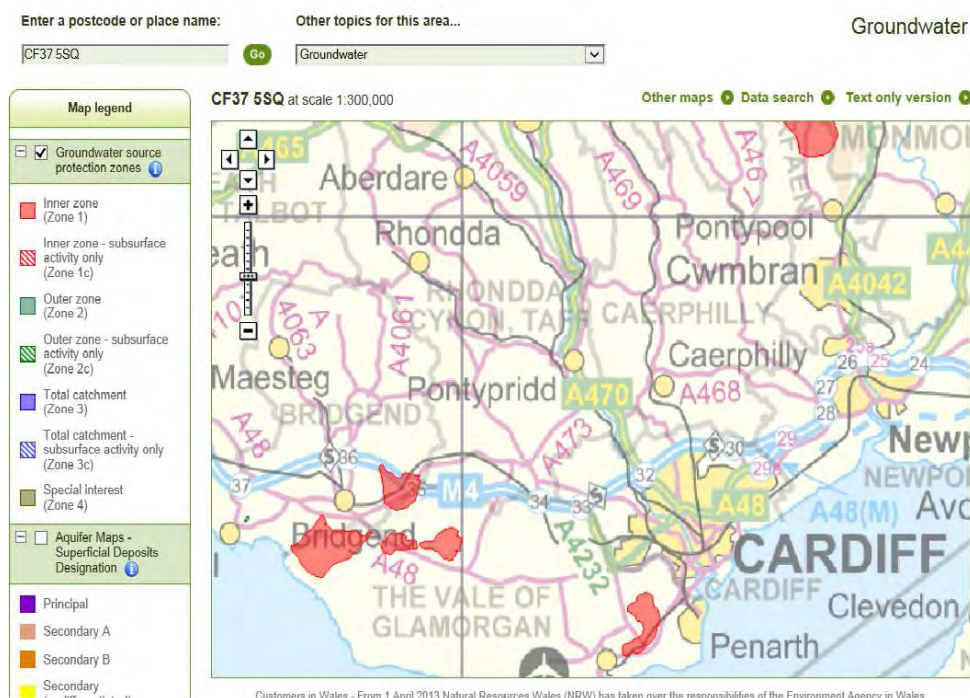
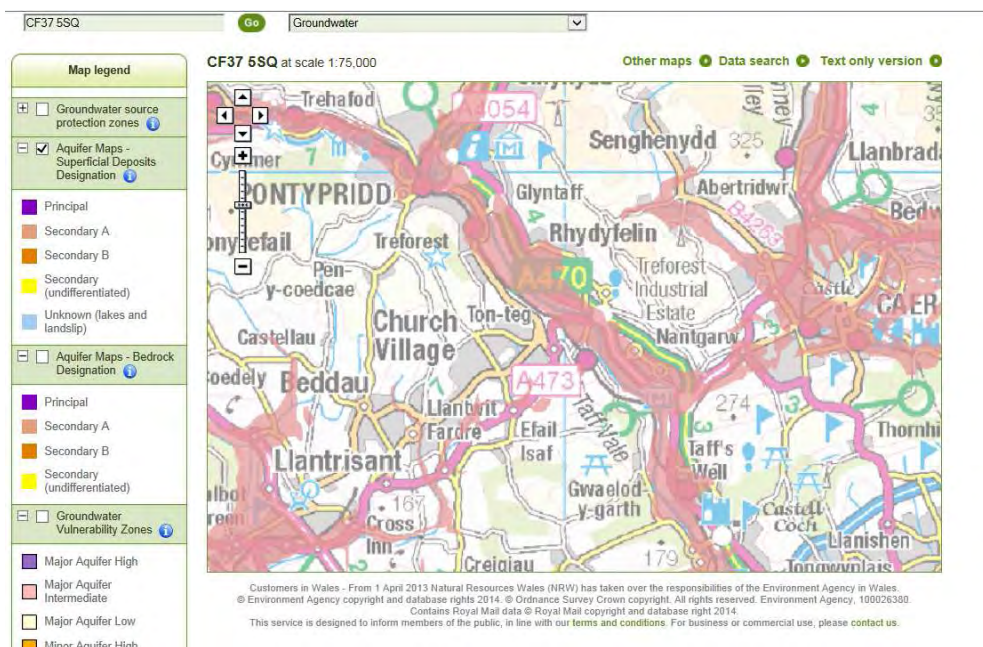


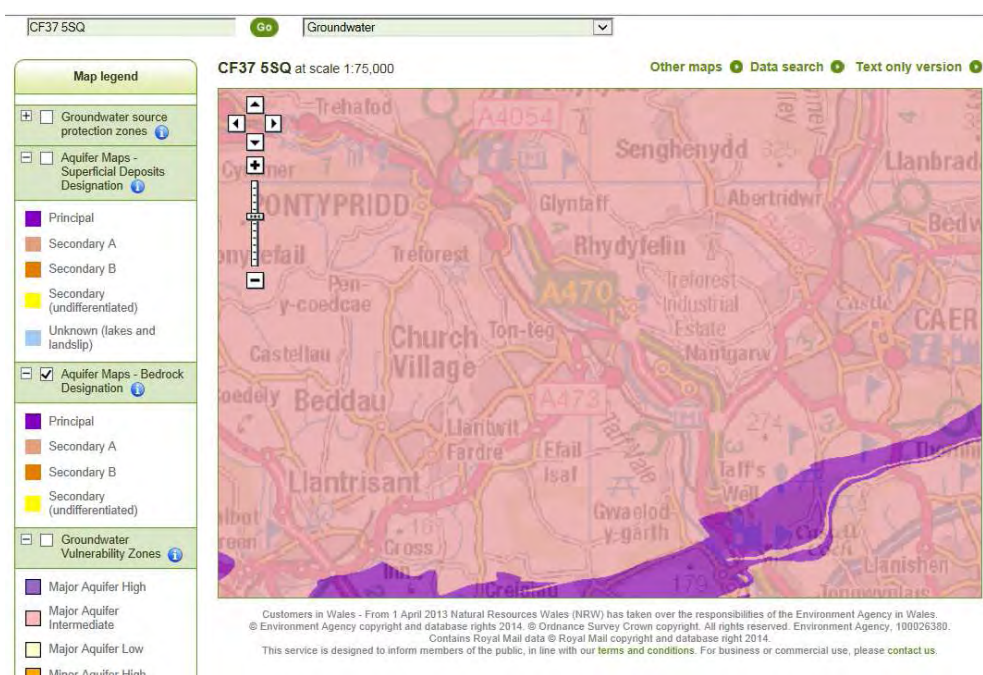
Figure 3.4.2: Map identifying 'Groundwater Source protection Zones' (<http://maps.environment-agency.gov.uk>)

Figure 3.4.3 below identifies that the superficial deposits that underlie the site have an aquifer designation of 'Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.



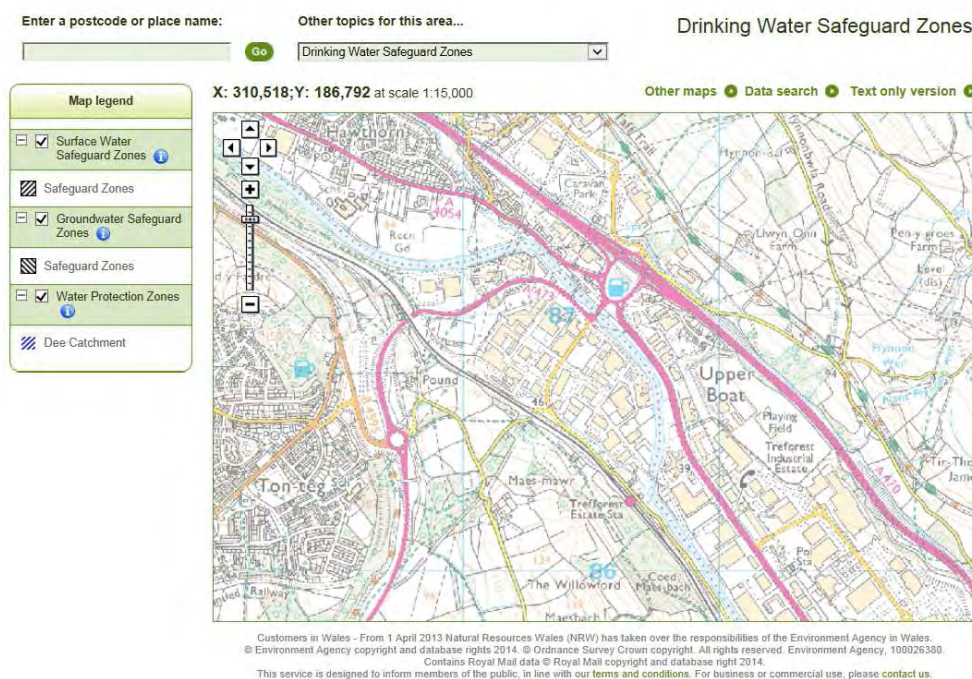
**Figure 3.4.3: Map identifying 'Aquifer Superficial Deposits Designations'** (<http://maps.environment-agency.gov.uk>)

Figure 3.4.4 below identifies that the bedrock that underlies the site has an aquifer designation of 'Secondary A - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.



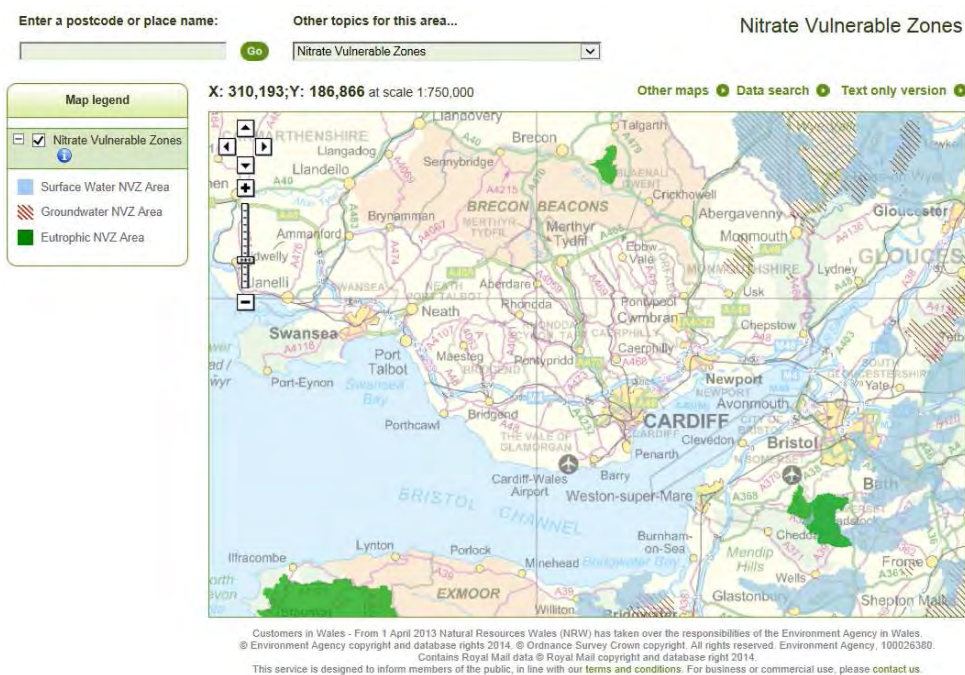
**Figure 3.4.4: Map identifying 'Aquifer Bedrock Designations'** (<http://maps.environment-agency.gov.uk>)

Figure 3.4.5 below identifies that the receptors do not fall within areas designated 'Surface Water Safeguard Zones, Groundwater Safeguard Zones or Water Protection zones'.



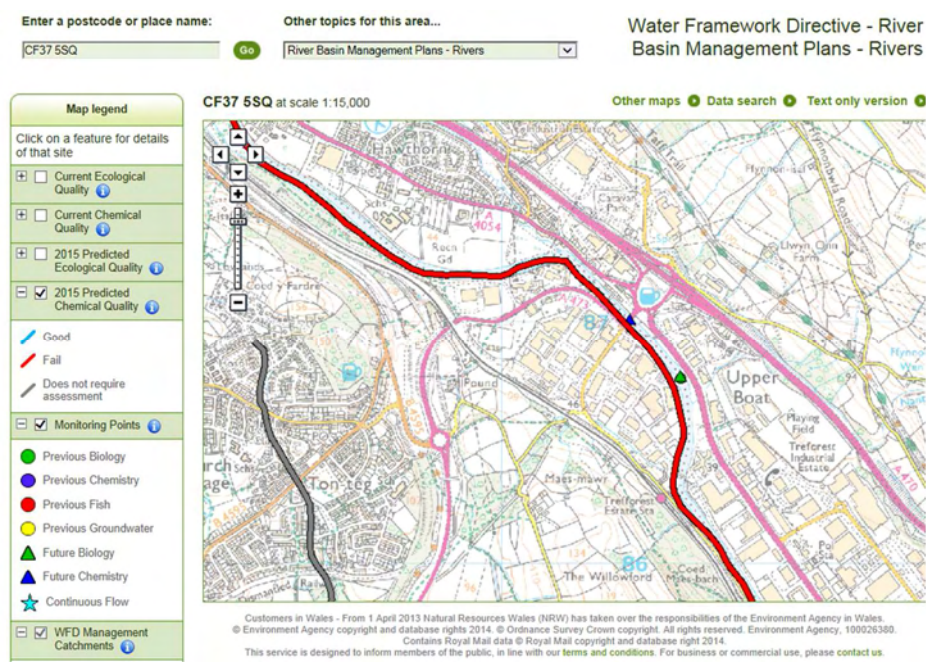
**Figure 3.4.5: Map identifying 'Surface Water Safeguard Zones, Groundwater Safeguard Zones and Water Protection Zones' (<http://maps.environment-agency.gov.uk>)**

Figure 3.4.6 below shows that the receptors do not fall within areas designated as 'Nitrate Vulnerable Zones'.



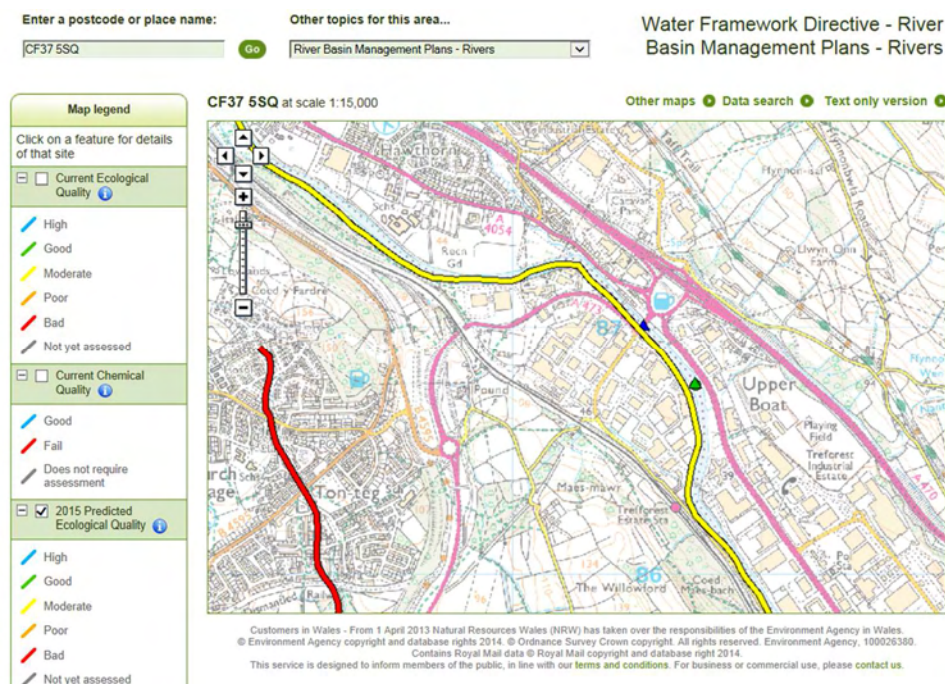
**Figure 3.4.6: Map identifying 'Nitrate Vulnerability Zones' (<http://maps.environment-agency.gov.uk>)**

Figure 3.4.7 below identifies that the River Taff is expected to fail the Water Framework Directive 'Chemical Quality Standard' in 2015.



**Figure 3.4.7: Map identifying '2015 Predicted Chemical Quality' according to the Water Framework Directive – River Basin Management Plans - Rivers** (<http://maps.environment-agency.gov.uk>)

Figure 3.4.8 below identifies that the River Taff is expected to have 'Moderate Ecological Quality' in 2015 according to the Water Framework Directive classification.



**Figure 3.4.8: Map identifying '2015 Predicted Ecological Quality' according to the Water Framework Directive – River Basin Management Plans - Rivers** (<http://maps.environment-agency.gov.uk>)

Based upon the above information the River Taff has not been highlighted as a nationally significant watercourse, but has been recognised as having 'moderate' ecological value. In addition the aquifers which feed the river have been identified as having 'Secondary A' designations indicating that they are a potentially regionally significant natural resource.

Based upon this, both the River Taff and the Soils and Groundwater have been assigned a 'Receptor Hazard Rating' of MODERATE.

### 3.4 Site Hazard Ratings

By combining the Source, Pathway and Receptor Hazard Ratings, Site Hazard Ratings have been determined. The following combinations have been used to determine the Site Hazard Ratings.

| Source : Pathway : Receptor Hazard Rating combinations | Site Hazard Rating |
|--------------------------------------------------------|--------------------|
| HHH or HHM or HMM                                      | HIGH               |
| HHL or MMM or HML                                      | MODERATE           |
| MML or HLL or LLL                                      | LOW                |

As a number of pathways and receptors have been considered for each of the inventories, each inventory has multiple Site Hazard Ratings. Sheets summarising the Site Hazard Ratings are included in **Appendix F**.

### 3.5 Site Risk Rating

The likelihood of an inventory release occurring which has the capacity to follow the pathway and reach the receptor has been considered for each of the combinations of source, pathway and receptor. In doing so, Site Risk Ratings have been determined which correspond to each of the Site Hazard Ratings. Site Risk Ratings have been determined based upon an assessment of the likelihood of the event or sequenced of events occurring, based upon the following:

H - Greater than 1% (1 in 100)

M - Between 1% (1 in 100) and 0.001% (1 in 1 million)

L - Less than 0.001% (1 in 1 million)

The assessment of site risk ratings is included in the sheets in **Appendix E**.

### 3.6 Overall Site Hazard Ratings and Inventory Classifications

By combining the Site Hazard Ratings with the Site Risk Ratings an Overall Site Hazard rating has been determined. For each inventory, the worst case Overall Site Hazard Rating has been identified which determines the containment classification against which the storage facilities have been assessed. The following combinations have been used in this respect.

| Site Risk: Site Hazard combination | Overall Site Hazard Rating | Inventory Classification |
|------------------------------------|----------------------------|--------------------------|
| HH or HM or MH                     | HIGH                       | Class 3                  |
| MM or HL or LH                     | MODERATE                   | Class 2                  |

LL or ML or LM

LOW

Class 1

The classifications determined for each of the inventory's are displayed below in Figure 3.6.1.

| Inventory              | Classification |
|------------------------|----------------|
| A18 Phosphoric         | Class 2        |
| A18 Sulphuric          | Class 2        |
| Truefloc TAC40         | Class 2        |
| A21 Caustic            | Class 2        |
| A21 Caustic day tank   | Class 2        |
| A21 Deioniser effluent | Class 2        |
| A21 Hydrochloric Acid  | Class 3        |
| A21 Hydrogen Peroxide  | Class 2        |
| A21 Acetic Acid        | Class 2        |
| A21 Phosphoric         | Class 2        |
| Lime (hydrated)        | Class 2        |

**Figure 3.6.1: Inventory Classifications**

Details of how the inventory's have been classified are contained in **Appendix F**.

#### 4.0 BASELINE ASSET SURVEY

The baseline asset survey consisted of a two day site investigation of the facilities, in addition to the collecting and review of information provided by PB Gelatins.

The primary purpose of the site investigation was to determine the form of secondary and tertiary containment provided to each storage facility, assess its integrity, and to locate any defects or inadequacies. In addition, likely pathways and environmental receptors were investigated.

Where drainage features were identified which were not on the plans provided, then these were investigated and traced where applicable.

#### 4.1 A18 Phosphoric

##### Summary

The inventory is stored in an HDPE primary tank which is within a half-height HDPE secondary containment tank with rainwater cover. Externally tertiary containment is provided in the form of 900mm high concrete block masonry walls to three sides of the tank including on the site boundary side, with large channel drainage which discharges to the industrial effluent sewer to the fourth side. See drawing J-5016-CIE-3004-A in **Appendix G** for further details.



**Figure 4.1.1: Photograph of A18 Phosphoric Primary Tank with Collar Bund**

##### Primary Containment

|              |                                                                                                  |
|--------------|--------------------------------------------------------------------------------------------------|
| Construction | HDPE spiral wound tank by Schoeller Allibert Helix Tanks<br>See <b>Appendix H</b> for GA detail. |
|--------------|--------------------------------------------------------------------------------------------------|

|                                                |                                                 |
|------------------------------------------------|-------------------------------------------------|
| Diameter                                       | 2.46m                                           |
| Height                                         | 4.36m                                           |
| Working Volume                                 | 19.11 m <sup>3</sup>                            |
| Volume to Overflow                             | 20.73m <sup>3</sup>                             |
| Inventory level indication                     | Ultrasonic level indicator, no high level alarm |
| Design Standards                               | Not known                                       |
| Design Life                                    | 10 years                                        |
| Expiry of Design Life                          | June 2015                                       |
| Last Inspection                                | 15 <sup>th</sup> September 2014                 |
| Next Inspection Due                            | September 2015                                  |
| Inventory compatible with form of construction | Yes                                             |
| Defects noted                                  | None                                            |

**Table 4.1.1: Details of A18 Phosphoric Acid Primary Containment**Secondary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Local Secondary Containment / self bunded                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Diameter                                                                                            | 3.80m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Height                                                                                              | 2.10 m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Containment Volume                                                                                  | 23.82m <sup>3</sup> (115% max primary)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Other material stored                                                                               | Sulphuric acid stored adjacent in similar self bunded vessel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | HDPE secondary containment tank with structurally independent base and walls with HDPE rain cover skirt over annulus. Vessels are founded on reinforced concrete base slab with Vinyl Ester coating.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Linings/ Coatings                                                                                   | Vinyl Ester coating applied to concrete base slab.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Inventory compatible with form of construction                                                      | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Condition, cracks                                                                                   | Vinyl Ester coating has delaminated and become detached in several patches on the base slab.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Was the facility constructed to conform to a particular containment class                           | No construction records available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Penetrations through bund                                                                           | <ul style="list-style-type: none"> <li>- Blanked off manway access formed through secondary tank for inspections of annulus. Blanking plate sealed with rubber gasket and M12 bolts.</li> <li>- 63mm diameter HDPE main outlet formed through walls of primary and secondary tanks near to base, with manual isolation valve in annulus operable by spindle accessible from hatch in bund rain cover.</li> <li>- 63mm diameter HDPE tank drain pipe formed through walls of primary and secondary containment tanks near to base, with manual isolation valve in annulus operable by spindle accessible from hatch in bund rain cover.</li> <li>- 63mm diameter HDPE bund drain formed through secondary containment wall near to base of tank.</li> </ul> |

|                                                                              |                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                              | - All pipe penetrations can be isolated externally by padlocked manual ball valves.                                                                                                                                                              |
| Joints - Spacing, form, condition                                            | None                                                                                                                                                                                                                                             |
| Leak detection systems                                                       | Checks for leakage form part of the site operatives' weekly duties. The bund drain pipework has the facility to check for liquid in the annulus, and to take a sample for testing to determine what the liquid is, if present.                   |
| Means of emptying rainwater/spills                                           | Cover excludes rainwater. Gravity bund drain to industrial effluent sewer controlled by padlocked ball valve used to check for leakage or spillages on a weekly basis.                                                                           |
| In service performance (ability to withstand applied loads/fire resistance). | Primary and secondary tanks are both designed to withstand the applied loads, and are structurally independent of one another.<br>The fire resistance of the tanks is likely to be low, but the likelihood of fire in this location is very low. |

**Table 4.1.2: Details of A18 Phosphoric Acid Secondary Containment**Tertiary

There are 900mm high concrete block masonry walls to three sides of the tank with large channel drainage which discharges to the industrial effluent sewer to the fourth side.

The bund drain is piped to the effluent channel drain, which could be used if a spillage within the bund was to be detected.

The masonry walls and channel drainage provide a degree of tertiary containment which would contain minor spillages outside of the main bund.

Maintenance/inspections

Work Instruction No. MWI 032 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary and secondary tanks are inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

Defects and Potential Pathways to Sensitive Receptors

The two pipe penetrations through the wall of the primary and secondary containment tanks are a potential weakness in the containment facilities. However, there is no vehicle access to the area, and pedestrian access is limited to those inspecting/maintaining the storage facilities. The likelihood of accidental damage to these pipes is therefore very low. In addition, should the pipes be damaged, there are valves within the annulus which could be used to isolate the primary tank. In addition, the walls and channel drainage in the area would provide a degree of tertiary containment.

As the collar bund only extends half way up the primary tank and has a raincover, any leakages from the tank above this point would not be contained by the bund.

## 4.2 A18 Sulphuric

### Summary

The inventory is stored in an HDPE primary tank which is within a three quarter height HDPE secondary containment tank with rainwater cover. Externally tertiary containment is provided in the form of 900mm high concrete block masonry walls to three sides of the tank including on the site boundary side, with large channel drainage which discharges to the industrial effluent sewer to the fourth side. See drawing J-5016-CIE-3004-A in **Appendix G** for further details.



**Figure 4.2.1: Photograph of A18 Sulphuric Primary Tank with Collar Bund**

### Primary Containment

|              |                                                                                                  |
|--------------|--------------------------------------------------------------------------------------------------|
| Construction | HDPE spiral wound tank by Schoeller Allibert Helix Tanks<br>See <b>Appendix H</b> for GA detail. |
| Diameter     | 2.50m                                                                                            |
| Height       | 4.35m                                                                                            |

|                                                |                                                 |
|------------------------------------------------|-------------------------------------------------|
| Working Volume                                 | 20.00m <sup>3</sup>                             |
| Volume to Overflow                             | 20.80m <sup>3</sup>                             |
| Inventory level indication                     | Ultrasonic level indicator, no high level alarm |
| Design Standards                               | Tank design and manufacture to EN 12573-1:2000  |
| Design Life                                    | 15 years                                        |
| Expiry of Design Life                          | April 2027                                      |
| Last Inspection                                | 15 <sup>th</sup> September 2014                 |
| Next Inspection Due                            | September 2015                                  |
| Inventory compatible with form of construction | Yes                                             |
| Defects noted                                  | None                                            |

**Table 4.2.1: Details of A18 Sulphuric Acid Primary Containment**Secondary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Local Secondary Containment / self bunded                                                                                                                                                                                                                                                                                                                                                            |
| Diameter                                                                                            | 2.90m                                                                                                                                                                                                                                                                                                                                                                                                |
| Height                                                                                              | 3.45 m                                                                                                                                                                                                                                                                                                                                                                                               |
| Containment Volume                                                                                  | 22.79m <sup>3</sup> (110% max primary)                                                                                                                                                                                                                                                                                                                                                               |
| Other material stored                                                                               | Phosphoric acid stored adjacent in similar self bunded vessel                                                                                                                                                                                                                                                                                                                                        |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | HDPE secondary containment tank with structurally independent base and walls with HDPE rain cover skirt over annulus. Vessels are founded on reinforced concrete base slab.                                                                                                                                                                                                                          |
| Linings/ Coatings                                                                                   | None.                                                                                                                                                                                                                                                                                                                                                                                                |
| Inventory compatible with form of construction                                                      | Yes                                                                                                                                                                                                                                                                                                                                                                                                  |
| Condition, cracks                                                                                   | Tanks appear in good working condition                                                                                                                                                                                                                                                                                                                                                               |
| Was the facility constructed to conform to a particular containment class                           | Not known.                                                                                                                                                                                                                                                                                                                                                                                           |
| Penetrations through bund                                                                           | <ul style="list-style-type: none"> <li>- Blanked off manway access formed through secondary tank for inspections of annulus. Blanking plate sealed with rubber gasket and M12 bolts.</li> <li>- 32mm HDPE gravity bund drain formed through secondary tank near to the base</li> <li>- 63mm diameter HDPE pumped main outlet formed through primary and bund tank walls near to the base.</li> </ul> |
| Joints - Spacing, form, condition                                                                   | None                                                                                                                                                                                                                                                                                                                                                                                                 |
| Leak detection systems                                                                              | Checks for leakage form part of the site operatives' weekly duties. The bund drain pipework has the facility to check for liquid in the annulus, and to take a sample for testing to determine what the liquid is, if present.                                                                                                                                                                       |
| Means of emptying rainwater/spills                                                                  | Cover excludes rainwater. Gravity bund drain to industrial effluent sewer controlled by padlocked ball valve used to check for leakage or spillages on a weekly basis.                                                                                                                                                                                                                               |

|                                                                              |                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| In service performance (ability to withstand applied loads/fire resistance). | Primary and secondary tanks are both designed to withstand the applied loads, and are structurally independent of one another.<br>The fire resistance of the tanks is likely to be low, but the likelihood of fire in this location is very low. |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Table 4.2.2: Details of A18 Phosphoric Acid Secondary Containment**

### Tertiary

There are 900mm high concrete block masonry walls to three sides of the tank with large channel drainage which discharges to the industrial effluent sewer to the fourth side.

The bund drain is piped to the channel drain, which could be used if a spillage within the bund was to be detected.

The masonry walls and channel drainage provide a degree of tertiary containment which would contain minor spillages outside of the bund.

### Maintenance/inspections

Work Instruction No. MWI 032 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary and secondary tanks are inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

### Defects and Potential Pathways to Sensitive Receptors

The main outlet pipe penetration through the wall of the primary and secondary containment tanks is a potential weakness in the containment facility. However, there is no vehicle access to the area, and pedestrian access is limited to those inspecting/maintaining the storage facilities. The likelihood of accidental damage to these pipes is therefore very low. In addition, the walls and channel drainage in the area would provide a degree of tertiary containment should any leakage occur.

As the collar bund only extends three quarters of the way up the primary tank and has a raincover, any leakages from the tank above this point would not be contained by the bund.

## **4.3 Water Works Truefloc TAC40**

### Summary

The inventory is stored in an HDPE primary tank which is sited on a concrete base within a concrete block masonry bund. Externally there is a concrete filling area with gully draining to the industrial effluent drainage system, and a bund drainage gully with concrete surround which also drains to the industrial effluent drainage system. See drawing J-5016-CIE-3003-A in **Appendix G** for further details.



**Figure 4.3.1: Photograph of Truefloc TAC40 Primary Tank within Block Masonry Bund**

Primary Containment

|                                                |                                                                                |
|------------------------------------------------|--------------------------------------------------------------------------------|
| Construction                                   | HDPE roto-moulded tank by Balmoral Tanks. See <b>Appendix H</b> for GA detail. |
| Diameter                                       | 2.50m                                                                          |
| Height                                         | 2.85m                                                                          |
| Working Volume                                 | 11.04m <sup>3</sup>                                                            |
| Volume to Overflow                             | 12.03m <sup>3</sup>                                                            |
| Inventory level indication                     | Ultrasonic level indicator, with high level alarm and flashing beacon          |
| Design Standards                               | Not known                                                                      |
| Design Life                                    | 10 years                                                                       |
| Expiry of Design Life                          | April 2019                                                                     |
| Last Inspection                                | 15 <sup>th</sup> September 2014                                                |
| Next Inspection Due                            | September 2015                                                                 |
| Inventory compatible with form of construction | Yes                                                                            |
| Defects noted                                  | None                                                                           |

**Table 4.3.1: Details of Water Works Truefloc TAC40 Primary Containment**

Secondary containment

|                    |                                        |
|--------------------|----------------------------------------|
| Type               | Local block masonry bund               |
| Length             | Max 4.37m (varies)                     |
| Breadth            | Max 3.65m (varies)                     |
| Height             | 1.165m                                 |
| Containment Volume | 19.40m <sup>3</sup> (161% max primary) |

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other material stored                                                                               | None                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | 300mm thick reinforced concrete base. Reinforcement detected by cover meter at 80mm cover, 200mm centres in two directions, bar size could not be detected. 1.165m high 6" concrete block masonry. 75mm mortar fillet along wall to base joint. Vinyl ester coating painted on inner face of walls and base.                                                                                                                                                       |
| Linings/ Coatings                                                                                   | Vinyl Ester coating to inner walls and base.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Inventory compatible with form of construction                                                      | Truefloc TAC40 has a low pH which could corrode the concrete. The Vinyl Ester coating provides protection to the concrete, however, defective patches are open to corrosion.                                                                                                                                                                                                                                                                                       |
| Condition, cracks                                                                                   | 2 No vertical thermal/shrinkage cracks in walls as noted on plan. <b>(See photos 4.3.1 and 2 in Appendix I)</b>                                                                                                                                                                                                                                                                                                                                                    |
| Was the facility constructed to conform to a particular containment class                           | Not known, no construction records available.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Penetrations through bund                                                                           | - 1 x 32mm stainless steel pipe bund drain through base of wall.<br>- 1 x redundant and uncapped 32mm stainless steel pipe penetrates base of wall and provides pathway for uncontrolled escape of liquid from bund. <b>(See photo 4.9.3 Appendix I)</b>                                                                                                                                                                                                           |
| Joints - Spacing, form, condition                                                                   | None                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Leak detection systems                                                                              | Checks for leakage form part of the site operatives' weekly inspections.                                                                                                                                                                                                                                                                                                                                                                                           |
| Means of emptying rainwater/spills                                                                  | Gravity drain to industrial effluent sewer controlled by padlocked ball valve. Inspection and release of rainwater undertaken weekly.                                                                                                                                                                                                                                                                                                                              |
| In service performance (ability to withstand applied loads/fire resistance).                        | CIRIA C736 states that ' <i>Unreinforced masonry should not be used for bund construction because of its susceptibility to thermal and shrinkage cracking and vulnerability to impact damage.</i> ' In this instance, thermal/shrinkage cracking is evident and provides a potential leakage pathway. Structurally, taking into consideration the possible effects of surge as indicated in CIRIA C736, the walls would fail by overturning under service loading. |

**Table 4.3.2: Details of Water Works Truefloc TAC40 Secondary Containment**Tertiary

Externally to the bund there is a concrete slab with effluent gully below the filling point.

There is also a drainage gully with concrete surround which drains to the industrial effluent drainage system below the valved bund drain.

Maintenance/inspections

Work Instruction No. MWI 031 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary tank is inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

### Defects and Potential Pathways to Sensitive Receptors

The structural stability and thermal/shrinkage cracks visible in the masonry bund walls provide potential pathways to the surrounding areas should there be an escape of inventory within the bund.

The uncapped pipe which penetrates the masonry wall at low level also provides a direct pathwath for any spillage within the bund to escape to the surrounding environment. There is a surface water drain near to the bund which could potentially act as a direct pathway to the River Taff.

## **4.4 A21 Caustic**

### Summary

The inventory is stored in an HDPE primary tank which is sited on a suspended steelwork floor above a reinforced concrete tank, previously used as a water treatment tank. The bund tank has other redundant tank compartments on three of its sides. On the fourth side of the bund, there are concrete troughs at high and low level which drain to the sites industrial effluent system.

See drawing J-5016-CIE-3002-A in Appendix G for further details.



**Figure 4.4.1: Photograph of Caustic Primary Tank within Reinforced Concrete Bund**

### Primary Containment

|                                                |                                                                                                                                                                                                                                                                          |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction                                   | HDPE helix spiral wound tank by Chemresist. See <b>Appendix H</b> for design calculations and details.                                                                                                                                                                   |
| Diameter                                       | 3.60m                                                                                                                                                                                                                                                                    |
| Height                                         | 8.00m                                                                                                                                                                                                                                                                    |
| Working Volume                                 | 70.0m <sup>3</sup>                                                                                                                                                                                                                                                       |
| Volume to Overflow                             | 77.0m <sup>3</sup>                                                                                                                                                                                                                                                       |
| Inventory level indication                     | Pressure transducer level indicator, no high level alarm                                                                                                                                                                                                                 |
| Design Standards                               | Tank Designed to BS EN 12573:2000 Parts 1 + 2 welded Static non-pressurised thermoplastic tanks and BS EN 1778:2000 Characteristic Values for welded thermoplastic constructions – Determination of allowable stresses and moduli for design of thermoplastics equipment |
| Design Life                                    | 20 years                                                                                                                                                                                                                                                                 |
| Expiry of Design Life                          | September 2023                                                                                                                                                                                                                                                           |
| Last Inspection                                | 15 <sup>th</sup> September 2014                                                                                                                                                                                                                                          |
| Next Inspection Due                            | September 2015                                                                                                                                                                                                                                                           |
| Inventory compatible with form of construction | Yes                                                                                                                                                                                                                                                                      |
| Defects noted                                  | 2 No. areas of minor surface damage to tank walls at 2.64m from base.<br>It was noted that the tank was not bolted down at its base.<br>See photo 4.4.1 in <b>Appendix I</b>                                                                                             |

**Table 4.4.1: Details of Caustic Tank Primary Containment**

### Secondary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Compartment of redundant reinforced concrete water treatment works tank converted to containment bund.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Length                                                                                              | Max 6.72m (varies)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Breadth                                                                                             | Max 6.68m (varies)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Height                                                                                              | 5.0m to open holes through wall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Containment Volume                                                                                  | >200m <sup>3</sup> (>260% max primary)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Other material stored                                                                               | 13.7m <sup>3</sup> caustic day tank stored in the same bund                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | <p>No construction records available.</p> <p>Secondary containment provided by redundant compartment of water treatment plant structure thought to have been constructed 1920-1930. Structure comprises 6 compartments, one of which has been modified to support and provide secondary containment to 2 no. MDPE caustic soda tanks.</p> <p>The water treatment plant structure is reinforced concrete. The main walls of the compartment have 500mm wide ring beam at the top, are 200mm thick, and have a taper which starts part way down the wall and increases in thickness towards the base. Vertical reinforcement on inside face of wall directly underneath ring beam detected. Cover meter recorded sporadic readings of cover 35-60mm, 12 - 23mmØ bars at 250-560mm centres.</p> |

|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           | <p>Ring beam depth 310mm, penetrations through wall at base of ring beam draining to tertiary containment system. Underside of ring beam to top of taper 2100mm, top of taper to base 2900mm vertically approximately 400mm horizontally.</p> <p>Containment volume of single compartment &gt; 200m<sup>3</sup>/.</p> <p>Primary storage tanks are supported on suspended 14mm thick steel floor plates with open mesh flooring surrounding to provide pedestrian access. Suspended floor structure comprises 4 no. 406x178mm universal beams bolted to compartment walls, and 8no. 406x356mm universal columns supporting beams from base slab.</p> <p>Secondary containment provided by redundant compartment of water treatment plant structure thought to have been constructed 1920-1930. Structure comprises 6 compartments, one of which has been modified to support and provide secondary containment to 2 no. MDPE caustic soda tanks. The water treatment plant structure is reinforced concrete. The main walls of the compartment have 500mm wide ring beam at the top, are 200mm thick, and have a taper which starts part way down the wall and increases in thickness towards the base. Vertical reinforcement on inside face of wall directly underneath ring beam detected. Cover meter recorded sporadic readings of cover 35-60mm, 12 - 23mmØ bars at 250-560mm centres.</p> <p>Ring beam depth 310mm, penetrations through wall at base of ring beam draining to tertiary containment system. Underside of ring beam to top of taper 2100mm, top of taper to base 2900mm vertically approximately 400mm horizontally.</p> <p>Containment volume of single compartment &gt; 200m<sup>3</sup>/.</p> <p>Primary storage tanks are supported on suspended 14mm thick steel floor plates with open mesh flooring surrounding to provide pedestrian access. Suspended floor structure comprises 4 no. 406x178mm universal beams bolted to compartment walls, and 8no. 406x356mm universal columns supporting beams from base slab.</p> |
| Linings/ Coatings                                                         | Unknown coating to inner walls and base present, although not required due to compatibility of inventory with construction materials.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Inventory compatible with form of construction                            | Yes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Condition, cracks                                                         | 3 No. vertical cracks in walls 0.15 to 0.35mm width. 3 No. vertical formed joints which appear as cracks.<br><b>(See photos 4.4.2,3,4,5,6+7 in Appendix I)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Was the facility constructed to conform to a particular containment class | Not known. Previous use of facility indicates that the structure would have been constructed to water retaining standards as applicable at the time of design.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Penetrations through bund                                                 | 4 No penetrations in base of wall on external face. 1 x bund drain, 1 x fill point, 2 x redundant penetrations. All appear to have been cast into concrete and appear watertight. All are positioned above an external concrete trough which drains to the industrial effluent sewer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Joints - Spacing, form, condition                                            | There appear to be two contraction/movement joints running through the compartment in two perpendicular directions. The joints appear to have been filled with mortar, so appear as two aligned vertical cracks either side of the presumed joint. Joints appear relatively watertight, but full details of their construction are unknown.                                                                                                                                                                                                                                                                                                                                                                               |
| Leak detection systems                                                       | Checks for leakage form part of the site operatives' weekly duties. The bund drain pipework has the facility to check for liquid in the annulus, and to take a sample for testing to determine what the liquid is, if present.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Means of emptying rainwater/spills                                           | Gravity drain to industrial effluent sewer controlled by padlocked ball valve. Inspection and release of rainwater undertaken weekly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| In service performance (ability to withstand applied loads/fire resistance). | There are no records available to verify the design of the structure. However, considering the previous use of the compartment as a water treatment vessel, it is assumed that the structure was constructed to water retaining standards as applicable at the time. The inventory stored has a slightly higher specific gravity than water at 1.3. However, the bund has a capacity 2.6 time greater than the primary storage tank. Potential service loads would therefore be lower than the presumed original design loads. Crack widths measured on the structure are slightly higher than permissible limits in current design guidance, however, all of the walls are provided with effective tertiary containment. |

**Table 4.4.2: Details of Caustic Tank Secondary Containment**

### Tertiary

There are 5 other compartments to three sides of the main containment structure which would provide containment should the main bund compartment fail. On the fourth side of the compartment there are concrete troughs at the top and base of the compartment wall which drain to the industrial effluent sewer system. These would effectively contain any leakage should the cracks or joints prove not to be entirely watertight.

There is also a concrete slab with a drainage gully to effluent sewer, below the tank filling point, external to the bund.

### Maintenance/inspections

Work Instruction No. MWI 031 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary tank is inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

### Defects and Potential Pathways to Sensitive Receptors

There are cracks present through the walls of the bund which could leak should the bund be filled with inventory. However, there is effective tertiary containment provided to all sides of the bund which would prevent the release of inventory to the environment.

There are four pipe penetrations through one of the bund walls, although these appear to have been cast into the concrete, appear well constructed and watertight. These are also provided with tertiary containment from the concrete trough below them.

#### 4.5 A21 Caustic Day Tank

##### Summary

The inventory is stored in an HDPE primary tank which is sited on a suspended steelwork floor above a reinforced concrete tank, previously used as a water treatment tank. The bund tank has other redundant tank compartments on three of its sides. On the fourth side of the bund, there are concrete troughs at high and low level which drain to the site's industrial effluent system.

See drawing J-5016-CIE-3002-A in Appendix G for further details.



**Figure 4.5.1: Photograph of Caustic Day Tank Primary Vessel (left) and Caustic Tank (right) on Suspended Steelwork Floor above Reinforced Concrete Bund**

##### Primary Containment

|                                                |                                                                                                                |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Construction                                   | HDPE helix spiral wound tank by B&M Pipeline Services.                                                         |
| Diameter                                       | 1.80m                                                                                                          |
| Height                                         | 5.40m                                                                                                          |
| Working Volume                                 | 10.4m <sup>3</sup>                                                                                             |
| Volume to Overflow                             | 13.74m <sup>3</sup>                                                                                            |
| Inventory level indication                     | Pressure transducer level indicator, no high level alarm                                                       |
| Design Standards                               | No records available.                                                                                          |
| Design Life                                    | 10 years                                                                                                       |
| Expiry of Design Life                          | July 2019                                                                                                      |
| Last Inspection                                | 15 <sup>th</sup> September 2014                                                                                |
| Next Inspection Due                            | September 2015                                                                                                 |
| Inventory compatible with form of construction | Yes                                                                                                            |
| Defects noted                                  | 3 No. areas of minor surface damage to tank walls at 1.8m from base. See photos 4.5.1,2+3 in <b>Appendix I</b> |

**Table 4.5.1: Details of Caustic Day Tank Primary Containment**Secondary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Compartment of redundant reinforced concrete water treatment works tank converted to containment bund.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Length                                                                                              | Max 6.72m (varies)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Breadth                                                                                             | Max 6.68m (varies)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Height                                                                                              | 5.0m to open holes through wall                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Containment Volume                                                                                  | >200m <sup>3</sup> (>260% max primary)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Other material stored                                                                               | 77.0m <sup>3</sup> caustic tank stored in the same bund                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | <p>No construction records available.</p> <p>Secondary containment provided by redundant compartment of water treatment plant structure thought to have been constructed 1920-1930. Structure comprises 6 compartments, one of which has been modified to support and provide secondary containment to 2 no. MDPE caustic soda tanks.</p> <p>The water treatment plant structure is reinforced concrete. The main walls of the compartment have 500mm wide ring beam at the top, are 200mm thick, and have a taper which starts part way down the wall and increases in thickness towards the base. Vertical reinforcement on inside face of wall directly underneath ring beam detected. Cover meter recorded sporadic readings of cover 35-60mm, 12 - 23mmØ bars at 250-560mm centres.</p> <p>Ring beam depth 310mm, penetrations through wall at base of ring beam draining to tertiary containment system.</p> <p>Underside of ring beam to top of taper 2100mm, top of taper to base 2900mm vertically approximately 400mm horizontally.</p> <p>Containment volume of single compartment &gt; 200m<sup>3</sup>/. Primary storage tanks are supported on suspended 14mm thick steel floor plates with open mesh flooring surrounding to</p> |

|                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                           | <p>provide pedestrian access. Suspended floor structure comprises 4 no. 406x178mm universal beams bolted to compartment walls, and 8no. 406x356mm universal columns supporting beams from base slab.</p> <p>Secondary containment provided by redundant compartment of water treatment plant structure thought to have been constructed 1920-1930. Structure comprises 6 compartments, one of which has been modified to support and provide secondary containment to 2 no. MDPE caustic soda tanks.</p> <p>The water treatment plant structure is reinforced concrete. The main walls of the compartment have 500mm wide ring beam at the top, are 200mm thick, and have a taper which starts part way down the wall and increases in thickness towards the base. Vertical reinforcement on inside face of wall directly underneath ring beam detected. Cover meter recorded sporadic readings of cover 35-60mm, 12 - 23mmØ bars at 250-560mm centres.</p> <p>Ring beam depth 310mm, penetrations through wall at base of ring beam draining to tertiary containment system. Underside of ring beam to top of taper 2100mm, top of taper to base 2900mm vertically approximately 400mm horizontally.</p> <p>Containment volume of single compartment &gt; 200m<sup>3</sup>/.</p> <p>Primary storage tanks are supported on suspended 14mm thick steel floor plates with open mesh flooring surrounding to provide pedestrian access. Suspended floor structure comprises 4 no. 406x178mm universal beams bolted to compartment walls, and 8no. 406x356mm universal columns supporting beams from base slab.</p> |
| Linings/ Coatings                                                         | Unknown coating to inner walls and base present, although not required due to compatibility of inventory with construction materials.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Inventory compatible with form of construction                            | Yes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Condition, cracks                                                         | 3 No. vertical cracks in walls 0.15 to 0.35mm width. 3 No. vertical formed joints which appear as cracks.<br><b>(See photos 4.4.2,3,4,5,6,+7 in Appendix I)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Was the facility constructed to conform to a particular containment class | Not known. Previous use of facility indicates that the structure would have been constructed to water retaining standards as applicable at the time of design.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Penetrations through bund                                                 | 4 No penetrations in base of wall on external face. 1 x bund drain, 1 x fill point, 2 x redundant penetrations. All appear to have been cast into concrete and appear watertight. All are positioned above an external concrete trough which drains to the industrial effluent sewer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Joints - Spacing, form, condition                                         | There appear to be two contraction/movement joints running through the compartment in two perpendicular directions. The joints appear to have been filled with mortar, so appear as two aligned vertical cracks either side of the presumed joint. Joints appear relatively watertight, but full details of their construction are unknown.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

|                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Leak detection systems                                                       | Checks for leakage form part of the site operatives' weekly inspections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Means of emptying rainwater/spills                                           | Gravity drain to industrial effluent sewer controlled by padlocked ball valve. Inspection and release of rainwater undertaken weekly.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| In service performance (ability to withstand applied loads/fire resistance). | There are no records available to verify the design of the structure. However, considering the previous use of the compartment as a water treatment vessel, it is assumed that the structure was constructed to water retaining standards as applicable at the time. The inventory stored has a slightly higher specific gravity than water at 1.3. However, the bund has a capacity 2.6 time greater than the primary storage tank. Potential service loads would therefore be lower than the presumed original design loads.<br>Crack widths measured on the structure are slightly higher than permissible limits in current design guidance, however, all of the walls are provided with effective tertiary containment. |

**Table 4.5.2: Details of Caustic Day Tank Secondary Containment**Tertiary

There are 5 other compartments to three sides of the main containment structure which would provide containment should the main bund compartment fail. On the fourth side of the compartment there are concrete troughs at the top and base of the compartment wall which drain to the industrial effluent sewer system. These would effectively contain any leakage should the cracks or joints prove not to be entirely watertight.

There is also a concrete slab with a drainage gully to effluent sewer, below the tank filling point, external to the bund.

Maintenance/inspections

Work Instruction No. MWI 031 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary tank is inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

Defects and Potential Pathways to Sensitive Receptors

There are cracks present through the walls of the bund which could leak should the bund be filled with inventory. However, there is effective tertiary containment provided to all sides of the bund which would prevent the release of inventory to the environment.

There are four pipe penetrations through one of the bund walls, although these appear to have been cast into the concrete, appear well constructed and watertight. These are also provided with tertiary containment from the concrete trough below them.

#### 4.6 A21 Deioniser effluent

##### Summary

The inventory is stored in an HDPE primary tank which is within a half-height HDPE secondary containment tank with rainwater cover. Externally a degree of tertiary containment is provided by a nearby channel drain which discharges to industrial effluent sewer. See drawing J-5016-CIE-3001-A in **Appendix G** for further details.



**Figure 4.6.1: Photograph of A21 Deioniser Effluent (Diluted HCL) Primary Tank with Collar Bund**

##### Primary Containment

|                            |                                                           |
|----------------------------|-----------------------------------------------------------|
| Construction               | HDPE spiral wound tank by Schoeller Allibert Helix Tanks. |
| Diameter                   | 3.10m                                                     |
| Height                     | 7.80m                                                     |
| Working Volume             | 51.3m <sup>3</sup>                                        |
| Volume to Overflow         | 53.0m <sup>3</sup>                                        |
| Inventory level indication | Ultrasonic level indicator, no high level alarm           |

|                                                |                                                                                                                        |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Design Standards                               | No records available                                                                                                   |
| Design Life                                    | 10years                                                                                                                |
| Expiry of Design Life                          | December 2017                                                                                                          |
| Last Inspection                                | 15 <sup>th</sup> September 2014                                                                                        |
| Next Inspection Due                            | September 2015                                                                                                         |
| Inventory compatible with form of construction | Yes                                                                                                                    |
| Defects noted                                  | High level filling pipe has become detached from three of its support brackets. See <b>photo 4.6.1 in Appendix I</b> . |

**Table 4.6.1: Details of A21 Deioniser Effluent Primary Containment**Secondary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Local Secondary Containment / self bunded                                                                                                                                                                                                                                                                                                                                                                                  |
| Diameter                                                                                            | 4.20m                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Height                                                                                              | 4.3 m                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Containment Volume                                                                                  | 59.6m <sup>3</sup> (101% max volume, 112% working volume)                                                                                                                                                                                                                                                                                                                                                                  |
| Other material stored                                                                               | Hydrochloric acid, acetic acid, hydrogen peroxide and phosphoric acid stored in bulk in local area.                                                                                                                                                                                                                                                                                                                        |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | HDPE secondary containment tank with structurally independent base and walls with HDPE rain cover skirt over annulus. Vessels are founded on minimum 300mm thick reinforced concrete base slab. 12mm reinforcement bars detected at 70mm cover, at approximately 150mm centres.                                                                                                                                            |
| Linings/ Coatings                                                                                   | None.                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Inventory compatible with form of construction                                                      | Yes                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Condition, cracks                                                                                   | Tanks appear in good working condition                                                                                                                                                                                                                                                                                                                                                                                     |
| Was the facility constructed to conform to a particular containment class                           | Not known.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Penetrations through bund                                                                           | <ul style="list-style-type: none"> <li>- 90mm HDPE main outlet pipe formed through walls of primary and secondary tank walls near the base. No valve isolation in annulus.</li> <li>- 63mm HDPE bund drain penetrates wall of secondary tank near base.</li> <li>- Blanked off man way access formed through secondary tank for inspections of annulus. Blanking plate sealed with rubber gasket and M12 bolts.</li> </ul> |
| Joints - Spacing, form, condition                                                                   | None                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Leak detection systems                                                                              | Checks for leakage form part of the site operatives' weekly duties. The bund drain pipework has the facility to check for liquid in the annulus, and to take a sample for testing to determine what the liquid is, if present.                                                                                                                                                                                             |
| Means of emptying rainwater/spills                                                                  | Cover excludes rainwater. Gravity bund drain to industrial effluent sewer controlled by ball valve used to check for leakage or spillages on a weekly basis.                                                                                                                                                                                                                                                               |
| In service performance (ability to withstand applied loads/fire)                                    | Primary and secondary tanks are both designed to withstand the applied loads, and are structurally independent of one another.                                                                                                                                                                                                                                                                                             |

|              |                                                                                                                |
|--------------|----------------------------------------------------------------------------------------------------------------|
| resistance). | The fire resistance of the tanks is likely to be low, but the likelihood of fire in this location is very low. |
|--------------|----------------------------------------------------------------------------------------------------------------|

**Table 4.6.2: Details of A21 Deioniser Secondary Containment**Tertiary

A degree of tertiary containment is provided by the nearby channel drain which discharges to the industrial effluent sewer.

Maintenance/inspections

Work Instruction No. MWI 032 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary and secondary tanks are inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

Defects and Potential Pathways to Sensitive Receptors

The main outlet pipe penetration through the wall of the primary and secondary containment tanks is a potential weakness in the containment facility.

As the collar bund only extends half of the way up the primary tank and has a raincover, any leakages from the tank above this point would not be contained by the bund.

The inlet pipe to the tank is at high level and has become detached from its support brackets. This presents a risk to the H+S of operatives on site and of leakage, should the pipe become damaged.

**4.7 A21 Hydrochloric Acid**Summary

The inventory is stored in an HDPE primary tank which is within a near full height HDPE secondary containment tank with rainwater cover. Externally tertiary containment is provided around the concrete slab which the tank rests on, by 900mm high reinforced concrete walls to half of the slab and concrete kerbs to the other half. There is a shallow (75mm deep) channel drain installed in front of the kerbs which drains to the industrial effluent system. Part of the drainage to the industrial effluent sewer is installed above ground. During the inspection it was noted that this system was incomplete and provides a drainage route to the ground.

See drawing J-5016-CIE-3001-A in **Appendix G** for further details.



**Figure 4.7.1: Photograph of A21 Hydrochloric Acid Primary Tank with Collar Bund**

Primary Containment

|                            |                                                             |
|----------------------------|-------------------------------------------------------------|
| Construction               | HDPE spiral wound tank by Schoeller Allibert Helix Tanks.   |
| Diameter                   | 2.90m                                                       |
| Height                     | 5.40m                                                       |
| Working Volume             | 32.0m <sup>3</sup>                                          |
| Volume to Overflow         | 35.0m <sup>3</sup>                                          |
| Inventory level indication | Ultrasonic level indicator, no high level alarm             |
| Design Standards           | Tank design and manufactured to Standard BS-EN12573-1:2000. |
| Design Life                | 20 years                                                    |
| Expiry of Design Life      | June 2034                                                   |
| Last Inspection            | 15 <sup>th</sup> September 2014                             |
| Next Inspection Due        | September 2015                                              |

|                                                |                                                                                                            |
|------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Inventory compatible with form of construction | Yes                                                                                                        |
| Defects noted                                  | Above ground tertiary containment effluent pipe damaged/incomplete. See <b>photo 4.7.1 in Appendix I</b> . |

**Table 4.7.1: Details of A21 HCl Primary Containment**Secondary containment

| Type                                                                                                | Local Secondary Containment / self bunded                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diameter                                                                                            | 3.08m                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Height                                                                                              | 4.90m                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Containment Volume                                                                                  | 36.6m <sup>3</sup> (105% max primary)                                                                                                                                                                                                                                                                                                                                                                                     |
| Other material stored                                                                               | Deioniser effluent, acetic acid, hydrogen peroxide and phosphoric acid stored in bulk in local area.                                                                                                                                                                                                                                                                                                                      |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | HDPE secondary containment tank with structurally independent base and walls with HDPE rain cover skirt over annulus. Vessels are founded on recently built concrete slab containing reinforcement mesh at 200mm centres in both directions, thought to have been cast over pre-existing concrete slab in areas giving total thickness >600mm.                                                                            |
| Linings/ Coatings                                                                                   | None.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Inventory compatible with form of construction                                                      | Yes                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Condition, cracks                                                                                   | Tanks appear in good working condition                                                                                                                                                                                                                                                                                                                                                                                    |
| Was the facility constructed to conform to a particular containment class                           | Not known.                                                                                                                                                                                                                                                                                                                                                                                                                |
| Penetrations through bund                                                                           | <ul style="list-style-type: none"> <li>- 50mm HDPE main outlet pipe formed through walls of primary and secondary tank walls near the base. No valve isolation in annulus.</li> <li>- 56mm HDPE bund drain penetrates wall of secondary tank near base.</li> <li>- Blanked off manway access formed through secondary tank for inspections of annulus. Blanking plate sealed with rubber gasket and M12 bolts.</li> </ul> |
| Joints - Spacing, form, condition                                                                   | None                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Leak detection systems                                                                              | Checks for leakage form part of the site operatives' weekly duties. The bund drain pipework has the facility to check for liquid in the annulus, and to take a sample for testing to determine what the liquid is, if present.                                                                                                                                                                                            |
| Means of emptying rainwater/spills                                                                  | Cover excludes rainwater. Gravity bund drain to industrial effluent sewer controlled by ball valve used to check for leakage or spillages on a weekly basis.                                                                                                                                                                                                                                                              |
| In service performance (ability to withstand applied loads/fire resistance).                        | Primary and secondary tanks are both designed to withstand the applied loads, and are structurally independent of one another.<br>The fire resistance of the tanks is likely to be low, but the likelihood of fire in this location is very low.                                                                                                                                                                          |

**Table 4.7.2: Details of A21 HCl Secondary Containment**

### Tertiary

Tertiary containment is provided around the concrete base that the tank rests on. There are reinforced concrete walls around half of the slab and concrete kerbs around the remaining half. There are shallow (75mm) channel drains installed in front of the kerbs, which are supposed to drain to the industrial effluent sewer. At the time of the inspection it was noted that the above ground drainage pipework was damaged/incomplete, leaving the drain to discharge into a hole in the ground.

### Maintenance/inspections

Work Instruction No. MWI 032 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary and secondary tanks are inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

### Defects and Potential Pathways to Sensitive Receptors

The main outlet pipe penetration through the wall of the primary and secondary containment tanks is a potential weakness in the containment facility.

As the collar bund does not extend to the top of the primary tank and has a raincover, any leakages from the tank above this point would not be contained by the bund.

The damaged/incomplete drainage pipe would direct any spillages outside of the main bund to the ground. The tertiary containment system therefore currently gives a false sense of security at present.

## **4.8 A21 Hydrogen Peroxide**

### Summary

The inventory is stored within an HDPE primary tank, which is sited on a concrete base within a concrete block masonry bund. There is a degree of tertiary containment outside the bund in the form of a nearby channel drain which drains to the industrial effluent sewer. See drawing J-5016-CIE-3001-A in **Appendix G** for further details.



**Figure 4.8.1: Photograph of Hydrogen Peroxide tank (black) and Bund**

Primary Containment

|                                                |                                                                         |
|------------------------------------------------|-------------------------------------------------------------------------|
| Construction                                   | HDPE tank by Balmoral Tanks. See <b>Appendix H</b> for GA detail.       |
| Diameter                                       | 2.20m                                                                   |
| Height                                         | 2.95m                                                                   |
| Working Volume                                 | 8.75m <sup>3</sup>                                                      |
| Volume to Overflow                             | 9.57m <sup>3</sup>                                                      |
| Inventory level indication                     | Ultrasonic level indicator, with float switch operated high level alarm |
| Design Standards                               | Not known                                                               |
| Design Life                                    | 10 years                                                                |
| Expiry of Design Life                          | May 2018                                                                |
| Last Inspection                                | August 2010                                                             |
| Next Inspection Due                            | August 2020                                                             |
| Inventory compatible with form of construction | Yes                                                                     |
| Defects noted                                  | None                                                                    |

**Table 4.8.1: Details of Hydrogen Peroxide Primary Containment**

Secondary containment

|                    |                                        |
|--------------------|----------------------------------------|
| Type               | Local block masonry bund               |
| Length             | 4.27m                                  |
| Breadth            | 4.22m                                  |
| Height             | 0.90m                                  |
| Containment Volume | 16.2m <sup>3</sup> (169 % max primary) |

| Other material stored                                                                               | None within bund                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | 425mm thick concrete base. No reinforcement detected by cover meter, but no joints or surface cracks visible. Cracks could be hidden by vinyl ester coating to base. Walls of single skin 6" concrete block masonry. No reinforcement, pillars or other restraints to walls. Two walls extend to form second bund compartment adjacent                                                                                                                             |
| Linings/ Coatings                                                                                   | Internal base and walls painted with ChemGaurd epoxy coating. Areas of coating delamination on the base. See drawing for details. Date of application not known.                                                                                                                                                                                                                                                                                                   |
| Inventory compatible with form of construction                                                      | The inventory has the potential to corrode the concrete base and walls. The coating provides a degree of protection to the concrete, however the delaminated areas are susceptible to corrosion.                                                                                                                                                                                                                                                                   |
| Condition, cracks                                                                                   | 2 No vertical thermal/shrinkage cracks in walls as noted on plan. ( <b>See photos 4.8.1 and 2 in Appendix I</b> ) Crack visible on external base to wall joint in areas above ground. 75mm mortar fillet applied to internal wall to base joint.                                                                                                                                                                                                                   |
| Was the facility constructed to conform to a particular containment class                           | No construction records available.                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Penetrations through bund                                                                           | <ul style="list-style-type: none"> <li>- 1 No. 100mm stainless steel pipe cast into base drains bund to effluent system. Flow controlled by padlocked ball valve.</li> <li>- 1 No 25mm stainless steel pipe penetrates wall. Mortar poorly pointed around pipe on external face with void extending a minimum of 125mm into wall.</li> </ul>                                                                                                                       |
| Joints - Spacing, form, condition                                                                   | None                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Leak detection systems                                                                              | Checks for leakage form part of the site operatives' weekly inspections.                                                                                                                                                                                                                                                                                                                                                                                           |
| Means of emptying rainwater/spills                                                                  | Gravity drain to industrial effluent sewer controlled by padlocked ball valve. Inspection and release of rainwater undertaken weekly.                                                                                                                                                                                                                                                                                                                              |
| In service performance (ability to withstand applied loads/fire resistance).                        | CIRIA C736 states that ' <i>Unreinforced masonry should not be used for bund construction because of its susceptibility to thermal and shrinkage cracking and vulnerability to impact damage.</i> ' In this instance, thermal/shrinkage cracking is evident and provides a potential leakage pathway. Structurally, taking into consideration the possible effects of surge as indicated in CIRIA C736, the walls would fail by overturning under service loading. |

**Table 4.8.2: Details of Hydrogen Peroxide Secondary Containment**Tertiary

There is a degree of tertiary containment outside the bund in the form of a nearby channel drain which drains to the industrial effluent sewer. The tank filling point is located above the channel drain.

Other than the channel drain, there is no other form of containment in the area which would prevent a spillage from flowing off the site. There are surface water gullies in the road outside of the entrance to the site which could potentially provide a direct pathway to the River Taff.

### Maintenance/inspections

Work Instruction No. MWI 031 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary tank is inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

There are no known procedures for formal checks of the concrete bund by a competent person.

### Defects and Potential Pathways to Sensitive Receptors

The structural stability and thermal/shrinkage cracks visible in the masonry bund walls provide potential pathways to the surrounding areas should there be an escape of inventory within the bund.

The locations in which pipes penetrate the bund wall provide further potential for leakage from the bund.

## **4.9 Acetic Acid**

### Summary

The inventory is stored within an HDPE primary tank, which is sited on a concrete base within a concrete block masonry bund. There are tertiary protection measures outside of the bund in the form of drainage features which drain to the PB Gelatins pump station, which pumps to the PB Gelatins effluent treatment plant which discharges to a public foul water sewer. See drawing J-5016-CIE-3001-A in **Appendix G** for further details.



**Figure 4.9.1: Photograph of Acetic Acid tank (white) and Bund**

### Primary Containment

|                                                |                                                                                                                |
|------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Construction                                   | HDPE roto-moulded tank by Balmoral Tanks. See <b>Appendix H</b> for GA detail.                                 |
| Diameter                                       | 2.00m                                                                                                          |
| Height                                         | 2.00m                                                                                                          |
| Working Volume                                 | 5.35m <sup>3</sup>                                                                                             |
| Volume to Overflow                             | 5.65m <sup>3</sup>                                                                                             |
| Inventory level indication                     | Ultrasonic level indicator and float switch high level alarm                                                   |
| Design Standards                               | Not known                                                                                                      |
| Design Life                                    | 10 years                                                                                                       |
| Expiry of Design Life                          | September 2020                                                                                                 |
| Last Inspection                                | August 2010                                                                                                    |
| Next Inspection Due                            | August 2020                                                                                                    |
| Inventory compatible with form of construction | Yes                                                                                                            |
| Defects noted                                  | Small vertical crack 0.2mm wide at top of wall adjacent to lifting point ( <b>See photo 4.9.1 Appendix I</b> ) |

**Table 4.9.1: Details of Acetic Acid Primary Containment**

### Secondary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Local block masonry bund                                                                                                                                                                                                                                                                                                               |
| Length                                                                                              | 4.345m                                                                                                                                                                                                                                                                                                                                 |
| Breadth                                                                                             | 4.22m                                                                                                                                                                                                                                                                                                                                  |
| Height                                                                                              | 0.90m                                                                                                                                                                                                                                                                                                                                  |
| Containment Volume                                                                                  | 16.5m <sup>3</sup> (292% max primary)                                                                                                                                                                                                                                                                                                  |
| Other material stored                                                                               | None within bund                                                                                                                                                                                                                                                                                                                       |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | 425mm thick concrete base. No reinforcement detected by cover meter, but no joints or surface cracks visible. Cracks could be hidden by vinyl ester coating to base. Walls of single skin 6" concrete block masonry. No reinforcement, pillars or other restraints to walls. Two walls extend to form second bund compartment adjacent |
| Linings/ Coatings                                                                                   | Internal base and walls painted with vinyl ester coating. Areas of coating delamination on the base. See drawing for details. Date of application not known.                                                                                                                                                                           |
| Inventory compatible with form of construction                                                      | The inventory has the potential to corrode the concrete base and walls. The coating provides a degree of protection to the concrete, however the delaminated areas are susceptible to corrosion.                                                                                                                                       |
| Condition, cracks                                                                                   | 3 No vertical thermal/shrinkage cracks in walls as noted on plan. ( <b>See photos 4.9.2, 3 and 4 in Appendix I</b> ) Crack visible on external base to wall joint in areas above ground. 75mm mortar fillet applied to internal wall to base joint.                                                                                    |
| Was the facility constructed to conform to a particular containment class                           | No construction records available.                                                                                                                                                                                                                                                                                                     |

|                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Penetrations through bund                                                    | 1No. 75mm stainless steel pipe cast into base drains bund to tertiary system. Flow controlled by padlocked ball valve.                                                                                                                                                                                                                                                                                                                                             |
| Joints - Spacing, form, condition                                            | None                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Leak detection systems                                                       | Checks for leakage form part of the site operatives' weekly inspections.                                                                                                                                                                                                                                                                                                                                                                                           |
| Means of emptying rainwater/spills                                           | Gravity drain to industrial effluent sewer controlled by padlocked ball valve. Inspection and release of rainwater undertaken weekly.                                                                                                                                                                                                                                                                                                                              |
| In service performance (ability to withstand applied loads/fire resistance). | CIRIA C736 states that ' <i>Unreinforced masonry should not be used for bund construction because of its susceptibility to thermal and shrinkage cracking and vulnerability to impact damage.</i> ' In this instance, thermal/shrinkage cracking is evident and provides a potential leakage pathway. Structurally, taking into consideration the possible effects of surge as indicated in CIRIA C736, the walls would fail by overturning under service loading. |

**Table 4.9.2: Details of Acetic Acid Secondary Containment**

### Tertiary

There is a channel drain adjacent to the bund which is connected to the site's industrial effluent sewer system. The channel drain is used for draining rainwater and any spillages from the bund area. The channel drain also provides tertiary containment which would likely contain minor spillages which could arise during the primary containment filling operation and subsequent rainfall events.

### Maintenance/inspections

Work Instruction No. MWI 031 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary tank is inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

There are no known procedures for formal checks of the concrete bund by a competent person.

### Defects and Potential Pathways to Sensitive Receptors

The structural stability and thermal/shrinkage cracks visible in the masonry bund walls provide potential pathways to the surrounding areas should there be an escape of inventory within the bund.

## **4.10 A21 Phosphoric Acid**

### Summary

The inventory is stored within an HDPE primary tank, which is sited on a concrete base within a concrete block masonry bund. There is a degree of tertiary containment outside the bund in the form of a nearby channel drain which drains to the industrial effluent sewer. See drawing J-5016-CIE-3001-A in **Appendix G** for further details.



**Figure 4.10.1: Photograph of A21 Phosphoric Acid Tank and Concrete Block Masonry Bund**

Primary Containment

|                                                |                                                                         |
|------------------------------------------------|-------------------------------------------------------------------------|
| Construction                                   | HDPE tank by Balmoral Tanks. See <b>Appendix H</b> for GA detail.       |
| Diameter                                       | 2.20m                                                                   |
| Height                                         | 2.95m                                                                   |
| Working Volume                                 | 8.75m <sup>3</sup>                                                      |
| Volume to Overflow                             | 9.57m <sup>3</sup>                                                      |
| Inventory level indication                     | Ultrasonic level indicator, with float switch operated high level alarm |
| Design Standards                               | Not known                                                               |
| Design Life                                    | 10 years                                                                |
| Expiry of Design Life                          | May 2018                                                                |
| Last Inspection                                | August 2010                                                             |
| Next Inspection Due                            | August 2020                                                             |
| Inventory compatible with form of construction | Yes                                                                     |
| Defects noted                                  | None                                                                    |

**Table 4.10.1: Details of A21 Phosphoric Acid Primary Containment**

Secondary containment

|                    |                                          |
|--------------------|------------------------------------------|
| Type               | Local block masonry bund                 |
| Length             | 5.508m                                   |
| Breadth            | 3.208m reducing to 2.908, 2.64m from end |
| Height             | 0.78m                                    |
| Containment Volume | 12.4m <sup>3</sup> (130 % max primary)   |

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other material stored                                                                               | None within bund                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | Minimum 450mm thick concrete base. Reinforcement detected by cover meter 120mm below surface. But size and spacing of bars could not be determined. Walls of single skin 6" concrete block masonry to half of bund and double skin 6" masonry to remaining half. No reinforcement, pillars or other restraints to walls.                                                                                                                                                                                                              |
| Linings/ Coatings                                                                                   | Internal base and walls painted with Vinyl Ester coating. Areas of coating delamination on the base. See drawing for details. Date of application not known.                                                                                                                                                                                                                                                                                                                                                                          |
| Inventory compatible with form of construction                                                      | The inventory has the potential to corrode the concrete base and walls. The coating provides a degree of protection to the concrete, however the delaminated areas are susceptible to corrosion.                                                                                                                                                                                                                                                                                                                                      |
| Condition, cracks                                                                                   | 3 No vertical thermal/shrinkage cracks in walls as noted on plan, 0.35mm to 1.30mm wide. ( <b>See photos 4.10.1,2 and3 in Appendix I</b> )                                                                                                                                                                                                                                                                                                                                                                                            |
| Was the facility constructed to conform to a particular containment class                           | No construction records available.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Penetrations through bund                                                                           | <ul style="list-style-type: none"> <li>- 1 No. 60mm stainless steel pipe penetrates wall. Pipe capped off either side of wall and appears to be well pointed.</li> <li>- 1 No 50mm stainless steel bund drain pipe penetrates base of wall. Drain controlled by padlocked ball valve. Void in mortar pointing externally and not finished flush with face internally.</li> <li>- 1 No 50mm main outlet pipe penetrates base of bund wall. Void in mortar pointing on external face, appears well pointed on internal face.</li> </ul> |
| Joints - Spacing, form, condition                                                                   | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Leak detection systems                                                                              | Checks for leakage form part of the site operatives' weekly duties. The bund drain pipework has the facility to check for liquid in the annulus, and to take a sample for testing to determine what the liquid is, if present.                                                                                                                                                                                                                                                                                                        |
| Means of emptying rainwater/spills                                                                  | Gravity drain to industrial effluent sewer controlled by padlocked ball valve. Inspection and release of rainwater undertaken weekly.                                                                                                                                                                                                                                                                                                                                                                                                 |
| In service performance (ability to withstand applied loads/fire resistance).                        | CIRIA C736 states that ' <i>Unreinforced masonry should not be used for bund construction because of its susceptibility to thermal and shrinkage cracking and vulnerability to impact damage.</i> ' In this instance, thermal/shrinkage cracking is evident and provides a potential leakage pathway. Structurally, taking into consideration the possible effects of surge as indicated in CIRIA C736, the walls would fail by overturning under service loading.                                                                    |

**Table 4.10.2: Details of A21 Phosphoric Acid Secondary Containment**Tertiary

There is a degree of tertiary containment outside the bund in the form of a nearby channel drain which drains to the industrial effluent sewer. The tank filling point is located above the channel drain.

Other than the channel drain, there is no other form of containment in the area which would prevent a spillage from flowing off the site. There are surface water gullies in the road outside of the entrance to the site which could potentially provide a direct pathway to the River Taff.

#### Maintenance/inspections

Work Instruction No. MWI 031 (see copy in **Appendix J**) provides an inspection and maintenance procedure for the storage facility. The procedure describes a weekly inspection to check for signs of inventory leakage, damage to or deterioration of the primary and secondary containment vessels and ancillary equipment, as well as any operational faults.

The HDPE primary tank is inspected annually by a competent person and detailed records taken of its condition and any defects discovered. A record of the last inspection is included in **Appendix K**.

There are no known procedures for formal checks of the concrete bund by a competent person.

#### Defects and Potential Pathways to Sensitive Receptors

The structural stability and thermal/shrinkage cracks visible in the masonry bund walls provide potential pathways to the surrounding areas should there be an escape of inventory within the bund.

The locations in which pipes penetrate the bund wall provide further potential for leakage from the bund.

### **4.11 Hydrated Lime**

#### Summary

The inventory is stored in a cast in situ concrete primary tank with cast in situ cover. The tank is located within one of the factory buildings which is provided with tertiary containment in the form of dwarf concrete block masonry walls around its internal perimeter, with channel drainage across doorways. There are also widespread large bore channel drains within the building, which drain to the industrial effluent sewer. The industrial effluent sewer drains to the PB Gelatins pump station, which transfers effluent to the PB Gelatins treatment plant. At the head of the treatment plant, the effluent is screened and discharged into a glass fused to steel balance tank. The balance tank is double skinned, with a capacity in the main tank of 831m<sup>3</sup> and an additional 223m<sup>3</sup> of capacity available in the annulus.

See drawing J-5016-CIE-3005-A in **Appendix G** for further details.



**Figure 4.11.1: Photograph of A18 Hydrated lime Primary Tank**

Primary Containment

|                                                |                                                                                            |
|------------------------------------------------|--------------------------------------------------------------------------------------------|
| Construction                                   | Cast insitu concrete tank                                                                  |
| Diameter                                       | 8.75m external, estimated 7.96m internal                                                   |
| Height                                         | 2.95m                                                                                      |
| Working Volume                                 | Estimated 147m <sup>3</sup>                                                                |
| Volume to Overflow                             | Estimated 166m <sup>3</sup>                                                                |
| Inventory level indication                     | Sight                                                                                      |
| Design Standards                               | Not known                                                                                  |
| Design Life                                    | Not known                                                                                  |
| Expiry of Design Life                          | Not known                                                                                  |
| Last Inspection                                | Not known                                                                                  |
| Next Inspection Due                            | Not known                                                                                  |
| Inventory compatible with form of construction | Yes                                                                                        |
| Penetrations through tank                      | - 100mm $\phi$ steel pipe outlet pipe penetrates the wall of the primary tank at its base. |
| Defects noted                                  | None noted.                                                                                |

**Table 4.11.1: Details of A21 Hydrated Lime Primary Containment**

### Secondary and Tertiary containment

|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type                                                                                                | Remote secondary containment utilising local tertiary containment catchment area and transfer system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Description                                                                                         | Minimum 215mm high concrete block masonry wall (higher insitu concrete in areas) constructed around internal perimeter of factory building with the exception of external doors. External doors have channel drainage installed across gap between blockwork walls. Extensive network of large scale channel drainage installed within the building - see drawing J-5016-CIE-3005-A for details. Surface channel drainage capacity > 54m <sup>3</sup> in and around the building. All surface channels drain to the 300mm diameter industrial effluent sewer which drains to PB Gelatins pump station. (drainage and pump station not surveyed during baseline survey). Under normal operation the pump station transfers effluent to the PB Gelatins DAF treatment plant at up to 140m <sup>3</sup> /hour. The treatment plant has an upfront 831m <sup>3</sup> glass fused to steel buffer tank with an additional 223m <sup>3</sup> secondary containment capacity provided by a secondary tank skin. The treatment plant neutralises and floats out solids at 104m <sup>3</sup> /hour. After primary treatment, the effluent is discharged to the Dwr Cymru foul water sewer and full treatment works. |
| Containment Volume                                                                                  | Volume in local channel drainage system 54m <sup>3</sup><br>Volume in pump station estimated 51.3m <sup>3</sup> (based upon 3m estimated depth)<br>Volume of buffer tank 831m <sup>3</sup><br>Volume available in annulus of buffer tank 223m <sup>3</sup> (134% of hydrated lime tank volume)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Drainage conveyance capacity                                                                        | Gradient of 300mm $\phi$ pipe not known. Assuming a 1 in 200 fall, the discharge capacity would be in the region of 75 litres/second.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Pump transfer capacity                                                                              | There are two pumps installed at the pump station:<br>The 'Borger pump' runs at up to 150m <sup>3</sup> /hr (42 l/s)<br>The 'Groman Rupp' runs at up to 200m <sup>3</sup> /hr (55 l/s)<br>Combined maximum capacity 350m <sup>3</sup> /hr (97 l/s)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Pump Configuration                                                                                  | Duty Assist                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Other material stored                                                                               | Various gelatine production tanks within the factory building.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Materials description, design standards, year of construction, details of reinforcement, cover etc. | <ul style="list-style-type: none"> <li>- The floor of the factory building is thought to be constructed of reinforced concrete.</li> <li>- The factory building has a single course of concrete block masonry (215mm high) around the majority of its perimeter. In the remaining areas, the concrete production tanks (or walls of historic redundant tanks) are constructed up to the perimeter of the building, and the dwarf walls abut these.</li> <li>- The channel drainage within the building is formed from concrete with a clay drainage channel in the base. The channel is covered with galvanised steel open mesh flooring.</li> <li>- The sewer downstream of the channel drainage is thought to be of clay construction. Downstream of the channel drainage there is approximately 21m of 300mm<math>\phi</math> sewer, then approximately 81m of 450mm<math>\phi</math> sewer before the pump station. See the drainage plan in <b>Appendix D</b> for details.</li> <li>- The pump station is of reinforced concrete construction with a suspended steelwork platform which supports the pumps and ancillary equipment. See drawing J-3405-BW-3111C in</li> </ul>                         |

|                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                              | <b>Appendix H</b> for GA of pump station.<br>- The balance tank upstream of the treatment plant has a reinforced concrete base designed and constructed in accordance with BS 8007, with two Trifusion glass fused to steel tank walls designed and constructed in accordance with BS EN ISO 28765:2011. The facility was constructed in 2011.                                                                                                                                                                                                                                            |
| Linings/ Coatings                                                            | None.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Inventory compatible with form of construction                               | Yes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Condition, cracks                                                            | Factory floor, walls and surface drains appear in reasonable condition.<br>Integrity of drainage system has not been verified.<br>Integrity of pump station not verified.<br>Externally the balance tank appears to be in good condition.<br>The integrity of the inside of the tank has not been verified.                                                                                                                                                                                                                                                                               |
| Was the facility constructed to conform to a particular containment class    | Not known.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Leak detection systems                                                       | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Means of emptying rainwater/spills from secondary containment annulus        | Balance tank - Gravity discharge pipe cast into the concrete base controlled by padlocked ball valve, discharging to the industrial effluent sewer.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| In service performance (ability to withstand applied loads/fire resistance). | - The industrial effluent drainage, pump station and buffer tank are in service daily. The pump station and treatment plant have SCADA remote monitoring facilities, which mean that any issues with their performance are picked up quickly.<br>- The annulus to the buffer tank is designed to the same liquid retaining standards as the main tank.<br>- Should there be a fire in the area of the primary hydrated lime storage tank, this should not affect the operation of the gravity drainage system, the pump station or buffer tank as these are all remote from the building. |

**Table 4.11.2: Details of A18 Hydrated Lime Tertiary and Secondary Containment**Tertiary

Described above

Maintenance/inspections

There are currently no formal procedures in place for the maintenance and inspection of the lime tank, its catchment area, transfer system or the treatment plant balance tank.

## 5.0 GAP ANALYSIS

The headings underlined below broadly describe the criteria by which each of the facilities have been assessed for compliance or otherwise with the requirements of CIRIA 736. The requirements for Class 2 and 3 facilities have been described under each of the headings below, with assessment of compliance for each inventory assessed in sections 5.1-5.11.

Regardless of the requirements of CIRIA 736, the primary purpose of the gap analysis is to identify any defects or issues with the secondary containment provided that could render it ineffective. Wherever these have been identified, details and recommendations for improvement have been provided.

### Suitability of Form of Construction and Compatibility with In-Service Requirements

At PB Gelatins, secondary containment is currently provided in three principal ways.

1. HDPE primary tank with HDPE collar bund
2. HDPE primary tank within concrete block masonry bund
3. Concrete primary tank within tertiary containment and transfer system to remote secondary containment

The following extracts from the guidance are applicable in the assessment of these types of construction:

Section 6.1 states *'It should be noted that while collar bunds may appear similar to double skinned tanks, they differ in that the 'bund' element is structurally independent from the primary containment. This is not the case for double skinned tanks and for this reason the second skin of the double skinned tank is not considered to provide secondary containment.'*

Section 7.3.1 states *'Unreinforced masonry should not be used for bund construction because of its susceptibility to thermal and shrinkage cracking and vulnerability to impact damage'.*

The guidance highlights that fire is the most common cause of serious pollution incidents, particularly on sites where flammable inventory is stored.

The chemical corrosion resistance of the materials used to form the containment is also an important consideration.

### Transfer Systems

Section 10 on Transfer Systems states the following requirements:

- It should be leak proof
- It should be sufficiently strong and durable to perform adequately for the duration of its design life with only routine maintenance
- It should be resistant to fire
- It should be resistant to attack from the materials that may be released from the primary containment
- It should be of sufficient capacity to cope with the worst flow scenario without overflowing
- Where the transfer system forms part of a road or access route, the design should not compromise emergency vehicular or pedestrian access and means of escape.

- Incompatible materials should not come into contact with each other
- Surface and foul water systems should be entirely separate from the catchment area

#### Capacity of Secondary Containment

Section 4.2.1 states that it is general accepted industry practice that *'Where a single bulk liquid tank is bunded, the recommended minimum bund capacity is 110 per cent of the capacity of the primary tank'.*

The 10 per cent margin has been interpreted by industry and regulators to cover a range of factors including:

- Prevention of overtopping of the bund in the event of a surge of liquid caused by the catastrophic failure of the primary tank
- Prevention of overtopping, which may be caused by wind-induced wave action during the time that the bund is full following failure of a primary tank
- An allowance for firefighting agents, including a foam blanket on the surface or firefighting water
- Protection against overfilling
- An allowance for rain that might collect in the bund and reduce its net capacity, or for rain that might fall in coincident with, or immediately following, the failure of the primary containment

On more complex systems, it may be necessary to quantify each of these components, rather than relying upon the arbitrary 10% industry accepted allowance.

#### Clearance between Primary Tank Wall and Bund Wall

Section 6.4 states that for Class 2 and 3 installations it is *'recommended'* that *'not less than 750mm clearance between primary tank and bund walls for maintenance access is provided'.*

For Class 2 installation it is *'desirable'* and for class 3 installations *'recommended'* that *'no structure within the bund to be closer than its own height to the bund wall'.*

#### Jetting Failure

Section 6.3.2 states that for Class 2 and 3 installations it is *'recommended'* to *'take account of possible jetting failure'.*

#### Leak Detection

Section 6.3.2 of CIRIA 736 states:

*'The installation of leak detection systems (see Section 8.12) is one of the additional measures that distinguish a class 3 containment from class 1 and class 2 and their installation should therefore be subject to a risk assessment. However, they should be installed in circumstances where there is insufficient clearance between the base of a primary containment and the bund floor to enable visible inspection for class 3 containment systems.'*

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc.

Section 6.4 states that for Class 2 and 3 installations it is *'recommended'* that *'Penetrations of the bund wall to be avoided'* and that *'Pumps\*, valves, couplings, delivery nozzles and other*

*items associated with the operation of a primary container to be located inside the bund or within a separately bunded area.'*

Section 7.2.5 states '*Where penetrations through bund walls cannot be reasonably avoided, careful detailing is required to ensure they do not provide a leakage pathway during an incident*'.

#### Rainwater Draw-off

Section 5.4.4 states:

*The means of emptying accumulated rainwater from within the bund should be established. Under no circumstances should an uncontrolled gravity discharge of rainwater from a containment bund be permitted, even where routed via an interceptor, unless it is draining to a further (tertiary) stage of containment.*

*Where this is a gravity connection, even when controlled by a penstock or valve, for a class 2 facility, this should be taken out if practicable. However, for a class 3 facility, these arrangements should be replaced with either a portable or fixed installation pump.*

*Rainwater that has accumulated within a containment bund may be contaminated by spillages and leakage from the primary containment. Rainwater should be tested before discharge to any drain or sewer, unless it is to be routed to treatment works specifically designed to accommodate this effluent.*

*Procedures should be in place to remove any contaminated rainwater to a WWTW.*

## **5.1 A18 Phosphoric Acid**

### Suitability of Form of Construction and Compatibility with In-Service Requirements

During the baseline survey, the base area of the primary vessel was inspected by opening the access manway. This showed that the primary tank has a separate base and walls to the secondary vessel. These appeared entirely structurally independent of one another, other than a weld between the two bases which prevents independent movement. This type of construction therefore appears appropriate.

The primary and secondary tanks are compatible with the inventory in terms of their material corrosion resistance.

The HDPE construction of the primary and secondary containment tanks leave them both susceptible to damage by fire. Fire is highly unlikely at the site due to the lack of flammable substances or materials stored at the factory, however there is a perceivable risk due to arson, or a fire outside of the boundary of the site. Should a fire cause catastrophic failure of the vessels, then the tertiary containment provided around the vessels would likely contain part of the spillage, however, full containment would be unlikely.

Recommendations:

- PB Gelatins and the EPR regulator should agree whether the risk of tank failure posed by fire on the site is as low as is reasonably practicable, or if further mitigation is required on site to manage this.
- The tertiary containment provided in this area could be improved by extending the site boundary wall up to the factory building. In addition, some of the channel drainage covers are currently steel plates. Capacity would be increased if these were changed for open mesh flooring covers as present elsewhere.

### Capacity of Secondary Containment

The collar bund has been assessed as having a capacity of 115% of the primary tank maximum volume. This therefore exceeds the 110% requirement.

As the bund is fitted with a rain cover, rain and fire water are highly unlikely to enter the bund. There is therefore no need to consider these elements.

Should the bund be filled with the contents of the primary vessel, there would be 270mm freeboard to the top of the secondary vessel. This is greater than the recommended 250mm for secondary containment tanks.

The capacity of secondary containment provided is therefore entirely appropriate.

### Clearance Between Primary Tank Wall and Bund Wall

The facility has 650mm between the primary and secondary tank walls. Although this is less than the recommended and desirable minimums, it is not considered practical to change this at present due to this being a fundamental design change. It is recommended therefore that PB Gelatins should consider this recommendation when it comes to replacing the installation at the end of its service life.

### Jetting Failure

The collar bund extends approximately half way up the primary tank, which leaves the top half of the primary tank exposed to potential jetting failure. As there is tertiary containment around the tank on site, a jetting failure over the site boundary is the primary concern in this instance.

The following formula is provided for calculating the minimum distance (I) from the tank wall to the bund wall that should be observed for preventing jetting failure. In this instance, the sites perimeter wall shall be considered as the bund wall.

$$I_{\min} = H - h$$

where:

$$h = \text{height of wall} = 0.90\text{m}$$

$$H = \text{Height of top liquid level} = 4.36\text{m}$$

$$I_{\min} = 4.36 - 0.9$$

$$I = 3.45\text{m}$$

Although this distance appears a little conservative, as the tank wall is less than 1m from the site boundary, it shows that jetting failure could result in a loss of inventory off site, should a hole develop in this side of the tank, above the bund rainwater cover.

It is considered highly unlikely that the tank would develop a hole in its top half which would lead to such an escape. The only reasonably foreseeable mechanism by which a hole could develop is from deterioration of the tank, particularly on its welded sections.

Due to the layout of existing concrete slabs, channel drainage and the proximity of the building on site, it is not considered feasible to move the vessels away from the site boundary.

#### Recommendations:

- Ensure that the primary and secondary tanks are inspected annually by a competent person to check for sign of damage or deterioration. Where any defects are detected, additional caution should be exercised in this area with regard to decisions on the repair or the replacement of the tank.
- It may be prudent to consider additional forms of protection to prevent jetting failure from the top half of the tank. This could take the form of cladding to the top half of the tank. However, the benefit of such a shield should be weighed up against the fact that this would likely prevent visual inspections of the tank wall, and so the ability to detect deterioration.

#### Leak Detection

The bund drain has the facility to test for and take samples of any liquid collected in the bund annulus. There is a procedure in place to check for leakage on a weekly basis. This therefore exceeds the recommendations of the guidance.

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

The 63mm $\phi$  main outlet and 50mm $\phi$  tank drain point are formed through both the primary and secondary containment tanks. The penetrations are formed flanged penetrations which are the best available technique for this type of construction. There are also isolation valves present in the annulus, which can be operated from a hatch in the rain cover.

The pipework, valves and forward feed pump are installed on the slab outside of the main bund. These provide an area of weakness in the containment facilities, as any damage to these could result in the loss of inventory from the primary and secondary tanks. The guidance states that penetrations through the bund wall, and pipework, valves and pumps outside the secondary containment should be avoided. In this instance, due to the nature of the containment facilities, it is not considered possible to reconfigure the system.

Access to this area of the site is restricted to pedestrian access, which would only be used by those who have an interest in the storage facilities. The likelihood of impact damage to the pipework in this area is therefore very unlikely.

Deterioration of the pipework, valves or pump connected to the primary tank is therefore the only foreseeable mechanism by which a release from this area could occur. In addition weekly inspections procedure MWI 032 is in place on the site and includes '*Carry out visual inspection of ancillary equipment and pipe work for leaks*'.

Should leakage occur, there is tertiary containment in this area which would contain any minor leakages from the pipework, but could be overwhelmed if the pipework were to fail across its full bore. The capacity of the tertiary containment could be improved by implementing the recommendations listed below.

#### Recommendations:

- Review and update maintenance and inspection procedures to ensure they are reflective of the risks present on site. Consider including inspections of the tertiary containment systems. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.
- The tertiary containment provided in this area could be improved by extending the site boundary wall up to the factory building. In addition, some of the channel drainage covers are currently steel plates. Capacity would be increased if these were changed for open mesh flooring covers as present elsewhere.

### Rainwater Draw-off

Although rainwater is excluded from the bund, there is the facility to check for leakage into the bund annulus by means of a gravity discharge to the industrial effluent system. As this is a gravity system the guidance states that this should be taken out of service and replaced with a pumped system where practicable.

Recommendation:

- Take the gravity bund drain discharge out of service and replace with a pumped system. Due to the prevalence of gravity systems on site, it may be considered that this is only practicable when the integrally bunded storage facilities are being replaced at the end of their service lives

## **5.2 A18 Sulphuric Acid**

### Suitability of Form of Construction and Compatibility with In-Service Requirements

The as constructed record drawing contained in **Appendix H** shows that the primary tank has a separate base and walls to the secondary vessel. These are entirely structurally independent of one another, other than a weld between the two bases which prevents independent movement. This type of construction therefore appears appropriate in this instance.

The primary and secondary tanks are compatible with the inventory in terms of their material corrosion resistance.

The HDPE construction of the primary and secondary containment tanks leave them both susceptible to damage by fire. Fire is highly unlikely at the site due to the lack of flammable substances or materials stored at the factory, however there is a perceivable risk due to arson, or a fire outside of the boundary of the site. Should a fire cause catastrophic failure of the vessels, then the tertiary containment provided around the vessels would likely contain part of the spillage, however, full containment would be unlikely.

Recommendations:

- PB Gelatins and the EPR regulator should agree whether the risk of tank failure posed by fire on the site is as low as is reasonably practicable, or if further mitigation is required on site to manage this.
- Although not a requirement, the tertiary containment provided in this area could be improved by extending the site boundary wall up to the factory building. In addition, some of the channel drainage covers are currently steel plates. Capacity would be increased if these were changed for open mesh flooring covers as present elsewhere.

### Capacity of Secondary Containment

The collar bund has been assessed as having a capacity of 110% of the primary tank maximum volume. This is therefore in line with the guidance recommendation.

As the bund is fitted with a rain cover, rain and fire water are highly unlikely to enter the bund. There is therefore no need to consider these elements.

Should the bund be filled with the contents of the primary vessel, there would be 300mm freeboard to the top of the secondary vessel. This is greater than the recommended 250mm for secondary containment tanks.

The capacity of secondary containment provided is therefore entirely appropriate.

### Clearance Between Primary Tank Wall and Bund Wall

The facility has approximately 200mm between the primary and secondary tank walls. Although this is less than the recommended and desirable minimums, it is not considered practical to change this at present due to this being a fundamental design change. It is recommended therefore that PB Gelatins should consider this recommendation when it comes to replacing the installation at the end of its service life.

### Jetting Failure

The collar bund and its rain cover extend the majority of the way up the primary tank, but there is a region approximately 600mm high in which a jetting failure could arise.

The following formula is provided for calculating the minimum distance (I) from the tank wall to the bund wall that should be observed for preventing jetting failure. In this instance, the sites perimeter wall shall be considered as the bund wall.

$$I_{\min} = H - h$$

where:

$h$  = height of wall = 0.90m

$H$  = Height of top liquid level = 4.275m

$$I = 4.275 - 0.9$$

$$I_{\min} = 3.38\text{m}$$

Although this distance appears a little conservative, as the tank wall is less than 1m from the site boundary, it shows that jetting failure could result in a loss of inventory off site, should a hole develop in this side of the tank, above the bund rainwater cover.

It is considered highly unlikely that the tank would develop a hole in its top half which would lead to such an escape. The only reasonably foreseeable mechanism by which a hole could develop is from deterioration of the tank, particularly on its welded sections.

Due to the layout of existing concrete slabs, channel drainage and the proximity of the building on site, it is not considered feasible to move the vessels away from the site boundary.

### Recommendations:

- Ensure that the primary and secondary tanks are inspected annually by a competent person to check for sign of damage or deterioration. Where any defects are detected, additional caution should be exercised in this area with regard to decisions on the repair or the replacement of the tank.
- It may be prudent to consider additional forms of protection to prevent jetting failure from the top half of the tank. This could take the form of cladding to the top half of the tank. However, the benefit of such a shield should be weighed up against the fact that this would likely prevent visual inspections of the tank wall, and so the ability to detect deterioration.

### Leak Detection

The bund drain has the facility to test for and take samples of any liquid collected in the bund annulus. There is a procedure in place to check for leakage on a weekly basis. This therefore exceeds the recommendations of the guidance.

### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

The 50mm $\phi$  main outlet from the tank is formed through both the primary and secondary containment tanks. The penetrations are formed flanged penetrations which are the best available technique for this type of construction.

The pipework, valves and forward feed pump are installed on the slab outside of the main bund. These provide an area of weakness in the containment facilities, as any damage to these could result in the loss of inventory from the primary and secondary tanks. The guidance states that penetrations through the bund wall, and pipework, valves and pumps outside the secondary containment should be avoided. In this instance, due to the nature of the containment facilities, it is not considered possible to reconfigure the system.

Access to this area of the site is restricted to pedestrian access, which would only be used by those who have an interest in the storage facilities. The likelihood of impact damage to the pipework in this area is therefore very unlikely.

Deterioration of the pipework, valves or pump connected to the primary tank is therefore the only foreseeable mechanism by which a release from this area could occur.

The weekly inspections procedure MWI 032 in place on the site includes '*Carry out visual inspection of ancillary equipment and pipe work for leaks*'.

There is tertiary containment in this area which would contain any minor leakages from the pipework, but could be overwhelmed if the pipework were to fail across its full bore. The capacity of the tertiary containment could be improved by implementing the recommendations listed below.

#### Recommendations:

- Review and update maintenance and inspection procedures to ensure they are reflective of the risks present on site. Consider including inspections of the tertiary containment systems. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.
- The tertiary containment provided in this area could be improved by extending the site boundary wall up to the factory building. In addition, some of the channel drainage covers are currently steel plates. Capacity would be increased if these were changed for open mesh flooring covers as present elsewhere.

### Rainwater Draw-off

Although rainwater is excluded from the bund, there is the facility to check for leakage into the bund annulus by means of a gravity discharge to the industrial effluent system. As this is a gravity system the guidance states that this should be taken out of service and replaced with a pumped system where practicable.

#### Recommendation:

- Take the gravity bund drain discharge out of service and replace with a pumped system. Due to the prevalence of gravity systems on site, it may be considered that this is only practicable when the integrally banded storage facilities are being replaced at the end of their service lives

### 5.3 Water Works Truefloc TAC40

#### Suitability of Form of Construction and Compatibility with In-Service Requirements

The concrete block masonry walls of the bund are not considered an appropriate form of secondary containment by the guidance. It is recommended therefore that a compliant alternative form of secondary containment is installed at the site. Demolishing the masonry walls and reconstructing these in properly designed reinforced concrete is likely to represent the best solution in this instance.

Due to the low pH of the inventory, should the reconfigured secondary containment system be formed from concrete, then a protective coating shall be required to protect against corrosion.

Recommendations:

- Provide an alternative form of secondary containment to the inventory which does not rely upon concrete block masonry walls. Take the opportunity to remove undesirable elements of the existing construction such as pipe penetrations through secondary containment walls, and the gravity bund drainage system.

#### Capacity of Secondary Containment

The existing walls enclose a space which has 161% of the primary tank volume.

Recommendation:

Any replacement walls should provide a minimum storage volume of 13.3m<sup>3</sup> (110% primary tank volume). In addition, a freeboard of 250mm should be provided above the maximum theoretical liquid level to take account of the possible effects of surge.

#### Clearance Between Primary Tank Wall and Bund Wall

Recommendation:

The idealised facility would provide a clear distance, the height of the tank, between the tank and bund walls.

#### Jetting Failure

Jetting failure should be considered if practicable in the design of the replacement secondary containment facilities. Based upon the existing wall height it is recommended that a minimum of 1.69m be provided between the tank and the adjacent bund walls.

$$l_{\min} = H - h$$

where:

$$h = \text{height of wall} = 1.165\text{m}$$

$$H = \text{Height of top liquid level} = 2.85\text{m}$$

$$l = 2.85 - 1.165$$

$$l_{\min} = 1.69\text{m}$$

Recommendations:

- Take account of possible jetting failure in the design of the replacement secondary containment facilities if reasonably practicable.

#### Leak Detection

##### Recommendation:

A leak detection system is not a requirement for a class 2 facility, however, if this can be provided this would be desirable.

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

##### Recommendation:

Wherever possible penetrations through the secondary containment facility should be avoided, and all pumps, pipes and valves which are under gravitational head from the tank should be contained within the secondary containment.

#### Rainwater Draw-off

##### Recommendation:

- The replacement secondary containment facility should be installed with a pumped rainwater/leakage removal facility draining to the industrial effluent system if it is reasonably practicable to do so.

## **5.4 A21 Caustic**

#### Suitability of Form of Construction and Compatibility with In-Service Requirements

Although details of the secondary containment structure have not been verified, it is thought that it was designed to water retaining standards as applicable at the time of construction thought to be 1920-30.

The structure was in service as a water treatment works over a number of decades before being converted to its current use as a secondary containment bund. During the baseline survey, no signs of structural fatigue were identified. A number of vertical cracks were found, however the form of these was consistent with long term thermal/shrinkage cracks which affect the serviceability of a structure, but not its structure. The widest crack measured was found to be approximately 0.35mm, which is marginally wider than the acceptable limits in current design guidance (0.20mm max).

Although the specific gravity of the inventory is slightly higher than that of water, the theoretical maximum depth of liquid in the tank is far lower than the previous water level. In-service loads would therefore be lower than those of the historic use.

Considering the above, the observed performance of the tank is deemed sufficient to provide confidence in its structural integrity. Although some of the cracks identified are outside of current design guidance limits, as there is tertiary containment to all side of the compartment, any leakage from these would be adequately contained.

The primary tank and the secondary containment compartment are both compatible with the inventory in terms of their material corrosion resistance. No coating is required to the concrete in this instance.

The likelihood of fire in this area of the site is considered to be extremely low. Notwithstanding this, the construction of the secondary containment system is likely to be relatively fire resistant.

Considering the above, the form of construction is considered acceptable.

One defect noted on this installation was the absence of holding down bolts at the base of the primary tank. Considering the height of the tank in relation to its diameter, and its potentially exposed location, it is recommended that holding down bolts are installed.

Recommendation:

- Install holding down bolts at base of primary tank

#### Capacity of Secondary Containment

The secondary containment tank has been assessed as having a capacity >260% of the primary tank maximum volume, and 220% of the combined volume of the two primary tanks served by the bund. This is greater than the minimum capacity required.

As the containment capacity provided far outweighs what is required, a quantitative assessment of likely rainwater and firefighting water volumes and the possible effects of surge is not required.

The capacity of secondary containment provided is therefore entirely appropriate.

#### Clearance between Primary Tank Wall and Bund Wall

There is a minimum of approximately 500mm clear access around the primary vessels within the bund on top of the suspended floor. Access to the area below the tanks is provided by means of an access manway with ladder through the suspended floor. Although, this is less than the 750mm minimum recommendation, it is deemed adequate for this existing facility.

#### Jetting Failure

The primary tank is 8m high and is elevated within the bund so that its walls only extend approximately 1m from the tank base.

The following formula is provided for calculating the minimum distance (I) from the tank wall to the bund wall that should be observed for preventing jetting failure.

$$I_{\min} = H-h$$

where:

h = height of wall = 1.0m

H = Height of top liquid level = 8.0m

I = 8.0-1.0

$I_{\min} = 7.0\text{m}$

The minimum distance between the tank wall and the edge of the tertiary containment trough is approximately 3m. As such jetting failure could in theory result in a loss of inventory from the containment facilities.

It is considered highly unlikely that the tank would develop a hole in its wall which would lead to such an escape. The only reasonably foreseeable mechanism by which a hole could develop is from deterioration of the tank, particularly on its welded sections.

Due to the form of the containment facilities it is not feasible to move the vessel away from the bund wall.

#### Recommendations:

- Ensure that the primary tank is inspected annually by a competent person to check for sign of damage or deterioration. Where any defects are detected, additional caution should be exercised with regard to decisions on the repair or the replacement of the tank.
- It may be prudent to consider additional forms of protection to prevent jetting failure. This could take the form of cladding around the tank. However, the benefit of such a shield should be weighed up against the fact that this would likely prevent visual inspections of the tank wall, and so the ability to detect deterioration.

#### Leak Detection

The bund drain has the facility to test for and take samples of any liquid collected in the bund. There is a procedure in place to check for leakage on a weekly basis. This therefore exceeds the recommendations of the guidance.

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

The main outlet pipe and its associated valves and forward feed pump are located within the secondary containment facilities.

There are two redundant pipe penetrations through the wall of the secondary containment compartment at low level. These have been sealed externally with steel blanking plates. Adjacent to these there is a single bund drain pipe, which is controlled by a padlocked ball valve. Adjacent to this, the primary tank fill point penetrates the wall. All of these penetrations appear to have been cast into the structure originally, and modified to provide their current function. The form of sealing the pipes into the wall has not been verified, however, their service performance provides anecdotal evidence of their adequacy.

Trying to remove these penetrations would more likely reduced the water tightness of the structure overall. In addition, the concrete trough below the penetrations provides tertiary containment, which lowers the risk of an escape of inventory to the environment.

#### Recommendations:

- Review and update maintenance and inspection procedures to ensure they are reflective of the risks present on site. Consider including inspections of the tertiary containment systems. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.

#### Rainwater Draw-off

Rainwater is drawn from the secondary containment compartment by a gravity discharge pipe, controlled by a padlocked valve. The guidance states that this should be taken out of service and replaced with a pumped system where practicable.

#### Recommendation:

- Take the gravity bund drain discharge out of service and replace with a pumped system if reasonably practicable to do so.

## **5.5 A21 Caustic Day Tank**

#### Suitability of Form of Construction and Compatibility with In-Service Requirements

See section 5.4

### Capacity of Secondary Containment

See section 5.4

### Clearance between Primary Tank Wall and Bund Wall

There is a minimum of approximately 750mm clear access around the primary vessels within the bund on top of the suspended floor. Access to the area below the tanks is provided by means of an access manway with ladder through the suspended floor. This is in line with the 750mm minimum recommendation.

### Jetting Failure

The primary tank is 5.4m high and is elevated within the bund so that its walls only extend approximately 1m from the tank base.

The following formula is provided for calculating the minimum distance (I) from the tank wall to the bund wall that should be observed for preventing jetting failure.

$$I_{\min} = H - h$$

where:

h = height of wall = 1.0m

H = Height of top liquid level = 8.0m

$$I = 5.4 - 1.0$$

$$I_{\min} = 4.4\text{m}$$

The minimum distance between the tank wall and the edge of the tertiary containment trough is approximately 4.8m. As such any potential jetting failure should be contained by the secondary or tertiary containment facilities.

### Leak Detection

See section 5.4

### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

See section 5.4

### Rainwater Draw-off

See section 5.4

## **5.6 A21 Deioniser Effluent (HCl)**

### Suitability of Form of Construction and Compatibility with In-Service Requirements

During the baseline survey, the base area of the primary vessel was inspected by opening the access manway. This showed that the primary tank has a separate base and walls to the secondary vessel. These appeared entirely structurally independent of one another, other than a weld between the two bases which prevents independent movement. This type of construction therefore appears appropriate.

The primary and secondary tanks are compatible with the inventory in terms of their material corrosion resistance.

The HDPE construction of the primary and secondary containment tanks leave them both susceptible to damage by fire. Fire is highly unlikely at the site due to the lack of flammable substances or materials stored at the factory, however there is a perceivable risk due to arson. Should a fire cause catastrophic failure of the vessels, then the tertiary containment provided around the vessels would likely contain part of the spillage, however, full containment would unlikely be achieved.

During the baseline survey, it was noted that the high level inlet pipe had become detached from a number of the brackets which support it. This increases the likelihood of the pipe becoming damaged, and so a release of inventory in the area. This defect should be repaired as a matter of priority.

#### Recommendations:

- PB Gelatins and the EPR regulator should agree whether the risk of tank failure posed by fire on the site is as low as is reasonably practicable, or if further mitigation is required on site to manage this.
- Consider increasing the robustness of the tertiary containment in the area of the storage vessel. This could be achieved with the installation of a channel drain constructed across the gap between the 'A21 building' and the 'blender building', as shown on drawing J-5016-CIE-3001-A in **Appendix G**.
- Repair the defective inlet pipework at high level

#### Capacity of Secondary Containment

The collar bund has been assessed as having a capacity of 101% of the primary tank maximum volume or 112% of the primary tank working volume. Section 4.3.2 of the guidance states:

*'The volume of inventory should be taken as the capacity of the primary containment.'*

*For above ground storage tanks, the brimful capacity of the primary containment should normally be adopted as advised in the environmental permit. However, where the tank is fitted with a physical overflow, the capacity at which the tanks would overflow may be taken.*

*In some cases, and subject to a risk assessment, it may be appropriate to use the nominal capacity, or TRC. This should be discussed and agreed with regulators at an early stage in the design process.'*

As the bund is fitted with a rain cover, rain and fire-fighting water are highly unlikely to enter the bund. This therefore reduces the requirement for the full 10% additional capacity.

As the collar bund is relatively close to the primary tank, any failure of the primary vessel would be very unlikely to cause a great deal of surge up the walls of the secondary vessel. In addition, there is negligible risk of wind-induced wave action within the bund.

As the overflow pipe from the primary tank is routed directly to the industrial effluent sewer, any overflow from the primary tank will not reduce the secondary containment tank capacity.

Considering the above, the only way in which the bund is likely to be filled with liquid is from a leakage or failure of the primary vessel. As surges within the secondary vessel are unlikely, it is considered that the capacity of the secondary containment vessel is acceptable, although is less than the generally accepted industry standard.

There is a degree of tertiary containment provided in the area that the tank is stored. The robustness of this containment could however be improved, which would further mitigate the risks associated with the low capacity of the secondary containment tank.

**Recommendations:**

- PB Gelatins should seek agreement from the EPR regulator that the capacity of the secondary containment tank is sufficient.
- Consider increasing the robustness of the tertiary containment in the area of the storage vessel. This could be achieved with the installation of a channel drain constructed across the gap between the 'A21 building' and the 'blender building', as shown on drawing J-5016-CIE-3001-A in **Appendix G**.

Clearance Between Primary Tank Wall and Bund Wall

The facility has approximately 550mm between the primary and secondary tank walls. Although this is less than the recommended and desirable minimums, it is not considered practical to change this at present due to this being a fundamental design change. It is recommended therefore that PB Gelatins should consider this recommendation when it comes to replacing the installation at the end of its service life.

Jetting Failure

The collar bund extends approximately half way up the primary tank, which leaves the top half of the primary tank exposed to potential jetting failure. As the tank is stored adjacent to one of the factory buildings, with concrete slab and yard areas to its remaining sides, any jetting failure would release effluent into the factory grounds.

There is a degree of tertiary containment provided in this area, however, there is a potential pathway from the tank to a soft landscaped area between the A21 Building and the Blender Building. It is recommended therefore that further tertiary containment is provided to close off this pathway.

**Recommendations:**

- Ensure that the primary and secondary tanks are inspected annually by a competent person to check for sign of damage or deterioration. Where any defects are detected, additional caution should be exercised in this area with regard to decisions on the repair or the replacement of the tank.
- Consider increasing the robustness of the tertiary containment in the area of the storage vessel. This could be achieved with the installation of a channel drain constructed across the gap between the 'A21 building' and the 'blender building', as shown on drawing J-5016-CIE-3001-A in **Appendix G**.

Leak Detection

The bund drain has the facility to test for and take samples of any liquid collected in the bund annulus. There is a procedure in place to check for leakage on a weekly basis. This therefore exceeds the recommendations of the guidance.

Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

The 90mm $\phi$  main outlet from the tank is formed through both the primary and secondary containment tanks. The penetrations are formed flanged penetrations which are the best available technique for this type of construction.

The pipework and valves are installed on the slab outside of the main bund. These provide an area of weakness in the containment facilities, as any damage to these could result in the loss of inventory from the primary and secondary tanks. The guidance states that penetrations through the bund wall, and pipework, valves and pumps outside the secondary containment should be avoided. In this instance, due to the nature of the containment facilities, it is not considered possible to reconfigure the system.

Access to this area of the site is fairly open to, but rarely used by pedestrians or vehicles. The likelihood of impact damage to the pipework in this area is therefore unlikely, but possible. In order to protect against this it is recommended that an appropriate barrier is installed in front of the pipework.

Deterioration of the pipework or valves over time is also a feasible mechanism by which a release from this area could occur. The weekly inspections procedure MWI 032 in place on the site includes *'Carry out visual inspection of ancillary equipment and pipe work for leaks'*. This should therefore ensure that any leakages are detected within a week.

There is also a degree of tertiary containment in this area which would likely contain any minor leakages from the pipework. However, it is recommended that the robustness of this containment is increased to reduce the likelihood of a release of inventory to the environment.

#### Recommendations:

- Install appropriate barriers to protect the main outlet pipework from possible impact damage.
- Review and update maintenance and inspection procedures to ensure they are reflective of the risks present on site. Consider including inspections of the tertiary containment systems. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.
- Consider increasing the robustness of the tertiary containment in the area of the storage vessel. This could be achieved with the installation of a channel drain constructed across the gap between the 'A21 building' and the 'blender building', as shown on drawing J-5016-CIE-3001-A in **Appendix G**.

#### Rainwater Draw-off

Although rainwater is excluded from the bund, there is the facility to check for leakage into the bund annulus by means of a gravity discharge to the industrial effluent system. As this is a gravity system the guidance states that this should be taken out of service and replaced with a pumped system where practicable.

#### Recommendation:

- Take the gravity bund drain discharge out of service and replace with a pumped system. Due to the prevalence of gravity systems on site, it may be considered that this is only practicable when the integrally banded storage facilities are being replaced at the end of their service lives

## 5.7 A21 Hydrochloric Acid

### Suitability of Form of Construction and Compatibility with In-Service Requirements

The as constructed record drawing contained in **Appendix H** shows that the primary tank has a separate base and walls to the secondary vessel. These are entirely structurally independent of one another, other than a weld between the two bases which prevents independent movement. This type of construction therefore appears appropriate in this instance.

The primary and secondary tanks are compatible with the inventory in terms of their material corrosion resistance.

The HDPE construction of the primary and secondary containment tanks leave them both susceptible to damage by fire. Fire is highly unlikely at the site due to the lack of flammable substances or materials stored at the factory, however there is a perceivable risk due to arson for example. Should a fire cause catastrophic failure of the vessels, then the tertiary containment provided around the vessels would likely contain part of the spillage, however, full containment would be unlikely.

During the baseline survey, it was noted that the above ground pipework from the tertiary containment drainage to the industrial effluent sewer was damaged/incomplete, leaving the drain to discharge into a hole in the ground. This defect should be repaired as a matter of priority.

#### Recommendations:

- PB Gelatins and the EPR regulator should agree whether the risk of tank failure posed by fire on the site is as low as is reasonably practicable, or if further mitigation is required on site to manage this.
- Repair the incomplete/damaged pipework detected during the baseline survey as a matter of priority.

#### Capacity of Secondary Containment

The collar bund has been assessed as having a capacity of 105% of the primary tank maximum volume or 114% of the primary tank working volume. Section 4.3.2 of the guidance states:

*'The volume of inventory should be taken as the capacity of the primary containment.'*

*For above ground storage tanks, the brimful capacity of the primary containment should normally be adopted as advised in the environmental permit. However, where the tank is fitted with a physical overflow, the capacity at which the tanks would overflow may be taken.*

*In some cases, and subject to a risk assessment, it may be appropriate to use the nominal capacity, or TRC. This should be discussed and agreed with regulators at an early stage in the design process.'*

As the bund is fitted with a rain cover, rain and fire-fighting water are highly unlikely to enter the bund. This therefore reduces the requirement for the full 10% additional capacity.

As the collar bund is relatively close to the primary tank, any failure of the primary vessel would be very unlikely to cause a great deal of surge up the walls of the secondary vessel. In addition, there is negligible risk of wind-induced wave action within the bund.

Due to the requirement to scrub the vapour from the tank, the overflow from the primary vessel is routed to the secondary containment tank via a lute bend.

Considering the above, the bund could only be filled via the overflow from the primary tank or due to leakage or failure of the primary vessel. As surges within the secondary vessel are unlikely, it is considered that the capacity of the secondary containment vessel is acceptable, although is less than the generally accepted industry standard.

There is a relatively robust tertiary containment system installed around the vessels, which further mitigates the risks associated with the reduced containment capacity of the secondary vessel.

#### Recommendations:

- PB Gelatins should seek agreement from the EPR regulator that the capacity of the secondary containment tank is sufficient.

#### Clearance Between Primary Tank Wall and Bund Wall

The facility has approximately 50mm between the primary and secondary tank walls. This is less than the recommended and desirable minimums, it is not considered practical to change this at present due to this being a fundamental design change. It is recommended therefore that PB Gelatins should consider this recommendation when it comes to replacing the installation at the end of its service life.

#### Jetting Failure

The collar bund and its rain cover extend the majority of the way up the primary tank, but there is a region approximately 400mm high in which a jetting failure could arise.

The following formula is provided for calculating the minimum distance (I) from the tank wall to the bund wall that should be observed for preventing jetting failure. In this instance, the kerb to the edge of the base slab will be considered the bund wall.

$$I_{\min} = H - h$$

where:

$h$  = height of wall = 0.10m

$H$  = Height of top liquid level = 5.31m

$$I = 5.31 - 0.10$$

$$I_{\min} = 5.21\text{m}$$

Although this distance appears a little conservative, as the tank wall is approximately 1m from the edge of the tertiary containment area, it shows that jetting failure could result in a loss of inventory to the environment, should a hole develop in this side of the tank, above the bund rainwater cover.

It is considered highly unlikely that the tank would develop a hole in its top half which would lead to such an escape. The only reasonably foreseeable mechanism by which a hole could develop is from deterioration of the tank, particularly on its welded sections.

Due to the size of the concrete slab that the tank sits on, it is not considered feasible to move the vessels away from the edge of the area of tertiary containment.

#### Recommendations:

- Ensure that the primary and secondary tanks are inspected annually by a competent person to check for sign of damage or deterioration. Where any defects are detected, additional caution should be exercised in this area with regard to decisions on the repair or the replacement of the tank.
- It may be prudent to consider additional forms of protection to prevent jetting failure from the top part of the tank. This could take the form of cladding to the top region. However, the benefit of such a shield should be weighed up against the fact that this would likely prevent visual inspections of the tank wall, and so the ability to detect deterioration.

### Leak Detection

The bund drain has the facility to test for and take samples of any liquid collected in the bund annulus. There is a procedure in place to check for leakage on a weekly basis. This therefore in line with the recommendations of the guidance.

### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

The 50mm $\phi$  main outlet from the tank is formed through both the primary and secondary containment tanks. The penetrations are formed flanged penetrations which are the best available technique for this type of construction. There is also a 'flexi connector' installed directly outside the tank, which adds flexibility to the pipework and connections, and so reduces the likelihood of damage due to impact.

The pipework and valves are installed on the slab outside of the main bund. These provide an area of weakness in the containment facilities, as any damage to these could result in the loss of inventory from the primary and secondary tanks. The guidance states that penetrations through the bund wall, and pipework, valves and pumps outside the secondary containment should be avoided. In this instance, due to the nature of the containment facilities, it is not considered possible to reconfigure the system.

Access to this area of the site is fairly restricted to, and rarely used by pedestrians or vehicles. The likelihood of impact damage to the pipework in this area is therefore very unlikely. There are also kerbs installed around the base slab which would provide protection against impact damage.

Deterioration of the pipework or valves over time is a feasible mechanism by which a release from this area could occur. The weekly inspections procedure MWI 032 in place on the site includes '*Carry out visual inspection of ancillary equipment and pipe work for leaks*'. This should therefore ensure that any leakages are detected within a week.

There is also a good level of tertiary containment in this area which would contain any minor leakages from the pipework.

### Recommendations:

- Review and update maintenance and inspection procedures to ensure they are reflective of the risks present on site. Consider including inspections of the tertiary containment systems. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.

### Rainwater Draw-off

Although rainwater is excluded from the bund, there is the facility to check for leakage into the bund annulus by means of a gravity discharge to the industrial effluent system. As this is a gravity system the guidance states that this should be taken out of service and replaced with a pumped system where practicable.

Due to the very limited space between the primary and secondary containment tanks, it is unlikely to be possible to install a pumped system to drain the bund annulus.

## **5.8 A21 Hydrogen Peroxide**

### Suitability of Form of Construction and Compatibility with In-Service Requirements

The concrete block masonry walls of the bund are not considered an appropriate form of secondary containment by the guidance. It is recommended therefore that a compliant alternative form of secondary containment is installed at the site. Demolishing the masonry

walls and reconstructing these in properly designed reinforced concrete is likely to represent the best solution in this instance.

Due to the low pH of the inventory, should the reconfigured secondary containment system be formed from concrete, then a protective coating shall be required to protect against corrosion.

#### Recommendations:

- Provide an alternative form of secondary containment to the inventory which does not rely upon concrete block masonry walls. Take the opportunity to remove undesirable elements of the existing construction such as pipe penetrations through secondary containment walls, and the gravity bund drainage system.

#### Capacity of Secondary Containment

The existing walls enclose a space which has 169% of the primary tank volume.

#### Recommendation:

Any replacement walls should provide a minimum storage volume of 10.5m<sup>3</sup> (110% primary tank volume). In addition, a freeboard of 250mm should be provided above the maximum theoretical liquid level to take account of the possible effects of surge.

#### Clearance Between Primary Tank Wall and Bund Wall

#### Recommendation:

The idealised facility would provide a clear distance, the height of the tank, between the tank and bund walls.

#### Jetting Failure

Jetting failure should be considered if practicable in the design of the replacement secondary containment facilities. Based upon the existing wall height it is recommended that a minimum of 1.3m be provided between the tank and the adjacent bund walls.

$$I_{\min} = H - h$$

where:

h = height of wall = 0.9m

H = Height of top liquid level = 2.2m

$$I = 2.2 - 0.9$$

$$I_{\min} = 1.3\text{m}$$

#### Recommendations:

- Take account of possible jetting failure in the design of the replacement secondary containment facilities if reasonably practicable.

#### Leak Detection

#### Recommendation:

A leak detection system is not a requirement for a class 2 facility, however, if this can be provided this would be desirable.

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

##### Recommendation:

Wherever possible penetrations through the secondary containment facility should be avoided, and all pumps, pipes and valves which are under gravitational head from the tank should be contained within the secondary containment.

#### Rainwater Draw-off

##### Recommendation:

- The replacement secondary containment facility should be installed with a pumped rainwater/leakage removal facility draining to the industrial effluent system if it is reasonably practicable to do so.

## **5.9 A21 Acetic Acid**

#### Suitability of Form of Construction and Compatibility with In-Service Requirements

The concrete block masonry walls of the bund are not considered an appropriate form of secondary containment by the guidance. It is recommended therefore that a compliant alternative form of secondary containment is installed at the site. Demolishing the masonry walls and reconstructing these in properly designed reinforced concrete is likely to represent the best solution in this instance.

Due to the low pH of the inventory, should the reconfigured secondary containment system be formed from concrete, then a protective coating shall be required to protect against corrosion.

##### Recommendations:

- Provide an alternative form of secondary containment to the inventory which does not rely upon concrete block masonry walls. Take the opportunity to remove undesirable elements of the existing construction such as pipe penetrations through secondary containment walls, and the gravity bund drainage system.

#### Capacity of Secondary Containment

The existing walls enclose a space which has 292% of the primary tank volume.

##### Recommendation:

Any replacement walls should provide a minimum storage volume of 6.3m<sup>3</sup> (110% primary tank volume). In addition, a freeboard of 250mm should be provided above the maximum theoretical liquid level to take account of the possible effects of surge.

#### Clearance Between Primary Tank Wall and Bund Wall

##### Recommendation:

The idealised facility would provide a clear distance, the height of the tank, between the tank and bund walls.

#### Jetting Failure

Jetting failure should be considered if practicable in the design of the replacement secondary containment facilities. Based upon the existing wall height it is recommended that a minimum of 1.1m be provided between the tank and the adjacent bund walls.

$$l_{\min} = H - h$$

where:

$h$  = height of wall = 0.9m

$H$  = Height of top liquid level = 2.0m

$$l = 2.0 - 0.9$$

$$l_{\min} = 1.1\text{m}$$

Recommendations:

- Take account of possible jetting failure in the design of the replacement secondary containment facilities if reasonably practicable.

#### Leak Detection

Recommendation:

A leak detection system is not a requirement for a class 2 facility, however, if this can be provided this would be desirable.

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

Recommendation:

Wherever possible penetrations through the secondary containment facility should be avoided, and all pumps, pipes and valves which are under gravitational head from the tank should be contained within the secondary containment.

#### Rainwater Draw-off

Recommendation:

- The replacement secondary containment facility should be installed with a pumped rainwater/leakage removal facility draining to the industrial effluent system if it is reasonably practicable to do so.

### **5.10 A21 Phosphoric Acid**

#### Suitability of Form of Construction and Compatibility with In-Service Requirements

The concrete block masonry walls of the bund are not considered an appropriate form of secondary containment by the guidance. It is recommended therefore that a compliant alternative form of secondary containment is installed at the site. Demolishing the masonry walls and reconstructing these in properly designed reinforced concrete is likely to represent the best solution in this instance.

Due to the low pH of the inventory, should the reconfigured secondary containment system be formed from concrete, then a protective coating shall be required to protect against corrosion.

Recommendations:

- Provide an alternative form of secondary containment to the inventory which does not rely upon concrete block masonry walls. Take the opportunity to remove undesirable elements of the existing construction such as pipe penetrations through secondary containment walls, and the gravity bund drainage system.

#### Capacity of Secondary Containment

The existing walls enclose a space which has 130% of the primary tank volume.

Recommendation:

Any replacement walls should provide a minimum storage volume of 10.6m<sup>3</sup> (110% primary tank volume). In addition, a freeboard of 250mm should be provided above the maximum theoretical liquid level to take account of the possible effects of surge.

#### Clearance Between Primary Tank Wall and Bund Wall

Recommendation:

The idealised facility would provide a clear distance, the height of the tank, between the tank and bund walls.

#### Jetting Failure

Jetting failure should be considered if practicable in the design of the replacement secondary containment facilities. Based upon the existing wall height it is recommended that a minimum of 2.17m be provided between the tank and the adjacent bund walls.

$$l_{\min} = H - h$$

where:

$$h = \text{height of wall} = 0.78\text{m}$$

$$H = \text{Height of top liquid level} = 2.95\text{m}$$

$$l = 2.95 - 0.78$$

$$l_{\min} = 2.17\text{m}$$

Recommendations:

- Take account of possible jetting failure in the design of the replacement secondary containment facilities if reasonably practicable.

#### Leak Detection

Recommendation:

A leak detection system is not a requirement for a class 2 facility, however, if this can be provided this would be desirable.

#### Penetrations through Bund Wall and Position of Pumps, Valves, Couplings etc

Recommendation:

Wherever possible penetrations through the secondary containment facility should be avoided, and all pumps, pipes and valves which are under gravitational head from the tank should be contained within the secondary containment.

### Rainwater Draw-off

#### Recommendation:

- The replacement secondary containment facility should be installed with a pumped rainwater/leakage removal facility draining to the industrial effluent system if it is reasonably practicable to do so.

## **5.11 Hydrated Lime**

As the Hydrated Lime storage facility rely upon the primary tank, a catchment area, transfer system and secondary containment tank, each element of the system has been considered separately in the following sections.

### Primary Tank

Records of the primary tank construction are not available, and few details could be ascertained during the site survey due to the concealed nature of the structure and restricted access on the grounds of health and safety. Reinforcement steel was not detected within the concrete during a cover meter survey from the outside of the tank, although it was noted that there were tensioned steel bands around the outside perimeter of the tank. The steel bands may contribute to the structural strength of the vessel, although would not prevent cracking of the concrete which is a requirement for the serviceability of a liquid retaining concrete structure. It is not possible therefore to verify the liquid retaining or structural integrity of the vessel by comparison to design codes or standards at present.

An inspection of the outside of the vessel did not reveal any signs of structural fatigue or cracks, although the concrete surface itself could not be examined due to the profiled sheeting present, thought to be permanent formwork, which is wrapped around the tank.

At the time of the survey there was a liquid on the factory floor around approximately one third of the tank base. It is not known whether this had leaked from the tank or if it was from an entirely different origin such as factory wash down water. It was also noted that there was widespread staining and calcification on the tank walls and cover slab of the tank.

Without being able to verify the structural condition of the primary tank, it is not possible to quantify the likelihood of a catastrophic failure with any confidence. As the tank has been in service for some years already, there is the presumption that it is structurally capable and a catastrophic failure is unlikely.

The inventory is chemically compatible with the concrete construction of the vessel. Indeed the calcifying properties of the material would likely aid the sealing of any dormant cracks within the concrete. This process is normally relied upon in the design of liquid retaining concrete structures due to the cementitious content of the concrete which in the presence of moisture deposits calcium carbonate within cracks and aids their autogenous healing. The inventory is therefore likely to increase the water tightness of the vessel.

There is a low level outlet through the wall of the tank which could provide an uncontrolled means of release. There is no barrier protection in front of the outlet or to the pump or pipework and there is vehicular access into the factory. It is deemed possible therefore that the pipework could be damaged by a vehicular collision, which considering the worst case outcome could fully sever the pipe.

In order to quantify the potential release rate of the above scenario, and in order to assess the adequacy of the transfer system, the following equation for free discharge through a small orifice has been used:

$$Q_A = C_D.A.(2gH)^{1/2}$$

Where  $Q_A$  = Discharge rate

$C_D$  = orifice discharge coefficient = 0.97 for a rounded orifice (conservative approximation)

$A$  = Area of orifice =  $0.00785\text{m}^2$

$g$  = gravity =  $9.81\text{m/s/s}$

$H$  = Head of liquid =  $2.8\text{m}$

$Q_A = 0.97 \times 0.00785(2 \times 9.81 \times 2.8)^{1/2}$

$= 0.0564\text{m}^3/\text{s}$

$= 56.4 \text{ l/s}$

$= 203\text{m}^3/\text{hr}$

This is the rate at which the release would occur while the tank were full. The rate would in fact reduce as the head of liquid in the tank falls.

Recommendation:

- Investigate and verify the structural integrity of the primary vessel further by either seeking details from the designer or contractor of the vessel, or by intrusive investigation which would likely require the vessel to be taken out of service.
- Install a vehicle barrier in front of the tank outlet pipework to prevent accidental damage.

#### Catchment Area

The catchment area in the event of a spillage from the primary tank could include all of the floor of the building. The floor is of reinforced concrete construction, is level, and is generally treated as a wet area which drains to the industrial effluent sewer. The floor is contained by the walls and channel drainage to the perimeter of the building and there are no surface or foul water drainage features within the building which could collect liquid from the factory floor. The form of the catchment area is therefore appropriate in this regard.

The floor area not including those spaces occupied by tanks, has been calculated to be in the region of  $1100\text{m}^2$ . As a very rough guide, should the entire contents of the tank be instantaneously spilt and distributes across the floor, this would result in a depth of liquid of  $136\text{mm}$ .

There is in excess of 80 linear meters of  $400\text{mm}$  wide channel drainage within the building which would be available to collect any spillage. The area most at risk of being overwhelmed by flow is the roller shutter door opening nearest to the tank. There are however two further lines of channel drainage beyond this externally to the building which drain to the industrial effluent sewer.

Although a quantitative assessment of the capacity of the channel drainage has not been undertaken, it is judged that due to the size and prevalence of the channels, these would be capable of intercepting flows in excess of the 56 litres per second release rate from the tank associated with a pipe failure.

Should a more sudden, catastrophic failure of the tank occur, it is considered unlikely that the drainage within the building and transfer system downstream would be able to convey all of the inventory to the remote secondary containment. In this scenario it is credible therefore that there may be an uncontrolled release of inventory to the environment. The likelihood of

this event is likely to be very low. It is recommended therefore that PB Gelatins and the EPR regulator appraise this risk to determine whether it is as low as is reasonably practicable.

The channel drainage within the building is formed from concrete, with a clay drainage channel invert and galvanized steel covers. These materials are all resistant to the inventory, and are therefore appropriate for this use.

In the event of fire, the catchment area and drainage materials are not flammable, and would perform well until extreme fire temperatures. The materials are considered appropriate in this regard.

There are not currently any formal procedures in place for the inspection and checking of the Hydrated Lime tank.

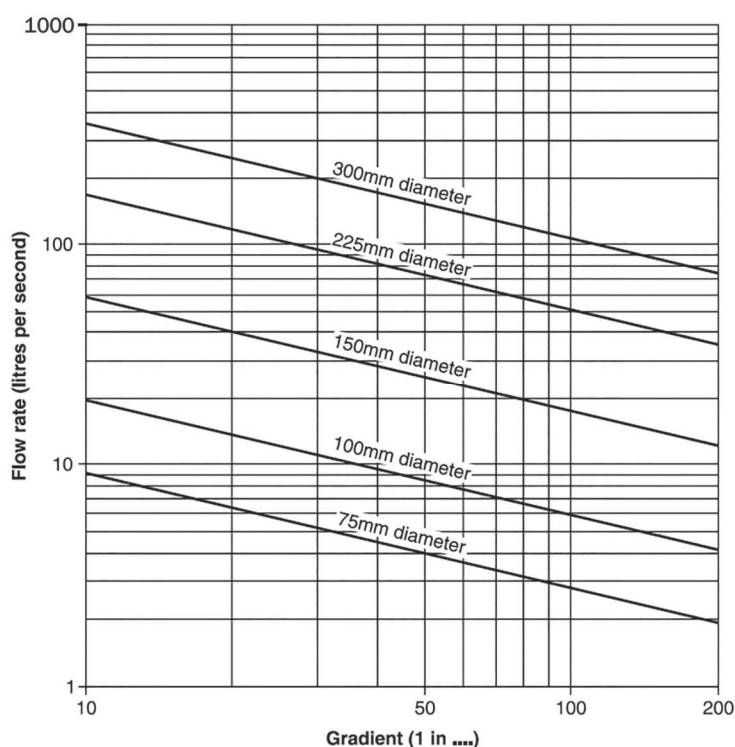
Recommendation:

- Review and update the maintenance and inspection procedures to include the Hydrated Lime Storage facilities and ensure that the procedures are reflective of the risks present on site. Consider including inspections of the tertiary containment, transfer drainage, pump station and treatment plant balance tank. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.
- PB Gelatins and the EPR regulator should appraise the risk of a catastrophic failure of the primary concrete tank and the potential for this to result in an uncontrolled release of inventory to the environment, to determine whether the risk is as low as is reasonably practicable.

Gravity Drainage System

The gravity drainage system was not surveyed as part of the baseline asset survey, but information on its routing and size have been provided by the drawings included in **Appendix D**. Information on drainage levels is not available, and as such some estimates have been made in order to assess its likely conveyance capacity.

There is approximately 21m of 300mm $\phi$  sewer directly downstream of the factories channel drainage and then 81m of 450mm $\phi$  sewer before the pump station. The following graph provided in CIRIA 736 indicates the discharge capacities of drains conveying water running full:



**Figure 5.11.1: Discharge capacities of drains conveying water running full (CIRIA 736)**

Considering the shallowest gradient of 1 in 200 provided on the graph, a 300mm diameter sewer has a capacity of 75 litres/second. This suggests that the sewer would likely convey the highest likely release rate from the primary tank (56.4 litres/second) with spare capacity in the region of 20 litres/second for conveying other normal flows at the same time.

Figure 5.11.2 below from CIRIA 736 provides guidance on the suitability of different drainage materials for class 1, 2 and 3 installations. As the material of the drainage is not currently known, it cannot be determined whether the existing drainage materials are appropriate.

| Pipe material |                             | Suitability for |         |         | Chemical resistance | Pressure pipeline | Above ground |
|---------------|-----------------------------|-----------------|---------|---------|---------------------|-------------------|--------------|
|               |                             | Class 1         | Class 2 | Class 3 |                     |                   |              |
| Clayware      |                             | ✓✓✓             | ×       | ×       | ✓ <sup>1</sup>      | ×                 | ×            |
| Plastic       |                             | ✓✓✓             | ✓✓✓     | ✓       | ✓✓✓                 | ✓✓                | ✓✓✓          |
| Metallic      |                             | ✓✓✓             | ✓✓✓     | ✓       | ✓ <sup>2</sup>      | ✓✓                | ✓✓✓          |
| Cements       | Unreinforced                | ✓✓✓             | ×       | ×       | ✓ <sup>2</sup>      | ×                 | ×            |
|               | Reinforced and pre-stressed | ✓✓✓             | ✓✓      | ✓       | ✓ <sup>2</sup>      | ×                 | ×            |

**Key**

- ✓✓✓ = Good
- ✓✓ = Moderate
- ✓ = Poor
- × = Not suitable

**Notes**

- 1 Joints susceptible to chemical attack.
- 2 Requires internal coating to achieve chemical resistance.

**Figure 5.11.2: Performance comparison for pipework materials (CIRIA 736)**

The gravity drainage system is sensitive to blockage, however, as all of the channel drainage upstream is covered with open mesh flooring, this should filter out any large materials. In addition the drainage is relatively large bore, which reduces the potential for a blockage to occur. Notwithstanding this, if a blockage were to occur, this could compromise the integrity of the transfer system, which could result in an uncontrolled release.

#### Recommendations:

- A survey of the industrial effluent sewer from the factory building to the pump station should be undertaken. This should:
  - Check that the gradient of the sewers is sufficient to ensure a conveyance capacity greater than the likely maximum inventory release rate of 56 litres/second
  - Check that the sewer material is compatible with the inventory and its classification (class 2)
  - Check for defects which could lead to a release of inventory to the environment

#### Pump Station

The pump station comprises a reinforced concrete pump well, with two self-priming centrifugal pumps mounted on a suspended steelwork floor above. The pumps are operated in a duty assist arrangement, with a maximum pumping capacity of up to 350m<sup>3</sup>/hr (97 l/s). This is therefore greater than the maximum likely inventory release rate of 56 l/s. Should the pumps fail for any reason, there is an overflow facility from the wet well to the public foul water sewer.

The concrete construction of the wet well is compatible with the properties of the inventory, as are the pumps which have stainless steel casing liners.

As the electrical power input to the pump station is fed from the A18 building, it is possible that in the event of fire in this building power, both the primary tank and the operation of the pump station could be compromised. The pump station overflow would however remain operational, in which case any flows would be sent to the public works without any prior neutralization or treatment.

There are currently no formal procedures in place for the inspection and maintenance of the pump station facilities. However, there is a SCADA remote monitoring system installed, which would alert operators to any pump failures or issues.

#### Recommendations:

- Review and update the maintenance and inspection procedures to include the Hydrated Lime Storage facilities and ensure that the procedures are reflective of the risks present on site. Consider including inspections of the tertiary containment, transfer drainage, pump station and treatment plant balance tank. Consider whether daily, weekly, monthly, annual and after rainfall procedures are required.
- Consider a procedure to warn the public sewage treatment works operator of any event which leads to the discharge of untreated inventory to the public sewer

#### Secondary Containment Tank / PB Gelatins Treatment Plant Buffer Tank

The buffer tank and its secondary containment skin were designed and constructed in accordance with appropriate liquid retaining standards. The construction materials are also compatible for the inventory in terms of their corrosive resistance.

The main compartment of the buffer tank has a capacity of 750m<sup>3</sup>. As the tank is used for buffering flows to the treatment plant, it could be operating at any level at the time of an inventory release. However, as the tank has a secondary tank surrounding it, there is an additional 305m<sup>3</sup> capacity which is available at any time. This is 184% of the primary tank volume which exceeds the minimum recommended capacity.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

NH2OK have carried out a review of eleven bulk chemical storage facilities at PB Gelatins to assess their compliance or otherwise with CIRIA 736.

The assessment included carrying out an Environmental Risk Assessment based upon a Source, Pathway, Receptor risk assessment model. This was used to determine the classification of each of the inventories.

All of the chemicals considered were assessed as having a High Hazard Rating based upon their toxicity to aquatic organisms.

The pathways identified included direct runoff, infiltration through the ground, transmission through surface, foul and industrial effluent systems and flooding from the River Taff. The potential pathways for each inventory were considered, and given Hazard Ratings ranging from Low to High.

The environmental receptors identified which could foreseeably be affected by an inventory release were the soils and groundwater which underlay the site, and the River Taff. Both of these receptors were assessed as having a Medium Hazard Rating due to their statutory designations and status.

Finally, a Site Risk Rating was determined for each Source, Pathway and Receptor combination, which was then applied to determine a number of Overall Site Hazard Ratings for each inventory. The highest Overall Site Hazard Rating for each inventory determined its overall classification.

Ten of the eleven storage facilities were classed as being Class 2 facilities, with the A21 Hydrochloric Acid Storage facility determined to be Class 3.

A baseline asset survey of all of the facilities was carried out which consisted of a two day investigation on site, as well as a review of information provided by PB Gelatins.

The baseline survey revealed that ten of the primary storage tanks are formed of HDPE, with one constructed of concrete.

Four of the HDPE primary tanks were found to be provided with secondary containment by their construction within a second HDPE tank or integral collar bund.

Four HDPE primary tanks were sited within civils type bunds constructed from a concrete base and concrete block masonry walls.

Two of the HDPE primary tanks were sited within a shared civil bund, formed from the compartment of a redundant water treatment works which had been modified to accommodate the tanks.

The concrete primary tank was found to have a local catchment and containment area provided by drainage and containment walls within a factory building, with a gravity and pumped transfer system to a secondary containment vessel which normally functions as a balance tank for the onsite effluent treatment plant.

The site as a whole was found to have good separation of surface, foul and trade effluent drainage. In addition the areas surrounding the majority of the storage facilities are hard paved and drained to the effluent system, which provides tertiary containment to the chemical storage facilities. Some shortcomings in the tertiary containment provided were identified, and recommendations for improvement made where applicable in the gap analysis.

A gap analysis was carried out in order to highlight any shortcomings or defects with the secondary and tertiary containment facilities in terms of the requirements imposed upon them by the CIRIA 736 guidance. Where shortcomings have been recognised, bullet point recommendations are provided at the end of each section.

CIRIA 736 has few absolute requirements, but rather states recommended design standards, and calls for a risk based approach to be applied to the design and assessment of facilities. Where low likelihood but potentially high impact events have been highlighted in the study, it has been recommended that further assessment is required by PB Gelatins and the EPR regulator.

All of the facilities surveyed are fitted with gravity discharge bund drains. The guidance states that these should be removed where reasonably practicable to do so. In this instance it is recommended that this is undertaken as and when the facilities are upgraded or replaced e.g. at the end of a tank's normal service life.

The civils type bunds formed with concrete block masonry walls were all deemed not to comply with the requirements of CIRIA 763 on the grounds of their inadequate structural stability, and susceptibility to thermal and/or shrinkage cracking which provides a pathway for leakage. It has been recommended that these facilities are upgraded to compliant standards. Advice on this has been provided in the gap analysis chapter. Each block work bund structure should be subject to a site specific detail design process. It may be beneficial to retain the existing blockwork walls as sacrificial shutters in construction of the proposed reinforced concrete walls as this will maintain some degree of containment at all times during the improvement works.

The HDPE tanks constructed within a second HDPE collar bund have been found to broadly comply with the requirements, albeit falling short of some recommendations. Shortcoming of note include pipe penetrations which pass through the primary and secondary tank wall which provide an area of weakness in the containment.

The susceptibility of the HDPE tanks to be damaged by fire was also highlighted as a shortcoming of the installations. It has been recommended that PB Gelatins and the EPR regulator jointly appraise this risk to determine whether the risk of a release of inventory is as low as is reasonably practicable in this regard.

The two HDPE tanks which are provided with secondary containment by a compartment of the redundant water treatment works were also found to generally comply with the requirements if the CIRIA guidance. As the tanks are elevated above their bund walls, jetting failure from one of the tanks was highlighted as possible means of escape of inventory to the environment, albeit, very unlikely. Recommendations with regard to the maintenance and inspection of the tanks to mitigate this risk have therefore been made.

The single concrete tank with remote secondary containment is reliant on a collection and transfer system of a finite conveyance capacity. Albeit unlikely, should a catastrophic failure of the tank occur, it has been assessed that the accompanying rapid release of inventory could overwhelm the collection and conveyance drainage systems, and so could result in an uncontrolled release of inventory to the environment.

A more credible 'worst case' mechanism of failure would be a pipe failure at the base of the tank. In this scenario, the collection, conveyance and secondary containment systems have been assessed as being likely to be able to deal with the release. A quantitative assessment of conveyance capacity has been made.

For this installation it is again recommended that PB Gelatins and the EPR regulator appraise the risk associated with this facility and decide whether it is as low as is reasonably practicable.

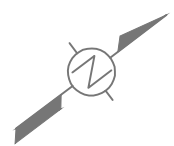
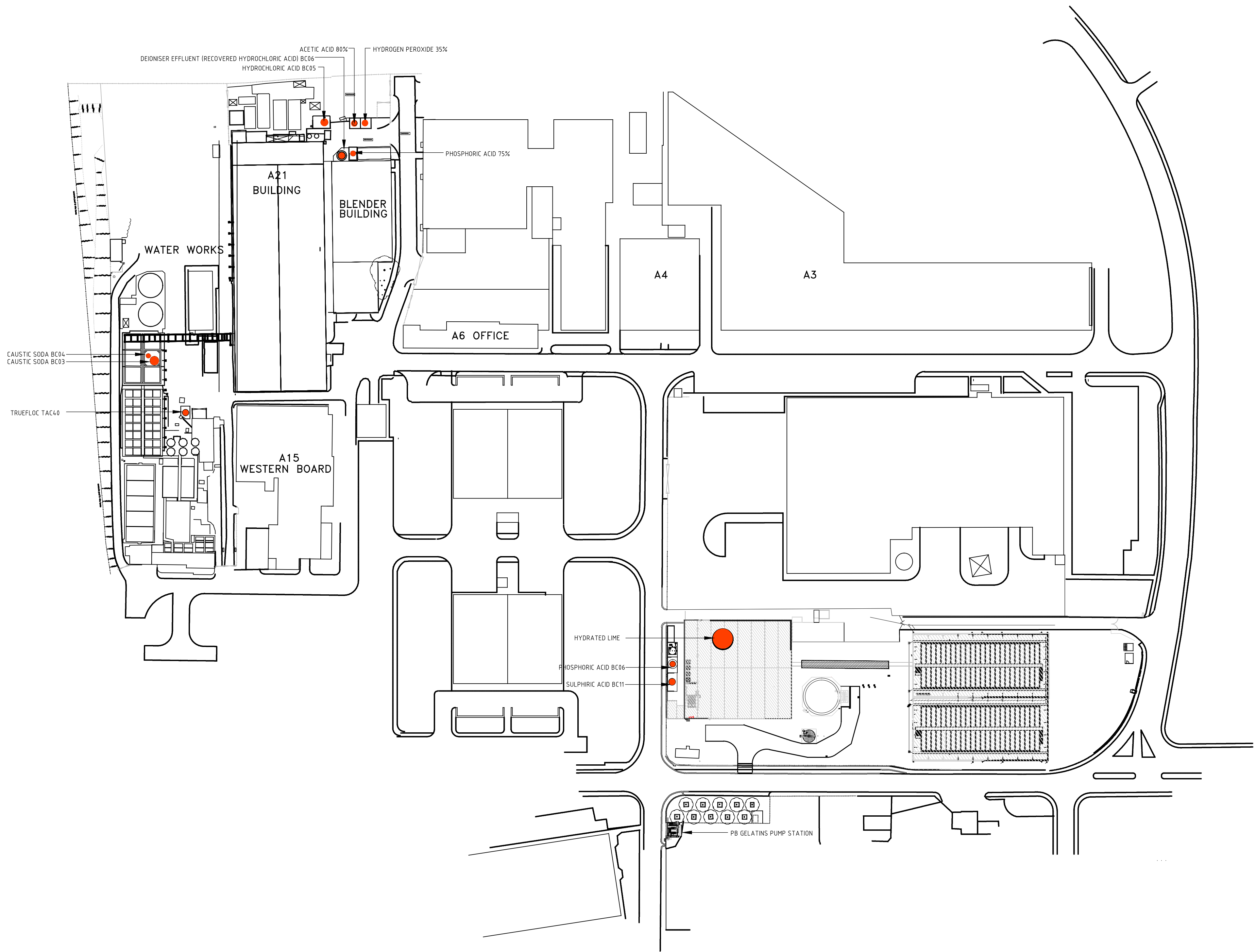
## **APPENDIX A**

## **PB GELATINS INVENTORY ASSET REGISTER**

| ID No | System                 | Area        | Inspection Date | Tank description           | Contents              | Function     | No. off | Material -construction | Height | Working height | Width | Length | Diameter | Actual Volume | Working volume M³ | Filling operation | Level control        | Level alarm  | Overflow | Discharge control | Discharge system | Inlet pipework | Outlet pipework | Agitation | Emergency controls | SCADA information | PSD | Action list | CDM & H&OP | POWER | Weekly audit | ESW | Emergency procedures | Nearest information |
|-------|------------------------|-------------|-----------------|----------------------------|-----------------------|--------------|---------|------------------------|--------|----------------|-------|--------|----------|---------------|-------------------|-------------------|----------------------|--------------|----------|-------------------|------------------|----------------|-----------------|-----------|--------------------|-------------------|-----|-------------|------------|-------|--------------|-----|----------------------|---------------------|
| BC 01 | A18 Phosphoric         | A18         | Jun-15          | Bulk Phosphoric Acid       | Phosphoric Acid 75%   | Bulk storage | 1       | HDPE                   | 4.36   | 4.02           |       |        | 2.46     | 20.73         | 19.11             | Tanker            | Ultrasonic indicator | No           | To bund  | Manual            | Pumped           | St.St          | St.St           | No        | No                 | No                | ✓   | X           | X          | X     | ✓            | ✓   | X                    | ✓                   |
| BC 02 | W Works Truefloc TAC40 | Water works | Apr-19          | Bulk Truefloc TAC40        | Truefloc TAC40        | Bulk storage | 1       | HDPE                   | 3.85   | 3.52           |       |        | 2.46     | 18.30         | 16.73             | Tanker            | Ultrasonic indicator | Yes          | To Bund  | Automatic         | Pumped           | St.St          | St.St           | No        | No                 | Yes               | ✓   | ✓           | ✓          | ✓     | X            | ✓   | X                    | ✓                   |
| BC 03 | A21 caustic            | Water works | Sep-23          | Bulk Caustic Soda          | Caustic Soda 20%      | Bulk storage | 1       | HDPE                   | 7.96   | 7.50           |       |        | 3.60     | 81.07         | 76.35             | Tanker            | Pressure transmitter | No           | To bund  | Manual            | Pumped           |                |                 | No        | No                 | Yes               | ✓   | X           | X          | X     | ✓            | ✓   |                      | X                   |
| BC 04 | A21 caustic            | Water works | Jun-15          | Bulk Caustic Soda          | Caustic Soda 20%      | Bulk storage | 1       | HDPE                   | 4.30   | 4.15           |       |        | 1.80     | 10.94         | 10.56             | Tanker            | Pressure transmitter | No           | To bund  | Manual            | Pumped           |                |                 | No        | No                 | Yes               | ✓   | X           | X          | X     | ✓            | ✓   |                      | X                   |
| BC 05 | A21 HCL                | Rear A21    | Jul-34          | Bulk Hydrochloric Acid     | Hydrochloric Acid 32% | Bulk storage | 1       | HDPE                   | 5.40   | 5.31           |       |        | 2.90     | 35.67         | 35.08             | Tanker            | Ultrasonic indicator | No           | To bund  | Manual            | Ejector          | Plastic        | Plastic         | No        | No                 | No                | ✓   | X           | X          | X     | ✓            | ✓   |                      | ✓                   |
| BC 06 | A21 Deioniser effluent | Rear A21    | Dec-17          | Bulk Acid Effluent storage | Acidic water          | Bulk storage | 1       | HDPE                   | 7.77   | 7.46           |       |        | 3.08     | 58.05         | 55.73             | Automatic         | Sight                | No           | To bund  | Manual            | Gravity          | Plastic        | Plastic         | No        | No                 | No                | X   | X           | X          | X     | ✓            | X   | X                    | X                   |
| BC 07 | A21 Phosphoric         | Rear A21    | May-18          | Bulk Phosphoric Acid       | Phosphoric Acid 75%   | Bulk storage | 1       | HDPE                   | 3.37   | 3.03           |       |        | 2.46     | 16.02         | 14.39             | Tanker            | Ultrasonic indicator | No           | To bund  | Manual            | Pumped           | St.St          | St.St           | No        | No                 | No                | ✓   | ✓           | ✓          | ✓     | ✓            | ✓   | X                    | ✓                   |
| BC 08 | A21 Hydrogen peroxide  | Rear A21    | May-18          | Bulk Hydrogen Peroxide     | Hydrogen Peroxide 35% | Bulk storage | 1       | HDPE                   | 2.86   | 2.52           |       |        | 2.20     | 10.87         | 9.57              | Tanker            | Ultrasonic indicator | No           | To bund  | Manual            | Pumped           | St.St          | St.St           | No        | No                 | No                | ✓   | X           | X          | ✓     | ✓            | ✓   |                      | X                   |
| BC 10 | A21 Acetic Acid        | Rear A21    | Aug-20          | Bulk Acetic Acid           | Acetic Acid 80%       | Bulk storage | 1       | HDPE                   | 2.19   | 1.62           |       |        | 2.08     | 7.44          | 5.51              | Tanker            | Ultrasonic indicator | Float switch | To bund  | Automatic         | Pumped           | St.St          | St.St           | No        | No                 | No                | ✓   | ✓           | ✓          | ✓     | ✓            | ✓   | X                    | ✓                   |
| BC 11 | A18 Sulphuric          | A18         | Jul-22          | Bulk Sulphuric Acid        | Sulphuric Acid 77%    | Bulk storage | 1       | HDPE                   | 4.35   | 4.28           |       |        | 2.50     | 21.36         | 20.99             | Tanker            | Ultrasonic indicator | No           | To bund  | Manual            | Pumped           | HDPE           | HDPE            | No        | No                 | No                | X   | X           | X          | X     | X            | X   | X                    | X                   |
| BC 09 | A18 lime               | A 18        |                 | Lime silo                  | Hydrated Lime         | Bulk storage | 1       | Concrete               | 3.35   | 2.95           |       |        | 7.96     | 166.73        | 146.82            | Tanker            | Sight                | No           | No       | Manual            | Pumped           | Mild steel     | Mild steel      | Stirrer   | No                 | No                | X   | X           | X          | X     | X            | ✓   | X                    | X                   |

## **APPENDIX B**

## **SITE PLAN INDENTIFYING INVENTORY STORAGE LOCATIONS**



|          |      |      |     |              |
|----------|------|------|-----|--------------|
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|                      |                |
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| DRAWN DATE:-         | OCTOBER 2014   |
| SCALE & SHEET SIZE:- | 1:000 @ A1     |

PRELIMINARY

CLIENT  
PB GELATINS

PROJECT  
REVIEW OF SITE CHEMICAL STORAGE ARRANGEMENTS

DRAWING TITLE  
SITE PLAN IDENTIFYING CHEMICAL STORAGE LOCATIONS



- Waste to Value (AD/Bogen)
- Industrial Effluent Treatment
- Seepage Treatment

- Asset Risk Management (NBS)
- Design Consultancy
- Service and Maintenance

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PROJECT No.  
J-5016-CIE

DRAWING No.  
1000

REV.  
A

## **APPENDIX C**

## **MSDS**



**PRODUCT: ACETIC ACID 80% PURE (ACAC80PU) REVISION: 6 DATED: 15/03/13 1 OF 12**

**PRODUCT SPECIFICATION**

|                         |                     |
|-------------------------|---------------------|
| Product Name            | Acetic Acid         |
| Product Grade           | 80% Pure            |
| Specification Reference | AA101/143/4 (03/95) |

**SALES SPECIFICATION**

| PROPERTY                       | 80% PURE                              | TEST                |
|--------------------------------|---------------------------------------|---------------------|
| Appearance                     | Clear, free from matter in suspension | BP method No SM111  |
| Colour                         | 5 Hazen units max                     | ASTM D1209          |
| Acetic acid content            | 80 ± 0.5                              | BP method No. 70014 |
| Crystallising point            | -7°C                                  | ASTM D1493          |
| Density at 20°C                | 1.07 kg/litre approx                  | ASTM D1298          |
| Non-volatile matter            | 0.003% mass max                       | ASTM D1353          |
| Chlorides (as Cl)              | 1ppm max                              | BP method No. 70020 |
| Sulphates (NaSO <sub>4</sub> ) | 1ppm max                              | BP method No. 70021 |
| Iron (as Fe)                   | 0.5ppm max                            | ASTME E394          |
| Heavy Metals (as Pb)           | 0.5ppm max                            | ASTM D1347          |
| Water                          |                                       | ASTM D1347          |
| Aldehydes (as acetaldehyde)    | 0.005% mass max                       | ASTM D2191          |
| Formic Acid                    | 0.05% max                             | ASTM D3546          |
| Permanganate time              | 2 hours min                           | USP                 |

**NOTES**

**Exclusion of Liability**

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**Health and Safety**

A Material Safety Data Sheet has been issued describing the health, safety and environmental properties of this product, identifying the potential hazards and giving advice on the handling precautions and emergency procedures. This must be consulted fully before handling, storage and use.



**PRODUCT: ACETIC ACID 80% PURE (ACAC80PU) REVISION: 6 DATED: 15/03/13 2 OF12**

## SAFETY DATA SHEET

### 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY

#### 1.1 Product Identifier

Chemical Name (EINECS) Acetic Acid 80% Pure  
Synonyms Ethanoic Acid; Ethylic Acid; Methane Carboxylic Acid; Glacial Acetic Acid 80%.  
CAS Number 64-19-7  
EINECS Number 200-580-7  
REACH Registration Number 01-2119475328-30-XXXX

#### 1.2 Relevant identified uses

Manufacture of the substance or use as an intermediate or a process chemical or extraction agent.  
Distribution of substance  
Formulation and (re)packing of substances and mixtures  
Use in Agrochemicals uses - Professional  
Use in Cleaning Agents - Industrial  
Use in Cleaning Agents - Professional  
Use as laboratory reagent - Industrial  
Use as laboratory reagent - Professional  
Use in Oil and Gas field drilling and production operations  
Water treatment chemicals - Industrial  
Water treatment chemicals - Professional

#### 1.3 Details of the supplier of the safety data sheet

Tennants Distribution Limited  
Hazelbottom Road  
Cheetham  
Manchester  
M8 0GR  
Tel: 44(0)161 205 4454  
Fax: 44(0) 161 203 4298  
Email: [msds@tennantsdistribution.com](mailto:msds@tennantsdistribution.com)

#### 1.4 Emergency telephone number

Tel: 44(0)844 335 0001 (24 hours)

### 2. HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance or mixture

##### Regulation 1272/2008 (GHS)

Skin Corr. 1A, H314

##### EEC Directive 67/548 and subsequent amendments. Directive 1999/45/CE and its amendments

C; R35

See section 16 for the full text of the phrases or H statements declared above.

See sections 11 and 12 for more detailed information on health effects and symptoms and environmental hazards

#### 2.2 Label elements

Hazard pictograms



Signal word Danger

Hazard Statements Causes severe skin burns and eye damage

#### Precautionary Statements

Prevention Do not breathe dust/fume/gas/mist/vapours/spray. Wear protective gloves/clothing and eye/face protection.  
Response IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.  
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.



**PRODUCT: ACETIC ACID 80% PURE (ACAC80PU) REVISION: 6 DATED: 15/03/13 3 OF 12**

|                                                                                               |                                                                                                                                      |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Storage                                                                                       | Not applicable.<br>Dispose of contents and container in accordance with all local, regional, national and international regulations. |
| Supplemental label elements                                                                   | Not applicable.                                                                                                                      |
| <b>Special packaging requirements</b>                                                         |                                                                                                                                      |
| Containers to be fitted with child-resistant fastenings                                       | Yes, applicable.                                                                                                                     |
| Tactile warning of danger                                                                     | Yes, applicable.                                                                                                                     |
| <b>2.3 Other hazards</b>                                                                      |                                                                                                                                      |
| Substances meets the criteria for PBT according to Regulation (EC) No. 1907/2006, Annex XIII  | No                                                                                                                                   |
| Substances meets the criteria for vPvB according to Regulation (EC) No. 1907/2006, Annex XIII | No                                                                                                                                   |

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

#### Substances

##### Acetic Acid

| CAS Number | EINECS Number | REACH registration number | ECC Index Number | Classification according to Directive 67/548/EEC | Classification according to Regulation 1272/2008 | Content |
|------------|---------------|---------------------------|------------------|--------------------------------------------------|--------------------------------------------------|---------|
| 64-19-7    | 200-580-7     | 01-2119475328-30-XXXX     |                  | C;R35                                            | Skin Corr. 1A, H314                              | 80%     |

See section 16 for the full text of the R, H- and EUH-phrases declared above

Occupational exposure limits, if available, are listed in section 8

### 4. FIRST AID MEASURES

#### 4.1 Description of first aid measures

##### Inhalation

If inhaled, remove to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention immediately.

##### Skin contact

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Contaminated leather, particularly footwear, must be discarded. Chemical burns must be treated promptly by a physician. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

##### Eye contact

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Check for and remove any contact lenses. Chemical burns must be treated promptly by a physician. Get medical attention immediately.

##### Ingestion

Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Chemical burns must be treated promptly by a physician. Get medical attention immediately. If swallowed, rinse mouth with water (only if the person is conscious). If affected person is conscious, give plenty of water to drink.

##### Protection of first-aiders

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

#### 4.2 Most important symptoms and effects, both acute and delayed

See Section 11 for more detailed information on health effects and symptoms.

#### 4.3 Indication of any immediate medical attention and special treatment needed

Notes for physician – Treatment should in general be symptomatic and directed to relieving any effects.

### 5. FIRE FIGHTING MEASURES

#### 5.1 Extinguishing Media

##### Suitable extinguishing media

Use dry chemical, CO<sub>2</sub>, water spray (fog) or foam. (alcohol-resistant foam)

##### Unsuitable extinguishing media

Do not use water jet.

#### 5.2 Special hazards arising from the substance or mixture

##### Hazards from the substance or mixture

Flammable liquid and vapour. In a fire or if heated, a pressure increase will occur and the container may burst, with the



**PRODUCT: ACETIC ACID 80% PURE (ACAC80PU) REVISION: 6 DATED: 15/03/13 4 OF 12**

risk of a subsequent explosion. Vapours can form explosive mixtures with air. Vapours are heavier than air and can spread along the ground or float on water surfaces to remote ignition sources. Vapours may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

**Hazardous combustion products**

Combustion products may include the following:  
carbon oxides (CO, CO<sub>2</sub>) (carbon monoxide, carbon dioxide)

**5.3 Advice for fire-fighters**

**Special precautions for fire-fighters**

DO NOT FIGHT FIRE WHEN IT REACHES MATERIAL. Withdraw from fire and let it burn.

Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

**Special protective equipment for fire-fighters**

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire-fighters (including helmets, protective boots and gloves) conforming to European standard EN 469 will provide a basic level of protection for chemical incidents.

**6. ACCIDENTAL RELEASE MEASURES**

**6.1 Personal precautions, protective equipment and emergency procedures**

**For non-emergency personnel**

Immediately contact emergency personnel. No action shall be taken involving any personal risk or without suitable training. Eliminate all ignition sources. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Floors may be slippery; use care to avoid falling. No flares, smoking or flames in hazard area. Do not breathe vapour or mist. Provide adequate ventilation. Put on appropriate personal protective equipment.

**For emergency responders**

Entry into a confined space or poorly ventilated area contaminated with vapour, mist or fume is extremely hazardous without the correct respiratory protective equipment and a safe system of work. Wear self-contained breathing apparatus. Wear a suitable chemical protective suit.  
Chemical resistant boots. See also the information in "For non-emergency personnel".

**6.2 Environmental precautions**

Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

**6.3 Methods and material for containment and cleaning up**

**Small spill**

Stop leak if without risk. Move containers from spill area. Absorb with an inert material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres.

**Large spill**

Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations. Use spark-proof tools and explosion-proof equipment. Contaminated absorbent material may pose the same hazard as the spilt product. The method and equipment used must be in conformance with appropriate regulations and industry practice on explosive atmospheres. Dispose of via a licensed waste disposal contractor.

**6.4 Reference to other sections**

See Section 1 for emergency contact information.  
See Section 5 for fire fighting measures.  
See Section 8 for information on appropriate personal protective equipment.  
See Section 12 for environmental precautions.  
See Section 13 for additional waste treatment information

**7. HANDLING AND STORAGE**

**7.1 Precautions for safe handling**

**Protective measures**

Put on appropriate personal protective equipment (see Section 8). Do not get in eyes or on skin or clothing. Do not breathe vapour or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Do not reuse container. Empty containers retain product residue and can be hazardous.



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**Advice on general occupational hygiene**

Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Wash thoroughly after handling. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

**7.2 Conditions for safe storage, including any incompatibilities**

Store in accordance with local regulations. Store in a segregated and approved area. Store in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Store locked up. Eliminate all ignition sources. Separate from oxidising materials. Keep container tightly closed and sealed until ready for use. Store and use only in equipment/containers designed for use with this product. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Keep away from heat and direct sunlight. Protect from freezing.

**7.3 Specific end use(s)**

See subsection 1.2. and Exposure scenarios in annex, if applicable.

**8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

The information in this section contains generic advice and guidance. The list of identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s)

**8.1 Control parameters**

Occupational exposure limits

Product/ingredient

Acetic Acid

Exposure limit values

**EU OEL(Europe)**

TWA: 25mg/m<sup>3</sup> 8 hour(s). Issued/Revised:7/1991

TWA: 10ppm 8 hour(s). Issued/Revised 7/1991

**ACGIH TLVs**

Acetic Acid

**ACGIH TLV (United States)**

STEL: 37 mg/m<sup>3</sup> 15 minute(s). Issued/Revised: 9/1994

STEL: 15 ppm 15 minute(s). Issued/Revised: 9/1994

TWA: 25 mg/m<sup>3</sup> 8 hour(s). Issued/Revised: 9/1994

TWA: 10 ppm 8 hour(s). Issued/Revised: 9/1994

For information and guidance, the ACGIH values are included. For further information on these please consult your supplier.

Whilst specific OELs for certain components may be shown in this section, other components may be present in any mist, vapour or dust produced. Therefore, the specific OELs may not be applicable to the product as a whole and are provided for guidance only.

**Recommended monitoring procedures**

If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Reference should be made to European Standard EN 689 for methods for the assessment of exposure by inhalation to chemical agents and national guidance documents for methods for the determination of hazardous substances.

**Derived No Effect Level**

| Derived No Effect Level |            |            |                     |                     |            |         |
|-------------------------|------------|------------|---------------------|---------------------|------------|---------|
| Product/ingredient name | Type       | Exposure   |                     | Value               | Population | Effects |
| Acetic acid             | DNEL       | Short term | -                   | 25mg/m <sup>3</sup> | Workers    | Local   |
|                         |            | Inhalation |                     |                     |            |         |
|                         | DNEL       | Long term  | -                   | 25mg/m <sup>3</sup> | Workers    | Local   |
|                         |            | Inhalation |                     |                     |            |         |
|                         | DNEL       | Short term | -                   | 25mg/m <sup>3</sup> | Consumers  | Local   |
|                         |            | Inhalation |                     |                     |            |         |
| DNEL                    | Long term  | -          | 25mg/m <sup>3</sup> | Consumers           | Local      |         |
|                         | Inhalation |            |                     |                     |            |         |

**Predicted No Effect Concentration**

| Product/ingredient name | Type | Compartment Detail     | Value           | Method Detail            |
|-------------------------|------|------------------------|-----------------|--------------------------|
| Acetic acid             | PNEC | Fresh water sediment   | 11.36 mg/kg dwt | Equilibrium Partitioning |
|                         | PNEC | Marine water sediment  | 1.136 mg/kg dwt | Equilibrium Partitioning |
|                         | PNEC | Marine                 | 0.3058 mg/l     | Assessment Factors       |
|                         | PNEC | Fresh water            | 3.058mg/l       | Assessment Factors       |
|                         | PNEC | Intermittent release   | 30.58mg/l       | Assessment Factors       |
|                         | PNEC | Soil                   | 0.478mg/kg dwt  | Equilibrium Partitioning |
|                         | PNEC | Sewage Treatment Plant | 85mg/l          | Assessment Factors       |



**PRODUCT: ACETIC ACID 80% PURE (ACAC80PU) REVISION: 6 DATED: 15/03/13 6 OF 12**

**8.2 Exposure controls**

**Appropriate engineering controls**

Provide exhaust ventilation or other engineering controls to keep the relevant airborne concentrations below their respective occupational exposure limits.

All activities involving chemicals should be assessed for their risks to health, to ensure exposures are adequately controlled. Personal protective equipment should only be considered after other forms of control measures (e.g. engineering controls) have been suitably evaluated. Personal protective equipment should conform to appropriate standards, be suitable for use, be kept in good condition and properly maintained.

Your supplier of personal protective equipment should be consulted for advice on selection and appropriate standards. For further information contact your national organisation for standards. The final choice of protective equipment will depend upon a risk assessment. It is important to ensure that all items of personal protective equipment are compatible.

**Individual protection measures**

**Hygiene Measures**

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Ensure that eyewash stations and safety showers are close to the workstation location.

**Respiratory protection**

Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary.

The correct choice of respiratory protection depends upon the chemicals being handled, the conditions of work and use, and the condition of the respiratory equipment. Safety procedures should be developed for each intended application. Respiratory protection equipment should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

**Recommended:** acid gas filter (Type A)

**Hand protection**

Wear suitable gloves. The correct choice of protective gloves depends upon the chemicals being handled, the conditions of work and use, and the condition of the gloves (even the best chemically resistant glove will break down after repeated chemical exposures). Most gloves provide only a short time of protection before they must be discarded and replaced. Because specific work environments and material handling practices vary, safety procedures should be developed for each intended application. Gloves should therefore be chosen in consultation with the supplier/manufacturer and with a full assessment of the working conditions.

**Gloves material**

Recommended: Butyl rubber gloves

**Eye protection**

Recommended: Chemical splash goggles. Face shield.

**Skin protection**

Use of protective clothing is good industrial practice.

Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Cotton or polyester/cotton overalls will only provide protection against light superficial contamination that will not soak through to the skin. Overalls should be laundered on a regular basis. When the risk of skin exposure is high (e.g. when cleaning up spillages or if there is a risk of splashing) then chemical resistant aprons and/or impervious chemical suits and boots will be required.

Recommended: Hard hat.

Chemical resistant boots.

Chemical resistant apron

Full chemical protective suit with a hood.

Chemical protective suit consisting of a jacket and trousers. The jacket should be buttoned up to the neck, sleeves sealed at the gloves, and trouser legs worn outside the boots. These precautions are required to prevent the clothing from accidentally trapping product against the skin.

**Environmental exposure controls**

Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.



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**9. PHYSICAL AND CHEMICAL PROPERTIES**

**9.1 Information on basic physical and chemical properties**

|                                |                                                                       |
|--------------------------------|-----------------------------------------------------------------------|
| Physical State                 | Liquid                                                                |
| Colour                         | Clear. Colourless                                                     |
| Odour                          | Vinegar                                                               |
| Odour threshold                | Not available                                                         |
| pH[conc. (%w/w): 6.006%]       | 2.4                                                                   |
| Boiling Range/Point (°C)       | 117.9                                                                 |
| Melting Point (°C)             | -7                                                                    |
| Flash Point (PMCC) (°C)        | 60.56 (Closed Cup) Pensky-Martens                                     |
| Evaporation rate               | Not available.                                                        |
| Flammability (solids, gas)     | Not applicable. Endpoint waved according to REACH Annex VII, IX or XI |
| Explosion Limits (%)           | Lower limit 4.0 Upper limit 19.9                                      |
| Density (kg/m <sup>3</sup> )   | 1.07 at 25°C                                                          |
| Auto-flammability (°C)         | 463                                                                   |
| Viscosity                      | Kinematic: 1.22 cP at 20°C                                            |
| Solubility                     | Miscible in water, (100%)                                             |
| Auto-ignition temperature (°C) | 516                                                                   |

**10. STABILITY AND REACTIVITY**

**10.1 Reactivity**

No specific test data available for this product. Refer to Conditions to avoid and Incompatible materials for additional information

**10.2 Chemical stability**

The product is stable.

**10.3 Possibility of hazardous reactions**

Under normal conditions of storage and use, hazardous reactions will not occur.

Under normal conditions of storage and use, hazardous polymerisation will not occur.

**10.4 Conditions to avoid**

Keep away from heat, sparks and flame. This product should be stored away from oxidising materials and strong bases. Protect from freezing.

**10.5 Incompatible materials**

Reactive with metals, oxidising materials, reducing agents, alkalis and alcohols.

**10.6 Hazardous decomposition products**

Under normal conditions of storage and use, hazardous decomposition products should not be produced.

**11. TOXICOLOGICAL INFORMATION**

**11.1 Information on toxicological effects**

**Acute toxicity**

| Product /Ingredient Name | Result/Route           | Test Authority /Number | Species | Dose       | Exposure  | Remarks |                         |
|--------------------------|------------------------|------------------------|---------|------------|-----------|---------|-------------------------|
| Acetic acid              | LD50 Oral              | Not guideline          | -       | Mouse      | 4960mg/kg | -       | Based on sodium acetate |
|                          | LD50 Oral              | Not guideline          | -       | Rat        | 3530mg/kg | -       | -                       |
|                          | LD50 Oral              | Not guideline          | -       | Rat        | 3310mg/kg | -       | Based on sodium acetate |
|                          | LC50 Inhalation Vapour | Not guideline          | -       | Rat        | >16000ppm | 4 hours | -                       |
|                          | LC50 Inhalation Vapour | Not guideline          | -       | Mouse      | 5620ppm   | 1 hour  | -                       |
|                          | LC50 Inhalation Vapour | Not guideline          | -       | Mouse-Male | 277ppm    | 1 hour  | -                       |
|                          |                        |                        |         |            |           |         |                         |

**Irritation/Corrosion**

| Product/Ingredient Name | Test Authority/Test Number | Species | Route/Result                         | Test Concentration | Remarks |
|-------------------------|----------------------------|---------|--------------------------------------|--------------------|---------|
| Acetic acid             | Equivalent to OECD 404     | Rabbit  | Skin-slightly irritating to the skin | 3.3%               | -       |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------|-----------------------------------------|----------|------------------------------|--------------------------------------|----------------------|-----------|------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | Equivalent to OECD 404     | Rabbit                                  |          |                              | Skin-slightly irritating to the skin | 10%                  | -         |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | Equivalent to OECD 405     | Rabbit                                  |          |                              | Eyes Irritant                        | 0.1ml, 10%           | -         |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | Equivalent to OECD 405     | Rabbit                                  |          |                              | Eyes-Severe Irritant                 | 0.01ml,10%           | -         |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  | Equivalent to EPA OPP 81-4 | Rabbit                                  |          |                              | Eyes –Cornea opacity                 | 0.1ml, 5%            | -         |                                                                        |
| <b>Skin</b><br>Corrosive to the skin<br><b>Eyes</b><br>Corrosive to the eyes                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
| Product/<br>Ingredient Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Test<br>Authority/Test<br>Number | Cell                       | Type                                    | Results  | Remarks                      |                                      |                      |           |                                                                        |
| Acetic acid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | OECD 476 -                       | Experiment:<br>In Vitro    | Subject: Mammal-<br>species unspecified | Negative | Based on Acetic<br>anhydride |                                      |                      |           |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | OECD 473 -                       | Experiment:<br>In Vitro    | Subject: Mammal<br>Species unspecified  | Negative | -                            |                                      |                      |           |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | OECD 471 -                       | Experiment:<br>In Vitro    | Subject: non-<br>mammalian species      | Negative | -                            |                                      |                      |           |                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | OECD 474 -                       | Experiment:<br>In Vitro    | Subject: unspecified                    | Negative | Based on Acetic<br>anhydride |                                      |                      |           |                                                                        |
| <b>Conclusion/Summary</b><br>Not classified. Based on available data, the classification criteria are not met.                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
| <b>Reproductive Toxicity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
| Product<br>/Ingredi<br>ent<br>Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Test<br>Authority                | Test<br>Number             | Species                                 | Route    | Exposure                     | Developmental                        | Maternal<br>Toxicity | Fertility | Remarks                                                                |
| Acetic<br>acid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | EU                               | B.31                       | Rabbit                                  | Oral     | 13 days                      | Negative                             | -                    | -         | No effects<br>observed<br>(based on<br>vinegar<br>(5%Acetic<br>acid)). |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EU                               | B.31                       | Rat                                     | Oral     | 10 days                      | Negative                             | -                    | -         | No effects<br>observed<br>(based on<br>vinegar<br>(5%Acetic<br>acid)). |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | EU                               | B.31                       | Mouse                                   | Oral     | 10 days                      | Negative                             | -                    | -         | No effects<br>observed<br>(based on<br>vinegar<br>(5%Acetic<br>acid)). |
| <b>Conclusion/Summary</b><br>Development: Not classified. Based on available data, the classification criteria are not met. Assessment was by using a weight of evidence approach .Fertility: Not classified. Based on available data, the classification criteria are not met. Assessment was by using a weight of evidence approach.<br>Effects on or via lactation: Not classified. Based on available data, the classification criteria are not met. Assessment was by using a weight of evidence approach. |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
| <b>Aspiration hazard</b><br>Not classified. Based on available data, the classification criteria are not met.                                                                                                                                                                                                                                                                                                                                                                                                   |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
| <b>Specific target organ toxicity</b><br><b>Information on the likely routes of exposure</b><br>Routes of entry anticipated: Dermal, Inhalation.                                                                                                                                                                                                                                                                                                                                                                |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |
| <b>Potential acute health effect</b><br><b>Inhalation</b><br>May give off gas, vapour or dust that is very irritating or corrosive to the respiratory system.                                                                                                                                                                                                                                                                                                                                                   |                                  |                            |                                         |          |                              |                                      |                      |           |                                                                        |



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Causes burns to mouth, throat and stomach

Causes severe burns.

Causes serious eye damage.

## Inhalation

respiratory tract irritation

## Ingestion

Stomach pains

Adverse symptoms may include the following:

## Redness

## Eye contact

Pain

## Watering

Redness

## General

### Other chronic toxicity data

**Acetic Acid:** Humans unacclimatized to acetic acid vapours experience extreme eye and nasal irritation at concentrations above 25 ppm. Air concentrations of 50 ppm are considered intolerable, causing intense lachrymation (eye weeping), nose, and throat irritation. Repeated exposures to high concentrations in man can cause eye conjunctival lesions, blackening of the hands, hyperkeratosis (thickening) of the skin, teeth erosion, congestion and oedema of the pharynx, bronchial constriction, and respiratory tract irritation

Not classified. Based on available data, the classification criteria are not met.

No known significant effects or critical hazards

No known significant effects or critical hazards

**Reproductive Toxicity**  
No known significant effects or critical hazards

## 12.1 Toxicity

| Product/<br>Ingredient<br>Name | Test<br>Authority | Test<br>Number | Species            | Type/Result                                       | Exposure | Effects          | Remarks                 |
|--------------------------------|-------------------|----------------|--------------------|---------------------------------------------------|----------|------------------|-------------------------|
| Acetic acid                    | OECD              | 202            | Daphnia            | Acute EC50>300.82<br>mg/l Nominal Fresh water     | 48 hours | Mobility         | Based on<br>Acetate ion |
|                                | ISO               | 10253          | Algae              | Acute EC%0> 300.82<br>mg/Nominal Marine<br>water  | 72 hours | (growth rate)    | Based on<br>Acetate ion |
|                                | OECD              | 203            | Fish               | Acute LC50> 300.82<br>mg/l Nominal fresh water    | 96 hours | Mortality        | Based on<br>Acetate ion |
|                                | not guideline     | -              | Micro-<br>Organism | Acute NOEC<br>850mg/lNominal Fresh<br>Water       | 16 hours | -                | -                       |
|                                | ISO               | 10253          | Algae              | Acute NOEC 300.82<br>mg/l<br>Nominal Marine water | 72 hours | (Growth<br>Rate) | Based on<br>Acetate ion |

Not classified as dangerous



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**12.2 Persistence and degradability**

Readily biodegradable

| Product/Ingredient Name | Test/Authority/Test Number                      | Result/Exposure                                           | Remarks                                                   |
|-------------------------|-------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------|
| Acetic acid             | Not guideline<br>Not guideline<br>Not guideline | 96% - Readily – 20 days<br>50% -26.7 days<br>50% - 2 days | -<br>Phototransformation In Air<br>Biodegradation In Soil |

**12.3 Bioaccumulative potential**

This product is not expected to bioaccumulate through food chains in the environment

| Product/Ingredient Name | Log P <sub>ow</sub> | BCF  | Potential |
|-------------------------|---------------------|------|-----------|
| Acetic acid             | -0.17               | 3.16 | low       |

**12.4 Mobility in soil**

**Soil/water partition coefficient (K<sub>oc</sub>)**

Not available

**Mobility**

This product may move with surface or groundwater flows because its water solubility is: 100% Miscible in water.

**12.5 Results of PBT and vPvB assessment**

BPT

No

vPvB

No

**12.6 Other adverse effects**

No known significant effects or critical hazards.

**13. DISPOSAL CONSIDERATIONS**

The information in this section contains generic advice and guidance. The list of Identified Uses in Section 1 should be consulted for any available use-specific information provided in the Exposure Scenario(s).

**13.1 Waste treatment methods**

**Product**

**Methods of disposal**

The generation of waste should be avoided or minimised wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements

**Hazardous waste**

The classification of the product may meet the criteria for a hazardous waste.

**Packaging**

**Methods of disposal**

Where possible, arrange for product to be recycled. Dispose of via an authorised person/ licensed waste disposal contractor in accordance with local regulations.

**Special precautions**

This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapour from product residues may create a highly flammable or explosive atmosphere inside the container. Empty containers represent a fire hazard as they may contain flammable product residues and vapour. Never weld, solder or braze empty containers. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers

**14. TRANSPORT INFORMATION**

|                                | ADR/RID                                                                                  | AND/ADNR                                                                                 | IMDG                                                                                       | IATA                                                                                       |
|--------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| 14.1 UN number                 | UN 2790                                                                                  | UN 2790                                                                                  | UN2790                                                                                     | UN2790                                                                                     |
| 14.2 UN proper shipping name   | Acetic acid, glacial or acetic acid solution, more than 80% acid, by mass acid solution  | Acetic acid, glacial or acetic acid solution, more than 80% acid, by mass acid solution  | Acetic acid, glacial or acetic acid solution, more than 80% acid, by mass acid solution    | Acetic acid, glacial or acetic acid solution, more than 80% acid, by mass acid solution    |
| 14.3 Transport hazard class(s) | 8<br> | 8<br> | 8<br> | 8<br> |
| 14.4 Packaging group           | II                                                                                       | II                                                                                       | II                                                                                         | II                                                                                         |
| 14.5 Environmental hazards     | No                                                                                       | No                                                                                       | No                                                                                         | No                                                                                         |



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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                         |                                    |                                    |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|------------------------------------|------------------------------------|---------------|
| 14.6 special precautions for user                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Not Available                                           | Not Available                      | Not Available                      | Not Available |
| Additional Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Hazardous identification number 80<br>Tunnel code E     | Remarks<br>Table C.      Danger: 8 | Emergency schedules (EmS) F-E, S-C |               |
| UK emergency Action code: 2P<br>ADR/RID Classification code: CF1<br>AND/ADNR Classification code: CF1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                         |                                    |                                    |               |
| 14.7 Transport in bulk according to Annex II of Marpol 73/78 and the IBC code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Proper shipping name<br>Ship type<br>Pollution category | Acetic acid<br>3<br>Z              |                                    |               |
| 15.      REGULATORY INFORMATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                         |                                    |                                    |               |
| 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                         |                                    |                                    |               |
| EU Regulation (EC) No. 1907/2006 (REACH)<br>Annex XIV- list of substances subject to authorisation Substances of very high concern<br>None of the components are listed.<br>Annex XVII – Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles.<br>Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                         |                                    |                                    |               |
| Other regulations<br>United States inventory (TSCA 8b) All components are listed or exempted<br>Australia inventory (AICS) All components are listed or exempted<br>Canada inventory All components are listed or exempted<br>China inventory (IECSC) All components are listed or exempted<br>Japan inventory (ENCS) All components are listed or exempted<br>Korea inventory (KECI) All components are listed or exempted<br>Philippines inventory (PICCS) All components are listed or exempted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                         |                                    |                                    |               |
| 15.2 Chemical safety assessment<br>Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                         |                                    |                                    |               |
| 16.      OTHER INFORMATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                         |                                    |                                    |               |
| Abbreviation and acronyms<br>ADN/ADNR = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway<br>ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road<br>ATE = Acute Toxicity Estimate<br>BCF = Bioconcentration Factor<br>CAS = Chemical Abstracts Service<br>CLP = Classification, Labelling and Packaging Regulation [Regulation (EC) No. 1272/2008]<br>CSA = Chemical Safety Assessment<br>CSR = Chemical Safety Report<br>DMEL = Derived Minimal Effect Level<br>DNEL = Derived No Effect Level<br>DPD = Dangerous Preparations Directive [1999/45/EC]<br>DSD = Dangerous Substances Directive [67/548/EEC]<br>EINECS = European Inventory of Existing Commercial chemical Substances<br>ES = Exposure Scenario<br>EUH statement = CLP-specific Hazard statement<br>EWC = European Waste Catalogue<br>GHS = Globally Harmonized System of Classification and Labelling of Chemicals<br>IATA = International Air Transport Association<br>IBC = Intermediate Bulk Container<br>IMDG = International Maritime Dangerous Goods<br>LogPow = logarithm of the octanol/water partition coefficient<br>MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)<br>OECD = Organisation for Economic Co-operation and Development<br>PBT = Persistent, Bioaccumulative and Toxic<br>PNEC = Predicted No Effect Concentration<br>RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail<br>RRN = REACH Registration Number<br>SADT = Self-Accelerating Decomposition Temperature<br>SVHC = Substances of Very High Concern |                                                         |                                    |                                    |               |



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STOT-RE = Specific Target Organ Toxicity - Repeated Exposure

STOT-SE = Specific Target Organ Toxicity - Single Exposure

TWA = Time weighted average

UN = United Nations

UVCB = Complex hydrocarbon substance

VOC = Volatile Organic Compound

vPvB = Very Persistent and Very Bioaccumulative

**Full text of abbreviated H statements**

H314 causes severe skin burns and eye damage

**Full text of classifications (CLP/GHS)**

Skin Corr. 1A, H314 SKIN CORROSION/IRRITATION – Category 1A

**Full text of abbreviated R phrases**

R35 – causes severe burns.

Full text of classifications (DSD/DPD)

C - Corrosive

**Modifications from last revision**

The Safety Data Sheets have been revised in Section 1

**Date:** 15/03/13

*SAFETY DATA SHEET according to Regulation (EC) No. 1907/2006***Caustic Soda 5 - 50% (11-106°TW)**

Version 7.0

Print Date 2013/07/26

Revision date / valid from 2013/07/26

**MSDS code: MCSS550****Section 1: Identification of the substance/mixture and of the company/undertaking****1.1. Product identifier**

Trade name : Caustic Soda 5 - 50% (11-106°TW)  
Substance name : sodium hydroxide  
Index-No. : 011-002-00-6  
CAS-No. : 1310-73-2  
EC-No. : 215-185-5  
Registration number : 01-2119457892-27-xxxx

**1.2. Relevant identified uses of the substance or mixture and uses advised against**

Use of the Substance/Mixture : Identified use: See table in front of appendix for a complete overview of identified uses.  
Uses advised against : At this moment we have not identified any uses advised against

**1.3. Details of the supplier of the safety data sheet**

Company : Brenntag UK & Ireland  
Albion House, Rawdon Park  
GB LS19 7XX Leeds Yeadon  
Telephone : +44 (0) 113 3879 200  
Telefax : +44 (0) 113 3879 280  
E-mail address : msds@brenntag.co.uk

**1.4. Emergency telephone number**

Emergency telephone number : Emergency only telephone number (open 24 hours):  
+44 (0) 1865 407333 (N.C.E.C. Culham)

**Section 2: Hazards identification****2.1. Classification of the substance or mixture****Classification according to Regulation (EC) No 1272/2008**

| REGULATION (EC) No 1272/2008 |                 |               |                   |
|------------------------------|-----------------|---------------|-------------------|
| Hazard class                 | Hazard category | Target Organs | Hazard statements |
| Corrosive to metals          | Category 1      | ---           | H290              |
| Skin corrosion               | Category 1A     | ---           | H314              |

## Caustic Soda 5 - 50% (11-106°TW)

For the full text of the H-Statements mentioned in this Section, see Section 16.

### Classification according to EU Directives 67/548/EEC or 1999/45/EC

| Directive 67/548/EEC or 1999/45/EC |              |
|------------------------------------|--------------|
| Hazard symbol / Category of danger | Risk phrases |
| Corrosive (C)                      | R35          |

For the full text of the R-phrases mentioned in this Section, see Section 16.

### Most important adverse effects

- Human Health : See section 11 for toxicological information.
- Physical and chemical hazards : See section 9 for physicochemical information.
- Potential environmental effects : See section 12 for environmental information.

## 2.2. Label elements

### Labelling according to Regulation (EC) No 1272/2008

- Hazard symbols : 
- Signal word : Danger
- Hazard statements : H290 May be corrosive to metals.  
H314 Causes severe skin burns and eye damage.
- Precautionary statements
- Prevention : P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.
- Response : P301 + P330 + P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.  
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.  
P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.  
P308 IF exposed or concerned:  
P310 Immediately call a POISON CENTER or doctor/ physician.

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### Hazardous components which must be listed on the label:

- sodium hydroxide

### 2.3. Other hazards

For Results of PBT and vPvB assessment see section 12.5.

## Section 3: Composition/information on ingredients

### 3.1. Substances

Chemical nature : Aqueous solution

| Hazardous components                 | Amount [%]   | Classification<br>(REGULATION (EC) No 1272/2008) |                      | Classification<br>(67/548/EEC) |
|--------------------------------------|--------------|--------------------------------------------------|----------------------|--------------------------------|
|                                      |              | Hazard class /<br>Hazard category                | Hazard<br>statements |                                |
| sodium hydroxide                     |              |                                                  |                      |                                |
| Index-No. : 011-002-00-6             | >= 5 - <= 50 | Met. Corr.1                                      | H290                 | Corrosive; C; R35              |
| CAS-No. : 1310-73-2                  |              | Skin Corr.1A                                     | H314                 |                                |
| EC-No. : 215-185-5                   |              |                                                  |                      |                                |
| Registration : 01-2119457892-27-xxxx |              |                                                  |                      |                                |

For the full text of the R-phrases mentioned in this Section, see Section 16.

For the full text of the H-Statements mentioned in this Section, see Section 16.

## Section 4: First aid measures

### 4.1. Description of first aid measures

- General advice : Take off all contaminated clothing immediately.
- If inhaled : In case of accident by inhalation: remove casualty to fresh air and keep at rest. If breathing is irregular or stopped, administer artificial respiration. Call a physician immediately.
- In case of skin contact : Wash off immediately with plenty of water for at least 15 minutes. Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and with difficulty.
- In case of eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Consult an eye specialist immediately. Go to an ophthalmic hospital if possible.
- If swallowed : Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a physician immediately. Rinse

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mouth with water.  
Give small amounts of water to drink.

### 4.2. Most important symptoms and effects, both acute and delayed

Symptoms : See Section 11 for more detailed information on health effects and symptoms.

Effects : See Section 11 for more detailed information on health effects and symptoms.

### 4.3. Indication of any immediate medical attention and special treatment needed

Treatment : Treat symptomatically. No further information available.

## Section 5: Firefighting measures

### 5.1. Extinguishing media

Suitable extinguishing media : The product itself does not burn. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media : High volume water jet

### 5.2. Special hazards arising from the substance or mixture

Specific hazards during firefighting : Reacts exothermic with water, Gives off hydrogen by reaction with base metals (zinc, aluminium). Risk of explosion.

### 5.3. Advice for firefighters

Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus. Wear appropriate body protection (full protective suit)

Further information : Collect contaminated fire extinguishing water separately. This must not be discharged into drains.

## Section 6: Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions : Use personal protective equipment. Keep away unprotected persons. Danger of slipping if spilled. Avoid contact with skin and eyes. Do not breathe vapours or spray mist.

### 6.2. Environmental precautions

Environmental precautions : Do not flush into surface water or sanitary sewer system. Avoid subsoil penetration. If the product contaminates rivers and lakes or drains inform respective authorities. If material reaches soil inform authorities responsible for such cases.

### 6.3. Methods and materials for containment and cleaning up

## Caustic Soda 5 - 50% (11-106°TW)

Methods and materials for containment and cleaning up : Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders). Keep in suitable, closed containers for disposal.

Further information : Treat recovered material as described in the section "Disposal considerations".

### 6.4. Reference to other sections

See Section 1 for emergency contact information.

See Section 8 for information on personal protective equipment.

See Section 13 for waste treatment information.

## Section 7: Handling and storage

### 7.1. Precautions for safe handling

Advice on safe handling : Keep container tightly closed. Use personal protective equipment. Provide sufficient air exchange and/or exhaust in work rooms. Avoid formation of aerosol. In case of mist, spray or aerosol exposure wear suitable personal respiratory protection and protective suit. Avoid contact with the skin and the eyes. Avoid inhalation of vapour or mist. Emergency eye wash fountains and emergency showers should be available in the immediate vicinity.

Hygiene measures : Keep away from food, drink and animal feedingstuffs. Smoking, eating and drinking should be prohibited in the application area. Wash hands before breaks and at the end of workday. Take off all contaminated clothing immediately.

### 7.2. Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers : Keep in an area equipped with alkali resistant flooring. Store in original container. Materials to avoid; Aluminium; Zinc; Tin; Suitable materials for containers: Stainless steel; carbon steel

Advice on protection against fire and explosion : The product is not flammable. Normal measures for preventive fire protection. Gives off hydrogen by reaction with base metals (zinc, aluminium). Risk of explosion.

Further information on storage conditions : Keep tightly closed in a dry and cool place. Keep in a well-ventilated place.

Advice on common storage : Keep away from food, drink and animal feedingstuffs. Do not store together with acids and ammonium salts. Materials to avoid: Organic peroxides

German storage class : 8B: Non-combustible substances, corrosive

### 7.3. Specific end use(s)

Specific use(s) : Identified use: See table in front of appendix for a complete overview of identified uses.

## Caustic Soda 5 - 50% (11-106°TW)

### Section 8: Exposure controls/personal protection

#### 8.1. Control parameters

|                                                                           |                         |                                    |
|---------------------------------------------------------------------------|-------------------------|------------------------------------|
| <b>Component:</b>                                                         | <b>sodium hydroxide</b> | <b>CAS-No.</b><br><b>1310-73-2</b> |
| <b>Derived No Effect Level (DNEL)/Derived Minimal Effect Level (DMEL)</b> |                         |                                    |

DNEL

Workers, Long-term - local effects, Inhalation : 1.0 mg/m<sup>3</sup>

#### Other Occupational Exposure Limit Values

EH40 WEL, Short Term Exposure Limit (STEL):  
2 mg/m<sup>3</sup>

ELV (IE), Short Term Exposure Limit (STEL):  
2 mg/m<sup>3</sup>

#### 8.2. Exposure controls

##### Appropriate engineering controls

Refer to protective measures listed in sections 7 and 8.

##### Personal protective equipment

###### *Respiratory protection*

Advice : Use respirator with appropriate filter if vapours or aerosol are released.  
Recommended Filter type:  
Particle filter:P2  
Particle filter:P3

###### *Hand protection*

Advice : Wear suitable gloves.  
The glove material has to be impermeable and resistant to the product / the substance / the preparation.  
Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).  
Protective gloves should be replaced at first signs of wear.

Material : Natural Rubber  
Break through time : >= 8 h  
Glove thickness : 0.5 mm

Material : polychloroprene

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Break through time :  $\geq 8$  h  
 Glove thickness : 0.5 mm

Material : Nitrile rubber  
 Break through time :  $\geq 8$  h  
 Glove thickness : 0.35 mm

Material : butyl-rubber  
 Break through time :  $\geq 8$  h  
 Glove thickness : 0.5 mm

Material : Fluorinated rubber  
 Break through time :  $\geq 8$  h  
 Glove thickness : 0.4 mm

Material : Polyvinylchloride  
 Break through time :  $\geq 8$  h  
 Glove thickness : 0.5 mm

### Eye protection

Advice : Tightly fitting safety goggles

### Skin and body protection

Advice : alkali resistant protective clothing

### Environmental exposure controls

General advice : Do not flush into surface water or sanitary sewer system.  
 Avoid subsoil penetration.  
 If the product contaminates rivers and lakes or drains inform respective authorities.  
 If material reaches soil inform authorities responsible for such cases.

## Section 9: Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

Form : liquid  
 Colour : colourless  
 Odour : odourless  
 Odour Threshold : no data available  
 pH : ca. 14 (20 °C)

## Caustic Soda 5 - 50% (11-106°TW)

|                                        |                             |
|----------------------------------------|-----------------------------|
| Melting point/range                    | : no data available         |
| Boiling point/boiling range            | : no data available         |
| Flash point                            | : not applicable            |
| Evaporation rate                       | : no data available         |
| Flammability (solid, gas)              | : does not ignite           |
| Upper explosion limit                  | : not applicable            |
| Lower explosion limit                  | : not applicable            |
| Vapour pressure                        | : no data available         |
| Relative vapour density                | : no data available         |
| Density                                | : no data available         |
| Water solubility                       | : completely soluble        |
| Partition coefficient: n-octanol/water | : no data available         |
| Auto-ignition temperature              | : not applicable            |
| Thermal decomposition                  | : no data available         |
| Viscosity, dynamic                     | : no data available         |
| Explosivity                            | : Product is not explosive. |
| Oxidizing properties                   | : no data available         |

### 9.2. Other information

|                     |                       |
|---------------------|-----------------------|
| Corrosion to metals | : Corrosive to metals |
|---------------------|-----------------------|

## Section 10: Stability and reactivity

### 10.1. Reactivity

|        |                                                                      |
|--------|----------------------------------------------------------------------|
| Advice | : Gives off hydrogen by reaction with base metals (zinc, aluminium). |
|--------|----------------------------------------------------------------------|

### 10.2. Chemical stability

|        |                                                       |
|--------|-------------------------------------------------------|
| Advice | : No decomposition if stored and applied as directed. |
|--------|-------------------------------------------------------|

### 10.3. Possibility of hazardous reactions

|                     |                                                                |
|---------------------|----------------------------------------------------------------|
| Hazardous reactions | : Exothermic reaction with strong acids. Gives off hydrogen by |
|---------------------|----------------------------------------------------------------|

## Caustic Soda 5 - 50% (11-106°TW)

reaction with base metals (zinc, aluminium). Risk of explosion.

### 10.4. Conditions to avoid

Conditions to avoid : No information available.  
Thermal decomposition : no data available

### 10.5. Incompatible materials

Materials to avoid : Materials to avoid: Acids, Light metals, Aluminium, Zinc, Organic peroxides

### 10.6. Hazardous decomposition products

Hazardous decomposition products : No information available.

## Section 11: Toxicological information

### 11.1. Information on toxicological effects

#### Acute toxicity

##### Inhalation

Inhalation may cause pain in respiratory system, sneezing, coughing and difficulty in breathing. Risk for pulmonary edema by high concentration.

#### Irritation

##### Eyes

Result : Very corrosive (rabbit)  
Risk of serious damage to eyes.

|                   |                         |                                    |
|-------------------|-------------------------|------------------------------------|
| <b>Component:</b> | <b>sodium hydroxide</b> | <b>CAS-No.</b><br><b>1310-73-2</b> |
|-------------------|-------------------------|------------------------------------|

#### Acute toxicity

##### Inhalation

no data available

## Section 12: Ecological information

### 12.1. Toxicity

|                   |                         |                                    |
|-------------------|-------------------------|------------------------------------|
| <b>Component:</b> | <b>sodium hydroxide</b> | <b>CAS-No.</b><br><b>1310-73-2</b> |
|-------------------|-------------------------|------------------------------------|

## Caustic Soda 5 - 50% (11-106°TW)

### Acute toxicity

#### Fish

LC50 : 125 mg/l (Gambusia affinis; 96 h)

LC50 : 145 mg/l (Poecilia reticulata; 24 h)

#### Toxicity to daphnia and other aquatic invertebrates

EC50 : 76 mg/l (Daphnia magna; 24 h)

#### Bacteria

EC50 : 22 mg/l (Photobacterium phosphoreum; 15 min)

### 12.2. Persistence and degradability

#### Persistence and degradability

##### Biodegradability

Result : The methods for determining biodegradability are not applicable to inorganic substances.

### 12.3. Bioaccumulative potential

#### Bioaccumulation

Result : Does not bioaccumulate.

### 12.4. Mobility in soil

#### Mobility

Result : The product is mobile in water environment.

### 12.5. Results of PBT and vPvB assessment

### 12.6. Other adverse effects

## Section 13: Disposal considerations

### 13.1. Waste treatment methods

Product : Eliminate waste in conditions authorized by the regulations.

## Caustic Soda 5 - 50% (11-106°TW)

Store waste in containers provided for this purpose. Do not dump in drains, water sheets or the ground.

Contaminated packaging : Empty contaminated packagings thoroughly. They can be recycled after thorough and proper cleaning. Packagings that cannot be cleaned are to be disposed of in the same manner as the product.

European Waste Catalogue Number : No waste code according to the European Waste Catalogue can be assigned for this product, as the intended use dictates the assignment. The waste code is established in consultation with the regional waste disposer.

### Section 14: Transport information

#### 14.1. UN number

1824

#### 14.2. UN proper shipping name

ADR : SODIUM HYDROXIDE SOLUTION  
 RID : SODIUM HYDROXIDE SOLUTION  
 IMDG : SODIUM HYDROXIDE SOLUTION

#### 14.3. Transport hazard class(es)

ADR-Class : 8  
 (Labels; Classification Code; Hazard identification No; Tunnel restriction code) 8; C5; 80; (E)  
 RID-Class : 8  
 (Labels; Classification Code; Hazard identification No) 8; C5; 80  
 IMDG-Class : 8  
 (Labels; EmS) 8; F-A, S-B

#### 14.4. Packaging group

ADR : II  
 RID : II  
 IMDG : II

#### 14.5. Environmental hazards

Labeling according to 5.2.1.8 ADR : no  
 Labeling according to 5.2.1.8 RID : no  
 Labeling according to 5.2.1.6.3 IMDG : no  
 Classification as environmentally hazardous according to 2.9.3 IMDG : no  
 Classified as "P" according to 2.10 IMDG : no

#### 14.6. Special precautions for user

Not applicable.

## Caustic Soda 5 - 50% (11-106°TW)

### 14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

IMDG : Not applicable.

### Section 15: Regulatory information

#### 15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Other regulations : Occupational restrictions: Take note of Dir 92/85/EEC on the safety and health of pregnant workers at work and of Dir 94/33/EC on the protection of young people at work.

#### || sodium hydroxide

EU. Regulation No 1451/2007 [Biocides], Annex I, Active substances identified as existing (OJ (L 325)  
Listed EC Number: 215-185-5

#### 15.2. Chemical Safety Assessment

A Chemical Safety Assessment has been carried out for this substance.

### Section 16: Other information

#### Full text of R-phrases referred to under sections 2 and 3.

R35 Causes severe burns.

#### Full text of H-Statements referred to under sections 2 and 3.

H290 May be corrosive to metals.

H314 Causes severe skin burns and eye damage.

#### Further information

Other information : The information provided in this Safety Data Sheet is correct to our knowledge at the date of its revision. The information given only describes the products with regard to safety arrangements and is not to be considered as a warranty or quality specification and does not constitute a legal relationship. The information contained in this Safety Data Sheet relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text

|| Indicates updated section.

**Caustic Soda 5 - 50% (11-106°TW)**

| No. | Short title                       | Main User Group (SU) | Sector of Use (SU) | Product Category (PC) | Process Category (PROC)                  | Environmental Release Category (ERC) | Article Category (AC) | Specified |
|-----|-----------------------------------|----------------------|--------------------|-----------------------|------------------------------------------|--------------------------------------|-----------------------|-----------|
| 1   | Manufacture of substance - liquid | 3                    | 8                  | NA                    | 1, 2, 3, 4, 8a, 8b, 9                    | 1                                    | NA                    | ES035     |
| 2   | Manufacture of substance - solid  | 3                    | 8                  | NA                    | 1, 2, 3, 4, 8a, 8b, 9                    | 1                                    | NA                    | ES057     |
| 3   | Industrial use                    | 3                    | NA                 | NA                    | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 15  | 2, 4, 6a, 6b, 7                      | NA                    | ES065     |
| 4   | Professional use                  | 22                   | NA                 | NA                    | 1, 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15 | 8a, 8b, 8d, 9a                       | NA                    | ES067     |
| 5   | Consumer use                      | 21                   | NA                 | 20, 35, 39            | NA                                       | 8a, 8b, 8d, 9a                       | NA                    | ES075     |

## Caustic Soda 5 - 50% (11-106°TW)

### 1. Short title of Exposure Scenario 1: Manufacture of substance - liquid

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Sectors of end-use               | SU8: Manufacture of bulk, large scale chemicals (including petroleum products)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |
| Environmental Release Categories | ERC1: Manufacture of substances                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 2.1 Contributing scenario controlling environmental exposure for: ERC1

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Concentration of substance in product : 0% - 50%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Other given operational conditions affecting environmental exposure                                                                                                                                                                                            | Continuous exposure                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Application Area                                  | Industrial use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                                | Water                                             | Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised. In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. Risk management measures related to the environment aim to avoid discharging the substance into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. |
|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Conditions and measures related to external treatment of waste for disposal                                                                                                                                                                                    | Disposal methods                                  | Waste should be reused or discharged to the industrial wastewater and further neutralized if needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9

|                                                                                        |                                                                                                                                                                                   |                                                  |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Product characteristics                                                                | Concentration of the Substance in Mixture/Article                                                                                                                                 | Concentration of substance in product : 0% - 50% |
|                                                                                        | Physical Form (at time of use)                                                                                                                                                    | liquid                                           |
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                  | 200 days/year                                    |
|                                                                                        | Frequency of use                                                                                                                                                                  | 8 hours/day                                      |
| Technical conditions and measures to control dispersion from source towards the worker | Application Area                                                                                                                                                                  | Industrial use                                   |
|                                                                                        | Use closed systems or covering of open containers (e.g. screens)<br>Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.) |                                                  |

## Caustic Soda 5 - 50% (11-106°TW)

|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                       | Use of pliers, grip arms with long handles with manual use to avoid direct contact and exposure by splashes (no working over one's head)                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Organisational measures to prevent /limit releases, dispersion and exposure           | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                       | Industrial use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                       | Replacing, where appropriated, manual processes by automated and/or closed processes. This would avoid irritating mists, sprayings and subsequent potential splashes.<br>Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects and c) to follow the safety procedures instructed by the employer.<br>The employer has also to ascertain that the required PPE is available                          |
| Conditions and measures related to personal protection, hygiene and health evaluation | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                       | Industrial use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                       | In case of dust or aerosol formation: use respiratory protection with approved filter (P2)<br>Wear chemically resistant gloves.<br>material: butyl-rubber, PVC, polychloroprene with natural latex liner, material thickness: 0.5 mm, breakthrough time: >480 min<br>material: nitrile-rubber, fluorinated rubber, material thickness: 0.35-0.4 mm, breakthrough time: > 480 min<br>wear tightly fitting safety goggles, face-shield<br>Wear suitable protective clothing, aprons, shield and suits<br>If splashes are likely to occur:<br>Rubber or plastic boots |

### 3. Exposure estimation and reference to its source

#### Environment

The aquatic effect and risk assessment only deals with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, as the toxicity of the metal ion is expected to be insignificant compared to the (potential) pH effect. The high water solubility and very low vapour pressure indicates that the substance will be found predominantly in water. When the risk management measures related to the environment are implemented, there is no exposure to the activated sludge of a sewage treatment plant and there is no exposure to the receiving surface water. The sediment compartment is not considered, because it is not relevant for the substance. If emitted to the aquatic compartment, sorption to sediment particles will be negligible. Significant emissions to air are not expected due to the very low vapour pressure of the substance. If emitted to air as a water-based aerosol, the substance will be rapidly neutralised as a result of its reaction with CO<sub>2</sub> (or acids). Significant emissions to the terrestrial environment are not expected. The sludge application route is not relevant for the emission to agricultural soil, as no sorption of the substance to particulate matter will occur in STPs/WWTPs. If emitted to soil, sorption to soil particles will be negligible. Depending on the buffer capacity of the soil, OH<sup>-</sup> will be neutralised in the soil pore water or the pH may increase. Bioaccumulation will not occur.

#### Workers

PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9 Used ECETOC TRA model.

| Contributing Scenario                                               | Specific conditions                                                                                                | Exposure routes                         | Level of Exposure     | RCR  |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------|------|
| PROC1,<br>PROC2,<br>PROC3,<br>PROC4,<br>PROC8a,<br>PROC8b,<br>PROC9 | Modeled exposure data, very low vapour pressure, without local exhaust ventilation, without respiratory protection | Inhalation worker exposure              | 0.17mg/m <sup>3</sup> | 0.17 |
| PROC1,<br>PROC2,<br>PROC3,<br>PROC4,<br>PROC8a,                     | Measured exposure data, worst-case                                                                                 | Worker - inhalative, short-term - local | 0.33mg/m <sup>3</sup> | 0.33 |

### Caustic Soda 5 - 50% (11-106°TW)

|                                                                     |                                       |                                            |                       |      |
|---------------------------------------------------------------------|---------------------------------------|--------------------------------------------|-----------------------|------|
| PROC8b,<br>PROC9                                                    |                                       |                                            |                       |      |
| PROC1,<br>PROC2,<br>PROC3,<br>PROC4,<br>PROC8a,<br>PROC8b,<br>PROC9 | Measured exposure data,<br>worst-case | Worker - inhalative, long-<br>term - local | 0.14mg/m <sup>3</sup> | 0.14 |

This substance is corrosive. For the handling of corrosive substances and formulations, immediate dermal contacts occur only occasionally and it is assumed that repeated daily dermal exposure can be neglected. Dermal exposure to the substance was not quantified. The substance is not expected to be systemically available in the body under normal handling and use conditions. Systemic effects of NaOH after dermal or inhalation exposure are not expected to occur.

#### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below

If measured data are not available, the DU may make use of an appropriate scaling tool such as ECETOC TRA. Important note: By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2).

#### Additional good practice advice beyond the REACH Chemical Safety Assessment

Local exhaust ventilation is not required but good practice.  
General ventilation is good practice unless local exhaust ventilation

## Caustic Soda 5 - 50% (11-106°TW)

### 1. Short title of Exposure Scenario 2: Manufacture of substance - solid

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Sectors of end-use               | SU8: Manufacture of bulk, large scale chemicals (including petroleum products)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |
| Environmental Release Categories | ERC1: Manufacture of substances                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 2.1 Contributing scenario controlling environmental exposure for: ERC1

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Covers percentage substance in the product up to 100 % (unless stated differently).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Other given operational conditions affecting environmental exposure                                                                                                                                                                                            | Continuous exposure                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Application Area                                  | Industrial use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                                | Water                                             | Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised. In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. Risk management measures related to the environment aim to avoid discharging the substance into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. |
|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9

|                                                                                        |                                                                                                                                                                                                                                                                                                                               |                                                                                     |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Product characteristics                                                                | Concentration of the Substance in Mixture/Article                                                                                                                                                                                                                                                                             | Covers percentage substance in the product up to 100 % (unless stated differently). |
|                                                                                        | Physical Form (at time of use)                                                                                                                                                                                                                                                                                                | solid                                                                               |
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                                                                                                                              | 200 days/year                                                                       |
|                                                                                        | Frequency of use                                                                                                                                                                                                                                                                                                              | 8 hours/day                                                                         |
| Technical conditions and measures to control dispersion from source towards the worker | Application Area                                                                                                                                                                                                                                                                                                              | Industrial use                                                                      |
|                                                                                        | Use closed systems or covering of open containers (e.g. screens)<br>Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.)<br>Use of pliers, grip arms with long handles with manual use to avoid direct contact and exposure by splashes (no working over one's head) |                                                                                     |
| Organisational measures to                                                             | Application Area                                                                                                                                                                                                                                                                                                              | Industrial use                                                                      |

## Caustic Soda 5 - 50% (11-106°TW)

|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| prevent /limit releases, dispersion and exposure                                      | <p>Replacing, where appropriated, manual processes by automated and/or closed processes. This would avoid irritating mists, sprayings and subsequent potential splashes.</p> <p>Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects and c) to follow the safety procedures instructed by the employer.</p> <p>The employer has also to ascertain that the required PPE is available</p>                                                    |                |
| Conditions and measures related to personal protection, hygiene and health evaluation | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Industrial use |
|                                                                                       | <p>In case of dust or aerosol formation: use respiratory protection with approved filter (P2)</p> <p>Wear chemically resistant gloves.</p> <p>material: butyl-rubber, PVC, polychloroprene with natural latex liner, material thickness: 0.5 mm, breakthrough time: &gt;480 min</p> <p>material: nitrile-rubber, fluorinated rubber, material thickness: 0.35-0.4 mm, breakthrough time: &gt; 480 min</p> <p>wear tightly fitting safety goggles, face-shield</p> <p>Wear suitable protective clothing, aprons, shield and suits</p> <p>If splashes are likely to occur:</p> <p>Rubber or plastic boots</p> |                |

### 3. Exposure estimation and reference to its source

#### Environment

The aquatic effect and risk assessment only deals with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, as the toxicity of the metal ion is expected to be insignificant compared to the (potential) pH effect. The high water solubility and very low vapour pressure indicates that the substance will be found predominantly in water. When the risk management measures related to the environment are implemented, there is no exposure to the activated sludge of a sewage treatment plant and there is no exposure to the receiving surface water. The sediment compartment is not considered, because it is not relevant for the substance. If emitted to the aquatic compartment, sorption to sediment particles will be negligible. Significant emissions to air are not expected due to the very low vapour pressure of the substance. If emitted to air as a water-based aerosol, the substance will be rapidly neutralised as a result of its reaction with CO<sub>2</sub> (or acids). Significant emissions to the terrestrial environment are not expected. The sludge application route is not relevant for the emission to agricultural soil, as no sorption of the substance to particulate matter will occur in STPs/WWTPs. If emitted to soil, sorption to soil particles will be negligible. Depending on the buffer capacity of the soil, OH<sup>-</sup> will be neutralised in the soil pore water or the pH may increase. Bioaccumulation will not occur.

#### Workers

PROC1, PROC2, PROC3, PROC4, PROC8a, PROC9 Used ECETOC TRA model.

| Contributing Scenario | Specific conditions                                                           | Exposure routes                         | Level of Exposure     | RCR  |
|-----------------------|-------------------------------------------------------------------------------|-----------------------------------------|-----------------------|------|
| PROC1, PROC2          | Modeled exposure data, Low dustiness, no LEV, no respiratory protection (RPE) | Inhalation worker exposure              | 0.01mg/m <sup>3</sup> | 0.01 |
| PROC3, PROC9          | Modeled exposure data, Low dustiness, no LEV, no respiratory protection (RPE) | Inhalation worker exposure              | 0.1mg/m <sup>3</sup>  | 0.1  |
| PROC4, PROC8a         | Modeled exposure data, Low dustiness, no LEV, no respiratory protection (RPE) | Inhalation worker exposure              | 0.5mg/m <sup>3</sup>  | 0.5  |
| PROC9                 | Measured exposure data, worst-case                                            | Worker - inhalative, short-term - local | 0.26mg/m <sup>3</sup> | 0.26 |

**Caustic Soda 5 - 50% (11-106°TW)**

This substance is corrosive. For the handling of corrosive substances and formulations, immediate dermal contacts occur only occasionally and it is assumed that repeated daily dermal exposure can be neglected. Dermal exposure to the substance was not quantified. The substance is not expected to be systemically available in the body under normal handling and use conditions. Systemic effects of NaOH after dermal or inhalation exposure are not expected to occur.

**4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below.

If measured data are not available, the DU may make use of an appropriate scaling tool such as ECETOC TRA. Important note: By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2).

**Additional good practice advice beyond the REACH Chemical Safety Assessment**

Local exhaust ventilation is not required but good practice.  
General ventilation is good practice unless local exhaust ventilation

## Caustic Soda 5 - 50% (11-106°TW)

### 1. Short title of Exposure Scenario 3: Industrial use

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Process categories               | <p>PROC1: Use in closed process, no likelihood of exposure</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3: Use in closed batch process (synthesis or formulation)</p> <p>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>PROC7: Industrial spraying</p> <p>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC10: Roller application or brushing</p> <p>PROC13: Treatment of articles by dipping and pouring</p> <p>PROC15: Use as laboratory reagent</p> |
| Environmental Release Categories | <p>ERC2: Formulation of preparations</p> <p>ERC4: Industrial use of processing aids in processes and products, not becoming part of articles</p> <p>ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)</p> <p>ERC6b: Industrial use of reactive processing aids</p> <p>ERC7: Industrial use of substances in closed systems</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

### 2.1 Contributing scenario controlling environmental exposure for: ERC2, ERC4, ERC6a, ERC6b, ERC7

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Covers percentage substance in the product up to 100 % (unless stated differently).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Other given operational conditions affecting environmental exposure                                                                                                                                                                                            | Continuous exposure                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Application Area                                  | Industrial use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                                                                                                                                                | Water                                             | Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised. In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. Risk management measures related to the environment aim to avoid discharging the substance into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. |
|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Conditions and measures related to external treatment of waste for disposal                                                                                                                                                                                    | Disposal methods                                  | Waste should be reused or discharged to the industrial wastewater and further neutralized if needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC5, PROC7, PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC15

|                         |                                   |                                                                                     |
|-------------------------|-----------------------------------|-------------------------------------------------------------------------------------|
| Product characteristics | Concentration of the Substance in | Covers percentage substance in the product up to 100 % (unless stated differently). |
|-------------------------|-----------------------------------|-------------------------------------------------------------------------------------|

## Caustic Soda 5 - 50% (11-106°TW)

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                                                                                        | Mixture/Article                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |
|                                                                                        | Physical Form (at time of use)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | liquid               |
|                                                                                        | Physical Form (at time of use)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Solid, low dustiness |
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8 hours/day          |
|                                                                                        | Frequency of use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 200 days/year        |
| Technical conditions and measures to control dispersion from source towards the worker | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Industrial use       |
|                                                                                        | Use closed systems or covering of open containers (e.g. screens)<br>Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.)<br>Use of pliers, grip arms with long handles with manual use to avoid direct contact and exposure by splashes (no working over one's head)                                                                                                                                                                                                                                      |                      |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Industrial use       |
|                                                                                        | Replacing, where appropriated, manual processes by automated and/or closed processes. This would avoid irritating mists, sprayings and subsequent potential splashes.<br>Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects and c) to follow the safety procedures instructed by the employer.<br>The employer has also to ascertain that the required PPE is available                          |                      |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Industrial use       |
|                                                                                        | In case of dust or aerosol formation: use respiratory protection with approved filter (P2)<br>Wear chemically resistant gloves.<br>material: butyl-rubber, PVC, polychloroprene with natural latex liner, material thickness: 0.5 mm, breakthrough time: >480 min<br>material: nitrile-rubber, fluorinated rubber, material thickness: 0.35-0.4 mm, breakthrough time: > 480 min<br>If splashes are likely to occur:<br>wear tightly fitting safety goggles, face-shield<br>Wear suitable protective clothing, aprons, shield and suits<br>Rubber or plastic boots |                      |

### 3. Exposure estimation and reference to its source

#### Environment

The aquatic effect and risk assessment only deals with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, as the toxicity of the metal ion is expected to be insignificant compared to the (potential) pH effect. The high water solubility and very low vapour pressure indicates that the substance will be found predominantly in water. When the risk management measures related to the environment are implemented, there is no exposure to the activated sludge of a sewage treatment plant and there is no exposure to the receiving surface water. The sediment compartment is not considered, because it is not relevant for the substance. If emitted to the aquatic compartment, sorption to sediment particles will be negligible. Significant emissions to air are not expected due to the very low vapour pressure of the substance. If emitted to air as a water-based aerosol, the substance will be rapidly neutralised as a result of its reaction with CO<sub>2</sub> (or acids). Significant emissions to the terrestrial environment are not expected. The sludge application route is not relevant for the emission to agricultural soil, as no sorption of the substance to particulate matter will occur in STPs/WWTPs. If emitted to soil, sorption to soil particles will be negligible. Depending on the buffer capacity of the soil, OH<sup>-</sup> will be neutralised in the soil pore water or the pH may increase. Bioaccumulation will not occur.

#### Workers

Used ECETOC TRA model.

| Contributing Scenario | Specific conditions | Exposure routes | Level of Exposure | RCR |
|-----------------------|---------------------|-----------------|-------------------|-----|
|-----------------------|---------------------|-----------------|-------------------|-----|

### Caustic Soda 5 - 50% (11-106°TW)

|                                                                                                                                                                      |                                                 |                                         |                       |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------|-----------------------|-----|
| PROC1,<br>PROC2,<br>PROC3,<br>PROC4,<br>PROC5,<br>PROC7,<br>PROC8a,<br>PROC8b,<br>PROC9,<br>PROC10,<br>PROC13,<br>PROC14,<br>PROC15,<br>PROC19,<br>PROC23,<br>PROC24 | liquid, no LEV, no respiratory protection (RPE) | Worker - inhalative, short-term - local | 0.17mg/m <sup>3</sup> | --- |
| PROC1, PROC2                                                                                                                                                         | solid, no LEV, no respiratory protection (RPE)  | Worker - inhalative, short-term - local | 0.01mg/m <sup>3</sup> | --- |
| PROC3, PROC15                                                                                                                                                        | solid, no LEV, no respiratory protection (RPE)  | Worker - inhalative, short-term - local | 0.1mg/m <sup>3</sup>  | --- |
| PROC4, PROC5, PROC14                                                                                                                                                 | solid, no respiratory protection (RPE)          | Worker - inhalative, short-term - local | 0.2mg/m <sup>3</sup>  | --- |
| PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC19                                                                                                                        | solid, no LEV, no respiratory protection (RPE)  | Worker - inhalative, short-term - local | 0.5mg/m <sup>3</sup>  | --- |
| PROC23                                                                                                                                                               | solid, with RPE (90%)                           | Worker - inhalative, short-term - local | 0.4mg/m <sup>3</sup>  | --- |
| PROC24                                                                                                                                                               | solid, with RPE (90%)                           | Worker - inhalative, short-term - local | 0.5mg/m <sup>3</sup>  | --- |

This substance is corrosive. For the handling of corrosive substances and formulations, immediate dermal contacts occur only occasionally and it is assumed that repeated daily dermal exposure can be neglected. Dermal exposure to the substance was not quantified. The substance is not expected to be systemically available in the body under normal handling and use conditions. Systemic effects of NaOH after dermal or inhalation exposure are not expected to occur. Based on workplace measurements and following the proposed risk management measures controlling worker and professional exposure, the inhalation exposure is below the DNEL.

#### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below.

If measured data are not available, the DU may make use of an appropriate scaling tool such as ECETOC TRA. Important note: By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2).

#### Additional good practice advice beyond the REACH Chemical Safety Assessment

Local exhaust ventilation is not required but good practice.  
General ventilation is good practice unless local exhaust ventilation

## Caustic Soda 5 - 50% (11-106°TW)

### 1. Short title of Exposure Scenario 4: Professional use

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Process categories               | <p>PROC1: Use in closed process, no likelihood of exposure</p> <p>PROC2: Use in closed, continuous process with occasional controlled exposure</p> <p>PROC3: Use in closed batch process (synthesis or formulation)</p> <p>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)</p> <p>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities</p> <p>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC10: Roller application or brushing</p> <p>PROC11: Non industrial spraying</p> <p>PROC13: Treatment of articles by dipping and pouring</p> <p>PROC15: Use as laboratory reagent</p> |
| Environmental Release Categories | <p>ERC8a: Wide dispersive indoor use of processing aids in open systems</p> <p>ERC8b: Wide dispersive indoor use of reactive substances in open systems</p> <p>ERC8d: Wide dispersive outdoor use of processing aids in open systems</p> <p>ERC9a: Wide dispersive indoor use of substances in closed systems</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8b, ERC8d, ERC9a

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Covers percentage substance in the product up to 100 % (unless stated differently).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Other given operational conditions affecting environmental exposure                                                                                                                                                                                            | Continuous exposure                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Application Area                                  | Professional use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                                                                                                                                                                | Water                                             | Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised. In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. Risk management measures related to the environment aim to avoid discharging the substance into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. |
| Conditions and measures related to external treatment of waste for disposal                                                                                                                                                                                    | Disposal methods                                  | Waste should be reused or discharged to the industrial wastewater and further neutralized if needed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC5, PROC8a, PROC8b, PROC9, PROC10, PROC11, PROC13, PROC15

|                         |                                                   |                                                                                     |
|-------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------|
| Product characteristics | Concentration of the Substance in Mixture/Article | Covers percentage substance in the product up to 100 % (unless stated differently). |
|                         | Physical Form (at time of use)                    | liquid                                                                              |

## Caustic Soda 5 - 50% (11-106°TW)

|                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |
|----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
|                                                                                        | Physical Form (at time of use)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Solid, low dustiness |
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 8 hours/day          |
|                                                                                        | Frequency of use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 200 days/year        |
| Technical conditions and measures to control dispersion from source towards the worker | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Professional use     |
|                                                                                        | Use of pliers, grip arms with long handles with manual use to avoid direct contact and exposure by splashes (no working over one's head)<br>Where possible use of specific dispensers and pumps specifically designed to prevent splashes/spills/exposure to occur.                                                                                                                                                                                                                                                                                                |                      |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Professional use     |
|                                                                                        | Replacing, where appropriated, manual processes by automated and/or closed processes. This would avoid irritating mists, sprayings and subsequent potential splashes.<br>Workers in the risky process/areas identified should be trained a) to avoid to work without respiratory protection and b) to understand the corrosive properties and, especially, the respiratory inhalation effects and c) to follow the safety procedures instructed by the employer.<br>The employer has also to ascertain that the required PPE is available                          |                      |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Application Area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Professional use     |
|                                                                                        | In case of dust or aerosol formation: use respiratory protection with approved filter (P2)<br>Wear chemically resistant gloves.<br>material: butyl-rubber, PVC, polychloroprene with natural latex liner, material thickness: 0.5 mm, breakthrough time: >480 min<br>material: nitrile-rubber, fluorinated rubber, material thickness: 0.35-0.4 mm, breakthrough time: > 480 min<br>If splashes are likely to occur:<br>wear tightly fitting safety goggles, face-shield<br>Wear suitable protective clothing, aprons, shield and suits<br>Rubber or plastic boots |                      |

### 3. Exposure estimation and reference to its source

#### Environment

The aquatic effect and risk assessment only deals with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, as the toxicity of the metal ion is expected to be insignificant compared to the (potential) pH effect. The high water solubility and very low vapour pressure indicates that the substance will be found predominantly in water. When the risk management measures related to the environment are implemented, there is no exposure to the activated sludge of a sewage treatment plant and there is no exposure to the receiving surface water. The sediment compartment is not considered, because it is not relevant for the substance. If emitted to the aquatic compartment, sorption to sediment particles will be negligible. Significant emissions to air are not expected due to the very low vapour pressure of the substance. If emitted to air as a water-based aerosol, the substance will be rapidly neutralised as a result of its reaction with CO<sub>2</sub> (or acids). Significant emissions to the terrestrial environment are not expected. The sludge application route is not relevant for the emission to agricultural soil, as no sorption of the substance to particulate matter will occur in STPs/WWTPs. If emitted to soil, sorption to soil particles will be negligible. Depending on the buffer capacity of the soil, OH<sup>-</sup> will be neutralised in the soil pore water or the pH may increase. Bioaccumulation will not occur.

#### Workers

Used ECETOC TRA model.

| Contributing Scenario                | Specific conditions                             | Exposure routes                            | Level of Exposure     | RCR |
|--------------------------------------|-------------------------------------------------|--------------------------------------------|-----------------------|-----|
| PROC1,<br>PROC2,<br>PROC3,<br>PROC4, | liquid, no LEV, no respiratory protection (RPE) | Worker - inhalative,<br>short-term - local | 0.17mg/m <sup>3</sup> | --- |

### Caustic Soda 5 - 50% (11-106°TW)

|                                                                                                                               |                                                |                                         |                       |     |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------|-----------------------|-----|
| PROC5,<br>PROC8a,<br>PROC8b,<br>PROC9,<br>PROC10,<br>PROC11,<br>PROC13,<br>PROC14,<br>PROC15,<br>PROC19,<br>PROC23,<br>PROC24 |                                                |                                         |                       |     |
| PROC1, PROC2                                                                                                                  | solid, no LEV, no respiratory protection (RPE) | Worker - inhalative, short-term - local | 0.01mg/m <sup>3</sup> | --- |
| PROC3, PROC15                                                                                                                 | solid, no LEV, no respiratory protection (RPE) | Worker - inhalative, short-term - local | 0.1mg/m <sup>3</sup>  | --- |
| PROC4, PROC5, PROC11, PROC14                                                                                                  | solid, no respiratory protection (RPE)         | Worker - inhalative, short-term - local | 0.2mg/m <sup>3</sup>  | --- |
| PROC8a, PROC8b, PROC9, PROC10, PROC13, PROC19                                                                                 | solid, no LEV, no respiratory protection (RPE) | Worker - inhalative, short-term - local | 0.5mg/m <sup>3</sup>  | --- |
| PROC23                                                                                                                        | solid, with RPE (90%)                          | Worker - inhalative, short-term - local | 0.4mg/m <sup>3</sup>  | --- |
| PROC24                                                                                                                        | solid, with RPE (90%)                          | Worker - inhalative, short-term - local | 0.5mg/m <sup>3</sup>  | --- |

This substance is corrosive. For the handling of corrosive substances and formulations, immediate dermal contacts occur only occasionally and it is assumed that repeated daily dermal exposure can be neglected. Dermal exposure to the substance was not quantified. The substance is not expected to be systemically available in the body under normal handling and use conditions. Systemic effects of NaOH after dermal or inhalation exposure are not expected to occur. Based on workplace measurements and following the proposed risk management measures controlling worker and professional exposure, the inhalation exposure is below the DNEL.

#### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below.

If measured data are not available, the DU may make use of an appropriate scaling tool such as ECETOC TRA.

Important note: By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2).

#### Additional good practice advice beyond the REACH Chemical Safety Assessment

Local exhaust ventilation is not required but good practice.  
General ventilation is good practice unless local exhaust ventilation

## Caustic Soda 5 - 50% (11-106°TW)

### 1. Short title of Exposure Scenario 5: Consumer use

|                                  |                                                                                                                                                                                                                                                                                                |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 21: Consumer uses: Private households (= general public = consumers)                                                                                                                                                                                                                        |
| Chemical product category        | PC20: Products such as ph-regulators, flocculants, precipitants, neutralization agents<br>PC35: Washing and cleaning products (including solvent based products)<br>PC39: Cosmetics, personal care products                                                                                    |
| Environmental Release Categories | ERC8a: Wide dispersive indoor use of processing aids in open systems<br>ERC8b: Wide dispersive indoor use of reactive substances in open systems<br>ERC8d: Wide dispersive outdoor use of processing aids in open systems<br>ERC9a: Wide dispersive indoor use of substances in closed systems |

### 2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8b, ERC8d, ERC9a

|                                                                                                                                                                                                                                                                |                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article                      | Covers percentage substance in the product up to 100 % (unless stated differently).                                                                                                                                                                                                                                                                                                                        |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | There are no specific risk management measures related to environment. |                                                                                                                                                                                                                                                                                                                                                                                                            |
| Conditions and measures related to external treatment of waste for disposal                                                                                                                                                                                    | Disposal methods                                                       | This material and its container must be disposed of in a safe way (e.g. by returning to a public recycling facility)., If container is empty, trash as regular municipal waste., Batteries should be recycled as much as possible (e.g. by returning to a public recycling facility)., Recovery of the substance from alkaline batteries includes emptying the electrolyte, collection and neutralization. |

### 2.2 Contributing scenario controlling consumer exposure for: PC20, PC35, PC39

|                                                                                                                      |                                                   |                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                              | Concentration of the Substance in Mixture/Article | Covers percentage substance in the product up to 100 % (unless stated differently).                                                                                                                                                                                    |
|                                                                                                                      | Physical Form (at time of use)                    | liquid                                                                                                                                                                                                                                                                 |
|                                                                                                                      | Physical Form (at time of use)                    | Solid, low dustiness                                                                                                                                                                                                                                                   |
| Conditions and measures related to protection of consumer (e.g. behavioural advice, personal protection and hygiene) | Consumer Measures                                 | It is required to use resistant labelling-package to avoid its auto-damage and loss of the label integrity, under normal use and storage of the product. The lack of quality of the package provokes the physical loss of information on hazards and use instructions. |
|                                                                                                                      | Consumer Measures                                 | In case of dust or aerosol formation: use respiratory protection with approved filter (P2)                                                                                                                                                                             |

### 3. Exposure estimation and reference to its source

#### Environment

## Caustic Soda 5 - 50% (11-106°TW)

Consumer uses relate to already diluted products which will further be neutralized quickly in the sewer, well before reaching a WWTP or surface water.

### Consumers

ConsExpo and SrayExpo

| Contributing Scenario | Specific conditions                                                                     | Exposure routes                    | Level of Exposure          | RCR |
|-----------------------|-----------------------------------------------------------------------------------------|------------------------------------|----------------------------|-----|
| PC20, PC35, PC39      | Assessed only for the most critical use, (use of the substance in a spray oven cleaner) | consumer inhalation, acute - local | 0.3 - 1.6mg/m <sup>3</sup> | < 1 |

The calculated short-term exposure is slightly higher than the long term DNEL for inhalation, but smaller than the short term occupational exposure limit. The substance will be rapidly neutralised as a result of its reaction with CO<sub>2</sub> (or other acids) Consumer exposure to the substance in batteries is zero because batteries are sealed articles with a long service life maintenance.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PCs listed above) as given below

If measured data are not available, the DU may make use of an appropriate scaling tool such as ConsExpo software.

Important note: By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2).

SAFETY DATA SHEET

HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw)

mhcl100

1. Identification of the substance/preparation and of the company/undertaking

|                                    |                                               |                |                                                                                                            |
|------------------------------------|-----------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------|
| Product name                       | : HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw) | Supplier       | : Albion Chemical Distribution<br>Albion House<br>Rawdon Park<br>Green Lane<br>Yeadon<br>Leeds<br>LS19 7XX |
| Chemical product name              | : HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw) |                |                                                                                                            |
| Synonyms                           | : HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw) |                |                                                                                                            |
| EMERGENCY ONLY<br>TELEPHONE NUMBER | : (N.C.E.C. CULHAM) 01865 407333              | Telephone No.  | : (0113) 3879200                                                                                           |
|                                    |                                               | Fax No.        | : (0113) 3879280                                                                                           |
| Formula                            | : HCl                                         | Molecular Mass | : 36.47                                                                                                    |

2. Composition/information on ingredients

|                                                |           |             |           |        |           |
|------------------------------------------------|-----------|-------------|-----------|--------|-----------|
| Substance/Preparation                          |           | : Substance |           |        |           |
| Chemical name*                                 | CAS No.   | %           | EC Number | Symbol | R-Phrases |
| 1) HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw) | 7647-01-0 | 100         | 231-595-7 | C      | R34, R37  |

\* Occupational Exposure Limit(s), if available, are listed in Section 8

|               |                                                                                                     |
|---------------|-----------------------------------------------------------------------------------------------------|
| Composition   | AQUEOUS SOLUTION OF HYDROCHLORIC ACID AT SPECIFIED<br>MASS CONCENTRATION.<br>SEE OTHER INFORMATION. |
| CAS No.       | 7647-01-0                                                                                           |
| EINECS Number | 231-595-7                                                                                           |

3. Hazards identification

|                      |                                                   |
|----------------------|---------------------------------------------------|
| Human health hazards | : Causes burns. Irritating to respiratory system. |
|----------------------|---------------------------------------------------|

4. First-aid measures

|                        |                                                                                                                                                                                                                                                                                               |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First-Aid measures     |                                                                                                                                                                                                                                                                                               |
| Inhalation             | : Remove from exposure. If breathing stops or shows signs of failing, give artificial respiration. Obtain medical attention urgently. Keep warm and at rest. If there is difficulty in breathing, give oxygen. Do not use mouth to mouth ventilation.                                         |
| Ingestion              | : Wash out mouth with water. Have victim drink 1-3 glasses of water to dilute stomach contents. Obtain medical attention. Do not induce vomiting. Never administer anything by mouth if a victim is losing consciousness, is unconscious or is convulsing. Treatment may be needed for shock. |
| Skin contact           | : Immediately flood the skin with large quantities of water, preferably under a shower. Remove contaminated clothing as washing proceeds. Contaminated clothing should be washed or dry-cleaned before re-use. Obtain medical attention if blistering occurs or redness persists.             |
| Eye Contact            | : Immediately flood the eye with plenty of water for at least 15 minutes, holding the eye open. Obtain medical attention urgently.                                                                                                                                                            |
| Effects and symptoms   |                                                                                                                                                                                                                                                                                               |
| Inhalation             | : Exposure to vapour may have the following effects:- severe irritation to nose, throat and respiratory tract and possibly lung damage.                                                                                                                                                       |
| Ingestion              | : Swallowing may have the following effects:- corrosion of mouth, throat and digestive tract. gastrointestinal irritation. haematemesis. perforation of the oesophagus. gastric perforation. Aspiration during swallowing or vomiting may severely damage the lungs.                          |
| Skin contact           | : Material will cause chemical burns. Repeated or prolonged contact may produce defatting of the skin leading to irritation and dermatitis.                                                                                                                                                   |
| Eye Contact            | : Liquid or vapour will cause conjunctival irritation and possibly corneal damage.                                                                                                                                                                                                            |
| Aggravating conditions | : Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation, leading to frequent attacks of bronchial infection.                                     |
| Notes to physician     | : Keep under medical surveillance for 48 hours if exposure to fumes is suspected.                                                                                                                                                                                                             |

## 5. Fire-fighting measures

### Extinguishing Media

- Suitable** : Select extinguishing agent appropriate to other materials involved. Use water spray. Keep containers and surroundings cool with water spray.
- Unusual fire/explosion Hazards** : This product may give rise to hazardous fumes in a fire.  
HYDROGEN , CHLORINE / HYDROGEN CHLORIDE GAS
- Hazardous thermal (de)composition products** : Attacks many metals liberating hydrogen gas.  
Reacts with oxidising agents generating: Chlorine gas  
Reacts with conc. sulphuric acid generating: hydrogen chloride.  
Heating may produce: hydrogen chloride.
- Special fire-fighting procedures** : Fire fighters should wear self-contained positive pressure breathing apparatus (SCBA) and full turnout gear.
- Protection of fire-fighters** : Wear full protective clothing and self-contained breathing apparatus.

## 6. Accidental release measures

- Personal Precautions** : Ventilate the area to dispel residual vapours. Wear appropriate protective clothing. Consider need for evacuation.
- Environmental precautions and cleanup methods** : Ne utralise by care ful addition of hydrate d lime or soda ash. Dre nch spillage with water and wash to drain, diluting greatly with water.  
: Advise Authorities if spillage has entered water course or sewer or has contaminated soil or vegetation.

## 7. Handling and storage

- Handling** : Use in well ventilated area. Avoid inhaling vapour. Avoid contact with eyes, skin and clothing. Emergency shower and eye wash facilities should be readily available.
- Storage** : Storage area should be: well ventilated. Stock tanks should be bunded and consideration should be given to a vent system with a water scrubber to dispel fumes. Tanks should be equipped with airflow pipes directed into the base of the bund with a frost-protected seal to contain fumes. Suitable storage materials are:- polyethylene. PVC. rubber lined tanks. Do not store in:- stainless steel. metal drums.
- Packaging materials**
- Recommended use** : Use original container.

## 8. Exposure controls/personal protection

- Engineering measures** : Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are close to the workstation location.
- Hygiene measures** : Wash hands after handling compounds and before eating, smoking, using lavatory, and at the end of day.

| <u>Ingredient Name</u>                         | <u>Workplace Exposure Limits</u>                                                                  |
|------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1) HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw) | <b>EH40 (United Kingdom (UK), 2005).</b><br>TWA: 2 mg/m <sup>3</sup><br>STEL: 8 mg/m <sup>3</sup> |

### Personal protective equipment

- Respiratory system** : Respiratory protection if there is a risk of uncontrolled exposure to vapour.
- Skin and body** : Wear: rubber apron. PVC or rubber boots.  
If there is danger of splashing, wear: PVC or other impermeable suit.
- Hands** : PVC or rubber gloves.
- Eyes** : Chemical goggles.

## 9. Physical and chemical properties

- Physical state** : Liquid.
- Colour** : Colourless. to Yellow.
- Odour** : Pungent. Characteristic.
- Boiling point** : 108 - 57
- Melting point** : - 67 - - 33
- Density** : Not available.
- Vapour density** : 1.27
- Vapour pressure** : 5-120mbar 15°C
- Solubility** : Completely soluble.
- pH** : pH<1
- Flash point** : Not available.
- Viscosity** : approx 2.0 cP AT 20°C

## 10. Stability and reactivity

|                                         |                                                                                                                                                                                                                       |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Stability</b>                        | : The product is stable.                                                                                                                                                                                              |
| <b>Conditions to Avoid</b>              | : High temperatures.                                                                                                                                                                                                  |
| <b>Materials to avoid</b>               | : Sulphuric acid. Concentrated nitric acid. Oxidising agents. Alkalies. Carbonates.                                                                                                                                   |
| <b>Hazardous decomposition products</b> | : Attacks many metals liberating hydrogen gas.<br>Reacts with oxidising agents generating: Chlorine gas<br>Reacts with conc. sulphuric acid generating: hydrogen chloride.<br>Heating may produce: hydrogen chloride. |

## 11. Toxicological information

|                         |                                                                                                                                                                                                                                                           |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Local effects</b>    |                                                                                                                                                                                                                                                           |
| <b>Skin irritation</b>  | : Hazardous in case of skin contact (corrosive).                                                                                                                                                                                                          |
| <b>Eye irritation</b>   | : Hazardous in case of eye contact (irritant).                                                                                                                                                                                                            |
| <b>Acute toxicity</b>   | : Oral LD50 (rabbit) 900mg/kg.                                                                                                                                                                                                                            |
| <b>Chronic toxicity</b> | : Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation, leading to frequent attacks of bronchial infection. |

## 12. Ecological information

|                    |                                                                                                                                                   |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ecotoxicity</b> | : Harmful effect on aquatic organisms. harmful effect due to pH shift. Lethal for fish from 25mg/l. For plants, harmful effects begin at 6mg/l. . |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|

## 13. Disposal considerations

|                                                                         |                                                                                |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| <b>Methods of disposal ; Waste of residues ; Contaminated packaging</b> | : Dispose of in accordance with all applicable local and national regulations. |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------|

|                             |                   |
|-----------------------------|-------------------|
| <b>Waste Classification</b> | : Not applicable. |
|-----------------------------|-------------------|

## 14. Transport information

### International transport regulations

|      |                      |                   |
|------|----------------------|-------------------|
| UN : | UN number            | 1789              |
| UN : | Proper shipping name | Hydrochloric acid |
| UN : | Class                | 8                 |
| UN : | Packing group        | II                |
| UN : | Label                |                   |



|           |                              |    |
|-----------|------------------------------|----|
| ADR/RID : | Class                        | 8  |
| ADR/RID : | Hazard identification number | 80 |
| IMDG :    | Packing group                | II |
| IMDG :    | Class                        | 8  |
| IATA :    | Packing group                | II |
| IATA :    | Class                        | 8  |

## 15. Regulatory information

### EU Regulations

|                         |                                                                                                                                                                                                                                                                                    |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Hazard symbol(s)</b> | :                                                                                                                                                                                               |
| <b>Classification</b>   | : Corrosive                                                                                                                                                                                                                                                                        |
| <b>Risk Phrases</b>     | : R34 Causes burns.<br>R37 Irritating to respiratory system.                                                                                                                                                                                                                       |
| <b>Safety Phrases</b>   | : S1/2- Keep locked up and out of the reach of children.<br>S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.<br>S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). |
| <b>Contains</b>         | : - HYDROCHLORIC ACID 25% - 36% (25°Tw - 36°Tw)                                                                                                                                                                                                                                    |

**Product Use**

: Classification and labelling have been performed according to EU directives 67/548/EEC, 88/379/EEC, including amendments and the intended use.  
- Consumer applications.

**16. Other information****HISTORY**

*(Please note that dates are in American format [month/day/year])*

**Date of printing** : 14/05/2007.  
**Date of issue** : 14/05/2007.  
**Date of previous issue** : 01/08/2001.  
**Version** : 3.03  
**Prepared by** : Michael Hale / Alistair Hunter

**Notice to Reader**

*To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein.*

*Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.*

**Version** 3.03

**Page: 4/4**

# SAFETY DATA SHEET

HYDROGEN PEROXIDE 35-&lt;50%

MYYY760

## 1. Identification of the substance/preparation and of the company/undertaking

**Product name** : HYDROGEN PEROXIDE 35-<50% **Supplier** : Albion Chemical Distribution  
Albion House  
Rawdon Park  
Green Lane  
Yeadon  
Leeds  
LS19 7XX

**Chemical product name** : Hydrogen Peroxide.

**Synonyms** : Puroxid Aseptic S

**Chemical formula** : H<sub>2</sub>O<sub>2</sub>

**EMERGENCY ONLY TELEPHONE NUMBER** : (N.C.E.C. CULHAM) 01865 407333 **Telephone No.** : (0113) 3879200  
**Fax No.** : (0113) 3879280

## 2. Composition/information on ingredients

**Substance/Preparation** : Substance

| Chemical name*            | CAS No.   | %      | EC Number | Symbol | R-Phrases           |
|---------------------------|-----------|--------|-----------|--------|---------------------|
| 1) HYDROGEN PEROXIDE ...% | 7722-84-1 | 35-<50 | 231-765-0 | O, C   | R5, R8, R20/22, R35 |

\* Occupational Exposure Limit(s), if available, are listed in Section 8

**CAS No.** 7722-84-1  
**EINECS Number** 231-765-0

## 3. Hazards identification

**Human health hazards** : Harmful if swallowed.  
Irritating to respiratory system and skin.  
Risk of serious damage to eyes.

## 4. First-aid measures

### First-Aid measures

**Inhalation** : If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Obtain medical attention immediately.

**Ingestion** : Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Skin contact** : In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Obtain medical attention.

**Eye Contact** : In case of contact, immediately flush eyes with a copious amount of water for at least 15 minutes. Obtain medical attention immediately.

### Effects and symptoms

**Inhalation** : Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking or shortness of breath. Overexposure by inhalation may cause respiratory irritation. May be fatal if inhaled.

**Ingestion** : May be fatal if swallowed. May cause burns to mouth, throat and stomach. Harmful if swallowed.

**Skin contact** : Hazardous in case of skin contact (irritant). Corrosive to skin on contact. Skin contact may produce burns. Prolonged exposure may result in skin burns and ulcerations. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

**Eye Contact** : Very hazardous in case of eye contact (irritant). Corrosive to eyes. Inflammation of the eye is characterized by redness, watering and itching.

**Aggravating conditions** : Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation, leading to frequent attacks of bronchial infection. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

## 5. Fire-fighting measures

### Extinguishing Media

- Suitable** : Oxidizing Material  
Do not use water jet. Use flooding quantities of water. Avoid contact with organic materials.
- Unusual fire/explosion Hazards** : Can cause an explosion hazard if mixed with organic material.
- Hazardous thermal (de)composition products** : Oxygen, water/ steam.
- Special fire-fighting procedures** : Fire fighters should wear self-contained positive pressure breathing apparatus (SCBA) and full turnout gear.
- Protection of fire-fighters** : Be sure to use an approved/certified respirator or equivalent.

## 6. Accidental release measures

- Personal Precautions** : Splash goggles. Protective overalls/suit. Vapour respirator. Boots. Gloves. If there is a significant airborne concentration then suitable breathing apparatus should be used to avoid inhalation of the product. Select appropriate protective clothing for the size of the spillage.
- Environmental precautions and cleanup methods** : Corrosive liquid. Oxidizing Material  
Stop leak if without risk. Absorb with dry earth, sand or other noncombustible material. Do not get water inside container. Avoid contact with a combustible material (wood, paper, oil, clothing, etc.). Keep substance damp using water spray. Do not touch spilled material. Use water spray curtain to divert vapour drift. Use water spray to reduce vapours. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Dispose of according to all federal, state and local applicable regulations. **Neutralize the residue with soda ash.**

## 7. Handling and storage

- Handling** : Keep locked up. Keep container dry. Keep away from heat. Keep away from sources of ignition. Keep away from combustible material. Empty containers may still contain significant residual amounts of the product. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/vapour/spray. Never add water to this product. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, reducing agents, combustible materials, organic materials, metals.
- Storage** : Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. Separate from acids, alkalis, reducing agents and combustibles. See NFPA 43A, Code for the Storage of liquid and Solid Oxidizers.
- Packaging materials**
- Recommended use** : Use original container.

## 8. Exposure controls/personal protection

- Engineering measures** : Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value. Ensure that eyewash stations and safety showers are close to the workstation location.
- Hygiene measures** : Wash hands, forearms, and face thoroughly after handling compounds and before eating, smoking, using lavatory, and at the end of day.

| <u>Ingredient Name</u> | <u>Workplace Exposure Limits</u>                                                                |
|------------------------|-------------------------------------------------------------------------------------------------|
| 1) Hydrogen Peroxide.  | <b>EH40 (United Kingdom (UK)).</b><br>MEL: 1.4 mg/m <sup>3</sup><br>STEL: 2.8 mg/m <sup>3</sup> |

### Personal protective equipment

- Respiratory system** : Vapour respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
- Skin and body** : Protective overalls/suit.
- Hands** : Gloves. Butyl rubber gloves. Neoprene gloves. Nitrile gloves. PVC gloves.
- Eyes** : Face shield and tightly fitting safety goggles.

## 9. Physical and chemical properties

- Physical state** : Liquid.
- Colour** : Colourless.
- Odour** : odourless / slightly pungent odour.
- Boiling point** : 114°C (237.2°F)
- Melting point** : -52°C (-61.6°F)
- Density** : Not available.
- Vapour pressure** : 2.4 kPa (18 mmHg) (at 20°C)
- Solubility** : Easily soluble in cold water.
- pH** : 1.5 to 4 [Acidic.]

## HYDROGEN PEROXIDE 35-<50%

|             |                    |
|-------------|--------------------|
| Flash point | : Not available.   |
| Viscosity   | : Dynamic: 1.17 cP |

### 10. Stability and reactivity

|                                  |                                                                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stability                        | : The product is stable.                                                                                                                                                                  |
| Conditions to Avoid              | : Keep away from heat. May decompose on exposure to light. Store away from direct sunlight. Protect from UV-light. High temperatures                                                      |
| Materials to avoid               | : Reactive with reducing agents, combustible materials, organic materials, metals, metal oxides, metal salts, metal ions (e.g. Mn, Fe, Cu, Ni, Cr, Zn), bases, contamination, rust, dirt. |
| Hazardous decomposition products | : Oxygen, water/ steam.                                                                                                                                                                   |

### 11. Toxicological information

#### Local effects

|                  |                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Skin irritation  | : Hazardous in case of skin contact (irritant).                                                                                                                                                                                                                                                                                                                                                     |
| Eye irritation   | : Very hazardous in case of eye contact (irritant).                                                                                                                                                                                                                                                                                                                                                 |
| Acute toxicity   | : Acute oral toxicity (LD50): 500 mg/kg [Rat].<br>Acute dermal toxicity (LD50): >4000 mg/kg [Rabbit].<br>Acute toxicity of the vapour (LC50): 2 mg/l 4 hours [Rat].                                                                                                                                                                                                                                 |
| Chronic toxicity | : Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation, leading to frequent attacks of bronchial infection. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs. |

### 12. Ecological information

|                           |                                                                                                                           |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Persistence/degradability | : <b>Biodegradability:</b><br>Readily biodegradable.                                                                      |
| Bioaccumulative potential | : Not expected to bioaccumulate.                                                                                          |
| Ecotoxicity               | : Ecotoxicity in water:<br>(LC50): 22 to 33 mg/l, 96 hours [Fish (Fathead minnow.)].<br><br>Harmful to aquatic organisms. |

### 13. Disposal considerations

|                                                                  |                                                                                                            |
|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Methods of disposal ; Waste of residues ; Contaminated packaging | : Waste must be disposed of in accordance with federal, state and local environmental control regulations. |
| Waste Classification                                             | : Not applicable.                                                                                          |

### 14. Transport information

#### International transport regulations

|           |                              |                                                                                                                                                                         |
|-----------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UN :      | UN number                    | 2014                                                                                                                                                                    |
| UN :      | Proper shipping name         | Hydrogen peroxide, aqueous solution. (Hydrogen Peroxide.)                                                                                                               |
| UN :      | Packing group                | II                                                                                                                                                                      |
| UN :      | Label                        |   |
| ADR/RID : | Class                        | 5.1                                                                                                                                                                     |
| ADR/RID : | Hazard identification number | 58                                                                                                                                                                      |
| IMDG :    | Proper shipping name         | Hydrogen peroxide, aqueous solution. (Hydrogen Peroxide.)                                                                                                               |
| IMDG :    | Packing group                | II                                                                                                                                                                      |
| IATA :    | Proper shipping name         | Hydrogen peroxide, aqueous solution. (Hydrogen Peroxide.)                                                                                                               |
| IATA :    | Packing group                | II                                                                                                                                                                      |
| IATA :    | Additional Information       | -                                                                                                                                                                       |

## 15. Regulatory information

### EU Regulations

|                  |                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hazard symbol(s) | :                                                                                                                                                                                                                                                                                                |
| Classification   | : Harmful                                                                                                                                                                                                                                                                                                                                                                         |
| Risk Phrases     | : R22- Harmful if swallowed.<br>R37/38- Irritating to respiratory system and skin.<br>R41- Risk of serious damage to eyes.                                                                                                                                                                                                                                                        |
| Safety Phrases   | : S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.<br>S28- After contact with skin, wash immediately with plenty of water.<br>S36/37/39- Wear suitable protective clothing, gloves and eye/face protection.<br>S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). |
| Contains         | : - Hydrogen Peroxide.                                                                                                                                                                                                                                                                                                                                                            |
| Product Use      | : Classification and labelling have been performed according to EU directives 67/548/EEC, 88/379/EEC, including amendments and the intended use.<br>- Consumer applications.                                                                                                                                                                                                      |

## 16. Other information

### HISTORY

(Please note that dates are in American format [month/day/year])

|                        |                                  |
|------------------------|----------------------------------|
| Date of printing       | : 21/02/2007.                    |
| Date of issue          | : 21/02/2007.                    |
| Date of previous issue | : No Previous Validation.        |
| Version                | : 2                              |
| Prepared by            | : Michael Hale / Alistair Hunter |

### Notice to Reader

*To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein.*

*Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.*

### CHANGES SINCE PREVIOUS VERSIONS:

Version 2: Exposure limits added.



**PRODUCT: HYDRATED LIME** (CAHY) REVISION: 5      DATED: 28/05/12      PAGE 1 OF 9

## PRODUCT SPECIFICATION

|                         |                                |
|-------------------------|--------------------------------|
| Product Name            | Hydrated Lime                  |
| Alternative Name        | Calcium Hydroxide, Slaked Lime |
| Specification Reference | CAHY/4 (08/08)                 |

## SALES SPECIFICATION

| Chemical Properties                           | Typical Analysis           | Specification* |
|-----------------------------------------------|----------------------------|----------------|
| Calcium Hydroxide $\text{Ca}(\text{OH})_2$    | 97.98%                     | 96% min        |
| Calcium Carbonate $\text{CaCO}_3$             | 0.55%                      | 1.0% max       |
| Magnesium Oxide $\text{MgO}$                  | 0.23%                      | 0.28% max      |
| Iron Oxide $\text{Fe}_2\text{O}_3$            | 0.03%                      | 0.04% max      |
| Aluminium Oxide $\text{Al}_2\text{O}_3$       | 0.04%                      | 0.08% max      |
| Silica $\text{SiO}_2$                         | 0.36%                      | 0.70% max      |
| Manganese Mn                                  | 122 ppm                    | 150 ppm        |
| Sulphur S                                     | <0.01%                     | 0.02% max      |
| Lead Pb                                       | 2 ppm                      | 4 ppm max      |
| Arsenic As                                    | <1 ppm                     | 1 ppm max      |
| Free Moisture                                 | 0.53%                      | 1.0% max       |
| Available Lime (as $\text{Ca}(\text{OH})_2$ ) | 97.06%                     | 96% min        |
| Neutralisation Value (as CaO)                 | 74.46%                     | 71% min        |
| <b>Physical Properties</b>                    |                            |                |
| Grading % Passing                             |                            |                |
| 200 $\mu\text{m}$                             | 99.87%                     | 98% min        |
| 90 $\mu\text{m}$                              | 98.81%                     | 93% min        |
| Surface Area ( $\text{m}^2/\text{kg}$ )       | 1150                       | 891 – 1409     |
| <b>Bulk Density</b>                           |                            |                |
| Loose                                         | 560 $\text{kg}/\text{m}^3$ |                |
| Compacted                                     | 670 $\text{kg}/\text{m}^3$ |                |

Conforms to EN459-2001

\*Specification levels given at 95% confidence level

## NOTES

### Exclusion of Liability

Information contained in this publication is accurate to the best of the knowledge and belief of Tennants.

Any information or advice obtained from Tennants otherwise than by means of this publication and whether relating to Tennants materials or other materials, is also given in good faith. However, it remains at all times the responsibility of the customer to ensure that Tennants materials are suitable for the particular purpose intended.

Tennants accepts no liability whatsoever (except as otherwise provided by law) arising out of the use of information supplied, the application, adaptation or processing of the products described herein, the use of other materials in lieu of Tennants materials or the use of Tennants materials in conjunction with such other materials.

### Health and Safety

A Material Safety Data Sheet has been issued describing the health, safety and environmental properties of this product, identifying the potential hazards and giving advice on the handling precautions and emergency procedures. This must be consulted fully before handling, storage and use.



PRODUCT: HYDRATED LIME (CAHY) REVISION: 5 DATED: 28/05/12 PAGE 2 OF 9

## SAFETY DATA SHEET

### 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY

#### 1.1 Product Identifier

|                           |                                                                                                                                                                                |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chemical Name (EINECS)    | Calcium dihydroxide                                                                                                                                                            |
| Chemical Formula          | Ca(OH) <sub>2</sub>                                                                                                                                                            |
| Synonyms                  | Slaked lime, Air slaked lime, Building lime, Fat lime, Chemical lime, Finishing lime, Mason's lime, Calcium dihydroxide, Calcium hydroxide, Calcium hydrate, Lime, Lime water. |
| CAS Number                | 1305-62-0                                                                                                                                                                      |
| EINECS Number             | 215-137-3                                                                                                                                                                      |
| Molecular weight          | 74.09g/mol                                                                                                                                                                     |
| REACH Registration Number | 01-2119475151-45-xxxx                                                                                                                                                          |

#### 1.2 Relevant identified uses of the substance or mixture and uses advised against

|                      |                                                                          |
|----------------------|--------------------------------------------------------------------------|
| Identified use(s)    | Please check the identified uses in table 1 of the Appendix of this SDS. |
| Uses advised against | There are no uses advised against.                                       |

#### 1.3 Details of the supplier of the safety data sheet

Tennants Distribution Limited  
Hazelbottom Roa  
Cheetham  
Manchester  
M8 0GR  
Tel: 44(0)161 205 4454  
Fax: 44(0) 161 203 4298  
Email: [msds@tennantsdistribution.com](mailto:msds@tennantsdistribution.com)

#### 1.4 Emergency telephone number

Tel: 44(0)844 335 0001 (24 hours)

### 2. HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance or mixture

##### 2.1.1 Regulation 1272/2008 (CLP)

STOT Single Exp. 3, Route of exposure: Inhalation  
Skin Irritation 2  
Eye Damage 1

##### 2.1.2 EEC Directive 67/548/EEC & Directive 1999/45/EC

Xi – irritant

#### 2.2 Label elements

##### 2.2.1

According to Regulation (EC) No. 1272/2008 (CLP).

Trade name

Hazard Pictogram



Signal word(s) Danger.

Hazard statement(s)

H315: Causes skin irritation

H318: Causes serious eye damage

H335: May cause respiratory irritation

Precautionary statement(s)

P102: Keep out of reach of children

P280: Wear protective gloves/protective clothing/eye protection/face protection

P305+P351+P330: IF IN EYES: Rinse cautiously with water for several minutes. Immediately call a POISON CENTRE or doctor/physician

P302+P352: IF ON SKIN: Wash with plenty of water

P261: Avoid breathing dust/spray

P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing



**PRODUCT: HYDRATED LIME (CAHY) REVISION: 5 DATED: 28/05/12 PAGE 3 OF 9**

P501: Dispose of contents/container in accordance with local/regional/national/international regulation.

**2.2.2 Label elements** According to Directive 67/548/EEC & Directive 1999/45/EC

Hazard Symbol



Xi irritant

Risk Phrases

R37: Irritating to respiratory system

R38: Irritating to skin

R41: Risk of serious damage to eyes

Safety Phrases:

S2: Keep out of the reach of children

S25: Avoid contact with eyes

S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

S37: Wear suitable gloves

S39: Wear eye/face protection

**2.3 Other hazards**

The substance does not meet the criteria for PBT or vPvB substance.

No other hazards identified

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

**Substances**

Name: Calcium dihydroxide

CAS: 1305-62-0

EINECS: 215-137-3

Impurities

No impurities relevant for classification and labelling

**4. FIRST AID MEASURES**

**4.1 Description of first aid measures**

**General Advice**

No known delayed effects. Consult a physician for all exposures except for minor instances

**Inhalation**

Move source of dust or move person to fresh air. Obtain medical attention immediately.

**Skin contact**

Carefully and gently brush the contaminated body surfaces in order to remove all traces of product. Wash affected area immediately with plenty of water. Remove contaminated clothing. If necessary seek medical advice

**Eye contact**

Rinse eyes immediately with plenty of water and seek medical advice.

**Ingestion**

Clean mouth with water and drink afterwards plenty of water. Do NOT induce vomiting. Obtain medical attention

**4.2 Most important symptoms and effects, both acute and delayed**

Calcium dihydroxide is not acutely toxic via the oral, dermal, or inhalation route. The substance is classified as irritating to skin and the respiratory tract, and entails a risk of serious damage to the eye. There is no concern for adverse systemic effects because local effects (pH-effect) are the major health hazard

**4.3 Indication of any immediate medical attention and special treatment needed**

Follow the advises given in section 4.1

**5. FIRE FIGHTING MEASURES**

**5.1 Extinguishing Media**

Suitable extinguishing media:

The product is not combustible. Use a dry powder, foam or CO2 fire extinguisher to extinguish the surrounding fire.

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media:

Do not use water.

**5.2 Special hazards arising from the substance or mixture**

None

**5.3 Advice for fire-fighters**

Avoid generation of dust. Use breathing apparatus. Use extinguishing measures that are appropriate to local



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circumstances and the surrounding environment.

## **6. ACCIDENTAL RELEASE MEASURES**

### **6.1 Personal precautions, protective equipment and emergency procedures**

#### **For non-emergency personnel**

Ensure adequate ventilation.

Keep dust levels to a minimum.

Keep unprotected persons away.

Avoid contact with skin, eyes, and clothing – wear suitable protective equipment (see section 8).

Avoid inhalation of dust – ensure that sufficient ventilation or suitable respiratory protective equipment is used, wear suitable protective equipment (see section 8).

#### **For emergency responders**

Keep dust levels to a minimum.

Ensure adequate ventilation.

Keep unprotected persons away.

Avoid contact with skin, eyes, and clothing – wear suitable protective equipment (see section 8).

Avoid inhalation of dust – ensure that sufficient ventilation or suitable respiratory protective equipment is used, wear suitable protective equipment (see section 8).

### **6.2 Environmental precautions**

Contain the spillage. Keep the material dry if possible. Cover area if possible to avoid unnecessary dust hazard. Avoid uncontrolled spills to watercourses and drains (pH increase). Any large spillage into watercourses must be alerted to the Environment Agency or other regulatory body.

### **6.3 Methods and material for containment and cleaning up**

In all cases avoid dust formation.

Keep the material dry if possible.

Pick up the product mechanically in a dry way.

Use vacuum suction unit, or shovel into bags.

### **6.4 Reference to other sections**

For more information on exposure controls/personal protection or disposal considerations, please check section 8 and 13 and the annex of this safety data sheet.

## **7. HANDLING AND STORAGE**

### **7.1 Precautions for safe handling**

Avoid contact with skin and eyes. Wear protective equipment (refer to section 8 of this safety data sheet). Do not wear contact lenses when handling this product. It is also advisable to have individual pocket eyewash. Keep dust levels to a minimum. Minimize dust generation. Enclose dust sources, use exhaust ventilation (dust collector at handling points). Handling systems should preferably be enclosed. When handling bags usual precautions should be paid to the risks outlined in the Council Directive 90/269/EEC.

Avoid inhalation or ingestion and contact with skin and eyes. General occupational hygiene measures are required to ensure safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no drinking, eating and smoking at the workplace. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home

### **7.2 Conditions for safe storage, including any incompatibilities**

The substance should be stored under dry conditions. Any contact with air and moisture should be avoided. Bulk storage should be in purpose – designed silos. Keep away from acids, significant quantities of paper, straw, and nitro compounds. Keep out of reach of children. Do not use aluminium for transport or storage if there is a risk of contact with water.

### **7.3 Specific end use(s)**

Please check the identified uses in table 1 of the Appendix of this SDS.

For more information please see the relevant exposure scenario, available via your supplier/given in the Appendix, and check section 2.1: Control of worker exposure.

## **8. EXPOSURE CONTROLS/PERSONAL PROTECTION**

### **8.1 Control parameters**

SCOEL recommendation (SCOEL/SUM/137 February 2008; see Section 16.6):

**Occupational Exposure Limit (OEL), 8 h TWA:** 1 mg/m<sup>3</sup> respirable dust of calcium dihydroxide

**Short-term exposure limit (STEL), 15 min:** 4 mg/m<sup>3</sup> respirable dust of calcium dihydroxide

PNEC aqua = 490 µg/l

PNEC soil/groundwater = 1080 mg/l

### **8.2 Exposure controls**

To control potential exposures, generation of dust should be avoided. Further, appropriate protective equipment is recommended. Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye



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can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate.  
Please check the relevant exposure scenario, given in the Appendix/available via your supplier.

**Appropriate engineering controls**

If user operations generate dust, use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne dust levels below recommended exposure limits.

**Respiratory protection**

Local ventilation to keep levels below established threshold values is recommended. A suitable particle filter mask is recommended, depending on the expected exposure levels - please check the relevant exposure scenario, given in the Appendix/available via your supplier.

**Eye protection**

Do not wear contact lenses. For powders, tight fitting goggles with side shields, or wide vision full goggles. It is also advisable to have individual pocket eyewash.

**Skin & hand protection**

Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. The use of protective gloves (nitrile), protective standard working clothes fully covering skin, full length trousers, long sleeved overalls, with close fittings at openings and shoes resistant to caustics and avoiding dust penetration are required to be worn

**Thermal hazards**

The substance does not represent a thermal hazard, thus special consideration is not required.

**Environmental exposure controls**

All ventilation systems should be filtered before discharge to atmosphere.

Avoid releasing to the environment.

Contain the spillage. Any large spillage into watercourses must be alerted to the regulatory authority responsible for environmental protection or other regulatory body.

For detailed explanations of the risk management measures that adequately control exposure of the environment to the substance please check the relevant exposure scenario, available via your supplier.

For further detailed information, please check the Appendix of this SDS.

**9. PHYSICAL AND CHEMICAL PROPERTIES**

**9.1 Information on basic physical and chemical properties**

|                                           |                                                                                                                                                                                                                               |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Appearance                                | White or off white (beige) fine powder                                                                                                                                                                                        |
| Odour                                     | Odourless                                                                                                                                                                                                                     |
| Odour threshold                           | Not applicable                                                                                                                                                                                                                |
| pH in water solution                      | 12.4 (saturated solution @ 20°C)                                                                                                                                                                                              |
| Melting point/freezing point              | >450 °C (study result, EU A.1 method)                                                                                                                                                                                         |
| Boiling point/boiling range               | Not applicable (solid with melting point > 450 °C)                                                                                                                                                                            |
| Flash point                               | Not applicable (solid with melting point > 450 °C)                                                                                                                                                                            |
| Evaporation rate                          | Not applicable (solid with melting point > 450 °C)                                                                                                                                                                            |
| Flammability (solid, gas)                 | Non flammable ( study result, EU A.10 method)                                                                                                                                                                                 |
| Explosive limit                           | Non explosive (void of any chemical structures commonly associated with explosive properties)                                                                                                                                 |
| Vapour pressure                           | Not applicable (solid with melting point > 450 °C)                                                                                                                                                                            |
| Vapour density                            | Not applicable                                                                                                                                                                                                                |
| Relative density                          | 2.24 (study result, EU A.10 method)                                                                                                                                                                                           |
| Water solubility                          | 1844.9 mg/l (study result, EU A.6 method)                                                                                                                                                                                     |
| Partition of coefficient: n-octanol/water | Not applicable (inorganic substance)                                                                                                                                                                                          |
| Auto-ignition temperature                 | No relative self-ignition temperature below 400°C (study result, EU A.16 method)                                                                                                                                              |
| Thermal decomposition                     | When heated above 580 °C, calcium dihydroxide decomposes to produce calcium oxide (CaO) and water (H <sub>2</sub> O)                                                                                                          |
| Viscosity                                 | not applicable (solid with a melting point > 450 °C)                                                                                                                                                                          |
| Oxidising properties                      | no oxidising properties (Based on the chemical structure, the substance does not contain a surplus of oxygen or any structural groups known to be correlated with a tendency to react exothermally with combustible material) |
| <b>9.2 Other information</b>              | Not available                                                                                                                                                                                                                 |

**10. STABILITY AND REACTIVITY**

**10.1 Reactivity**



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In aqueous media  $\text{Ca(OH)}_2$  dissociates resulting in the formation of calcium cations and hydroxyl anions (when below the limit of water solubility).

**10.2 Chemical stability**

Under normal conditions of use and storage, calcium dihydroxide is stable.

**10.3 Possibility of hazardous reactions**

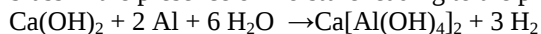
Calcium dihydroxide reacts exothermically with acids. When heated above 580 °C, calcium dihydroxide decomposes to produce calcium oxide (CaO) and water ( $\text{H}_2\text{O}$ ):  $\text{Ca(OH)}_2 \rightarrow \text{CaO} + \text{H}_2\text{O}$ . Calcium oxide reacts with water and generates heat. This may cause risk to flammable material.

**10.4 Conditions to avoid**

Minimise exposure to air and moisture to avoid degradation

**10.5 Incompatible materials**

Calcium dihydroxide reacts exothermically with acids to form salts. Calcium dihydroxide reacts with aluminium and brass in the presence of moisture leading to the production of hydrogen.



**10.6 Hazardous decomposition products**

None.

Further information: Calcium dihydroxide reacts with carbon dioxide to form calcium carbonate, which is a common material in nature.

**11. TOXICOLOGICAL INFORMATION**

**11.1 Information on toxicological effects**

Calcium dihydroxide is not acutely toxic.

Classification for acute toxicity is not warranted

**Acute Oral Toxicity**

LD50 > 2000 mg/kg bw (OECD 425, rat)

**Acute Dermal Toxicity**

LD50 > 2500 mg/kg bw (OECD 402, rabbit)

**Acute inhalation Toxicity**

no data available

**Skin Corrosion/Irritation**

Calcium dihydroxide is irritating to skin (*in vivo*, rabbit).

Based on experimental results, calcium dihydroxide requires classification as irritating to skin [R38, irritating to skin; Skin Irrit 2 (H315 – Causes skin irritation)].

**Serious eye damage/eye irritation**

Calcium dihydroxide entails a risk of serious damage to the eye (eye irritation studies (*in vivo*, rabbit).

Based on experimental results, calcium dihydroxide requires classification as severely irritating to the eye [R41, Risk of serious damage to eye; Eye Damage 1 (H318 - Causes serious eye damage)].

**Respiratory or skin sensitisation**

No data available.

Calcium dihydroxide is considered not to be a skin sensitiser, based on the nature of the effect (pH shift) and the essential requirement of calcium for human nutrition.

Classification for sensitisation is not warranted.

**Germ cell mutagenicity**

Bacterial reverse mutation assay (Ames test, OECD 471): Negative

Mammalian chromosome aberration test: Negative

In view of the omnipresence and essentiality of Ca and of the physiological non-relevance of any pH shift induced by lime in aqueous media, lime is obviously void of any genotoxic potential, including germ cell mutagenicity.

Classification for genotoxicity is not warranted.

**Carcinogenicity**

Calcium (administered as Ca-lactate) is not carcinogenic (experimental result, rat).

The pH effect of calcium dihydroxide does not give rise to a carcinogenic risk.

Human epidemiological data support lack of any carcinogenic potential of calcium dihydroxide.

Classification for carcinogenicity is not warranted

**Reproductive toxicity**

Calcium (administered as Ca-carbonate) is not toxic to reproduction (experimental result, mouse).

The pH effect does not give rise to a reproductive risk.

Human epidemiological data support lack of any potential for reproductive toxicity of calcium dihydroxide.

Both in animal studies and human clinical studies on various calcium salts no reproductive or developmental effects were detected. Also see the Scientific Committee on Food (Section 16.6). Thus, calcium dihydroxide is not toxic for reproduction and/or development.

Classification for reproductive toxicity according to regulation (EC) 1272/2008 is not required.



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**STOT-single exposure**

From human data it is concluded that  $\text{Ca}(\text{OH})_2$  is irritating to the respiratory tract.

As summarised and evaluated in the SCOEL recommendation (Anonymous, 2008), based on human data calcium dihydroxide is classified as irritating to the respiratory system [R37, Irritating to respiratory system; STOT SE 3 (H335 – May cause respiratory irritation)].

**STOT-repeated exposure**

Toxicity of calcium via the oral route is addressed by upper intake levels (UL) for adults determined by the Scientific Committee on Food (SCF), being  $\text{UL} = 2500 \text{ mg/d}$ , corresponding to  $36 \text{ mg/kg bw/d}$  (70 kg person) for calcium.

Toxicity of  $\text{Ca}(\text{OH})_2$  via the dermal route is not considered as relevant in view of the anticipated insignificant absorption through skin and due to local irritation as the primary health effect (pH shift).

Toxicity of  $\text{Ca}(\text{OH})_2$  via inhalation (local effect, irritation of mucous membranes) is addressed by an 8- h TWA determined by the Scientific Committee on Occupational Exposure Limits (SCOEL) of  $1 \text{ mg/m}^3$  respirable dust (see Section 8.1).

Therefore, classification of  $\text{Ca}(\text{OH})_2$  for toxicity upon prolonged exposure is not required.

**Aspiration hazard**

Calcium hydroxide is not known to present an aspiration hazard.

**12. ECOLOGICAL INFORMATION**

**12.1 Toxicity**

**12.1.1 Acute/Prolonged toxicity to fish**

$\text{LC}_{50}$  (96h) for freshwater fish:  $50.6 \text{ mg/l}$

$\text{LC}_{50}$  (96h) for marine water fish:  $457 \text{ mg/l}$

**12.1.2 Acute/Prolonged toxicity to aquatic invertebrates**

$\text{EC}_{50}$  (48h) for freshwater invertebrates:  $49.1 \text{ mg/l}$

$\text{LC}_{50}$  (96h) for marine water invertebrates:  $158 \text{ mg/l}$

**12.1.3 Acute/Prolonged toxicity to aquatic plants**

$\text{EC}_{50}$  (72h) for freshwater algae:  $184.57 \text{ mg/l}$

$\text{NOEC}$  (72h) for freshwater algae:  $48 \text{ mg/l}$

**12.1.4 Toxicity to micro-organisms e.g. bacteria**

At high concentration, through the rise of temperature and pH, calcium dihydroxide is used for disinfections of sewage sludge.

**12.1.5 Chronic toxicity to aquatic organisms**

$\text{NOEC}$  (14d) for marine water invertebrates:  $32 \text{ mg/l}$

**12.1.6 Toxicity to soil dwelling organisms**

$\text{EC}_{10}/\text{LC}_{10}$  or  $\text{NOEC}$  for soil macro organisms:  $2000 \text{ mg/kg soil dw}$

$\text{EC}_{10}/\text{LC}_{10}$  or  $\text{NOEC}$  for soil micro organisms:  $12000 \text{ mg/kg soil dw}$

**12.1.7 Toxicity to terrestrial plants**

$\text{NOEC}$  (21d) for terrestrial plants:  $1080 \text{ mg/kg}$

**12.1.8 General effect**

Acute pH-effect. Although this product is useful to correct water acidity, an excess of more than  $1 \text{ g/l}$  may be harmful to aquatic life. pH-value of  $> 12$  will rapidly decrease as result of dilution and carbonation.

**12.2 Persistence and degradability**

Not relevant for inorganic substances

**12.3 Bio accumulative potential**

Not relevant for inorganic substances

**12.4 Mobility in soil**

Calcium dihydroxide, which is sparingly soluble, presents a low mobility in most soils

**12.5 Results of PBT and vPvB assessment**

Not relevant for inorganic substances

**12.6 Other adverse effects**

No other adverse effects are identified

**13. DISPOSAL CONSIDERATIONS**

**13.1 Waste treatment methods**

Disposal of calcium dihydroxide should be in accordance with local and national legislation.

Processing, use or contamination of this product may change the waste management options.

Dispose of container and unused contents in accordance with applicable member state and local requirements.

The used packing is only meant for packing this product; it should not be reused for other purposes.

After usage, empty the packing completely.

**14. TRANSPORT INFORMATION**

**14.1 UN Number**



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Not regulated

**14.2 Proper Shipping Name**

Not regulated

**14.3 Transport hazard class**

Not regulated

**14.4 Packing group**

Not regulated

**14.5 Environmental**

None

**14.6 Special precautions for users**

Avoid any release of dust during transportation, by using air-tight tanks

**14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code**

Not regulated

**15. REGULATORY INFORMATION**

**15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

Authorisations: Not required

Restrictions on use: None

Other EU regulations: Calcium dihydroxide is not a SEVESO substance, not an ozone depleting substance and not a persistent organic pollutant.

National regulations: Water endangering class 1 (Germany)

**15.2 Chemical safety assessment**

A chemical safety assessment has been carried out for this substance.

**16. OTHER INFORMATION**

Data are based on our latest knowledge but do not constitute a guarantee for any specific product features and do not establish a legally valid contractual relationship.

**16.1 Hazard Statements**

H315: Causes skin irritation

H318: Causes serious eye damage

H335: May cause respiratory irritation

**16.2 Precautionary Statements**

P102: Keep out of reach of children

P280: Wear protective gloves/protective clothing/eye protection/face protection

P305+P351: IF IN EYES: Rinse cautiously with water for several minutes

P310: Immediately call a POISON CENTRE or doctor/physician

P302+P352: IF ON SKIN: Wash with plenty of soap and water

P261: Avoid breathing dust/fume/gas/mist/vapours/spray

P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

P501: Dispose of contents/container in accordance with local/regional/national/international regulation.

**16.3 Risk Phrases**

R37: Irritating to respiratory system

R38: Irritating to skin

R41: Risk of serious damage to eyes

**16.4 Safety Phrases**

S2: Keep out of the reach of children

S25: Avoid contact with eyes

S26: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice

S37: Wear suitable gloves

S39: Wear eye/face protection

**16.5 Abbreviations**

EC50: median effective concentration

LC50: median lethal concentration

LD50: median lethal dose

NOEC: no observable effect concentration

OEL: occupational exposure limit

PBT: persistent, bioaccumulative, toxic chemical

PNEC: predicted no-effect concentration

STEL: short-term exposure limit

TWA: time weighted average

vPvB: very persistent, very bioaccumulative chemical



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**Source of key data used to compile the data sheet**

Supplier information

**Modifications from last revision**

The Safety Data Sheets have been revised throughout to conform to EC Directive 1907/2007 and amendments

**Date:** 25.10.11

# PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

## APPENDIX: EXPOSURE SCENARIOS

The current document includes all relevant occupational and environmental exposure scenarios (ES) for the production and use of calcium dihydroxide as required under the REACH Regulation (Regulation (EC) No 1907/2006). For the development of the ES the Regulation and the relevant REACH Guidance have been considered. For the description of the covered uses and processes, the "R.12- Use descriptor system" guidance (Version: 2, March 2010, ECHA-2010-G-05-EN), for the description and implementation of risk management measures (RMM) the "R.13 - Risk management measures" guidance (Version: 1.1, May 2008), for the occupational exposure estimation the "R.14- Occupational exposure estimation" guidance (Version: 2, May 2010, ECHA-2010-G-09-EN) and for the actual environmental exposure assessment the "R.16 - Environmental Exposure Assessment" (Version: 2, May 2010, ECHA-10-G-06-EN) was used.

### Methodology used for environmental exposure assessment

The environmental exposure scenarios only address the assessment at the local scale, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, for industrial and professional uses as any effects that might occur is expected to take place on a local scale.

#### 1) Industrial uses (local scale)

The exposure and risk assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions in the industrial stages mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges. The exposure assessment for the aquatic environment only deals with the possible pH changes in STP effluent and surface water related to the OH<sup>-</sup> discharges at the local scale and is performed by assessing the resulting pH impact: the surface water pH should not increase above 9 (In general, most aquatic organisms can tolerate pH values in the range of 6-9).

Risk management measures related to the environment aim to avoid discharging calcium dihydroxide solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. Discharges should be carried out such that pH changes in receiving surface waters are minimised. The effluent pH is normally measured and can be neutralised easily, as often required by national laws.

#### 2) Professional uses (local scale)

The exposure and risk assessment is only relevant for the aquatic and terrestrial environment. The aquatic effect and risk assessment is determined by the pH effect. Nevertheless, the classical risk characterisation ratio (RCR), based on PEC (predicted environmental concentration) and PNEC (predicted no effect concentration) is calculated. The professional uses on a local scale refer to applications on agricultural or urban soil. The environmental exposure is assessed based on data and a modelling tool. The modelling FOCUS/ Exposit tool is used to assess terrestrial and aquatic exposure (typically conceived for biocidal applications).

Details and scaling approach indications are reported in the specific scenarios.

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

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### Methodology used for occupational exposure assessment

By definition an exposure scenario (ES) has to describe under which operational conditions (OC) and risk management measure (RMMs) the substance can be handled safely. This is demonstrated if the estimated exposure level is below the respective derived no-effect level (DNEL), which is expressed in the risk characterisation ratio (RCR). For workers, the repeated dose DNEL for inhalation as well as the acute DNEL for inhalation are based on the respective recommendations of the scientific committee on occupational exposure limits (SCOEL) being 1 mg/m<sup>3</sup> and 4 mg/m<sup>3</sup>, respectively. In cases where neither measured data nor analogous data are available, human exposure is assessed with the aid of a modelling tool. At the first tier screening level, the MEASE tool (<http://www.ebrc.de/mease.html>) is used to assess inhalation exposure according to the ECHA guidance (R.14).

Since the SCOEL recommendation refers to respirable dust while the exposure estimates in MEASE reflect the inhalable fraction, an additional safety margin is inherently included in the exposure scenarios below when MEASE has been used to derive exposure estimates.

### Methodology used for consumer exposure assessment

By definition an ES has to describe under which conditions the substances, preparation or articles can be handled safely. In cases where neither measured data nor analogous data are available, exposure is assessed with the aid of a modelling tool.

For consumers, the repeated dose DNEL for inhalation as well as the acute DNEL for inhalation are based on the respective recommendations of the Scientific Committee on Occupational Exposure Limits (SCOEL), being 1 mg/m<sup>3</sup> and 4 mg/m<sup>3</sup>, respectively.

For inhalation exposure to powders the data, derived from van Hemmen (van Hemmen, 1992: Agricultural pesticide exposure data bases for risk assessment. Rev Environ Contam Toxicol. 126: 1-85.), has been used to calculate the inhalation exposure. The inhalation exposure for consumers is estimated at 15 µg/hr or 0.25 µg/min. For larger tasks the inhalation exposure is expected to be higher. A factor of 10 is suggested when the product amount exceeds 2.5 kg, resulting in the inhalation exposure of 150 µg/hr. To convert these values in mg/m<sup>3</sup> a default value of 1.25 m<sup>3</sup>/hr for the breathing volume under light working conditions will be assumed (van Hemmen, 1992) giving 12 µg/m<sup>3</sup> for small tasks and 120 µg/m<sup>3</sup> for larger tasks.

When the preparation or substance is applied in granular form or as tablets, reduced exposure to dust was assumed. To take this into account if data about particle size distribution and attrition of the granule are lacking, the model for powder formulations is used, assuming a reduction in dust formation by 10 % according to Becks and Falks (Manual for the authorisation of pesticides. Plant protection products. Chapter 4 Human toxicology; risk operator, worker and bystander, version 1.0., 2006).

For dermal exposure and exposure to the eye a qualitative approach has been followed, as no DNEL could be derived for this route due to the irritating properties of calcium oxide. Oral exposure was not assessed as this is not a foreseeable route of exposure regarding the uses addressed.

Since the SCOEL recommendation refers to respirable dust while the exposure estimates by the model from van Hemmen reflect the inhalable fraction, an additional safety margin is inherently included in the exposure scenarios below, i.e. the exposure estimates are very conservative.

The exposure assessment of calcium dihydroxide professional and industrial and consumer use is performed and organized based on several scenarios. An overview of the scenarios and the coverage of substance life cycle is presented in Table 1.

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

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**Table 1:** Overview on exposure scenarios and coverage of substance life cycle

| ES number | Exposure scenario title                                                           | 03<br>TO<br>4<br>TO<br>s | Identified uses          |                          |                          | Resulting life cycle stage<br><br>Service life (for articles) | 03<br>Li | Sector of use category (SU)                                                             | Chemical Product Category (PC)                                                                                                            | Process category (PROC)                                                                          | Article category (AC)              | Environmental release category (ERC)                           |
|-----------|-----------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------|
|           |                                                                                   |                          | 03<br>TO<br>4<br>TO<br>s | 03<br>TO<br>4<br>TO<br>s | 03<br>TO<br>4<br>TO<br>s |                                                               |          |                                                                                         |                                                                                                                                           |                                                                                                  |                                    |                                                                |
| 9.1       | Manufacture and industrial uses of aqueous solutions of lime substances           | X                        | X                        | X                        |                          | X                                                             | 1        | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19                                  | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b |
| 9.2       | Manufacture and industrial uses of low dusty solids/powders of lime substances    | X                        | X                        | X                        |                          | X                                                             | 2        | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27a, 27b | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b |
| 9.3       | Manufacture and industrial uses of medium dusty solids/powders of lime substances | X                        | X                        | X                        |                          | X                                                             | 3        | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b        | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b |

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| ES number | Exposure scenario title                                                         | 03<br>TO<br>4<br>3<br>TO<br>S | Identified uses               |                               |                               | Resulting life cycle stage<br><br>Service life (for articles) | 03<br>73<br>0<br>0<br>73<br>0<br>Li | Sector of use category (SU)                                                             | Chemical Product Category (PC)                                                                                                            | Process category (PROC)                                                                   | Article category (AC)              | Environmental release category (ERC)                           |
|-----------|---------------------------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------|
|           |                                                                                 |                               | 03<br>TO<br>4<br>3<br>TO<br>S | 03<br>TO<br>4<br>3<br>TO<br>S | 03<br>TO<br>4<br>3<br>TO<br>S |                                                               |                                     |                                                                                         |                                                                                                                                           |                                                                                           |                                    |                                                                |
| 9.4       | Manufacture and industrial uses of high dusty solids/powders of lime substances | X                             | X                             | X                             |                               | X                                                             | 4                                   | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 11a           |
| 9.5       | Manufacture and industrial uses of massive objects containing lime substances   | X                             | X                             | X                             |                               | X                                                             | 5                                   | 3; 1, 2a, 2b, 4, 5, 6a, 6b, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 6, 14, 21, 22, 23, 24, 25                                                                 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 1, 2, 3, 4, 5, 6a, 6b, 6c, 6d, 7, 12a, 12b, 10a, 10b, 11a, 11b |
| 9.6       | Professional uses of aqueous solutions of lime substances                       |                               | X                             | X                             |                               | X                                                             | 6                                   | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24                         | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 12, 13, 15, 16, 17, 18, 19                                     | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f                                      |

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| ES number | Exposure scenario title                                             | 03<br>04<br>05<br>06<br>07<br>08<br>09<br>10<br>11<br>12<br>13<br>14<br>15<br>16<br>17<br>18<br>19<br>20<br>21<br>22<br>23<br>24<br>25<br>26<br>27<br>28<br>29<br>30<br>31<br>32<br>33<br>34<br>35<br>36<br>37<br>38<br>39<br>40 | Identified uses                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                  | Resulting life cycle stage | Service life (for articles) | Sector of use category (SU)                                     | Chemical Product Category (PC)                                                                                                            | Process category (PROC)                                       | Article category (AC)              | Environmental release category (ERC) |
|-----------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-----------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------|--------------------------------------|
|           |                                                                     |                                                                                                                                                                                                                                  | 03<br>04<br>05<br>06<br>07<br>08<br>09<br>10<br>11<br>12<br>13<br>14<br>15<br>16<br>17<br>18<br>19<br>20<br>21<br>22<br>23<br>24<br>25<br>26<br>27<br>28<br>29<br>30<br>31<br>32<br>33<br>34<br>35<br>36<br>37<br>38<br>39<br>40 | 03<br>04<br>05<br>06<br>07<br>08<br>09<br>10<br>11<br>12<br>13<br>14<br>15<br>16<br>17<br>18<br>19<br>20<br>21<br>22<br>23<br>24<br>25<br>26<br>27<br>28<br>29<br>30<br>31<br>32<br>33<br>34<br>35<br>36<br>37<br>38<br>39<br>40 | 03<br>04<br>05<br>06<br>07<br>08<br>09<br>10<br>11<br>12<br>13<br>14<br>15<br>16<br>17<br>18<br>19<br>20<br>21<br>22<br>23<br>24<br>25<br>26<br>27<br>28<br>29<br>30<br>31<br>32<br>33<br>34<br>35<br>36<br>37<br>38<br>39<br>40 |                            |                             |                                                                 |                                                                                                                                           |                                                               |                                    |                                      |
| 9.7       | Professional uses of low dusty solids/powders of lime substances    |                                                                                                                                                                                                                                  | X                                                                                                                                                                                                                                | X                                                                                                                                                                                                                                |                                                                                                                                                                                                                                  | X                          | 7                           | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 13, 15, 16, 17, 18, 19, 21, 25, 26 | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f            |
| 9.8       | Professional uses of medium dusty solids/powders of lime substances |                                                                                                                                                                                                                                  | X                                                                                                                                                                                                                                | X                                                                                                                                                                                                                                |                                                                                                                                                                                                                                  | X                          | 8                           | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 13, 15, 16, 17, 18, 19, 25, 26     | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f, 9a, 9b    |
| 9.9       | Professional uses of high dusty solids/powders of lime substances   |                                                                                                                                                                                                                                  | X                                                                                                                                                                                                                                | X                                                                                                                                                                                                                                |                                                                                                                                                                                                                                  | X                          | 9                           | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 | 1, 2, 3, 7, 8, 9a, 9b, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40 | 2, 3, 4, 5, 8a, 8b, 9, 10, 13, 15, 16, 17, 18, 19, 25, 26     | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 2, 8a, 8b, 8c, 8d, 8e, 8f            |

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| ES number | Exposure scenario title                                             | Manufacture | Identified uses |         |          | Resulting life cycle stage  | Linked to Identified Use | Sector of use category (SU)                                     | Chemical Product Category (PC) | Primary category (PROC) | Article category (AC)              | Environmental release category (ERC) |
|-----------|---------------------------------------------------------------------|-------------|-----------------|---------|----------|-----------------------------|--------------------------|-----------------------------------------------------------------|--------------------------------|-------------------------|------------------------------------|--------------------------------------|
|           |                                                                     |             | Formulation     | End use | Consumer | Service life (for articles) |                          |                                                                 |                                |                         |                                    |                                      |
| 9.10      | Professional use of lime substances in soil treatment               |             | X               | X       |          |                             | 10                       | 22                                                              | 9b                             | 5, 8b, 11, 26           |                                    | 2, 8a, 8b, 8c, 8d, 8e, 8f            |
| 9.11      | Professional uses of articles/containers containing lime substances |             |                 | X       |          | X                           | 11                       | 22; 1, 5, 6a, 6b, 7, 10, 11, 12, 13, 16, 17, 18, 19, 20, 23, 24 |                                | 0, 21, 24, 25           | 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13 | 10a, 11a, 11b, 12a, 12b              |
| 9.12      | Consumer use of building and construction material (DIY)            |             |                 |         | X        |                             | 12                       | 21                                                              | 9b, 9a                         |                         |                                    | 8                                    |
| 9.13      | Consumer use of $\text{CO}_2$ absorbent in breathing apparatuses    |             |                 |         | X        |                             | 13                       | 21                                                              | 2                              |                         |                                    | 8                                    |

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| ES number | Exposure scenario title                                                 | Manufacture | Identified uses |         |          | Resulting life cycle stage  | Linked to Identified Use | Sector of use category (SU) | Chemical Product Category (PC) | Principal category (PROC) | Article category (AC) | Environmental release category (ERC) |
|-----------|-------------------------------------------------------------------------|-------------|-----------------|---------|----------|-----------------------------|--------------------------|-----------------------------|--------------------------------|---------------------------|-----------------------|--------------------------------------|
|           |                                                                         |             | Formulation     | End use | Consumer | Service life (for articles) |                          |                             |                                |                           |                       |                                      |
| 9.14      | Consumer use of garden lime/fertilizer                                  |             |                 |         | X        |                             | 14                       | 21                          | 20, 12                         |                           |                       | 8e                                   |
| 9.15      | Consumer use of lime substances as water treatment chemicals in aquaria |             |                 |         | X        |                             | 15                       | 21                          | 20, 37                         |                           |                       | 8                                    |
| 9.16      | Consumer use of cosmetics containing lime substances                    |             |                 |         | X        |                             | 16                       | 21                          | 39                             |                           |                       | 8                                    |

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## ES number 9.1: Manufacture and industrial uses of aqueous solutions of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                 |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                 |
| Free short title                                                    | Manufacture and industrial uses of aqueous solutions of lime substances                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                 |
| Systematic title based on use descriptor                            | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                                                 |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                 |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE.                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                 |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                 |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Involved tasks<br><br>Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 1                                                              | Use in closed process, no likelihood of exposure                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                 |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                 |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                 |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                 |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                 |
| PROC 7                                                              | Industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                 |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                 |
| PROC 8b                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                 |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                 |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                 |
| PROC 12                                                             | Use of blowing agents in manufacture of foam                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                 |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                 |
| PROC 14                                                             | Production of preparations or articles by tableting, compression, extrusion, pelletisation                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                 |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                 |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                 |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                 |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                 |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                 |
| ERC 1-7, 12                                                         | Manufacture, formulation and all types of industrial uses                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                 |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------|---------------------|
| ERC 10, 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Wide-dispersive outdoor and indoor use of long-life articles and materials                                                                                                                                                                                                                                                                           |                           |                                       |                     |
| 2.1 Control of workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Product characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. The spraying of aqueous solutions (PROC7 and 11) is assumed to be involved with a medium emission. |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Use in preparation                                                                                                                                                                                                                                                                                                                                   | Content in preparation    | Physical form                         | Emission potential  |
| PROC 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | not restricted                                                                                                                                                                                                                                                                                                                                       |                           | aqueous solution                      | medium              |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | not restricted                                                                                                                                                                                                                                                                                                                                       |                           | aqueous solution                      | very low            |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Frequency and duration of use/exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Duration of exposure                                                                                                                                                                                                                                                                                                                                 |                           |                                       |                     |
| PROC 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | < 240 minutes                                                                                                                                                                                                                                                                                                                                        |                           |                                       |                     |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 480 minutes (not restricted)                                                                                                                                                                                                                                                                                                                         |                           |                                       |                     |
| Human factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m³/shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Other given operational conditions affecting workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Since aqueous solutions are not used in hot-metallurgical processes, operational conditions (e.g. process temperature and process pressure) are not considered relevant for occupational exposure assessment of the conducted processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Technical conditions and measures at process level (source) to prevent release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Technical conditions and measures to control dispersion from source towards the worker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC)   | Efficiency of LC (according to MEASE) | Further information |
| PROC 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | local exhaust ventilation | 78 %                                  | -                   |
| PROC 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                      | not applicable            | na                                    | -                   |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                      | not required              | na                                    | -                   |
| Organisational measures to prevent /limit releases, dispersion and exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |
| Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                      |                           |                                       |                     |

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### Conditions and measures related to personal protection, hygiene and health evaluation

| PROC                       | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
|----------------------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC 7                     | FFP1 mask                                               | APF=4                                            | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs | not required                                            |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE.

For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.

An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

## 2.2 Control of environmental exposure

### Amounts used

The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.

### Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

### Environment factors not influenced by risk management

Flow rate of receiving surface water: 18000 m<sup>3</sup>/day

### Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m<sup>3</sup>/day

### Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging lime solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation). In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. The justification for this risk management measure can be found in the introduction section.

### Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

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| 3. Exposure estimation and reference to its source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                                                                                                                                                                                                                                      |                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Occupational exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                                                                                                                                                                                                                                      |                                |
| The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                                                                                                                                                                                                                                      |                                |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Method used for inhalation exposure assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment                                                                                                                                                                                                           | Dermal exposure estimate (RCR) |
| PROC 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MEASE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | < 1 mg/m³<br>(0.001 - 0.66)        | Since calcium dihydroxide are classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |
| Environmental exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                                                                                                                                                                                                                                      |                                |
| The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of lime substance in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH- discharges, being the toxicity of Ca2+ is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that lime substance will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of lime substance. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH- discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    |                                                                                                                                                                                                                                                      |                                |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | The production of lime substance can potentially result in an aquatic emission and locally increase the lime substance concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from lime substance production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.                                                                             |                                    |                                                                                                                                                                                                                                                      |                                |
| Exposure concentration in waste water treatment plant (WWTP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Waste water from lime substance production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from lime substance production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs.                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                      |                                |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | When lime substance is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH may increase, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be. In general the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CO2), the bicarbonate ion (HC03-) and the carbonate ion (C032-). |                                    |                                                                                                                                                                                                                                                      |                                |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The sediment compartment is not included in this ES, because it is not considered relevant for lime substance: when lime substance is emitted to the aquatic compartment, sorption of to sediment particles is negligible.                                                                                                                                                                                                                                                                                                         |                                    |                                                                                                                                                                                                                                                      |                                |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                                                                                                                                                                                                                                      |                                |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | The air compartment is not included in this CSA because it is considered not relevant for lime substance: when emitted to air as an aerosol in water, lime substance is neutralised as a result of its reaction with C02 (or other acids), into HC03- and Ca2+. Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised lime substance largely end up in soil and water.                                                                                 |                                    |                                                                                                                                                                                                                                                      |                                |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Bioaccumulation in organisms is not relevant for lime substance: a risk assessment for secondary poisoning is therefore not required.                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                                                                                                                                                                                                                                      |                                |

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## 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

### Occupational exposure

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE

([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

### Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

**Tier 1:** retrieve information on effluent pH and the contribution of the lime substance on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

**Tier 2a:** retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \text{Log} \frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \quad (Eq1)$$

Where:

Q effluent refers to the effluent flow (in m<sup>3</sup>/day)

Q river upstream refers to the upstream river flow (in m<sup>3</sup>/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m<sup>3</sup>/day
- Q effluent: use default value of 2000 m<sup>3</sup>/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

**Tier 2b:** Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH<sup>-</sup> concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH<sup>-</sup> expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the lime substance.

**Tier 3:** measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.

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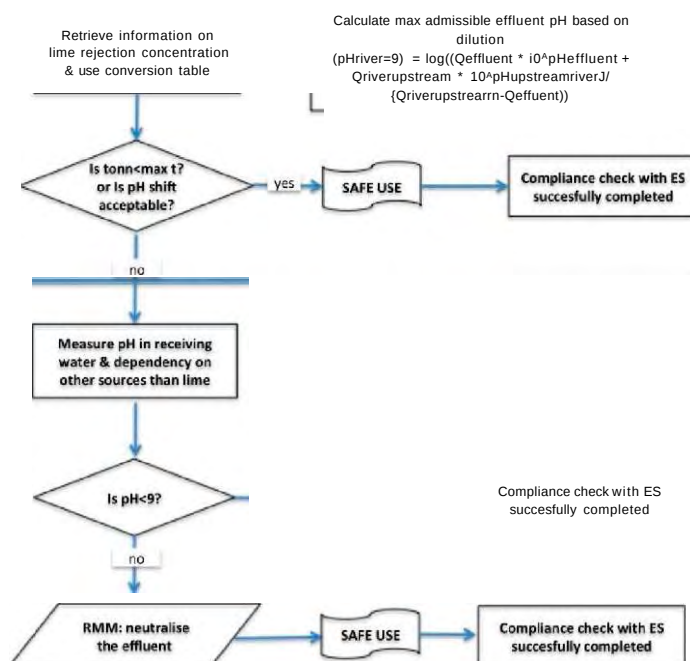
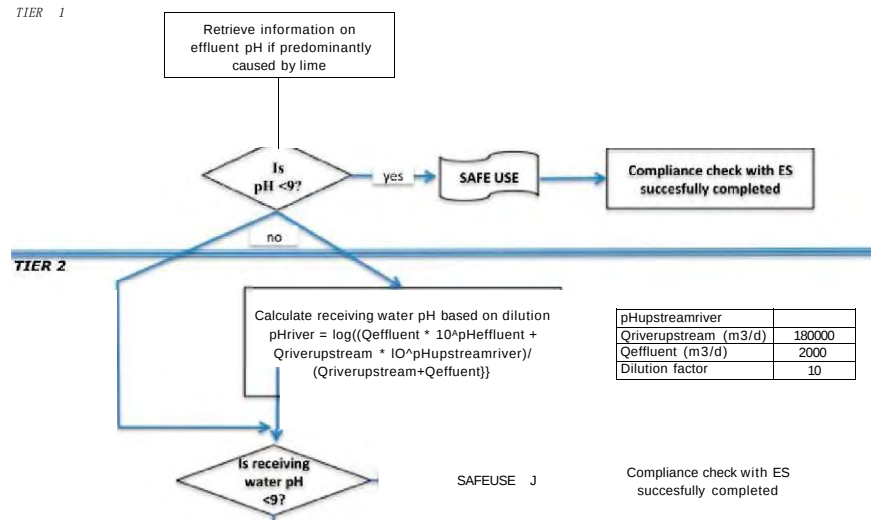
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TIER 1



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## ES number 9.2: Manufacture and industrial uses of low dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| Free short title                                                    | Manufacture and industrial uses of low dusty solids/powders of lime substances                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                           |
| Systematic title based on use descriptor                            | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                           |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE.                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Involved tasks                                                                                                                                                            |
| PROC 1                                                              | Use in closed process, no likelihood of exposure                                                                                                                                                                                                                                                                                                                                                                                                                                      | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                           |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |
| PROC 6                                                              | Calendering operations                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                           |
| PROC 7                                                              | Industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 8b                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                           |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                           |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 14                                                             | Production of preparations or articles by tabletting, compression, extrusion, pelletisation                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                           |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 21                                                             | Low energy manipulation of substances bound in materials and/or articles                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |

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|             |                                                                                                             |  |  |  |
|-------------|-------------------------------------------------------------------------------------------------------------|--|--|--|
| PROC 22     | Potentially closed processing operations with minerals/metals at elevated temperature<br>Industrial setting |  |  |  |
| PROC 23     | Open processing and transfer operations with minerals/metals at elevated temperature                        |  |  |  |
| PROC 24     | High (mechanical) energy work-up of substances bound in materials and/or articles                           |  |  |  |
| PROC 25     | Other hot work operations with metals                                                                       |  |  |  |
| PROC 26     | Handling of solid inorganic substances at ambient temperature                                               |  |  |  |
| PROC 27a    | Production of metal powders (hot processes)                                                                 |  |  |  |
| PROC 27b    | Production of metal powders (wet processes)                                                                 |  |  |  |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses                                                   |  |  |  |
| ERC 10, 11  | Wide-dispersive outdoor and indoor use of long-life articles and materials                                  |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                        |                      |                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------|----------------------|--------------------|
| 2.1 Control of workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                        |                      |                    |
| Product characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                        |                      |                    |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.      |                              |                        |                      |                    |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Use in preparation           | Content in preparation | Physical form        | Emission potential |
| PROC 22, 23, 25, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | not restricted               |                        | solid/powder, molten | high               |
| PROC 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | not restricted               |                        | solid/powder         | high               |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | not restricted               |                        | solid/powder         | low                |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                              |                        |                      |                    |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                                   |                              |                        |                      |                    |
| Frequency and duration of use/exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                        |                      |                    |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Duration of exposure         |                        |                      |                    |
| PROC 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | < 240 minutes                |                        |                      |                    |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 480 minutes (not restricted) |                        |                      |                    |
| Human factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                        |                      |                    |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m³/shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                              |                        |                      |                    |
| Other given operational conditions affecting workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                              |                        |                      |                    |
| Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. |                              |                        |                      |                    |
| Technical conditions and measures at process level (source) to prevent release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                        |                      |                    |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                              |                        |                      |                    |

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Printing Date: 17 November 2010

| Technical conditions and measures to control dispersion from source towards the worker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC)                          | Efficiency of LC (according to MEASE)                                                                                           | Further information                                                                                                                                                                                                                                                                            |
| PROC 7, 17, 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | general ventilation                              | 17 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| PROC 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      | not applicable                                   | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| PROC 22, 23, 24, 25, 26, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      | local exhaust ventilation                        | 78 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                      | not required                                     | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| <b>Organisational measures to prevent /limit releases, dispersion and exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Conditions and measures related to personal protection, hygiene and health evaluation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Specification of respiratory protective equipment (RPE)                                                                                                                                                                                                                                                                                              | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
| PROC 22, 24, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | FFP1 mask                                                                                                                                                                                                                                                                                                                                            | APF=4                                            | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | not required                                                                                                                                                                                                                                                                                                                                         | na                                               |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE. For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.<br>The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.<br>An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE. |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>2.2 Control of environmental exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Amounts used</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Frequency and duration of use</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Intermittent (< 12 time per year) or continuous use/release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Environment factors not influenced by risk management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Flow rate of receiving surface water: 18000 m <sup>3</sup> /day                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

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## Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m<sup>3</sup>/day

## Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging lime solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation). In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. The justification for this risk management measure can be found in the introduction section.

## Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

## 3. Exposure estimation and reference to its source

### Occupational exposure

The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC                                                                                                  | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR)    | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR) |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| PROC 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27a, 27b | MEASE                                          | <1 mg/m <sup>3</sup><br>(0.01 - 0.83) | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |

### Environmental emissions

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium dihydroxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, being the toxicity of Ca<sup>2+</sup> is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium dihydroxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium dihydroxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH<sup>-</sup> discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

|                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental emissions</b>                                      | The production of calcium dihydroxide can potentially result in an aquatic emission and locally increase the calcium dihydroxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium dihydroxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.                                                                                                                                  |
| <b>Exposure concentration in waste water treatment plant (WWTP)</b> | Waste water from calcium dihydroxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium dihydroxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs.                                                                                                                                                                                                             |
| <b>Exposure concentration in aquatic pelagic compartment</b>        | When calcium dihydroxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH may increase, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be. In general the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CO <sub>2</sub> ), the bicarbonate ion (HCO <sub>3</sub> <sup>-</sup> ) and the carbonate ion (CO <sub>3</sub> <sup>2-</sup> ). |
| <b>Exposure concentration in sediments</b>                          | The sediment compartment is not included in this ES, because it is not considered relevant for calcium dihydroxide: when calcium dihydroxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible.                                                                                                                                                                                                                                                                                                                                                                   |

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|                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exposure concentrations in soil and groundwater</b>                          | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Exposure concentration in atmospheric compartment</b>                        | The air compartment is not included in this CSA because it is considered not relevant for calcium dihydroxide: when emitted to air as an aerosol in water, calcium dihydroxide is neutralised as a result of its reaction with CO <sub>2</sub> (or other acids), into HCO <sub>3</sub> <sup>-</sup> and Ca <sup>2+</sup> . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium dihydroxide largely end up in soil and water. |
| <b>Exposure concentration relevant for the food chain (secondary poisoning)</b> | Bioaccumulation in organisms is not relevant for calcium dihydroxide: a risk assessment for secondary poisoning is therefore not required.                                                                                                                                                                                                                                                                                                                                                                         |

#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

##### Occupational exposure

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

##### Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

**Tier 1:** retrieve information on effluent pH and the contribution of the calcium dihydroxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

**Tier 2a:** retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \log \left( \frac{Q_{effluent} \cdot 10^{pH_{effluent}} + Q_{riverupstream} \cdot 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right) \quad (Eq1)$$

Where:

Q effluent refers to the effluent flow (in m<sup>3</sup>/day)

Q river upstream refers to the upstream river flow (in m<sup>3</sup>/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m<sup>3</sup>/day
- Q effluent: use default value of 2000 m<sup>3</sup>/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

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Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

**Tier 2b:** Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the  $\text{OH}^-$  concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium.  $\text{OH}^-$  expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium dihydroxide.

**Tier 3:** measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.

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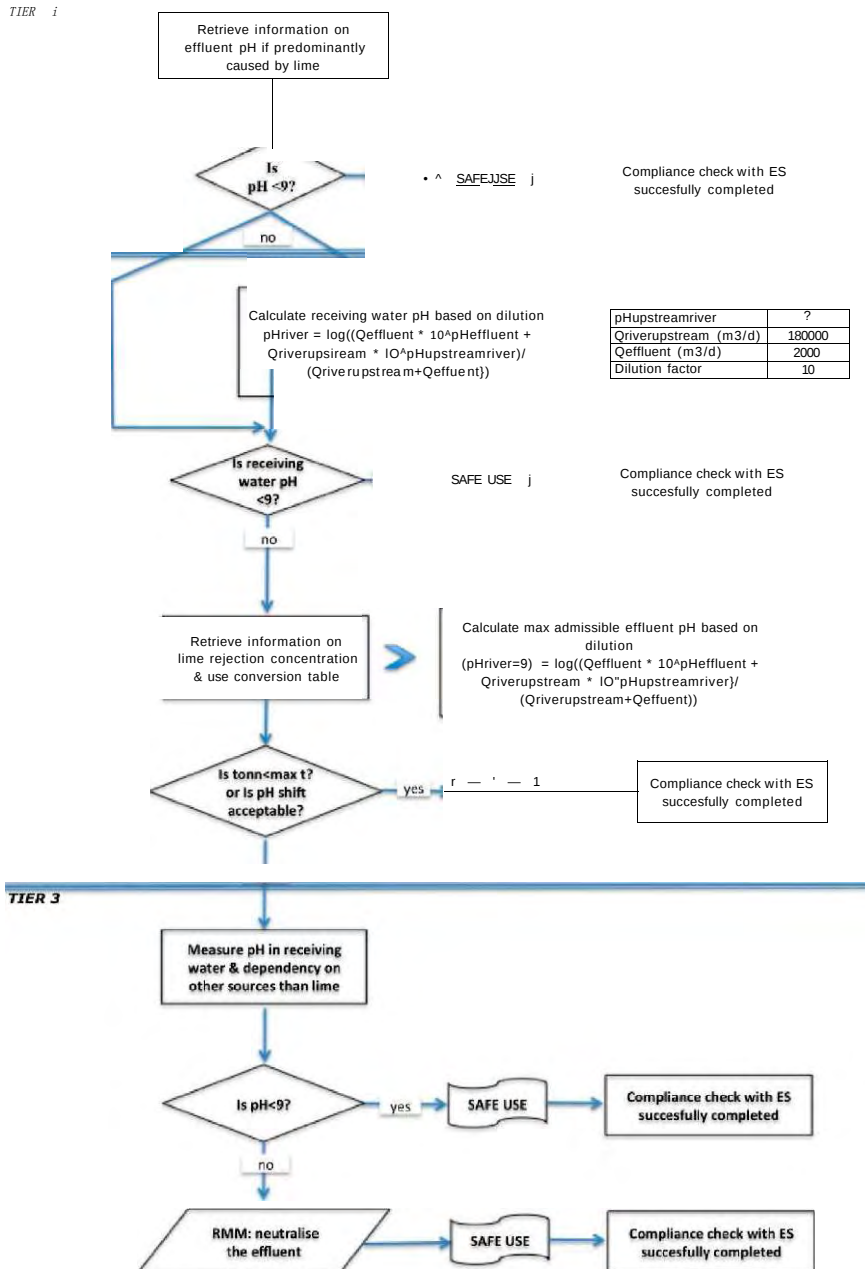
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TIER 1



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Revision date: 17 November 2010

Printing Date: 17 November 2010

### • ES number 9.3: Manufacture and industrial uses of medium dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| Free short title                                                    | Manufacture and industrial uses of medium dusty solids/powders of lime substances                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                           |
| Systematic title based on use descriptor                            | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                           |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE.                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Involved tasks                                                                                                                                                            |
| PROC 1                                                              | Use in closed process, no likelihood of exposure                                                                                                                                                                                                                                                                                                                                                                                                                                      | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                           |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |
| PROC 7                                                              | Industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 8b                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                           |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                           |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 14                                                             | Production of preparations or articles by tabletting, compression, extrusion, pelletisation                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                           |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 22                                                             | Potentially closed processing operations with minerals/metals at elevated temperature<br>Industrial setting                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| PROC 23                                                             | Open processing and transfer operations with                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

piepdiu in dLuordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | minerals/metals at elevated temperature                                           |                        |                      |                    |
| PROC 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | High (mechanical) energy work-up of substances bound in materials and/or articles |                        |                      |                    |
| PROC 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Other hot work operations with metals                                             |                        |                      |                    |
| PROC 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Handling of solid inorganic substances at ambient temperature                     |                        |                      |                    |
| PROC 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Production of metal powders (hot processes)                                       |                        |                      |                    |
| PROC 27b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Production of metal powders (wet processes)                                       |                        |                      |                    |
| ERC 1-7, 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Manufacture, formulation and all types of industrial uses                         |                        |                      |                    |
| ERC 10, 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Wide-dispersive outdoor and indoor use of long-life articles and materials        |                        |                      |                    |
| 2.1 Control of workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                   |                        |                      |                    |
| Product characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                   |                        |                      |                    |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.      |                                                                                   |                        |                      |                    |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Use in preparation                                                                | Content in preparation | Physical form        | Emission potential |
| PROC 22, 23, 25, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | not restricted                                                                    |                        | solid/powder, molten | high               |
| PROC 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | not restricted                                                                    |                        | solid/powder         | high               |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | not restricted                                                                    |                        | solid/powder         | medium             |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                   |                        |                      |                    |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                                   |                                                                                   |                        |                      |                    |
| Frequency and duration of use/exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                   |                        |                      |                    |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Duration of exposure                                                              |                        |                      |                    |
| PROC 7, 17, 18, 19, 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | < 240 minutes                                                                     |                        |                      |                    |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 480 minutes (not restricted)                                                      |                        |                      |                    |
| Human factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                   |                        |                      |                    |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m³/shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                   |                        |                      |                    |
| Other given operational conditions affecting workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                   |                        |                      |                    |
| Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. |                                                                                   |                        |                      |                    |
| Technical conditions and measures at process level (source) to prevent release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                   |                        |                      |                    |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                   |                        |                      |                    |

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| Technical conditions and measures to control dispersion from source towards the worker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC)                          | Efficiency of LC (according to MEASE)                                                                                           | Further information                                                                                                                                                                                                                                                                            |
| PROC 1, 2, 15, 27b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required                                     | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| PROC 3, 13, 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                      | general ventilation                              | 17 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| PROC 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      | not applicable                                   | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                      | local exhaust ventilation                        | 78 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| Organisational measures to prevent /limit releases, dispersion and exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Conditions and measures related to personal protection, hygiene and health evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Specification of respiratory protective equipment (RPE)                                                                                                                                                                                                                                                                                              | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
| PROC 4, 5, 7, 8a, 8b, 9, 10, 16, 17, 18, 19, 22, 24, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | FFP1 mask                                                                                                                                                                                                                                                                                                                                            | APF=4                                            | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | not required                                                                                                                                                                                                                                                                                                                                         | na                                               |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE. For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.<br>The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.<br>An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE. |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| 2.2 Control of environmental exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Frequency and duration of use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Intermittent (< 12 time per year) or continuous use/release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Environment factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Flow rate of receiving surface water: 18000 m³/day                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

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## Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m<sup>3</sup>/day

## Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging lime solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation). In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. The justification for this risk management measure can be found in the introduction section.

## Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

## 3. Exposure estimation and reference to its source

### Occupational exposure

The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC                                                                                           | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR)     | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR) |
|------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| PROC 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | MEASE                                          | < 1 mg/m <sup>3</sup><br>(0.01 - 0.88) | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |

### Environmental emissions

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium dihydroxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, being the toxicity of Ca<sup>2+</sup> is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium dihydroxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium dihydroxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH<sup>-</sup> discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental emissions                                      | The production of calcium dihydroxide can potentially result in an aquatic emission and locally increase the calcium dihydroxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium dihydroxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.                                                                                                                                  |
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from calcium dihydroxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium dihydroxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs.                                                                                                                                                                                                             |
| Exposure concentration in aquatic pelagic compartment        | When calcium dihydroxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH may increase, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be. In general the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CO <sub>2</sub> ), the bicarbonate ion (HCO <sub>3</sub> <sup>-</sup> ) and the carbonate ion (CO <sub>3</sub> <sup>2-</sup> ). |
| Exposure concentration in sediments                          | The sediment compartment is not included in this ES, because it is not considered relevant for calcium dihydroxide: when calcium dihydroxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible.                                                                                                                                                                                                                                                                                                                                                                   |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exposure concentrations in soil and groundwater</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Exposure concentration in atmospheric compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The air compartment is not included in this CSA because it is considered not relevant for calcium dihydroxide: when emitted to air as an aerosol in water, calcium dihydroxide is neutralised as a result of its reaction with CO <sub>2</sub> (or other acids), into HCO <sub>3</sub> <sup>-</sup> and Ca <sup>2+</sup> . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium dihydroxide largely end up in soil and water. |
| <b>Exposure concentration relevant for the food chain (secondary poisoning)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bioaccumulation in organisms is not relevant for calcium dihydroxide: a risk assessment for secondary poisoning is therefore not required.                                                                                                                                                                                                                                                                                                                                                                         |
| <b>4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Occupational exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <p>The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (<a href="http://www.ebrc.de/mease.html">www.ebrc.de/mease.html</a>) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness &gt;10 % are defined as "high dusty".</p> <p>DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)</p> <p>Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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### Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

**Tier 1:** retrieve information on effluent pH and the contribution of the calcium dihydroxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

**Tier 2a:** retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \log \frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \quad (Eq1)$$

Where:

Q effluent refers to the effluent flow (in m<sup>3</sup>/day)

Q river upstream refers to the upstream river flow (in m<sup>3</sup>/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m<sup>3</sup>/day
- Q effluent: use default value of 2000 m<sup>3</sup>/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

**Tier 2b:** Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH<sup>-</sup> concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH<sup>-</sup> expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium dihydroxide.

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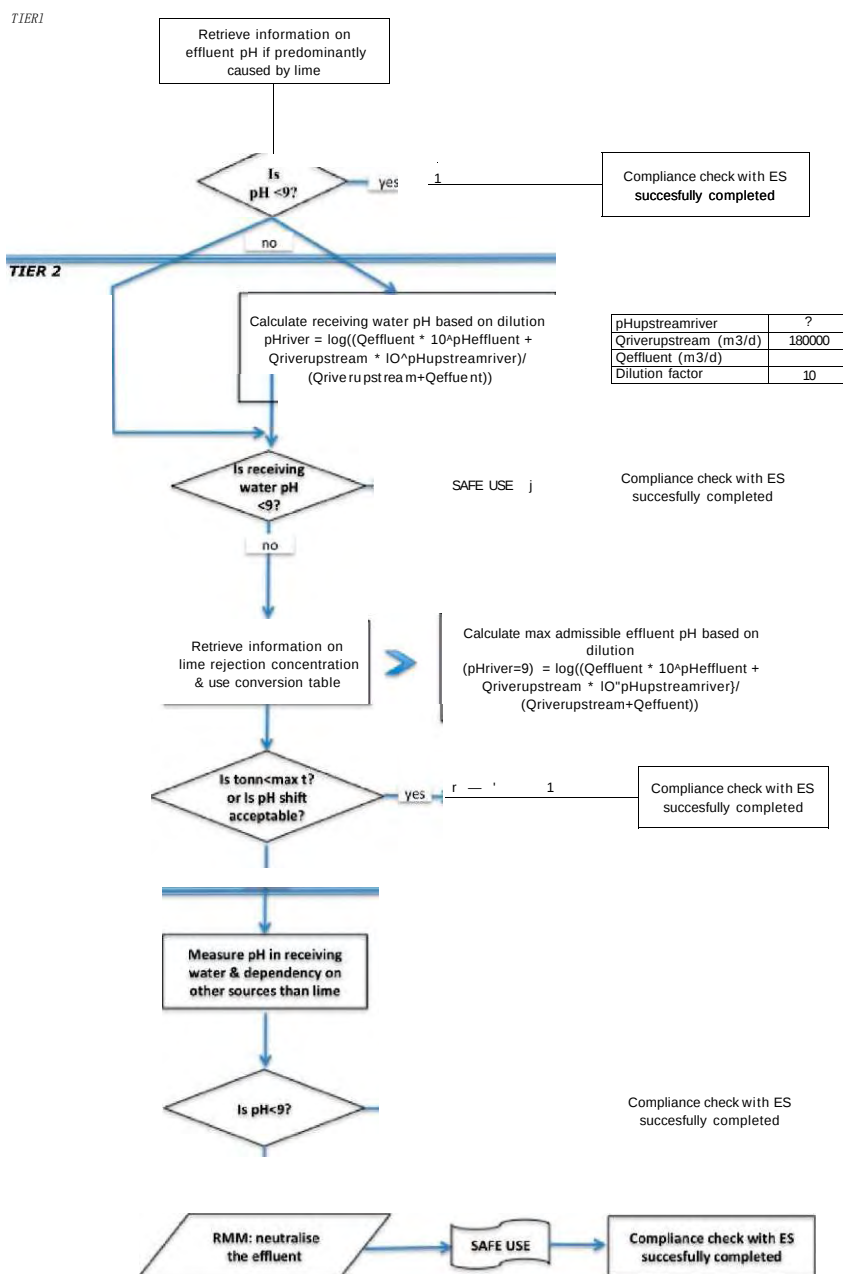
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**Tier 3:** measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.



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Revision date: 17 November 2010

Printing Date: 17 November 2010

## ES number 9.4: Manufacture and industrial uses of high dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| Free short title                                                    | Manufacture and industrial uses of high dusty solids/powders of lime substances                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| Systematic title based on use descriptor                            | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                           |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE.                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Involved tasks                                                                                                                                                            |
| PROC 1                                                              | Use in closed process, no likelihood of exposure                                                                                                                                                                                                                                                                                                                                                                                                                                      | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                           |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |
| PROC 7                                                              | Industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 8b                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                           |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                           |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 14                                                             | Production of preparations or articles by tableting, compression, extrusion, pelletisation                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                           |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 22                                                             | Potentially closed processing operations with minerals/metals at elevated temperature<br>Industrial setting                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| PROC 23                                                             | Open processing and transfer operations with minerals/metals at elevated temperature                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |

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| PROC 24     | High (mechanical) energy work-up of substances bound in materials and/or articles |  |  |  |
| PROC 25     | Other hot work operations with metals                                             |  |  |  |
| PROC 26     | Handling of solid inorganic substances at ambient temperature                     |  |  |  |
| PROC 27a    | Production of metal powders (hot processes)                                       |  |  |  |
| PROC 27b    | Production of metal powders (wet processes)                                       |  |  |  |
| ERC 1-7, 12 | Manufacture, formulation and all types of industrial uses                         |  |  |  |
| ERC 10, 11  | Wide-dispersive outdoor and indoor use of long-life articles and materials        |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                        |                      |                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------|----------------------|--------------------|
| 2.1 Control of workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                        |                      |                    |
| Product characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                        |                      |                    |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.      |                              |                        |                      |                    |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Use in preparation           | Content in preparation | Physical form        | Emission potential |
| PROC 22, 23, 25, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | not restricted               |                        | solid/powder, molten | high               |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | not restricted               |                        | solid/powder         | high               |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                              |                        |                      |                    |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                                   |                              |                        |                      |                    |
| Frequency and duration of use/exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                              |                        |                      |                    |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Duration of exposure         |                        |                      |                    |
| PROC 7, 8a, 17, 18, 19, 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | < 240 minutes                |                        |                      |                    |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 480 minutes (not restricted) |                        |                      |                    |
| Human factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                              |                        |                      |                    |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m³/shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                              |                        |                      |                    |
| Other given operational conditions affecting workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                              |                        |                      |                    |
| Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. |                              |                        |                      |                    |
| Technical conditions and measures at process level (source) to prevent release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                        |                      |                    |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                              |                        |                      |                    |

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| Technical conditions and measures to control dispersion from source towards the worker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC)                          | Efficiency of LC (according to MEASE)                                                                                           | Further information                                                                                                                                                                                                                                                                            |
| PROC 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required                                     | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| PROC 2, 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                      | general ventilation                              | 17 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| PROC 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      | integrated local exhaust ventilation             | 84 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| PROC 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                      | not applicable                                   | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| All other applicable PROCs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                      | local exhaust ventilation                        | 78 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| Organisational measures to prevent /limit releases, dispersion and exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Conditions and measures related to personal protection, hygiene and health evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Specification of respiratory protective equipment (RPE)                                                                                                                                                                                                                                                                                              | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
| PROC 1, 2, 3, 23, 25, 27b                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | not required                                                                                                                                                                                                                                                                                                                                         | na                                               | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 4, 5, 7, 8a, 8b, 9, 17, 18,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | FFP2 mask                                                                                                                                                                                                                                                                                                                                            | APF=10                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC 10, 13, 14, 15, 16, 22, 24, 26, 27a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | FFP1 mask                                                                                                                                                                                                                                                                                                                                            | APF=4                                            |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | FFP3 mask                                                                                                                                                                                                                                                                                                                                            | APF=20                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE. For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely. The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers. An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE. |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| 2.2 Control of environmental exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Frequency and duration of use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Intermittent (< 12 time per year) or continuous use/release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Environment factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Flow rate of receiving surface water: 18000 m³/day                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

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## Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m<sup>3</sup>/day

## Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging lime solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation). In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. The justification for this risk management measure can be found in the introduction section.

## Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

## 3. Exposure estimation and reference to its source

### Occupational exposure

The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC                                                                                           | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR)    | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR) |
|------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| PROC 1, 2, 3, 4, 5, 7, 8a, 8b, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25, 26, 27a, 27b | MEASE                                          | <1 mg/m <sup>3</sup><br>(0.01 - 0.96) | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |

### Environmental emissions

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium dihydroxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, being the toxicity of Ca<sup>2+</sup> is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium dihydroxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium dihydroxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH<sup>-</sup> discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

|                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental emissions                                      | The production of calcium dihydroxide can potentially result in an aquatic emission and locally increase the calcium dihydroxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium dihydroxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.                                                                   |
| Exposure concentration in waste water treatment plant (WWTP) | Waste water from calcium dihydroxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium dihydroxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs.                                                                                                                                              |
| Exposure concentration in aquatic pelagic compartment        | When calcium dihydroxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH may increase, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be. In general the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CQ2), the bicarbonate ion (HCQ3-) and the carbonate ion (CQ32-). |
| Exposure concentration in sediments                          | The sediment compartment is not included in this ES, because it is not considered relevant for calcium dihydroxide: when calcium dihydroxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible.                                                                                                                                                                                                                                                                                                    |

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|                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Exposure concentrations in soil and groundwater</b>                          | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Exposure concentration in atmospheric compartment</b>                        | The air compartment is not included in this CSA because it is considered not relevant for calcium dihydroxide: when emitted to air as an aerosol in water, calcium dihydroxide is neutralised as a result of its reaction with CO <sub>2</sub> (or other acids), into HCO <sub>3</sub> <sup>-</sup> and Ca <sup>2+</sup> . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium dihydroxide largely end up in soil and water. |
| <b>Exposure concentration relevant for the food chain (secondary poisoning)</b> | Bioaccumulation in organisms is not relevant for calcium dihydroxide: a risk assessment for secondary poisoning is therefore not required.                                                                                                                                                                                                                                                                                                                                                                         |

## 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

### Occupational exposure

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

**Important note:** The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

### Environmental exposure

If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.

**Tier 1:** retrieve information on effluent pH and the contribution of the calcium dihydroxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.

**Tier 2a:** retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:

$$pH_{river} = \log \left( \frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \right) \quad (Eq1)$$

Where:

Q effluent refers to the effluent flow (in m<sup>3</sup>/day)

Q river upstream refers to the upstream river flow (in m<sup>3</sup>/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m<sup>3</sup>/day
- Q effluent: use default value of 2000 m<sup>3</sup>/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

**Tier 2b:** Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once

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the maximum admissible pH value in the effluent is established, it is assumed that the  $\text{OH}^-$  concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium.  $\text{OH}^-$  expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium dihydroxide.

**Tier 3:** measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.

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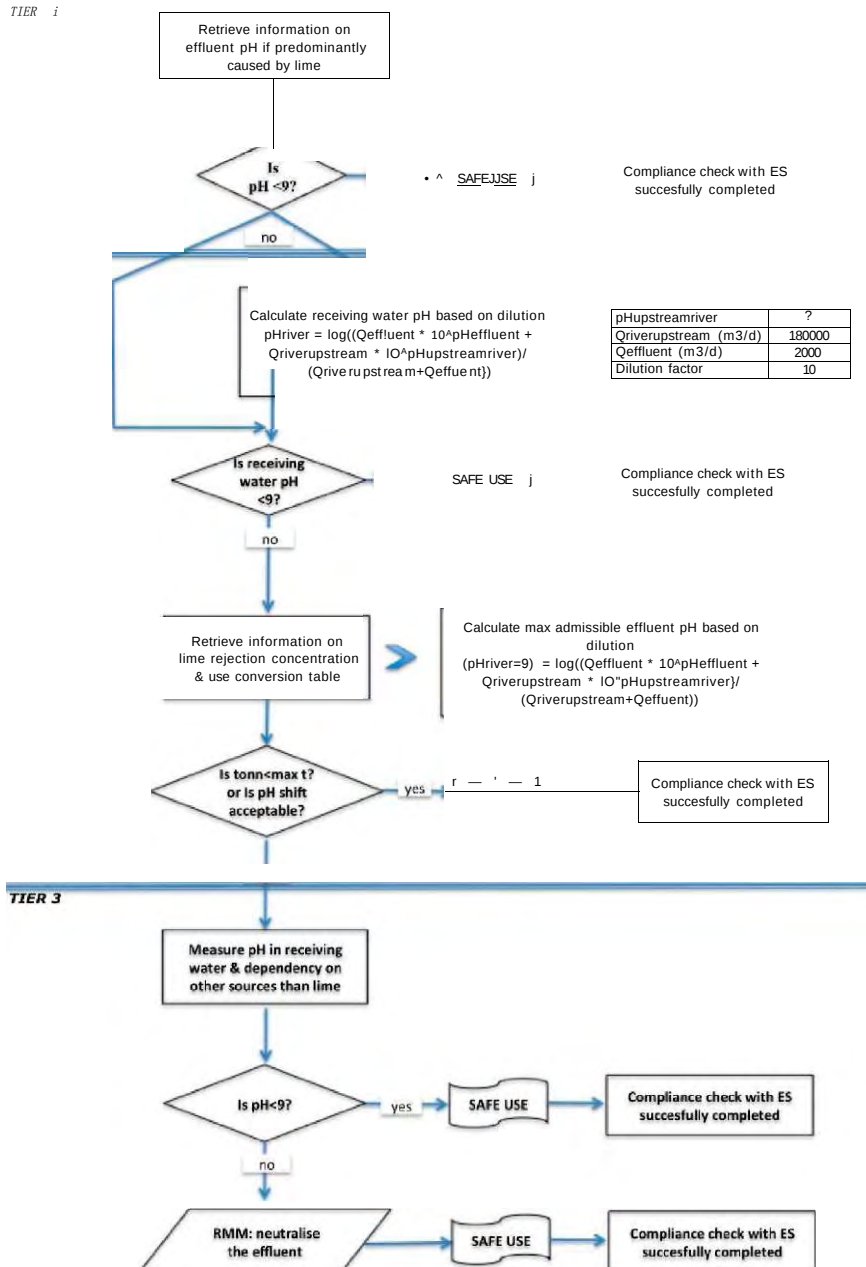
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TIER 1



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## ES number 9.5: Manufacture and industrial uses of massive objects containing lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------|
| <b>1. Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
| <b>Free short title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Manufacture and industrial uses of massive objects containing lime substances                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                  |                         |                           |
| <b>Systematic title based on use descriptor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SU3, SU1, SU2a, SU2b, SU4, SU5, SU6a, SU6b, SU7, SU8, SU9, SU10, SU11, SU12, SU13, SU14, SU15, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC38, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                                  |                         |                           |
| <b>Processes, tasks and/or activities covered</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |                         |                           |
| <b>Assessment Method</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The assessment of inhalation exposure is based on the exposure estimation tool MEASE.                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                  |                         |                           |
| <b>2. Operational conditions and risk management measures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
| <b>PROC/ERC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>REACH definition</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Involved tasks</b>                                                                                                                                                            |                         |                           |
| <b>PROC 6</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Calendering operations                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN).</b> |                         |                           |
| <b>PROC 14</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Production of preparations or articles by tableting, compression, extrusion, pelletisation                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                  |                         |                           |
| <b>PROC 21</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Low energy manipulation of substances bound in materials and/or articles                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                  |                         |                           |
| <b>PROC 22</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Potentially closed processing operations with minerals/metals at elevated temperature<br>Industrial setting                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |                         |                           |
| <b>PROC 23</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Open processing and transfer operations with minerals/metals at elevated temperature                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |                         |                           |
| <b>PROC 24</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | High (mechanical) energy work-up of substances bound in materials and/or articles                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                  |                         |                           |
| <b>PROC 25</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Other hot work operations with metals                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                  |                         |                           |
| <b>ERC 1-7, 12</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Manufacture, formulation and all types of industrial uses                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                  |                         |                           |
| <b>ERC 10, 11</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Wide-dispersive outdoor and indoor use of long-life articles and materials                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                  |                         |                           |
| <b>2.1 Control of workers exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
| <b>Product characteristic</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Use in preparation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Content in preparation</b>                                                                                                                                                    | <b>Physical form</b>    | <b>Emission potential</b> |
| <b>PROC 22, 23, 25</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | not restricted                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                  | massive objects, molten | high                      |
| <b>PROC 24</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | not restricted                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                  | massive objects         | high                      |
| <b>All other applicable PROCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | not restricted                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                  | massive objects         | very low                  |
| <b>Amounts used</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |                         |                           |

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Frequency and duration of use/exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Duration of exposure</b>                                                                                                                                                                                                                                                                                                                          |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>PROC 22</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | < 240 minutes                                                                                                                                                                                                                                                                                                                                        |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>All other applicable PROCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 480 minutes (not restricted)                                                                                                                                                                                                                                                                                                                         |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Human factors not influenced by risk management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m <sup>3</sup> /shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Other given operational conditions affecting workers exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Technical conditions and measures at process level (source) to prevent release</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Technical conditions and measures to control dispersion from source towards the worker</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Level of separation</b>                                                                                                                                                                                                                                                                                                                           | <b>Localised controls (LC)</b>                          | <b>Efficiency of LC (according to MEASE)</b>                                                                                    | <b>Further information</b>                                                                                                                                                                                                                                                                     |
| <b>PROC 6, 14, 21</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required                                            | na                                                                                                                              | -                                                                                                                                                                                                                                                                                              |
| <b>PROC 22, 23, 24, 25</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                      | local exhaust ventilation                               | 78 %                                                                                                                            | -                                                                                                                                                                                                                                                                                              |
| <b>Organisational measures to prevent /limit releases, dispersion and exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>Conditions and measures related to personal protection, hygiene and health evaluation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Specification of respiratory protective equipment (RPE)</b>                                                                                                                                                                                                                                                                                       | <b>RPE efficiency (assigned protection factor, APF)</b> | <b>Specification of gloves</b>                                                                                                  | <b>Further personal protective equipment (PPE)</b>                                                                                                                                                                                                                                             |
| <b>PROC 22</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | FFP1 mask                                                                                                                                                                                                                                                                                                                                            | APF=4                                                   | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| <b>All other applicable PROCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | not required                                                                                                                                                                                                                                                                                                                                         | na                                                      |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE.                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

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Printing Date: 17 November 2010

For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.

An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

## 2.2 Control of environmental exposure

### Amounts used

The daily and annual amount per site (for point sources) is not considered to be the main determinant for environmental exposure.

### Frequency and duration of use

Intermittent (< 12 time per year) or continuous use/release

### Environment factors not influenced by risk management

Flow rate of receiving surface water: 18000 m<sup>3</sup>/day

### Other given operational conditions affecting environmental exposure

Effluent discharge rate: 2000 m<sup>3</sup>/day

### Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Risk management measures related to the environment aim to avoid discharging lime solutions into municipal wastewater or to surface water, in case such discharges are expected to cause significant pH changes. Regular control of the pH value during introduction into open waters is required. In general discharges should be carried out such that pH changes in receiving surface waters are minimised (e.g. through neutralisation). In general most aquatic organisms can tolerate pH values in the range of 6-9. This is also reflected in the description of standard OECD tests with aquatic organisms. The justification for this risk management measure can be found in the introduction section.

### Conditions and measures related to waste

Solid industrial waste of lime should be reused or discharged to the industrial wastewater and further neutralized if needed.

## 3. Exposure estimation and reference to its source

### Occupational exposure

The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.

| PROC                           | Method used for inhalation exposure assessment | Inhalation exposure estimate (RCR)     | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR) |
|--------------------------------|------------------------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| PROC 6, 14, 21, 22, 23, 24, 25 | MEASE                                          | < 1 mg/m <sup>3</sup><br>(0.01 - 0.44) | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |

### Environmental emissions

The environmental exposure assessment is only relevant for the aquatic environment, when applicable including STPs/WWTPs, as emissions of calcium dihydroxide in the different life-cycle stages (production and use) mainly apply to (waste) water. The aquatic effect and risk assessment only deal with the effect on organisms/ecosystems due to possible pH changes related to OH<sup>-</sup> discharges, being the toxicity of Ca<sup>2+</sup> is expected to be negligible compared to the (potential) pH effect. Only the local scale is being addressed, including municipal sewage treatment plants (STPs) or industrial waste water treatment plants (WWTPs) when applicable, both for production and industrial use as any effects that might occur would be expected to take place on a local scale. The high water solubility and very low vapour pressure indicate that calcium dihydroxide will be found predominantly in water. Significant emissions or exposure to air are not expected due to the low vapour pressure of calcium dihydroxide. Significant emissions or exposure to the terrestrial environment are not expected either for this exposure scenario. The exposure assessment for the aquatic environment will therefore only deal with the possible pH changes in STP effluent and surface water related to the OH<sup>-</sup> discharges at the local scale. The exposure assessment is approached by assessing the resulting pH impact: the surface water pH should not increase above 9.

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Environmental emissions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The production of calcium dihydroxide can potentially result in an aquatic emission and locally increase the calcium dihydroxide concentration and affect the pH in the aquatic environment. When the pH is not neutralised, the discharge of effluent from calcium dihydroxide production sites may impact the pH in the receiving water. The pH of effluents is normally measured very frequently and can be neutralised easily as often required by national laws.                                                                                                                                  |
| <b>Exposure concentration in waste water treatment plant (WW TP)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Waste water from calcium dihydroxide production is an inorganic wastewater stream and therefore there is no biological treatment. Therefore, wastewater streams from calcium dihydroxide production sites will normally not be treated in biological waste water treatment plants (WWTPs), but can be used for pH control of acid wastewater streams that are treated in biological WWTPs.                                                                                                                                                                                                             |
| <b>Exposure concentration in aquatic pelagic compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | When calcium dihydroxide is emitted to surface water, sorption to particulate matter and sediment will be negligible. When lime is rejected to surface water, the pH may increase, depending on the buffer capacity of the water. The higher the buffer capacity of the water, the lower the effect on pH will be. In general the buffer capacity preventing shifts in acidity or alkalinity in natural waters is regulated by the equilibrium between carbon dioxide (CO <sub>2</sub> ), the bicarbonate ion (HCO <sub>3</sub> <sup>-</sup> ) and the carbonate ion (CO <sub>3</sub> <sup>2-</sup> ). |
| <b>Exposure concentration in sediments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | The sediment compartment is not included in this ES, because it is not considered relevant for calcium dihydroxide: when calcium dihydroxide is emitted to the aquatic compartment, sorption of to sediment particles is negligible.                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Exposure concentrations in soil and groundwater</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | The terrestrial compartment is not included in this exposure scenario, because it is not considered to be relevant.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Exposure concentration in atmospheric compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | The air compartment is not included in this CSA because it is considered not relevant for calcium dihydroxide: when emitted to air as an aerosol in water, calcium dihydroxide is neutralised as a result of its reaction with CO <sub>2</sub> (or other acids), into HCO <sub>3</sub> <sup>-</sup> and Ca <sup>2+</sup> . Subsequently, the salts (e.g. calcium(bi)carbonate) are washed out from the air and thus the atmospheric emissions of neutralised calcium dihydroxide largely end up in soil and water.                                                                                     |
| <b>Exposure concentration relevant for the food chain (secondary poisoning)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Bioaccumulation in organisms is not relevant for calcium dihydroxide: a risk assessment for secondary poisoning is therefore not required.                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Occupational exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p>The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE (<a href="http://www.ebrc.de/mease.html">www.ebrc.de/mease.html</a>) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness &gt;10 % are defined as "high dusty".</p> <p>DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)</p> <p>important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Environmental exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <p>If a site does not comply with the conditions stipulated in the safe use ES, it is recommended to apply a tiered approach to perform a more site-specific assessment. For that assessment, the following stepwise approach is recommended.</p> <p><b>Tier 1:</b> retrieve information on effluent pH and the contribution of the calcium dihydroxide on the resulting pH. Should the pH be above 9 and be predominantly attributable to lime, then further actions are required to demonstrate safe use.</p> <p><b>Tier 2a:</b> retrieve information on receiving water pH after the discharge point. The pH of the receiving water shall not exceed the value of 9. If the measures are not available, the pH in the river can be calculated as follows:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

piepdiu in dLuordance with Annex II of the REACH Regulation EC 1907/2006,  
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$$pH_{river} = \log \frac{Q_{effluent} * 10^{pH_{effluent}} + Q_{riverupstream} * 10^{pH_{upstream}}}{Q_{riverupstream} + Q_{effluent}} \quad (Eq1)$$

Where:

Q effluent refers to the effluent flow (in m<sup>3</sup>/day)

Q river upstream refers to the upstream river flow (in m<sup>3</sup>/day)

pH effluent refers to the pH of the effluent

pH upstream river refers to the pH of the river upstream of the discharge point

Please note that initially, default values can be used:

- Q river upstream flows: use the 10th of existing measurements distribution or use default value of 18000 m<sup>3</sup>/day
- Q effluent: use default value of 2000 m<sup>3</sup>/day
- The upstream pH is preferably a measured value. If not available, one can assume a neutral pH of 7 if this can be justified.

Such equation has to be seen as a worst case scenario, where water conditions are standard and not case specific.

**Tier 2b:** Equation 1 can be used to identify which effluent pH causes an acceptable pH level in the receiving body. In order to do so, pH of the river is set at value 9 and pH of the effluent is calculated accordingly (using default values as reported previously, if necessary). As temperature influences lime solubility, pH effluent might require to be adjusted on a case-by-case basis. Once the maximum admissible pH value in the effluent is established, it is assumed that the OH<sup>-</sup> concentrations are all dependent on lime discharge and that there is no buffer capacity conditions to consider (this is a unrealistic worst case scenario, which can be modified where information is available). Maximum load of lime that can be annually rejected without negatively affecting the pH of the receiving water is calculated assuming chemical equilibrium. OH<sup>-</sup> expressed as moles/litre are multiplied by average flow of the effluent and then divided by the molar mass of the calcium dihydroxide.

**Tier 3:** measure the pH in the receiving water after the discharge point. If pH is below 9, safe use is reasonably demonstrated and the ES ends here. If pH is found to be above 9, risk management measures have to be implemented: the effluent has to undergo neutralisation, thus ensuring safe use of lime during production or use phase.

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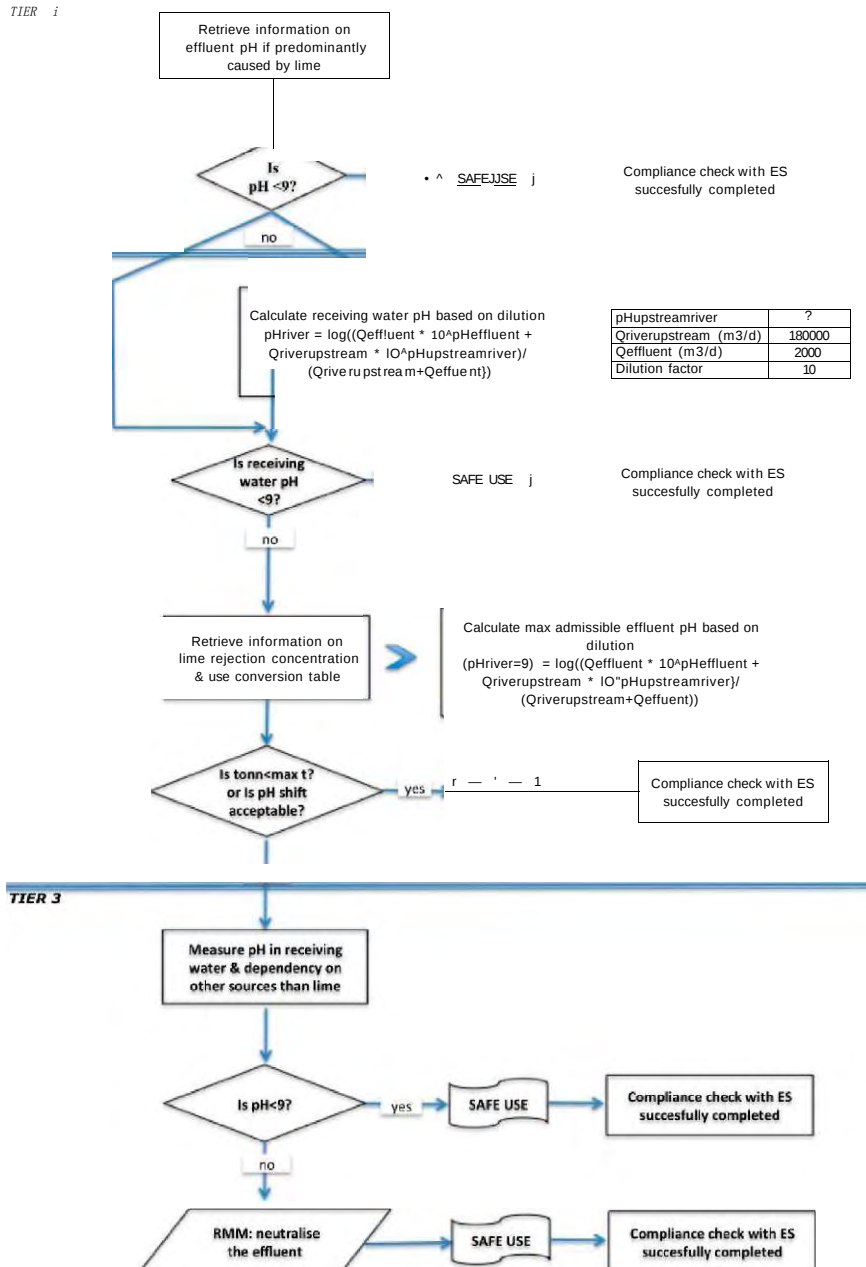
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TIER 1



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## ES number 9.6: Professional uses of aqueous solutions of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| Free short title                                                    | Professional uses of aqueous solutions of lime substances                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| Systematic title based on use descriptor                            | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                           |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit.                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                          | Involved tasks                                                                                                                                                            |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                     | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                           |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                           |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 8b                                                             | Transfer of substance or preparation (charging/ discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                           |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |
| PROC 11                                                             | Non industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 12                                                             | Use of blowing agents in manufacture of foam                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                           |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |

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ERC2, ERC8a,  
ERC8b, ERC8c,  
ERC8d, ERC8e,  
ERC8f

Wide dispersive indoor and outdoor use  
of reactive substances or processing  
aids in open systems

Calcium dihydroxide is applied in numerous cases of wide  
dispersive uses: agricultural, forestry, fish and shrimps  
farming, soil treatment and environmental protection.

## 2.1 Control of workers exposure

### Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. The spraying of aqueous solutions (PROC7 and 11) is assumed to be involved with a medium emission.

| PROC                 | Use in preparation | Content in preparation | Physical form    | Emission potential |
|----------------------|--------------------|------------------------|------------------|--------------------|
| All applicable PROCs | not restricted     |                        | aqueous solution | very low           |

### Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

### Frequency and duration of use/exposure

| PROC                       | Duration of exposure         |
|----------------------------|------------------------------|
| PROC 11                    | < 240 minutes                |
| All other applicable PROCs | 480 minutes (not restricted) |

### Human factors not influenced by risk management

The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m<sup>3</sup>/shift (8 hours).

### Other given operational conditions affecting workers exposure

Since aqueous solutions are not used in hot-metallurgical processes, operational conditions (e.g. process temperature and process pressure) are not considered relevant for occupational exposure assessment of the conducted processes.

### Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

### Technical conditions and measures to control dispersion from source towards the worker

| PROC                       | Level of separation                                | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
|----------------------------|----------------------------------------------------|-------------------------|---------------------------------------|---------------------|
| PROC 19                    | Separation of workers from the emission source is  | not applicable          |                                       |                     |
| All other applicable PROCs | generally not required in the conducted processes. | not required            |                                       |                     |

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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### Conditions and measures related to personal protection, hygiene and health evaluation

| PROC                       | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
|----------------------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC 11                    | FFP3mask                                                | APF=20                                           | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 17                    | FFP1 mask                                               | APF=4                                            |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| All other applicable PROCs | not required                                            |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE.

For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.

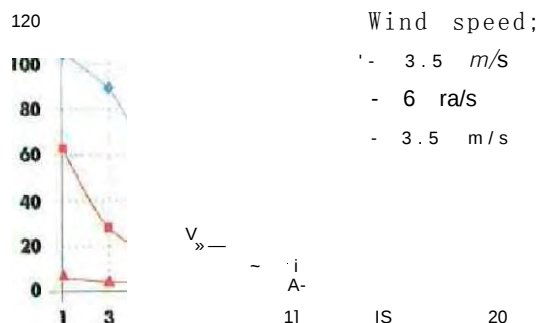
An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

### 2.2 Control of environmental exposure - only relevant for agricultural soil protection

#### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

Quantity of dust  
per m<sup>3</sup> (in mg)



Distance from the  
spreader(in m)

(Figure taken from: Laudet, A. et al., 1999)

#### Amounts used

Ca(OH)<sub>2</sub> 2,244 kg/ha

#### Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of

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2,244 kg/ha is not exceeded ( $\text{Ca(OH)}_2$ )

### Environment factors not influenced by risk management

Volume of surface water: 300 L/m<sup>2</sup>

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

### Technical conditions and measures at process level (source) to prevent release

There are no direct releases to adjacent surface waters.

### Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

### Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

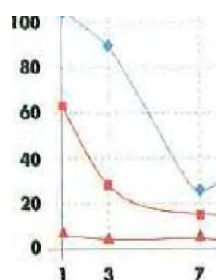
## 2.2 Control of environmental exposure - only relevant for soil treatment in civil engineering

### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

Quantity of dust  
per m<sup>3</sup> (in mg)

I2D



Wind speed:

~ 3,5 m/s

•» - 6 m/s

- 3.5 m/s

Distance from the  
spreader (in m)

(Figure taken from: Laudet, A. et al., 1999)

### Amounts used

$\text{Ca(OH)}_2$

238,208 kg/ha

### Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 238,208 kg/ha is not exceeded ( $\text{Ca(OH)}_2$ )

### Environment factors not influenced by risk management

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Technical conditions and measures at process level (source) to prevent release</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| Drift should be minimised.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>3. Exposure estimation and reference to its source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Occupational exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m <sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Method used for inhalation exposure assessment</b>                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Inhalation exposure estimate (RCR)</b> | <b>Method used for dermal exposure assessment</b>                                                                                                                                                                                                   | <b>Dermal exposure estimate (RCR)</b> |
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | MEASE                                                                                                                                                                                                                                                                                                                                                                                                                                                             | < 1 mg/m <sup>3</sup><br>(<0.001 -0.6)    | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                       |
| <b>Environmental exposure for agricultural soil protection</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium dihydroxide can indeed migrate then towards surface waters, via drift. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Environmental emissions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | See amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration in waste water treatment plant (WW TP)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Not relevant for agricultural soil protection                                                                                                                                                                                                                                                                                                                                                                                                                     |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration in aquatic pelagic compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Substance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>PEC (ug/L)</b>                         | <b>PNEC (ug/L)</b>                                                                                                                                                                                                                                  | <b>RCR</b>                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7.48                                      | 490                                                                                                                                                                                                                                                 | 0.015                                 |
| <b>Exposure concentration in sediments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO <sub>3</sub> <sup>-</sup> to form water and CO <sub>3</sub> <sup>2-</sup> . CO <sub>3</sub> <sup>2-</sup> forms CaCO <sub>3</sub> by reacting with Ca <sup>2+</sup> . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentrations in soil and groundwater</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Substance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>PEC (mg/L)</b>                         | <b>PNEC (mg/L)</b>                                                                                                                                                                                                                                  | <b>RCR</b>                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                               | 660                                       | 1080                                                                                                                                                                                                                                                | 0.61                                  |
| <b>Exposure concentration in atmospheric compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                                                                                                                                                                                                                               |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration relevant for the food chain (secondary poisoning)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | This point is not relevant because calcium dihydroxides can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca <sup>2+</sup> and OH <sup>-</sup> ) in the environment.                                                                                                                                                                                    |                                           |                                                                                                                                                                                                                                                     |                                       |

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Printing Date: 17 November 2010

| Environmental exposure for soil treatment in civil engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          |            |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------|
| The soil treatment in civil engineering scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies. |                                                                                                                                                                                                                                          |            |             |      |
| The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                          |            |             |      |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | See amounts used                                                                                                                                                                                                                         |            |             |      |
| Exposure concentration in waste water treatment plant (WW TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Substance                                                                                                                                                                                                                                | PEC (mg/L) | PNEC (mg/L) | RCR  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Ca(OH)2                                                                                                                                                                                                                                  | 701        | 1080        | 0.65 |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                      |            |             |      |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca2+ and OH-) in the environment. |            |             |      |
| Environmental exposure for other uses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                          |            |             |      |
| For all other uses, no quantitative environmental exposure assessment is carried because <ul style="list-style-type: none"><li>The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or soil treatment in civil engineering</li><li>Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water</li><li>Lime is specifically used to release CO2-free breathable air, upon reaction with CO2. Such applications only relates to the air compartment, where the lime properties are exploited</li><li>Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.</li></ul>                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          |            |             |      |

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#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

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## ES number 9.7: Professional uses of low dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| Free short title                                                    | Professional uses of low dusty solids/powders of lime substances                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| Systematic title based on use descriptor                            | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                           |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit.                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                           |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                          | Involved tasks                                                                                                                                                            |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                     | Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN). |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                           |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                           |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 8b                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                           |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                           |
| PROC 11                                                             | Non industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                           |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                           |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                           |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                           |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                           |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 21                                                             | Low energy manipulation of substances bound in materials and/or articles                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                           |
| PROC 25                                                             | Other hot work operations with metals                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                           |
| PROC 26                                                             | Handling of solid inorganic substances at ambient temperature                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                           |
| ERC2, ERC8a, ERC8b, ERC8c,                                          | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                           |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------|----------------------------|
| ERC8d, ERC8e,<br>ERC8f                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>2.1 Control of workers exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>Product characteristic</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.      |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Use in preparation</b>                                                                                                                                                                                                                                                                                                                            | <b>Content in preparation</b>  | <b>Physical form</b>                         | <b>Emission potential</b>  |
| <b>PROC 25</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | not restricted                                                                                                                                                                                                                                                                                                                                       |                                | solid/powder,<br>molten                      | high                       |
| <b>All other applicable PROCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | not restricted                                                                                                                                                                                                                                                                                                                                       |                                | solid/powder                                 | low                        |
| <b>Amounts used</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>Frequency and duration of use/exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Duration of exposure</b>                                                                                                                                                                                                                                                                                                                          |                                |                                              |                            |
| <b>PROC 17</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | < 240 minutes                                                                                                                                                                                                                                                                                                                                        |                                |                                              |                            |
| <b>All other applicable PROCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 480 minutes (not restricted)                                                                                                                                                                                                                                                                                                                         |                                |                                              |                            |
| <b>Human factors not influenced by risk management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m <sup>3</sup> /shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>Other given operational conditions affecting workers exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25. |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>Technical conditions and measures at process level (source) to prevent release</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>Technical conditions and measures to control dispersion from source towards the worker</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                      |                                |                                              |                            |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Level of separation</b>                                                                                                                                                                                                                                                                                                                           | <b>Localised controls (LC)</b> | <b>Efficiency of LC (according to MEASE)</b> | <b>Further information</b> |
| <b>PROC 19</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not applicable                 | na                                           | -                          |
| <b>All other applicable PROCs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      | not required                   | na                                           | -                          |

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Printing Date: 17 November 2010

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

### Conditions and measures related to personal protection, hygiene and health evaluation

| PROC                       | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
|----------------------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC 4, 5, 11, 26          | FFP1 mask                                               | APF=4                                            | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 16, 17, 18, 25        | FFP2 mask                                               | APF=10                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| All other applicable PROCs | not required                                            | na                                               |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE.

For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

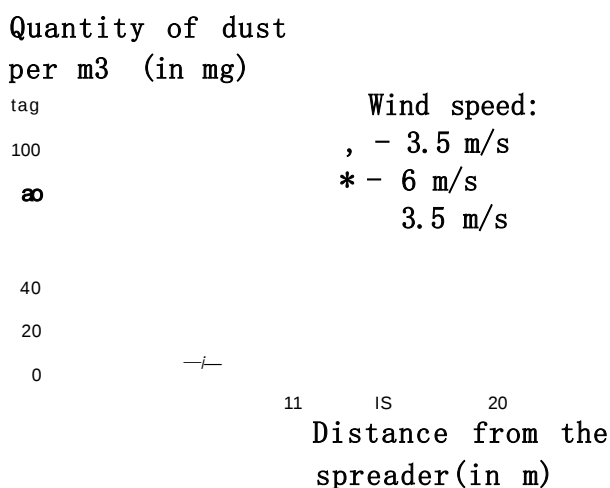
The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.

An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

## 2.2 Control of environmental exposure - only relevant for agricultural soil protection

### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

### Amounts used

Ca(OH)<sub>2</sub> 2,244 kg/ha

### Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of 2,244 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

### Environment factors not influenced by risk management

Volume of surface water: 300 L/m<sup>2</sup>

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

### Technical conditions and measures at process level (source) to prevent release

There are no direct releases to adjacent surface waters.

### Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

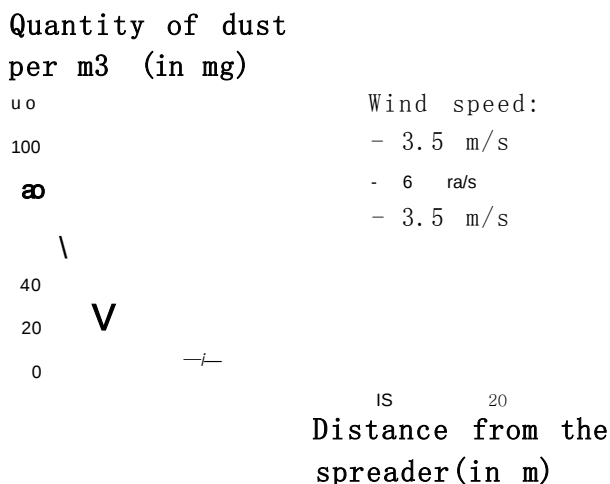
### Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

## 2.2 Control of environmental exposure - only relevant for soil treatment in civil engineering

### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

### Amounts used

Ca(OH)<sub>2</sub> 238,208 kg/ha

### Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 238,208 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

### Environment factors not influenced by risk management

Field surface area: 1 ha

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Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Other given operational conditions affecting environmental exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| Outdoor use of products<br>Soil mixing depth: 20 cm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Technical conditions and measures at process level (source) to prevent release</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| Drift should be minimised.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>3. Exposure estimation and reference to its source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Occupational exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m <sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Method used for inhalation exposure assessment</b>                                                                                                                                                                                                                                                                                                                                                | <b>Inhalation exposure estimate (RCR)</b> | <b>Method used for dermal exposure assessment</b>                                                                                                                                                                                                   | <b>Dermal exposure estimate (RCR)</b> |
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 16, 17, 18, 19, 21, 25, 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MEASE                                                                                                                                                                                                                                                                                                                                                                                                | < 1 mg/m <sup>3</sup><br>(0.01 - 0.75)    | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                       |
| <b>Environmental exposure for agricultural soil protection</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium dihydroxide can indeed migrate then towards surface waters, via drift. |                                                                                                                                                                                                                                                                                                                                                                                                      |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Environmental emissions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | See amounts used                                                                                                                                                                                                                                                                                                                                                                                     |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration in waste water treatment plant (WW TP)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Not relevant for agricultural soil protection                                                                                                                                                                                                                                                                                                                                                        |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration in aquatic pelagic compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Substance</b>                                                                                                                                                                                                                                                                                                                                                                                     | <b>PEC (ug/L)</b>                         | <b>PNEC (ug/L)</b>                                                                                                                                                                                                                                  | <b>RCR</b>                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                  | 7.48                                      | 490                                                                                                                                                                                                                                                 | 0.015                                 |
| <b>Exposure concentration in sediments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HC03 <sup>-</sup> to form water and C032 <sup>-</sup> . C032 <sup>-</sup> forms CaC03 by reacting with Ca2+. The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentrations in soil and groundwater</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Substance</b>                                                                                                                                                                                                                                                                                                                                                                                     | <b>PEC (mg/L)</b>                         | <b>PNEC (mg/L)</b>                                                                                                                                                                                                                                  | <b>RCR</b>                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                  | 660                                       | 1080                                                                                                                                                                                                                                                | 0.61                                  |
| <b>Exposure concentration in atmospheric compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                                                                                                                                                                  |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration relevant for the food chain</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca2+ and OH <sup>-</sup> ) in the environment.                                                                                                                                                |                                           |                                                                                                                                                                                                                                                     |                                       |

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Revision date: 17 November 2010

Printing Date: 17 November 2010

(secondary  
poisoning)

### Environmental exposure for soil treatment in civil engineering

The soil treatment in civil engineering scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies.

The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.

|                                                                          |                                                                                                                                                                                                                                                                   |            |             |      |
|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------|
| Environmental emissions                                                  | See amounts used                                                                                                                                                                                                                                                  |            |             |      |
| Exposure concentration in waste water treatment plant (WW TP)            | Not relevant for road border scenario                                                                                                                                                                                                                             |            |             |      |
| Exposure concentration in aquatic pelagic compartment                    | Not relevant for road border scenario                                                                                                                                                                                                                             |            |             |      |
| Exposure concentration in sediments                                      | Not relevant for road border scenario                                                                                                                                                                                                                             |            |             |      |
| Exposure concentrations in soil and groundwater                          | Substance                                                                                                                                                                                                                                                         | PEC (mg/L) | PNEC (mg/L) | RCR  |
|                                                                          | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                               | 701        | 1080        | 0.65 |
| Exposure concentration in atmospheric compartment                        | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                               |            |             |      |
| Exposure concentration relevant for the food chain (secondary poisoning) | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca <sup>2+</sup> and OH <sup>-</sup> ) in the environment. |            |             |      |

### Environmental exposure for other uses

For all other uses, no quantitative environmental exposure assessment is carried because

- The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or soil treatment in civil engineering
  - Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water
  - Lime is specifically used to release CO<sub>2</sub>-free breathable air, upon reaction with CO<sub>2</sub>. Such applications only relates to the air compartment, where the lime properties are exploited
- » Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.

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Printing Date: 17 November 2010

#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

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Revision date: 17 November 2010

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## ES number 9.8: Professional uses of medium dusty solids/powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |
| Free short title                                                    | Professional uses of medium dusty solids/powders of lime substances                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |
| Systematic title based on use descriptor                            | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                                  |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                  |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit.                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                  |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                          | Involved tasks                                                                                                                                                                   |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                     | <b>Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN).</b> |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                  |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                  |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
| PROC 8b                                                             | Transfer of substance or preparation (charging/ discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                  |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                  |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                  |
| PROC 11                                                             | Non industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                  |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                  |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                  |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                  |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
| PROC 25                                                             | Other hot work operations with metals                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                  |
| PROC 26                                                             | Handling of solid inorganic substances at ambient temperature                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                  |
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f                      | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |

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## 2.1 Control of workers exposure

### Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC                       | Use in preparation | Content in preparation | Physical form           | Emission potential |
|----------------------------|--------------------|------------------------|-------------------------|--------------------|
| PROC 25                    | not restricted     |                        | solid/powder,<br>molten | high               |
| All other applicable PROCs | not restricted     |                        | solid/powder            | medium             |

### Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

### Frequency and duration of use/exposure

| PROC                       | Duration of exposure         |
|----------------------------|------------------------------|
| PROC 11, 16, 17, 18, 19    | < 240 minutes                |
| All other applicable PROCs | 480 minutes (not restricted) |

### Human factors not influenced by risk management

The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m<sup>3</sup>/shift (8 hours).

### Other given operational conditions affecting workers exposure

Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

### Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

### Technical conditions and measures to control dispersion from source towards the worker

| PROC                       | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC)              | Efficiency of LC (according to MEASE) | Further information |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------|---------------------|
| PROC 11, 16                | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | generic local exhaust ventilation    | 72 %                                  | -                   |
| PROC 17, 18                |                                                                                                                                                                                                                                                                                                                                                      | integrated local exhaust ventilation | 87 %                                  | -                   |
| PROC 19                    |                                                                                                                                                                                                                                                                                                                                                      | not applicable                       | na                                    | -                   |
| All other applicable PROCs |                                                                                                                                                                                                                                                                                                                                                      | not required                         | na                                    | -                   |

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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Revision date: 17 November 2010

Printing Date: 17 November 2010

## Conditions and measures related to personal protection, hygiene and health evaluation

| PROC                                         | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
|----------------------------------------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC 2, 3, 16, 19                            | FFP1 mask                                               | APF=4                                            | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 4, 5, 8a, 8b, 9, 10, 13, 17, 18, 25, 26 | FFP2 mask                                               | APF=10                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC 11                                      | FFP1 mask                                               | APF=10                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC 15                                      | not required                                            | na                                               |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE.

For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.

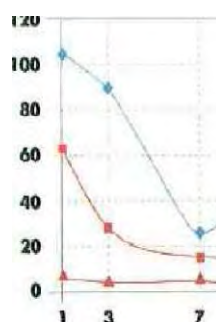
An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

## 2.2 Control of environmental exposure - only relevant for agricultural soil protection

### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

Quantity of dust  
per m<sup>3</sup> (in mg)



Wind speed:

– 3.5 m/s

– 6 m/s

– 3.5 m/s

Distance from the  
spreader (in m)

(Figure taken from: Laudet, A. et al., 1999)

### Amounts used

Ca(OH)<sub>2</sub>

2,244 kg/ha

### Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of 2,244 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

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### Environment factors not influenced by risk management

Volume of surface water: 300 L/m<sup>2</sup>

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

### Technical conditions and measures at process level (source) to prevent release

There are no direct releases to adjacent surface waters.

### Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

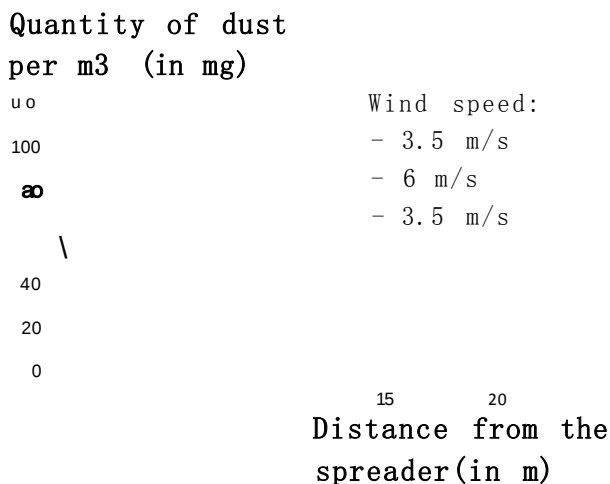
### Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

## 2.2 Control of environmental exposure - only relevant for soil treatment in civil engineering

### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

### Amounts used

Ca(OH)<sub>2</sub>

238,208 kg/ha

### Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 238,208 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

### Environment factors not influenced by risk management

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

### Technical conditions and measures at process level (source) to prevent release

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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Revision date: 17 November 2010

Printing Date: 17 November 2010

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| Drift should be minimised.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>3. Exposure estimation and reference to its source</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Occupational exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m <sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Method used for inhalation exposure assessment</b>                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Inhalation exposure estimate (RCR)</b> | <b>Method used for dermal exposure assessment</b>                                                                                                                                                                                                   | <b>Dermal exposure estimate (RCR)</b> |
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 16, 17, 18, 19, 25, 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MEASE                                                                                                                                                                                                                                                                                                                                                                                                                                                             | < 1 mg/m <sup>3</sup><br>(0.25 - 0.825)   | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                       |
| <b>Environmental exposure for agricultural soil protection</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium dihydroxide can indeed migrate then towards surface waters, via drift. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Environmental emissions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | See amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration in waste water treatment plant (WW TP)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Not relevant for agricultural soil protection                                                                                                                                                                                                                                                                                                                                                                                                                     |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration in aquatic pelagic compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Substance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>PEC (ug/L)</b>                         | <b>PNEC (ug/L)</b>                                                                                                                                                                                                                                  | <b>RCR</b>                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7.48                                      | 490                                                                                                                                                                                                                                                 | 0.015                                 |
| <b>Exposure concentration in sediments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HC0 <sub>3</sub> <sup>-</sup> to form water and C0 <sub>3</sub> <sup>2-</sup> . C0 <sub>3</sub> <sup>2-</sup> forms CaC0 <sub>3</sub> by reacting with Ca <sup>2+</sup> . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentrations in soil and groundwater</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Substance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>PEC (mg/L)</b>                         | <b>PNEC (mg/L)</b>                                                                                                                                                                                                                                  | <b>RCR</b>                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH) <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                               | 660                                       | 1080                                                                                                                                                                                                                                                | 0.61                                  |
| <b>Exposure concentration in atmospheric compartment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                                                                                                                                                                                                                               |                                           |                                                                                                                                                                                                                                                     |                                       |
| <b>Exposure concentration relevant for the food chain (secondary poisoning)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca <sup>2+</sup> and OH <sup>-</sup> ) in the environment.                                                                                                                                                                                                 |                                           |                                                                                                                                                                                                                                                     |                                       |

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| Environmental exposure for soil treatment in civil engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                   |            |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------|
| The soil treatment in civil engineering scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies. |                                                                                                                                                                                                                                                                   |            |             |      |
| The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                   |            |             |      |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | See amounts used                                                                                                                                                                                                                                                  |            |             |      |
| Exposure concentration in waste water treatment plant (WW TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not relevant for road border scenario                                                                                                                                                                                                                             |            |             |      |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Not relevant for road border scenario                                                                                                                                                                                                                             |            |             |      |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not relevant for road border scenario                                                                                                                                                                                                                             |            |             |      |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Substance                                                                                                                                                                                                                                                         | PEC (mg/L) | PNEC (mg/L) | RCR  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Ca(OH)2                                                                                                                                                                                                                                                           | 701        | 1080        | 0.65 |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                               |            |             |      |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca <sup>2+</sup> and OH <sup>-</sup> ) in the environment. |            |             |      |
| Environmental exposure for other uses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   |            |             |      |
| For all other uses, no quantitative environmental exposure assessment is carried because <ul style="list-style-type: none"><li>The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or soil treatment in civil engineering</li><li>Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water</li><li>Lime is specifically used to release CO2-free breathable air, upon reaction with CO2. Such applications only relates to the air compartment, where the lime properties are exploited</li><li>Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.</li></ul>                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                   |            |             |      |

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#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

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## ES number 9.9: Professional uses of high dusty solids/ powders of lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |
| Free short title                                                    | Professional uses of high dusty solids/powders of lime substances                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                  |
| Systematic title based on use descriptor                            | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>PC1, PC2, PC3, PC7, PC8, PC9a, PC9b, PC11, PC12, PC13, PC14, PC15, PC16, PC17, PC18, PC19, PC20, PC21, PC23, PC24, PC25, PC26, PC27, PC28, PC29, PC30, PC31, PC32, PC33, PC34, PC35, PC36, PC37, PC39, PC40<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                                  |
| Processes, tasks and/or activities covered                          | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                  |
| Assessment Method                                                   | The assessment of inhalation exposure is based on the exposure estimation tool MEASE. The environmental assessment is based on FOCUS-Exposit.                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                  |
| 2. Operational conditions and risk management measures              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                  |
| PROC/ERC                                                            | REACH definition                                                                                                                                                                                                                                                                                                                                                                                                                          | Involved tasks                                                                                                                                                                   |
| PROC 2                                                              | Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                     | <b>Further information is provided in the ECHA Guidance on information requirements and chemical safety assessment, Chapter R.12: Use descriptor system (ECHA-2010-G-05-EN).</b> |
| PROC 3                                                              | Use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                  |
| PROC 4                                                              | Use in batch and other process (synthesis) where opportunity for exposure arises                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| PROC 5                                                              | Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                  |
| PROC 8a                                                             | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
| PROC 8b                                                             | Transfer of substance or preparation (charging/ discharging) from/to vessels/large containers at dedicated facilities                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                  |
| PROC 9                                                              | Transfer of substance or preparation into small containers (dedicated filling line, including weighing)                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                  |
| PROC 10                                                             | Roller application or brushing                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                  |
| PROC 11                                                             | Non industrial spraying                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                  |
| PROC 13                                                             | Treatment of articles by dipping and pouring                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                  |
| PROC 15                                                             | Use as laboratory reagent                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                  |
| PROC 16                                                             | Using material as fuel sources, limited exposure to unburned product to be expected                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                  |
| PROC 17                                                             | Lubrication at high energy conditions and in partly open process                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |
| PROC 18                                                             | Greasing at high energy conditions                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                  |
| PROC 19                                                             | Hand-mixing with intimate contact and only PPE available                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                  |
| PROC 25                                                             | Other hot work operations with metals                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                  |
| PROC 26                                                             | Handling of solid inorganic substances at ambient temperature                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                  |
| ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f                      | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                  |

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## 2.1 Control of workers exposure

### Product characteristic

According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential.

| PROC                 | Use in preparation | Content in preparation | Physical form | Emission potential |
|----------------------|--------------------|------------------------|---------------|--------------------|
| All applicable PROCs | not restricted     |                        | solid/powder  | high               |

### Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

### Frequency and duration of use/exposure

| PROC                                         | Duration of exposure         |
|----------------------------------------------|------------------------------|
| PROC 4, 5, 8a, 8b, 9, 10, 16, 17, 18, 19, 26 | < 240 minutes                |
| PROC 11                                      | < 60 minutes                 |
| All other applicable PROCs                   | 480 minutes (not restricted) |

### Human factors not influenced by risk management

The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m<sup>3</sup>/shift (8 hours).

### Other given operational conditions affecting workers exposure

Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

### Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

### Technical conditions and measures to control dispersion from source towards the worker

| PROC                             | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC)              | Efficiency of LC (according to MEASE) | Further information                                         |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|---------------------------------------|-------------------------------------------------------------|
| PROC 4, 5, 8a, 8b, 9, 11, 16, 26 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | generic local exhaust ventilation    | 72 %                                  | -                                                           |
| PROC 17, 18                      |                                                                                                                                                                                                                                                                                                                                                      | integrated local exhaust ventilation | 87 %                                  | -                                                           |
| PROC 19                          |                                                                                                                                                                                                                                                                                                                                                      | not applicable                       | na                                    | only in well ventilated rooms or outdoors (efficiency 50 %) |
| All other applicable PROCs       |                                                                                                                                                                                                                                                                                                                                                      | not required                         | na                                    | -                                                           |

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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Revision date: 17 November 2010

Printing Date: 17 November 2010

### Conditions and measures related to personal protection, hygiene and health evaluation

| PROC                       | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
|----------------------------|---------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC 9, 26                 | FFP1 mask                                               | APF=4                                            | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 11, 17, 18, 19        | FFP3 mask                                               | APF=20                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| PROC 25                    | FFP2 mask                                               | APF=10                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| All other applicable PROCs | FFP2 mask                                               | APF=10                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE.

For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.

The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.

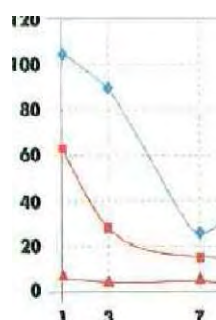
An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE.

### - only relevant for agricultural soil protection

#### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

Quantity of dust  
per m<sup>3</sup> (in mg)



Wind speed:

- 3.5 m/s
- 6 m/s
- 3.5 m/s

Distance from the  
spreader (in m)

(Figure taken from: Laudet, A. et al., 1999)

#### Amounts used

Ca(OH)<sub>2</sub>

2,244 kg/ha

#### Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of 2,244 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

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### Environment factors not influenced by risk management

Volume of surface water: 300 L/m<sup>2</sup>

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

### Technical conditions and measures at process level (source) to prevent release

There are no direct releases to adjacent surface waters.

### Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

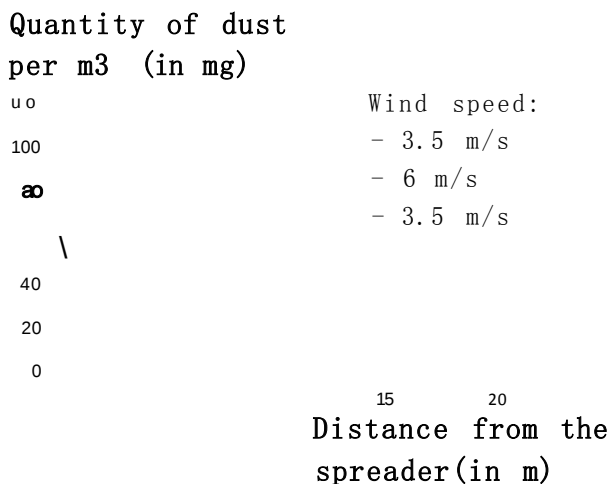
### Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

## 2.2 Control of environmental exposure - only relevant for soil treatment in civil engineering

### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)



(Figure taken from: Laudet, A. et al., 1999)

### Amounts used

Ca(OH)<sub>2</sub>

238,208 kg/ha

### Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 238,208 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

### Environment factors not influenced by risk management

Field surface area: 1 ha

### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

### Technical conditions and measures at process level (source) to prevent release

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| Drift should be minimised.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| 3. Exposure estimation and reference to its source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| Occupational exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Method used for inhalation exposure assessment                                                                                                                                                                                                                                                                                                                  | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR) |
| PROC 2, 3, 4, 5, 8a, 8b, 9, 10, 11, 13, 15, 16, 17, 18, 19, 25, 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MEASE                                                                                                                                                                                                                                                                                                                                                           | <1 mg/m³ (0.5 - 0.825)             | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |
| Environmental exposure for agricultural soil protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium dihydroxide can indeed migrate then towards surface waters, via drift. |                                                                                                                                                                                                                                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | See amounts used                                                                                                                                                                                                                                                                                                                                                |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentration in waste water treatment plant (WW TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not relevant for agricultural soil protection                                                                                                                                                                                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Substance                                                                                                                                                                                                                                                                                                                                                       | PEC (ug/L)                         | PNEC (ug/L)                                                                                                                                                                                                                                         | RCR                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH)2                                                                                                                                                                                                                                                                                                                                                         | 7.48                               | 490                                                                                                                                                                                                                                                 | 0.015                          |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HC03- to form water and C032-. C032- forms CaC03 by reacting with Ca2+. The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Substance                                                                                                                                                                                                                                                                                                                                                       | PEC (mg/L)                         | PNEC (mg/L)                                                                                                                                                                                                                                         | RCR                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH)2                                                                                                                                                                                                                                                                                                                                                         | 660                                | 1080                                                                                                                                                                                                                                                | 0.61                           |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                                                                                                                             |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca2+ and OH-) in the environment.                                                                                                                        |                                    |                                                                                                                                                                                                                                                     |                                |

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| Environmental exposure for soil treatment in civil engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          |            |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------|
| The soil treatment in civil engineering scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies. |                                                                                                                                                                                                                                          |            |             |      |
| The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                          |            |             |      |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | See amounts used                                                                                                                                                                                                                         |            |             |      |
| Exposure concentration in waste water treatment plant (WW TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Substance                                                                                                                                                                                                                                | PEC (mg/L) | PNEC (mg/L) | RCR  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Ca(OH)2                                                                                                                                                                                                                                  | 701        | 1080        | 0.65 |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                      |            |             |      |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca2+ and OH-) in the environment. |            |             |      |
| Environmental exposure for other uses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                          |            |             |      |
| For all other uses, no quantitative environmental exposure assessment is carried because <ul style="list-style-type: none"><li>The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or soil treatment in civil engineering</li><li>Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water</li><li>Lime is specifically used to release CO2-free breathable air, upon reaction with CO2. Such applications only relates to the air compartment, where the lime properties are exploited</li><li>Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.</li></ul>                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          |            |             |      |

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#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

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## ES number 9.10: Professional use of lime substances in soil treatment

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                       |                                                                                                                                                                          |                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|
| <b>Exposure Scenario Format (1) addressing uses carried out by workers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>1. Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>Free short title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Professional use of lime substances in soil treatment                                                                                                                 |                                                                                                                                                                          |                           |
| <b>Systematic title based on use descriptor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SU22<br>(appropriate PROCs and ERCs are given in Section 2 below)                                                                                                     |                                                                                                                                                                          |                           |
| <b>Processes, tasks and/or activities covered</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                          |                                                                                                                                                                          |                           |
| <b>Assessment Method</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The assessment of inhalation exposure is based on measured data and on the exposure estimation tool MEASE.<br>The environmental assessment is based on FOCUS-Exposit. |                                                                                                                                                                          |                           |
| <b>2. Operational conditions and risk management measures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>Task/ERC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>REACH definition</b>                                                                                                                                               | <b>Involved tasks</b>                                                                                                                                                    |                           |
| <b>Milling</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PROC 5                                                                                                                                                                | <b>Preparation and use of calcium dihydroxide for soil treatment.</b>                                                                                                    |                           |
| <b>Loading of spreader</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | PROC 8b, PROC 26                                                                                                                                                      |                                                                                                                                                                          |                           |
| <b>Application to soil (spreading)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | PROC 11                                                                                                                                                               |                                                                                                                                                                          |                           |
| <b>ERC2, ERC8a, ERC8b, ERC8c, ERC8d, ERC8e, ERC8f</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Wide dispersive indoor and outdoor use of reactive substances or processing aids in open systems                                                                      | Calcium dihydroxide is applied in numerous cases of wide dispersive uses: agricultural, forestry, fish and shrimps farming, soil treatment and environmental protection. |                           |
| <b>2.1 Control of workers exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>Product characteristic</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>Task</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Use in preparation</b>                                                                                                                                             | <b>Content in preparation</b>                                                                                                                                            | <b>Emission potential</b> |
| <b>Milling</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | not restricted                                                                                                                                                        |                                                                                                                                                                          | high                      |
| <b>Loading of spreader</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | not restricted                                                                                                                                                        |                                                                                                                                                                          | high                      |
| <b>Application to soil (spreading)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | not restricted                                                                                                                                                        |                                                                                                                                                                          | high                      |
| <b>Amounts used</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.                                                                                                                                                                                                                                                                                              |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>Frequency and duration of use/exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| <b>Task</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Duration of exposure</b>                                                                                                                                           |                                                                                                                                                                          |                           |
| <b>Milling</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 240 minutes                                                                                                                                                           |                                                                                                                                                                          |                           |
| <b>Loading of spreader</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 240 minutes                                                                                                                                                           |                                                                                                                                                                          |                           |
| <b>Application to soil (spreading)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 480 minutes (not restricted)                                                                                                                                          |                                                                                                                                                                          |                           |
| <b>Human factors not influenced by risk management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                       |                                                                                                                                                                          |                           |
| The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m <sup>3</sup> /shift (8 hours).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                       |                                                                                                                                                                          |                           |

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| Other given operational conditions affecting workers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operational conditions (e.g. process temperature and process pressure) are not considered relevant for occupational exposure assessment of the conducted processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Technical conditions and measures at process level (source) to prevent release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Technical conditions and measures to control dispersion from source towards the worker                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Level of separation                                                         | Localised controls (LC)                          | Efficiency of LC                                                                                                                | Further information                                                                                                                                                                                                                                                                            |
| Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Separation of workers is generally not required in the conducted processes. | not required                                     | na                                                                                                                              | .                                                                                                                                                                                                                                                                                              |
| Loading of spreader                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                             | not required                                     | na                                                                                                                              | .                                                                                                                                                                                                                                                                                              |
| Application to soil (spreading)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | During application the worker is sitting in the cabin of the spreader       | Cabin with filtered air supply                   | 99%                                                                                                                             | .                                                                                                                                                                                                                                                                                              |
| Organisational measures to prevent /limit releases, dispersion and exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Conditions and measures related to personal protection, hygiene and health evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Specification of respiratory protective equipment (RPE)                     | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                         | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
| Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | FFP3 mask                                                                   | APF=20                                           | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps. | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| Loading of spreader                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | FFP3 mask                                                                   | APF=20                                           |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Application to soil (spreading)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | not required                                                                | na                                               |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |
| Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE. For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely.<br>The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers.<br>An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE. |                                                                             |                                                  |                                                                                                                                 |                                                                                                                                                                                                                                                                                                |

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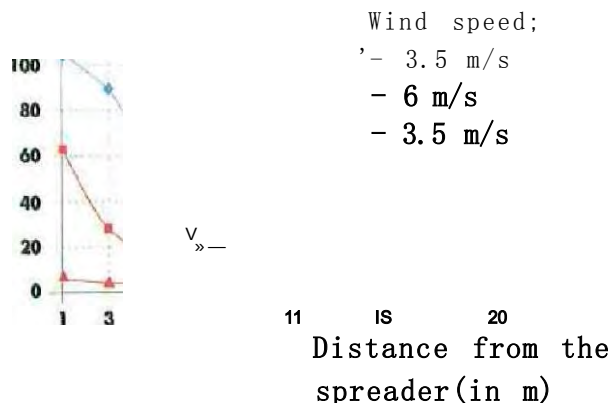
Printing Date: 17 November 2010

### 2.2 Control of environmental exposure - only relevant for agricultural soil protection

#### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

Quantity of dust  
per m<sup>3</sup> (in mg)



(Figure taken from: Laudet, A. et al., 1999)

#### Amounts used

Ca(OH)<sub>2</sub> 2,244 kg/ha

#### Frequency and duration of use

1 day/year (one application per year). Multiple applications during the year are allowed, provided the total yearly amount of 2,244 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

#### Environment factors not influenced by risk management

Volume of surface water: 300 L/m<sup>2</sup>

Field surface area: 1 ha

#### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

#### Technical conditions and measures at process level (source) to prevent release

There are no direct releases to adjacent surface waters.

#### Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

#### Organizational measures to prevent/limit release from site

In line with the requirements for good agricultural practice, agricultural soil should be analysed prior to application of lime and the application rate should be adjusted according to the results of the analysis.

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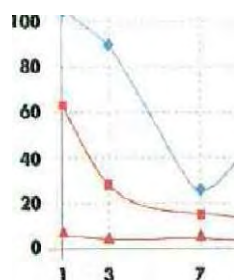
Printing Date: 17 November 2010

### 2.2 Control of environmental exposure - only relevant for soil treatment in civil engineering

#### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

Quantity of dust  
per m<sup>3</sup> (in mg)



Wind speed:

- 3.5 m/s
- 6 m/s
- 3.5 m/s

Distance from the  
spreader (in m)

(Figure taken from: Laudet, A. et al., 1999)

#### Amounts used

Ca(OH)<sub>2</sub>

238,208 kg/ha

#### Frequency and duration of use

1 day/year and only once in a lifetime. Multiple applications during the year are allowed, provided the total yearly amount of 238,208 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

#### Environment factors not influenced by risk management

Field surface area: 1 ha

#### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

#### Technical conditions and measures at process level (source) to prevent release

Lime is only applied onto the soil in the technosphere zone before road construction. There are no direct releases to adjacent surface waters.

#### Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

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| 3. Exposure estimation and reference to its source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                     |                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Occupational exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                     |                                |
| Measured data and modelled exposure estimates (MEASE) were used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m <sup>3</sup> (as respirable dust).                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                     |                                |
| Task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Method used for inhalation exposure assessment                                                                                                                                                                                                                                                                                                                                                                    | Inhalation exposure estimate (RCR) | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR) |
| Milling                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | MEASE                                                                                                                                                                                                                                                                                                                                                                                                             | 0.488 mg/m <sup>3</sup> (0.48)     | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                |
| Loading of spreader                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | MEASE (PROC 8b)                                                                                                                                                                                                                                                                                                                                                                                                   | 0.488 mg/m <sup>3</sup> (0.48)     |                                                                                                                                                                                                                                                     |                                |
| Application to soil (spreading)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | measured data                                                                                                                                                                                                                                                                                                                                                                                                     | 0.880 mg/m <sup>3</sup> (0.88)     |                                                                                                                                                                                                                                                     |                                |
| Environmental exposure for agricultural soil protection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                     |                                |
| The PEC calculation for soil and surface water was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data: once applied on the soil, calcium dihydroxide can indeed migrate then towards surface waters, via drift. |                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                                                                                                                                                                                                                                                     |                                |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | See amounts used                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentration in waste water treatment plant (WW TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not relevant for agricultural soil protection                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Substance                                                                                                                                                                                                                                                                                                                                                                                                         | PEC (ug/L)                         | PNEC (ug/L)                                                                                                                                                                                                                                         | RCR                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH)2                                                                                                                                                                                                                                                                                                                                                                                                           | 7.48                               | 490                                                                                                                                                                                                                                                 | 0.015                          |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | As described above, no exposure of surface water nor sediment to lime is expected. Further, in natural waters the hydroxide ions react with HCO3 <sup>-</sup> to form water and CO3 <sup>2-</sup> . CO3 <sup>2-</sup> forms CaCO3 by reacting with Ca <sup>2+</sup> . The calcium carbonate precipitates and deposits on the sediment. Calcium carbonate is of low solubility and a constituent of natural soils. |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Substance                                                                                                                                                                                                                                                                                                                                                                                                         | PEC (mg/L)                         | PNEC (mg/L)                                                                                                                                                                                                                                         | RCR                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Ca(OH)2                                                                                                                                                                                                                                                                                                                                                                                                           | 660                                | 1080                                                                                                                                                                                                                                                | 0.61                           |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                                                                                                                                                                                               |                                    |                                                                                                                                                                                                                                                     |                                |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca <sup>2+</sup> and OH <sup>-</sup> ) in the environment.                                                                                                                                                 |                                    |                                                                                                                                                                                                                                                     |                                |

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                          |            |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------|------|
| Environmental exposure for soil treatment in civil engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                          |            |             |      |
| The soil treatment in civil engineering scenario is based on a road border scenario. At the special road border technical meeting (Ispra, September 5, 2003), EU Member States and industry agreed on a definition for a "road technosphere". The road technosphere can be defined as "the engineered environment that carries the geotechnical functions of the road in connection with its structure, operation and maintenance including the installations to ensure road safety and manage run off. This technosphere, which includes the hard and soft shoulder at the edge of the carriageway, is vertically dictated by the groundwater watertable. The road authority has responsibility for this road technosphere including road safety, road support, prevention of pollution and water management". The road technosphere was therefore excluded as assessment endpoint for risk assessment for the purpose of the existing/new substances regulations. The target zone is the zone beyond the technosphere, to which the environmental risk assessment applies. |                                                                                                                                                                                                                                          |            |             |      |
| The PEC calculation for soil was based on the FOCUS soil group (FOCUS, 1996) and on the "draft guidance on the calculation of predicted environmental concentration values (PEC) of plant protection products for soil, ground water, surface water and sediment (Kloskowski et al., 1999). The FOCUS/EXPOSIT modelling tool is preferred to the EUSES as it is more appropriate for agricultural-like application as in this case where parameter as the drift needs to be included in the modelling. FOCUS is a model typically developed for biocidal applications and was further elaborated on the basis of the German EXPOSIT 1.0 model, where parameters such as drifts can be improved according to collected data.                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                          |            |             |      |
| Environmental emissions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | See amounts used                                                                                                                                                                                                                         |            |             |      |
| Exposure concentration in waste water treatment plant (WW TP)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentration in aquatic pelagic compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentration in sediments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Not relevant for road border scenario                                                                                                                                                                                                    |            |             |      |
| Exposure concentrations in soil and groundwater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Substance                                                                                                                                                                                                                                | PEC (mg/L) | PNEC (mg/L) | RCR  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Ca(OH)2                                                                                                                                                                                                                                  | 701        | 1080        | 0.65 |
| Exposure concentration in atmospheric compartment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | This point is not relevant. Calcium dihydroxide is not volatile. The vapour pressures is below 10 <sup>-5</sup> Pa.                                                                                                                      |            |             |      |
| Exposure concentration relevant for the food chain (secondary poisoning)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | This point is not relevant because calcium can be considered to be omnipresent and essential in the environment. The uses covered do not significantly influence the distribution of the constituents (Ca2+ and OH-) in the environment. |            |             |      |
| Environmental exposure for other uses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                          |            |             |      |
| For all other uses, no quantitative environmental exposure assessment is carried because                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                          |            |             |      |
| <ul style="list-style-type: none"><li>The operational conditions and risk management measures are less stringent than those outlined for agricultural soil protection or soil treatment in civil engineering</li><li>Lime is an ingredient and chemically bound into a matrix. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water</li><li>Lime is specifically used to release CO2-free breathable air, upon reaction with CO2. Such applications only relates to the air compartment, where the lime properties are exploited</li><li>Neutralisation/pH-shift is the intended use and there are no additional impacts beyond those desired.</li></ul>                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                          |            |             |      |

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#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

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## ES number 9.11: Professional uses of articles/containers containing lime substances

| Exposure Scenario Format (1) addressing uses carried out by workers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>Free short title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Professional uses of articles/containers containing lime substances                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>Systematic title based on use descriptor</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | SU22, SU1, SU5, SU6a, SU6b, SU7, SU10, SU11, SU12, SU13, SU16, SU17, SU18, SU19, SU20, SU23, SU24<br>AC1, AC2, AC3, AC4, AC5, AC6, AC7, AC8, AC10, AC11, AC13<br>(appropriate PROCs and ERCs are given in Section 2 below) |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>Processes, tasks and/or activities covered</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Processes, tasks and/or activities covered are described in Section 2 below.                                                                                                                                               |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>Assessment Method</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The assessment of inhalation exposure is based on the exposure estimation tool MEASE.                                                                                                                                      |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>2. Operational conditions and risk management measures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>PROC/ERC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>REACH definition</b>                                                                                                                                                                                                    | <b>Involved tasks</b>                                                                                                                                                                                                                                                                                             |                                                                                                                                                   |
| <b>PROC 0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Other process (PROC 21 (low emission potential) as proxy for exposure estimation)                                                                                                                                          | Use of containers containing calcium dihydroxide/preparations as CO <sub>2</sub> absorbents (e.g. breathing apparatus)                                                                                                                                                                                            |                                                                                                                                                   |
| <b>PROC 21</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Low energy manipulation of substances bound in materials and/or articles                                                                                                                                                   | Handling of substances bound in materials and/or articles                                                                                                                                                                                                                                                         |                                                                                                                                                   |
| <b>PROC 24</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | High (mechanical) energy work-up of substances bound in materials and/or articles                                                                                                                                          | Grinding, mechanical cutting                                                                                                                                                                                                                                                                                      |                                                                                                                                                   |
| <b>PROC 25</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Other hot work operations with metals                                                                                                                                                                                      | Welding, soldering                                                                                                                                                                                                                                                                                                |                                                                                                                                                   |
| <b>ERC10, ERC11, ERC 12</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Wide dispersive indoor and outdoor use of long-life articles and materials with low release                                                                                                                                | Calcium dihydroxide bound into or onto articles and materials such as: wooden and plastic construction and building materials (e.g. gutters, drains), flooring, furniture, toys, leather products, paper and cardboard products (magazines, books, news paper and packaging paper), electronic equipment (casing) |                                                                                                                                                   |
| <b>2.1 Control of workers exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>Product characteristic</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| According to the MEASE approach, the substance-intrinsic emission potential is one of the main exposure determinants. This is reflected by an assignment of a so-called fugacity class in the MEASE tool. For operations conducted with solid substances at ambient temperature the fugacity is based on the dustiness of that substance. Whereas in hot metal operations, fugacity is temperature based, taking into account the process temperature and the melting point of the substance. As a third group, high abrasive tasks are based on the level of abrasion instead of the substance intrinsic emission potential. |                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                   |
| <b>PROC</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Use in preparation</b>                                                                                                                                                                                                  | <b>Content in preparation</b>                                                                                                                                                                                                                                                                                     | <b>Emission potential</b>                                                                                                                         |
| <b>PROC 0</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | not restricted                                                                                                                                                                                                             | massive objects (pellets), low potential for dust formation due to abrasion during previous filling and handling activities of pellets, not during use of breathing apparatus                                                                                                                                     | low (worst case assumption as no inhalation exposure is assumed during the use of the breathing apparatus due to the very low abrasive potential) |
| <b>PROC 21</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | not restricted                                                                                                                                                                                                             | massive objects                                                                                                                                                                                                                                                                                                   | very low                                                                                                                                          |
| <b>PROC 24, 25</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | not restricted                                                                                                                                                                                                             | massive objects                                                                                                                                                                                                                                                                                                   | high                                                                                                                                              |

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### Amounts used

The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROC) is the main determinant of the process intrinsic emission potential.

### Frequency and duration of use/exposure

| PROC        | Duration of exposure                                                                                                                                                                            |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | 480 minutes                                                                                                                                                                                     |
| PROC 0      | (not restricted as far as occupational exposure to calcium dihydroxide is concerned, the actual wearing duration may be restricted due the user instructions of the actual breathing apparatus) |
| PROC 21     | 480 minutes (not restricted)                                                                                                                                                                    |
| PROC 24, 25 | < 240 minutes                                                                                                                                                                                   |

### Human factors not influenced by risk management

The shift breathing volume during all process steps reflected in the PROCs is assumed to be 10 m<sup>3</sup>/shift (8 hours).

### Other given operational conditions affecting workers exposure

Operational conditions like process temperature and process pressure are not considered relevant for occupational exposure assessment of the conducted processes. In process steps with considerably high temperatures (i.e. PROC 22, 23, 25), the exposure assessment in MEASE is however based on the ratio of process temperature and melting point. As the associated temperatures are expected to vary within the industry the highest ratio was taken as a worst case assumption for the exposure estimation. Thus all process temperatures are automatically covered in this exposure scenario for PROC 22, 23 and PROC 25.

### Technical conditions and measures at process level (source) to prevent release

Risk management measures at the process level (e.g. containment or segregation of the emission source) are generally not required in the processes.

### Technical conditions and measures to control dispersion from source towards the worker

| PROC               | Level of separation                                                                                                                                                                                                                                                                                                                                  | Localised controls (LC) | Efficiency of LC (according to MEASE) | Further information |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------------------------------------|---------------------|
| PROC 0, 21, 24, 25 | Any potentially required separation of workers from the emission source is indicated above under "Frequency and duration of exposure". A reduction of exposure duration can be achieved, for example, by the installation of ventilated (positive pressure) control rooms or by removing the worker from workplaces involved with relevant exposure. | not required            |                                       |                     |

### Organisational measures to prevent /limit releases, dispersion and exposure

Avoid inhalation or ingestion. General occupational hygiene measures are required to ensure a safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no eating and smoking at the workplace, the wearing of standard working clothes and shoes unless otherwise stated below. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home. Do not blow dust off with compressed air.

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| Conditions and measures related to personal protection, hygiene and health evaluation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Specification of respiratory protective equipment (RPE) | RPE efficiency (assigned protection factor, APF) | Specification of gloves                                                                                                                                                                                                                             | Further personal protective equipment (PPE)                                                                                                                                                                                                                                                    |
| PROC 0, 21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | not required                                            | na                                               | Since calcium dihydroxide is classified as irritating to skin, the use of protective gloves is mandatory for all process steps.                                                                                                                     | Eye protection equipment (e.g. goggles or visors) must be worn, unless potential contact with the eye can be excluded by the nature and type of application (i.e. closed process). Additionally, face protection, protective clothing and safety shoes are required to be worn as appropriate. |
| PROC 24, 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | FFP1 mask                                               | APF=4                                            |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| Any RPE as defined above shall only be worn if the following principles are implemented in parallel: The duration of work (compare with "duration of exposure" above) should reflect the additional physiological stress for the worker due to the breathing resistance and mass of the RPE itself, due to the increased thermal stress by enclosing the head. In addition, it shall be considered that the worker's capability of using tools and of communicating are reduced during the wearing of RPE. For reasons as given above, the worker should therefore be (i) healthy (especially in view of medical problems that may affect the use of RPE), (ii) have suitable facial characteristics reducing leakages between face and mask (in view of scars and facial hair). The recommended devices above which rely on a tight face seal will not provide the required protection unless they fit the contours of the face properly and securely. The employer and self-employed persons have legal responsibilities for the maintenance and issue of respiratory protective devices and the management of their correct use in the workplace. Therefore, they should define and document a suitable policy for a respiratory protective device programme including training of the workers. An overview of the APFs of different RPE (according to BS EN 529:2005) can be found in the glossary of MEASE. |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| 2.2 Control of environmental exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| Product characteristics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| Lime is chemically bound into/onto a matrix with very low release potential                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| 3. Exposure estimation and reference to its source                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| Occupational exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| The exposure estimation tool MEASE was used for the assessment of inhalation exposure. The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and has to be below 1 to demonstrate a safe use. For inhalation exposure, the RCR is based on the DNEL for calcium dihydroxide of 1 mg/m³ (as respirable dust) and the respective inhalation exposure estimate derived using MEASE (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction being a sub-fraction of the inhalable fraction according to EN 481.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| PROC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Method used for inhalation exposure assessment          | Inhalation exposure estimate (RCR)               | Method used for dermal exposure assessment                                                                                                                                                                                                          | Dermal exposure estimate (RCR)                                                                                                                                                                                                                                                                 |
| PROC 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | MEASE (PROC 21)                                         | 0.5 mg/m³ (0.5)                                  | Since calcium dihydroxide is classified as irritating to skin, dermal exposure has to be minimised as far as technically feasible. A DNEL for dermal effects has not been derived. Thus, dermal exposure is not assessed in this exposure scenario. |                                                                                                                                                                                                                                                                                                |
| PROC 21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MEASE                                                   | 0.05 mg/m³ (0.05)                                |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| PROC 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MEASE                                                   | 0.825 mg/m³ (0.825)                              |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| PROC 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MEASE                                                   | 0.6 mg/m³ (0.6)                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| Environmental exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |
| Lime is an ingredient and is chemically bound into a matrix: there is no intended release of lime during normal and reasonable foreseeable conditions of use. Releases are negligible and insufficient to cause a pH-shift in soil, wastewater or surface water.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                         |                                                  |                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                |

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#### 4. Guidance to DU to evaluate whether he works inside the boundaries set by the ES

The DU works inside the boundaries set by the ES if either the proposed risk management measures as described above are met or the downstream user can demonstrate on his own that his operational conditions and implemented risk management measures are adequate. This has to be done by showing that they limit the inhalation and dermal exposure to a level below the respective DNEL (given that the processes and activities in question are covered by the PROCs listed above) as given below. If measured data are not available, the DU may make use of an appropriate scaling tool such as MEASE ([www.ebrc.de/mease.html](http://www.ebrc.de/mease.html)) to estimate the associated exposure. The dustiness of the substance used can be determined according to the MEASE glossary. For example, substances with a dustiness less than 2.5 % according to the Rotating Drum Method (RDM) are defined as "low dusty", substances with a dustiness less than 10 % (RDM) are defined as "medium dusty" and substances with a dustiness >10 % are defined as "high dusty".

DNEL<sub>inhalation</sub>: 1 mg/m<sup>3</sup> (as respirable dust)

Important note: The DU has to be aware of the fact that apart from the long-term DNEL given above, a DNEL for acute effects exists at a level of 4 mg/m<sup>3</sup>. By demonstrating a safe use when comparing exposure estimates with the long-term DNEL, the acute DNEL is therefore also covered (according to R.14 guidance, acute exposure levels can be derived by multiplying long-term exposure estimates by a factor of 2). When using MEASE for the derivation of exposure estimates, it is noted that the exposure duration should only be reduced to half-shift as a risk management measure (leading to an exposure reduction of 40 %).

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## ES number 9.12: Consumer use of building and construction material (DIY - do it yourself)

Exposure Scenario Format (2) addressing uses carried out by consumers

### 1. Title

**Free short title**

Consumer use of building and construction material

**Systematic title based on use descriptor**

SU21, PC9a, PC9b, ERC8c, ERC8d, ERC8e, ERC8f

**Processes, tasks activities covered**

Handling (mixing and filling) of powder formulations

Application of liquid, pasty lime preparations.

Human health:

A qualitative assessment has been performed for oral and dermal exposure as well as exposure to the eye. Inhalation exposure to dust has been assessed by the Dutch model (van Hemmen, 1992).

Environment:

A qualitative justification assessment is provided.

**Assessment Method\***

### 2. Operational conditions and risk management measures

**RMM**

No product integrated risk management measures are in place.

**PC/ERC**

**Description of activity referring to article categories (AC) and environmental release categories (ERC)**

PC 9a, 9b

Mixing and loading of powder containing lime substances.

Application of lime plaster, putty or slurry to the walls or ceiling.

Post-application exposure.

ERC 8c, 8d, 8e, 8f

Wide dispersive indoor use resulting in inclusion into or onto a matrix

Wide dispersive outdoor use of processing aids in open systems

Wide dispersive outdoor use of reactive substances in open systems

Wide dispersive outdoor use resulting in inclusion into or onto a matrix

### 2.1 Control of consumers exposure

**Product characteristic**

| Description of the preparation           | Concentration of the substance in the preparation | Physical state of the preparation          | Dustiness (if relevant)                                                                                                                     | Packaging design             |
|------------------------------------------|---------------------------------------------------|--------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| Lime substance                           | 100 %                                             | <u>Solid, powder</u>                       | High, medium and low, depending on the kind of lime substance (indicative value from DIY <sup>1</sup> fact sheet see <u>section 9.0.3</u> ) | Bulk in bags of up to 35 kg. |
| Plaster, Mortar                          | 20-40%                                            | <u>Solid, powder</u>                       |                                                                                                                                             |                              |
| <u>Plaster, Mortar</u>                   | 20-40%                                            | <u>Pasty</u>                               |                                                                                                                                             |                              |
| Putty, filler                            | 30-55%                                            | <u>Pasty, highly viscous, thick liquid</u> |                                                                                                                                             | In tubes or buckets          |
| Pre-mixed lime wash paint                | -30%                                              | <u>Solid, powder</u>                       | High - low (indicative value from DIY <sup>1</sup> fact sheet see <u>section 9.0.3</u> )                                                    | Bulk in bags of up to 35 kg. |
| Lime wash paint/milk of lime preparation | ~30<                                              | <u>Milk of lime preparation</u>            |                                                                                                                                             |                              |

**Amounts used**

**Description of the preparation**

**Amount used per event**

Filler, putty

250 g - 1 kg powder (2:1 powder water)

Difficult to determine, because the amount is heavily dependent on the depth and size of the holes to be filled.

Plaster/lime wash paint

~ 25 kg depending on the size of the room, wall to be treated.

Floor/wall equalizer

~ 25 kg depending on the size of the room, wall to be equalized.

### Frequency and duration of use/exposure

**Description of task**

**Duration of exposure per event**

**frequency of events**

Mixing and loading of lime containing powder.

1.33 min (DIY-fact sheet, RIVM, Chapter 2.4.2 Mixing and loading of powders)

2/year (DIY<sup>1</sup> fact sheet)

Application of lime plaster, putty or slurry to the walls or ceiling

Several minutes - hours

2/year (DIY<sup>1</sup> fact sheet)

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### Human factors not influenced by risk management

| Description of the task                         | Population exposed | Breathing rate          | Exposed body part  | Corresponding skin area [cm <sup>2</sup> ] |
|-------------------------------------------------|--------------------|-------------------------|--------------------|--------------------------------------------|
| Handling of powder                              | Adult              | 1.25 m <sup>3</sup> /hr | Half of both hands | 430 (DIY <sup>1</sup> fact sheet)          |
| Application of liquid, pasty lime preparations. | Adult              | NR                      | Hands and forearms | 1900 (DIY <sup>1</sup> fact sheet)         |

### Other given operational conditions affecting consumers exposure

| Description of the task                         | Indoor/outdoor | Room volume                                                   | Air exchange rate                       |
|-------------------------------------------------|----------------|---------------------------------------------------------------|-----------------------------------------|
| Handling of powder                              | indoor         | 1 m <sup>3</sup> (personal space, small area around the user) | 0.6 hr <sup>-1</sup> (unspecified room) |
| Application of liquid, pasty lime preparations. | indoor         | NR                                                            | NR                                      |

### Conditions and measures related to information and behavioural advice to consumers

In order to avoid health damage DIYers should comply with the same strict protective measures which apply to professional workplaces:

- Change wet clothing, shoes and gloves immediately.
- Protect uncovered areas of skin (arms, legs, face): there are various effective skin protection products which should be used in accordance with a skin protection plan (skin protection, cleansing and care). Cleanse the skin thoroughly after the work and apply a care product.

### Conditions and measures related to personal protection and hygiene

In order to avoid health damage DIYers should comply with the same strict protective measures which apply to professional workplaces:

- When preparing or mixing building materials, during demolition or caulking and, above all, during overhead work, wear protective goggles as well as face masks during dusty work.
- Choose work gloves carefully. Leather gloves become wet and can facilitate burns. When working in a wet environment, cotton gloves with plastic covering (nitrile) are better. Wear gauntlet gloves during overhead work because they can considerably reduce the amount of humidity which permeates the working clothes.

## **2.2 Control of environmental exposure**

### Product characteristics

Not relevant for exposure assessment

### Amounts used\*

Not relevant for exposure assessment

### Frequency and duration of use

Not relevant for exposure assessment

### Environment factors not influenced by risk management

Default river flow and dilution

### Other given operational conditions affecting environmental exposure

Indoor

Direct discharge to the wastewater is avoided.

### Conditions and measures related to municipal sewage treatment plant

Default size of municipal sewage system/treatment plant and sludge treatment technique

### Conditions and measures related to external treatment of waste for disposal

Not relevant for exposure assessment

### Conditions and measures related to external recovery of waste

Not relevant for exposure assessment

## **3. Exposure estimation and reference to its source**

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the acute DNEL for lime substances of 4 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since limes are classified as irritating to skin and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Human exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Handling of powder</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Route of exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Exposure estimate</b>                                                             | <b>Method used, comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Oral                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                      | Qualitative assessment<br>Oral exposure does not occur as part of the intended product use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Dermal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | small task: 0.1 pg/cm <sup>2</sup> (-)<br>large task: 1 pg/cm <sup>2</sup> (-)       | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from loading of lime substances or direct contact to the lime cannot be excluded if no protective gloves are worn during application. This may occasionally result in mild irritation easily avoided by prompt rinsing with water.<br>Quantitative assessment<br>The constant rate model of ConsExpo has been used. The contact rate to dust formed while pouring powder has been taken from the DIY <sup>1</sup> -fact sheet (RIVM report 320104007). |
| Eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Dust                                                                                 | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. Dust from loading of the lime substances cannot be excluded if no protective goggles are used. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable.                                                                                                                                                                                                                                                                                            |
| Inhalation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Small task: 12 pg/m <sup>3</sup> (0.003)<br>Large task: 120 pg/m <sup>3</sup> (0.03) | Quantitative assessment<br>Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above).                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Application of liquid, pasty lime preparations.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Route of exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Exposure estimate</b>                                                             | <b>Method used, comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Oral                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                      | Qualitative assessment<br>Oral exposure does not occur as part of the intended product use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Dermal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Splashes                                                                             | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, splashes on the skin cannot be excluded if no protective gloves are worn during the application. Splashes may occasionally result in mild irritation easily avoided by immediate rinsing of the hands with water.                                                                                                                                                                                                                                                             |
| Eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Splashes                                                                             | Qualitative assessment<br>If appropriate goggles are worn no exposure to the eyes needs to be expected. However, splashes into the eyes cannot be excluded if no protective goggles are worn during the application of liquid or pasty lime preparations, especially during overhead work. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable.                                                                                                                                                                                                           |
| Inhalation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                      | Qualitative assessment<br>Not expected, as the vapour pressure of limes in water is low and generation of mists or aerosols does not take place.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Post-application exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| No relevant exposure will be assumed as the aqueous lime preparation will quickly convert to calcium carbonate with carbon dioxide from the atmosphere.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Environmental exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Referring to the OC/RMMs related to the environment to avoid discharging lime solutions directly into municipal wastewater, the pH of the influent of a municipal wastewater treatment plant is circum-neutral and therefore, there is no exposure to the biological activity. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment. |                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

## ES number 9.13: Consumer use of CO<sub>2</sub> absorbent in breathing apparatuses

| Exposure Scenario Format (2) addressing uses carried out by consumers |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
|-----------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Title                                                              |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| Free short title                                                      |  | Consumer use of CO2 absorbent in breathing apparatuses                                                                                                                                                                                                                                                                                                                                                                                                                    |                                     |                                                                                                                                               |
| Systematic title based on use descriptor                              |  | SU21, PC2 , ERC8b                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                     |                                                                                                                                               |
| Processes, tasks activities covered                                   |  | Filling of the formulation into the cartridge<br>Use of closed circuit breathing apparatuses<br>Cleaning of equipment                                                                                                                                                                                                                                                                                                                                                     |                                     |                                                                                                                                               |
| Assessment Method*                                                    |  | Human health<br>A qualitative assessment has been performed for oral and dermal exposure. The inhalation exposure has been assessed by the Dutch model (van Hemmen, 1992).<br>Environment<br>A qualitative justification assessment is provided.                                                                                                                                                                                                                          |                                     |                                                                                                                                               |
| 2. Operational conditions and risk management measures                |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| RMM                                                                   |  | The soda lime is available in granular form. Furthermore, a defined amount of water (14-18%) is added which will further reduce the dustiness of the absorbent. During the breathing cycle calcium dihydroxide will be quickly reacting with CO2 to form the carbonate.                                                                                                                                                                                                   |                                     |                                                                                                                                               |
| PC/ERC                                                                |  | Description of activity referring to article categories (AC) and environmental release categories (ERC)                                                                                                                                                                                                                                                                                                                                                                   |                                     |                                                                                                                                               |
| PC 2                                                                  |  | Use of closed circuit breathing apparatus for e.g. recreational diving containing soda lime as CO2 absorbent. The breathed air will flow through the absorbent and CO2 will quickly react (catalysed by water and sodium hydroxide) with the calcium dihydroxide to form the carbonate. The CC>2-free air can be re-breathed again, after addition of oxygen.<br>Handling of the absorbent: The absorbent will be discarded after each use and refilled before each dive. |                                     |                                                                                                                                               |
| ERC 8b                                                                |  | Wide dispersive indoor use resulting in inclusion into or onto a matrix                                                                                                                                                                                                                                                                                                                                                                                                   |                                     |                                                                                                                                               |
| 2.1 Control of consumers exposure                                     |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| Product characteristic                                                |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| Description of the preparation                                        |  | Concentration of the substance in the preparation                                                                                                                                                                                                                                                                                                                                                                                                                         | Physical state of the preparation   | Dustiness (if relevant)                                                                                                                       |
| CO2 absorbent                                                         |  | 78 - 84%<br>Depending on the application the main component has different additives.<br>A specific amount of water is always added (14-18%).                                                                                                                                                                                                                                                                                                                              | Solid, granular                     | Very low dustiness (reduction by 10 % compared to powder)<br>Dust formation cannot be ruled out during the filling of the scrubber cartridge. |
| "Used" CO2 absorbent                                                  |  | ~ 20%                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Solid, granular                     | Very low dustiness (reduction by 10 % compared to powder)                                                                                     |
| Packaging design                                                      |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
|                                                                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     | 4.5, 18 kg canister                                                                                                                           |
| 1-3 kg in breathing apparatus                                         |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| Amounts used                                                          |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| CCV Absorbent used in breathing apparatus                             |  | 1-3 kg depending on the kind of breathing apparatus                                                                                                                                                                                                                                                                                                                                                                                                                       |                                     |                                                                                                                                               |
| Frequency and duration of use/exposure                                |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| Description of the task                                               |  | Duration of exposure per event                                                                                                                                                                                                                                                                                                                                                                                                                                            | frequency of events                 |                                                                                                                                               |
| Filling of the formulation into the cartridge                         |  | Ca. 1.33 min per filling, in sum < 15 min                                                                                                                                                                                                                                                                                                                                                                                                                                 | Before each dive (up to 4 times)    |                                                                                                                                               |
| Use of closed circuit breathing apparatus                             |  | 1-2 h                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Up to 4 dives a day                 |                                                                                                                                               |
| Cleaning and emptying of equipment                                    |  | < 15 min                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | After each dive (up to 4 times)     |                                                                                                                                               |
| Human factors not influenced by risk management                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
| Description of the task                                               |  | Population exposed                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Breathing rate                      | Exposed body part                                                                                                                             |
| Filling of the formulation into the cartridge                         |  | adult                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1.25 m³/hr (light working activity) | hands                                                                                                                                         |
| Use of closed circuit breathing apparatus                             |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |                                                                                                                                               |
|                                                                       |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     | Corresponding skin area [cm²]<br>840<br>(REACH guidance R.15, men)                                                                            |

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Revision date: 17 November 2010

Printing Date: 17 November 2010

Cleaning and emptying  
of equipment

hands

840  
(REACH guidance  
R.15, men)

## **Other given operational conditions affecting consumers exposure**

| <b><u>Description of the task</u></b>         | <b><u>Indoor/outdoor</u></b> | <b><u>Room volume</u></b> | <b><u>Air exchange rate</u></b> |
|-----------------------------------------------|------------------------------|---------------------------|---------------------------------|
| Filling of the formulation into the cartridge | NR                           | NR                        | NR                              |
| Use of closed circuit breathing apparatus     |                              |                           |                                 |
| Cleaning and emptying of equipment            | NR                           | NR                        | NR                              |

## **Conditions and measures related to information and behavioural advice to consumers**

Do not get in eyes, on skin, or on clothing. Do not breathe dust.  
Keep container tightly closed as to avoid the soda lime to dry out.  
Keep out of reach of children.  
Wash thoroughly after handling.  
In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.  
Do not mix with acids.

Carefully read the instructions of the breathing apparatus to assure a proper use of the breathing apparatus.

## **Conditions and measures related to personal protection and hygiene**

Wear suitable gloves, goggles and protective clothes during handling. Use a filtering half mask (mask type FFP2 acc. to EN 149).

## **2.2 Control of environmental exposure**

### **Product characteristics**

Not relevant for exposure assessment

### **Amounts used\***

Not relevant for exposure assessment

### **Frequency and duration of use**

Not relevant for exposure assessment

### **Environment factors not influenced by risk management**

Default river flow and dilution

### **Other given operational conditions affecting environmental exposure**

Indoor

### **Conditions and measures related to municipal sewage treatment plant**

Default size of municipal sewage system/treatment plant and sludge treatment technique

### **Conditions and measures related to external treatment of waste for disposal**

Not relevant for exposure assessment

### **Conditions and measures related to external recovery of waste**

Not relevant for exposure assessment

## **3. Exposure estimation and reference to its source**

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the acute DNEL for lime substances of 4 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since lime substances are classified as irritating to skin, and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

Due to the very specialised kind of consumers (divers filling their own CO<sub>2</sub> scrubber) it can be assumed that instructions will be taken into account to reduce exposure

### **Human exposure**

#### **Filling of the formulation into the cartridge**

#### **Route of exposure      Exposure estimate**

Oral

Dermal

#### **Method used, comments**

Qualitative assessment

Oral exposure does not occur as part of the intended product use.

Qualitative assessment

If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from loading of granular soda lime or direct contact to the granules cannot be excluded if no protective gloves are worn during application. This may occasionally result in mild irritation easily avoided by prompt rinsing with water.

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Revision date: 17 November 2010

Printing Date: 17 November 2010

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Dust                                                                                                                     | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. Dust from loading of the granular soda lime is expected to be minimal, therefore eye exposure will be minimal even without protective goggles. Nevertheless, prompt rinsing with water and seeking medical advice after accidental exposure is advisable.                                                                                                                                                                                                        |
| Inhalation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Small task: 1.2 pg/m <sup>3</sup> (3 x 10 <sup>-4</sup> )<br>Large task: 12 pg/m <sup>3</sup> (0.003)                    | Quantitative assessment<br>Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form.                                                                                                                                                                                                                                                                                                                                        |
| <b>Use of closed circuit breathing apparatus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Route of exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Exposure estimate</b>                                                                                                 | <b>Method used, comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Oral                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                          | Qualitative assessment<br>Oral exposure does not occur as part of the intended product use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dermal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                          | Qualitative assessment<br>Due to the product characteristics, it can be concluded that dermal exposure to the absorbent in breathing apparatuses is non-existent.                                                                                                                                                                                                                                                                                                                                                                                                           |
| Eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                          | Qualitative assessment<br>Due to the product characteristics, it can be concluded that eye exposure to the absorbent in breathing apparatuses is non-existent.                                                                                                                                                                                                                                                                                                                                                                                                              |
| Inhalation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | negligible                                                                                                               | Qualitative assessment<br>Instructional advice is provided to remove any dust before finishing the assembly of the scrubber. Divers filling their own CO <sub>2</sub> scrubber represent a specific subpopulation within consumers. Proper use of equipment and materials is in their own interest; hence it can be assumed that instructions will be taken into account.<br>Due to the product characteristics and the instructional advices given, it can be concluded that inhalation exposure to the absorbent during the use of the breathing apparatus is negligible. |
| <b>Cleaning and emptying of equipment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Route of exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Exposure estimate</b>                                                                                                 | <b>Method used, comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Oral                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                          | Qualitative assessment<br>Oral exposure does not occur as part of the intended product use.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Dermal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Dust and splashes                                                                                                        | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from emptying granular soda lime or direct contact to the granules cannot be excluded if no protective gloves are worn during cleaning. Furthermore, during the cleaning of the cartridge with water contact to moistened soda lime may occur. This may occasionally result in mild irritation easily avoided by immediate rinsing of with water.                                                                                |
| Eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Dust and splashes                                                                                                        | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, contact to dust from emptying granular soda limes or during the cleaning of the cartridge with water contact to moisten soda limes may occur in very rare occasions. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable.                                                                                                                                                                                       |
| Inhalation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Small task: 0.3 pg/m <sup>3</sup> (7.5 x 10 <sup>-3</sup> )<br>Large task: 3 pg/m <sup>3</sup> (7.5 x 10 <sup>-4</sup> ) | Quantitative assessment<br>Dust formation while pouring the powder is addressed by using the Dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form and a factor of 4 to account for the reduced amount of lime in the "used" absorbent.                                                                                                                                                                                                                                                    |
| <b>Environmental exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| The pH impact due to use of lime in breathing apparatuses is expected to be negligible. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment. |                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

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Revision date: 17 November 2010

Printing Date: 17 November 2010

## ES number 9.14: Consumer use of garden lime/fertilizer

| Exposure Scenario Format (2) addressing uses carried out by consumers                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-----------------------------------------------|
| 1. Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Free short title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                   | Consumer use of garden lime/fertilizer                                                                                                                                                                                                                                            |                                             |                                               |
| Systematic title based on use descriptor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   | SU21, PC20, PC12, ERC8e                                                                                                                                                                                                                                                           |                                             |                                               |
| Processes, tasks activities covered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                   | Manual application of garden lime, fertilizer<br>Post-application exposure                                                                                                                                                                                                        |                                             |                                               |
| Assessment Method*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                   | Human health<br>A qualitative assessment has been performed for oral and dermal exposure as well as for the exposure to the eye. The dust exposure has been assessed by the Dutch model (van Hemmen, 1992).<br>Environment<br>A qualitative justification assessment is provided. |                                             |                                               |
| 2. Operational conditions and risk management measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| RMM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                   | No product integrated risk management measures are in place.                                                                                                                                                                                                                      |                                             |                                               |
| PC/ERC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                   | Description of activity referring to article categories (AC) and environmental release categories (ERC)                                                                                                                                                                           |                                             |                                               |
| PC 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   | Surface spreading of the garden lime by shovel/hand (worst case) and soil incorporation.<br>Post-application exposure to playing children.                                                                                                                                        |                                             |                                               |
| PC 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   | Surface spreading of the garden lime by shovel/ hand (worst case) and soil incorporation.<br>Post-application exposure to playing children.                                                                                                                                       |                                             |                                               |
| ERC 8e                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                   | Wide dispersive outdoor use of reactive substances in open systems                                                                                                                                                                                                                |                                             |                                               |
| 2.1 Control of consumers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Product characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Description of the preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Concentration of the substance in the preparation | Physical state of the preparation                                                                                                                                                                                                                                                 | Dustiness (if relevant)                     | Packaging design                              |
| Garden lime                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 100 %                                             | Solid, powder                                                                                                                                                                                                                                                                     | High dusty                                  | Bulk in bags or containers of 5, 10 and 25 kg |
| Fertilizer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Up to 20 %                                        | Solid, granular                                                                                                                                                                                                                                                                   | Low dusty                                   | Bulk in bags or containers of 5, 10 and 25 kg |
| Amounts used                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Description of the preparation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                   | Amount used per event                                                                                                                                                                                                                                                             | Source of information                       |                                               |
| Garden lime                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                   | 100g Irri¹ (up to 200g/m²)                                                                                                                                                                                                                                                        | Information and direction of use            |                                               |
| Fertilizer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                   | 100g /m¹ (up to 1 kg/m² (compost))                                                                                                                                                                                                                                                | Information and direction of use            |                                               |
| Frequency and duration of use/exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Description of the task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                   | Duration of exposure per event                                                                                                                                                                                                                                                    | frequency of events                         |                                               |
| Manual application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                   | Minutes-hours<br>Depending on the size of the treated area                                                                                                                                                                                                                        | 1 tasks per year                            |                                               |
| Post-application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                   | 2 h (toddlers playing on grass (EPA exposure factors handbook)                                                                                                                                                                                                                    | Relevant for up to 7 days after application |                                               |
| Human factors not influenced by risk management                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Description of the task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Population exposed                                | Breathing rate                                                                                                                                                                                                                                                                    | Exposed body part                           | Corresponding skin area [cm²]                 |
| Manual application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Adult                                             | 1.25 m³/hr                                                                                                                                                                                                                                                                        | Hands and forearms                          | 1900 (DIY fact sheet)                         |
| Post-application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Child/Toddlers                                    | NR                                                                                                                                                                                                                                                                                | NR                                          | NR                                            |
| Other given operational conditions affecting consumers exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Description of the task                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Indoor/outdoor                                    | Room volume                                                                                                                                                                                                                                                                       | Air exchange rate                           |                                               |
| Manual application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | outdoor                                           | 1 m³ (personal space, small area around the user)                                                                                                                                                                                                                                 | NR                                          |                                               |
| Post-application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | outdoor                                           | NR                                                                                                                                                                                                                                                                                | NR                                          |                                               |
| Conditions and measures related to information and behavioural advice to consumers                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Do not get in eyes, on skin, or on clothing. Do not breathe dust. Use a filtering half mask (mask type FFP2 acc. to EN 149).<br>Keep container closed and out of reach of children.<br>In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.<br>Wash thoroughly after handling.<br>Do not mix with acids and always add limes to water and not water to limes.<br>Incorporation of the garden lime or fertilizer into the soil with subsequent watering will facilitate the effect. |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Conditions and measures related to personal protection and hygiene                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |
| Wear suitable gloves, goggles and protection clothes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   |                                                                                                                                                                                                                                                                                   |                                             |                                               |

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Revision date: 17 November 2010

Printing Date: 17 November 2010

### 2.2 Control of environmental exposure

#### Product characteristics

Drift: 1 % (very worst-case estimate based on data from dust measurements in air as a function of the distance from application)

#### Amounts used

Amount used

|                                          |             |
|------------------------------------------|-------------|
| Ca(OH) <sub>2</sub>                      | 2,244 kg/ha |
| CaO                                      | 1,700 kg/ha |
| CaO.MgO                                  | 1,478 kg/ha |
| Ca(OH) <sub>2</sub> .Mg(OH) <sub>2</sub> | 2,030 kg/ha |
| CaCO <sub>3</sub> .MgO                   | 2,149 kg/ha |
| Ca(OH) <sub>2</sub> .MgO                 | 1,774 kg/ha |
| Natural hydraulic lime                   | 2,420 kg/ha |

In professional agricultural soil protection, it is recommended not to exceed 1700 kg CaO/ha or the corresponding amount of 2244 kg Ca(OH)<sub>2</sub>/ha. This rate is three times the amount needed to compensate the annual losses of lime by leaching. For this reason, the value of 1700 kg CaO/ha or the corresponding amount of 2244 kg Ca(OH)<sub>2</sub>/ha is used in this dossier as the basis for the risk assessment. The amount used for the other lime variants can be calculated based on their composition and the molecular weight.

#### Frequency and duration of use

1 day/year (one application per year) Multiple applications during the year are allowed, provided the total yearly amount of 2,244 kg/ha is not exceeded (Ca(OH)<sub>2</sub>)

#### Environment factors not influenced by risk management

Not relevant for exposure assessment

#### Other given operational conditions affecting environmental exposure

Outdoor use of products

Soil mixing depth: 20 cm

#### Technical conditions and measures at process level (source) to prevent release

There are no direct releases to adjacent surface waters.

#### Technical conditions and measures to reduce or limit discharges, air emissions and releases to soil

Drift should be minimised.

#### Conditions and measures related to municipal sewage treatment plant

Not relevant for exposure assessment

#### Conditions and measures related to external treatment of waste for disposal

Not relevant for exposure assessment

#### Conditions and measures related to external recovery of waste

Not relevant for exposure assessment

### 3. Exposure estimation and reference to its source

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the long-term DNEL for lime substances of 1 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since lime substances are classified as irritating to skin and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

#### Human exposure

##### Manual application

| Route of exposure | Exposure estimate | Method used, comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oral              |                   | Qualitative assessment<br><u>Oral exposure does not occur as part of the intended product use.</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Dermal            | Dust, powder      | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from application of lime substances or by direct contact to the limes cannot be excluded if no protective gloves are worn during application. Due to the relatively long application time, skin irritation would be expected. This can easily be avoided by immediate rinsing with water. It would be assumed that consumers who had experience of skin irritation will protect themselves. Therefore, any occurring skin irritation, which will be reversible, can be assumed to be non-recurring. |
| Eye               | Dust              | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. Dust from surfacing with lime cannot be excluded if no protective goggles are used. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable.                                                                                                                                                                                                                                                                                                                                                    |

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inhalation (garden lime)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Small task: 12 $\mu\text{g}/\text{m}^3$ (0.0012)<br>Large task: 120 $\mu\text{g}/\text{m}^3$ (0.012)                   | Quantitative assessment<br>No model describing the application of powders by shovel/hand is available, therefore, read-across from the dust formation model while pouring powders has been used as a worst case.<br>Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above).                                                                                                                                             |
| Inhalation (fertilizer)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Small task: 0.24 $\mu\text{g}/\text{m}^3$ ( $2.4 \cdot 10^{-4}$ )<br>Large task: 2.4 $\mu\text{g}/\text{m}^3$ (0.0024) | Quantitative assessment<br>No model describing the application of powders by shovel/hand is available, therefore, read across from the dust formation model while pouring powders has been used as a worst case.<br>Dust formation while pouring the powder is addressed by using the dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form and a factor of 5 to account for the reduced amount of limes in fertilizer. |
| Post-application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| According to the PSD (UK Pesticide Safety Directorate, now called CRD) post-application exposure need to be addressed for products which are applied in parks or amateur products used to treat lawns and plants grown in private gardens. In this case exposure of children, who may have access to these areas soon after treatment, needs to be assessed. The US EPA model predicts the post-application exposure to products used in private gardens (e.g. lawns) by toddlers crawling on the treated area and also via the oral route through hand-to-mouth activities.<br><br>Garden lime or fertilizer including lime is used to treat acidic soil. Therefore, after application to the soil and subsequent watering the hazard driving effect of lime (alkalinity) will be quickly neutralized. Exposure to lime substances will be negligible within a short time after application. |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Environmental exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| No quantitative environmental exposure assessment is carried out because the operational conditions and risk management measures for consumer use are less stringent than those outlined for professional agricultural soil protection. Moreover, the neutralisation/pH-effect is the intended and desired effect in the soil compartment. Releases to wastewater are not expected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

# PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

## ES number 9.15: Consumer use of lime substances as water treatment chemicals

Exposure Scenario Format (2) addressing uses carried out by consumers

### 1. Title

**Free short title**

Consumer use of lime substances as water treatment chemicals

**Systematic title based on use descriptor**

SU21, PC20, PC37, ERC8b

**Processes, tasks activities covered**

Loading, filling or re-filling of solid formulations into container/preparation of lime milk

Application of lime milk to water

**Assessment Method\***

Human health:

A qualitative assessment has been performed for oral and dermal exposure as well as for exposure of the eye. Dust exposure has been assessed by the Dutch model (van Hemmen, 1992).

Environment:

A qualitative justification assessment is provided.

### 2. Operational conditions and risk management measures

**RMM**

No further product integrated risk management measures are in place.

**PC/ERC**

**Description of activity referring to article categories (AC) and environmental release categories (ERC)**

PC 20/37

Filling and re-filling (transfer of lime substances (solid)) of lime reactor for water treatment. Transfer of lime substances (solid) into container for further application.

Dropwise application of lime milk to water.

ERC 8b

Wide dispersive indoor use of reactive substances in open systems

#### 2.1 Control of consumers exposure

**Product characteristic**

| Description of the preparation | Concentration of the substance in the preparation | Physical state of the preparation                                               | Dustiness (if relevant)                                                         | Packaging design                             |
|--------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------|
| Water treatment chemical       | Up to 100%                                        | Solid, fine powder                                                              | high dustiness (indicative value from DIY fact sheet see <u>section 9.0.3</u> ) | Bulk in bags or buckets/containers.          |
| Water treatment chemical       | Up to 99 <                                        | Solid, granular of different size (D50 value 0.7 D50 value 1.75 D50 value 3.08) | low dustiness (reduction by 10% compared to powder)                             | Bulk-tank lorry or in „Big Bags“ or in sacks |

**Amounts used**

**Description of the preparation**

**Amount used per event**

Water treatment chemical in lime reactor for aquaria

depending on the size of the water reactor to be filled (~ 100g /L)

Water treatment chemical in lime reactor for drinking water

depending on the size of the water reactor to be filled (~up to 1.2 kg/L)

Lime milk for further application

~ 20 g / 5L

**Frequency and duration of use/exposure**

**Description of task**

**Duration of exposure per event**

**frequency of events**

Preparation of lime milk (loading, filling and refilling)

1.33 min  
(DIY-fact sheet, RIVM, Chapter 2.4.2  
Mixing and loading of powders)

1 task/month  
1task/week

Dropwise application of lime milk to water

Several minutes - hours

1 tasks/ month

**Human factors not influenced by risk management**

| Description of the task                                   | Population exposed | Breathing rate          | Exposed body part  | Corresponding skin area [cm <sup>2</sup> ] |
|-----------------------------------------------------------|--------------------|-------------------------|--------------------|--------------------------------------------|
| Preparation of lime milk (loading, filling and refilling) | adult              | 1.25 m <sup>3</sup> /hr | Half of both hands | 430<br>(RIVM report<br><u>320104007</u> )  |
| Dropwise application of lime milk to water                | adult              | NR                      | Hands              | 860<br>(RIVM report<br><u>320104007</u> )  |

**Other given operational conditions affecting consumers exposure**

| Description of the task | Indoor/outdoor | Room volume | Air exchange rate |
|-------------------------|----------------|-------------|-------------------|
|-------------------------|----------------|-------------|-------------------|

# PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

|                                                           |                |                                                               |                                   |
|-----------------------------------------------------------|----------------|---------------------------------------------------------------|-----------------------------------|
| Preparation of lime milk (loading, filling and refilling) | Indoor/outdoor | 1 m <sup>3</sup> (personal space, small area around the user) | 0.6 hr" (unspecified room indoor) |
| Dropwise application of lime milk to water                | indoor         | NR                                                            | NR                                |

## Conditions and measures related to information and behavioural advice to consumers

Do not get in eyes, on skin, or on clothing. Do not breathe dust  
Keep container closed and out of reach of children.  
Use only with adequate ventilation.  
In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.  
Wash thoroughly after handling.

Do not mix with acids and always add limes to water and not water to limes.

## Conditions and measures related to personal protection and hygiene

Wear suitable gloves, goggles and protective clothes. Use a filtering half mask (mask type FFP2 acc. to EN 149).

## 2.2 Control of environmental exposure

### Product characteristics

Not relevant for exposure assessment

### Amounts used\*

Not relevant for exposure assessment

### Frequency and duration of use

Not relevant for exposure assessment

### Environment factors not influenced by risk management

Default river flow and dilution

### Other given operational conditions affecting environmental exposure

Indoor

### Conditions and measures related to municipal sewage treatment plant

Default size of municipal sewage system/treatment plant and sludge treatment technique

### Conditions and measures related to external treatment of waste for disposal

Not relevant for exposure assessment

### Conditions and measures related to external recovery of waste

Not relevant for exposure assessment

## 3. Exposure estimation and reference to its source

The risk characterisation ratio (RCR) is the quotient of the refined exposure estimate and the respective DNEL (derived no-effect level) and is given in parentheses below. For inhalation exposure, the RCR is based on the acute DNEL for lime substances of 4 mg/m<sup>3</sup> (as respirable dust) and the respective inhalation exposure estimate (as inhalable dust). Thus, the RCR includes an additional safety margin since the respirable fraction is a sub-fraction of the inhalable fraction according to EN 481. Since lime substances are classified as irritating to skin and eyes a qualitative assessment has been performed for dermal exposure and exposure to the eye.

### Human exposure

#### Preparation of lime milk (loading )

| Route of exposure | Exposure estimate | Method used, comments |
|-------------------|-------------------|-----------------------|
|-------------------|-------------------|-----------------------|

Oral

Qualitative assessment  
Oral exposure does not occur as part of the intended product use.  
Qualitative assessment

|                 |                                                                                |
|-----------------|--------------------------------------------------------------------------------|
| Dermal (powder) | small task: 0.1 µg/cm <sup>2</sup> (-)<br>large task: 1 µg/cm <sup>2</sup> (-) |
|-----------------|--------------------------------------------------------------------------------|

If risk reduction measures are taken into account no human exposure is expected. However, dermal contact to dust from loading of limes or direct contact to the lime cannot be excluded if no protective gloves are worn during application. This may occasionally result in mild irritation easily avoided by prompt rinsing with water.

Quantitative assessment

The constant rate model of ConsExpo has been used. The contact rate to dust formed while pouring powder has been taken from the DIY-fact sheet (RIVM report 320104007). For granules the exposure estimate will be even lower.

|     |      |
|-----|------|
| Eye | Dust |
|-----|------|

Qualitative assessment

If risk reduction measures are taken into account no human exposure is expected. Dust from loading of the limes cannot be excluded if no protective goggles are used. Prompt rinsing with water and seeking medical advice after accidental exposure is advisable.

|                     |                                                                                      |
|---------------------|--------------------------------------------------------------------------------------|
| Inhalation (powder) | Small task: 12 µg/m <sup>3</sup> (0.003)<br>Large task: 120 µg/m <sup>3</sup> (0.03) |
|---------------------|--------------------------------------------------------------------------------------|

Quantitative assessment

Dust formation while pouring the powder is addressed by using the Dutch model (van Hemmen, 1992, as described in section 9.0.3.1 above).

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Inhalation<br>(granules)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Small task: 1.2 pg/m <sup>3</sup> (0.0003)<br>Large task: 12 pg/m <sup>3</sup> (0.003) | Quantitative assessment<br>Dust formation while pouring the powder is addressed by using the Dutch model (van Hemmen, 1992 as described in section 9.0.3.1 above) and applying a dust reduction factor of 10 for the granular form.                                                                                                                                                                                                          |
| <b>Dropwise application of lime milk to water</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Route of exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Exposure estimate</b>                                                               | <b>Method used, comments</b>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Oral                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                        | Qualitative assessment<br>Oral exposure does not occur as part of the intended product use.                                                                                                                                                                                                                                                                                                                                                  |
| Dermal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Droplets or splashes                                                                   | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, splashes on the skin cannot be excluded if no protective gloves are worn during application. Splashes may occasionally result in mild irritation easily avoided by immediate rinsing of the hands in water.                                                                                                              |
| Eye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Droplets or splashes                                                                   | Qualitative assessment<br>If risk reduction measures are taken into account no human exposure is expected. However, splashes into the eyes cannot be excluded if no protective goggles are worn during the application. However, it is rare for eye irritation to occur as a result of exposure to a clear solution of calcium hydroxide (lime water) and mild irritation can easily be avoided by immediate rinsing of the eyes with water. |
| Inhalation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                        | Qualitative assessment<br>Not expected, as the vapour pressure of limes in water is low and generation of mists or aerosols does not take place.                                                                                                                                                                                                                                                                                             |
| <b>Environmental exposure</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| The pH impact due to use of lime in cosmetics is expected to be negligible. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment. |                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                              |

## PRODUCT SAFETY DATA SHEET for Ca(OH)<sub>2</sub>

prepared in accordance with Annex II of the REACH Regulation EC 1907/2006,  
Regulation (EC) 1272/2008 and Regulation (EC) 453/2010

Version: September 2010 1.0/EN

Revision date: 17 November 2010

Printing Date: 17 November 2010

### ES number 9.16: Consumer use of cosmetics containing lime substances

Exposure Scenario Format (2) addressing uses carried out by consumers

#### 1. Title

**Free short title**

Consumer use of cosmetics containing limes

**Systematic title based on use descriptor**

SU21, PC39, ERC8a

**Processes, tasks activities covered**

Human health:

According to Article 14(5) (b) of regulation (EC) 1907/2006 risks to human health need not be considered for substances included in cosmetic products within the scope of Directive 76/768/EC.

Environment

A qualitative justification assessment is provided.

**Assessment Method\***

#### 2. Operational conditions and risk management measures

ERC 8a | Wide dispersive indoor use of processing aids in open systems

##### 2.1 Control of consumers exposure

**Product characteristic**

Not relevant, as the risk to human health from this use does not need to be considered.

**Amounts used**

Not relevant, as the risk to human health from this use does not need to be considered.

**Frequency and duration of use/exposure**

Not relevant, as the risk to human health from this use does not need to be considered.

**Human factors not influenced by risk management**

Not relevant, as the risk to human health from this use does not need to be considered.

**Other given operational conditions affecting consumers exposure**

Not relevant, as the risk to human health from this use does not need to be considered.

**Conditions and measures related to information and behavioural advice to consumers**

Not relevant, as the risk to human health from this use does not need to be considered.

**Conditions and measures related to personal protection and hygiene**

Not relevant, as the risk to human health from this use does not need to be considered.

##### 2.2 Control of environmental exposure

**Product characteristics**

Not relevant for exposure assessment

**Amounts used\***

Not relevant for exposure assessment

**Frequency and duration of use**

Not relevant for exposure assessment

**Environment factors not influenced by risk management**

Default river flow and dilution

**Other given operational conditions affecting environmental exposure**

Indoor

**Conditions and measures related to municipal sewage treatment plant**

Default size of municipal sewage system/treatment plant and sludge treatment technique

**Conditions and measures related to external treatment of waste for disposal**

Not relevant for exposure assessment

**Conditions and measures related to external recovery of waste**

Not relevant for exposure assessment

#### 3. Exposure estimation and reference to its source

**Human exposure**

Human exposure to cosmetics will be addressed by other legislation and therefore need not be addressed under regulation (EC) 1907/2006 according to Article 14(5) (b) of this regulation.

**Environmental exposure**

The pH impact due to use of lime in cosmetics is expected to be negligible. The influent of a municipal wastewater treatment plant is often neutralized anyway and lime may even be used beneficially for pH control of acid wastewater streams that are treated in biological WWTPs. Since the pH of the influent of the municipal treatment plant is circum neutral, the pH impact is negligible on the receiving environmental compartments, such as surface water, sediment and terrestrial compartment.

End of the safety data sheet



# Phosphoric acid

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

Revision date: 20/04/2012

Version: 3.1

### SECTION 1: Identification of the substance/mixture and of the company/undertaking

#### 1.1. Product identifier

|                        |                                                    |
|------------------------|----------------------------------------------------|
| Product form           | : Substance                                        |
| Trade name             | : Phosphoric acid                                  |
| Chemical name          | : Orthophosphoric acid                             |
| EC index no            | : 015-011-00-6                                     |
| EC no                  | : 231-633-2                                        |
| CAS No.                | : 7664-38-2                                        |
| REACH registration No. | : 01-2119485924-24-0021                            |
| Product code           | : Prayphos - 001                                   |
| Formula                | : H <sub>3</sub> PO <sub>4</sub>                   |
| Synonyms               | : Orthophosphoric acid, E338, PRAYPHOS (P5, CODEX) |
| Product group          | : acid                                             |

#### 1.2. Relevant identified uses of the substance or mixture and uses advised against

##### 1.2.1. Relevant identified uses

Intended for general public

|                                  |                                                                                                                                                                                                                                                                                             |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Use of the substance/preparation | : Substance used as such, in formulation or in formulation of products for :<br>Food additive<br>PC 19:Intermediate<br>Metal treatment<br>Detergent<br>Substance of laboratory<br>Fertilizer<br>In construction and building products (paint, varnished, coating, ...).<br>Welding industry |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

##### 1.2.2. Uses advised against

| Title           | Use descriptors | Reason |
|-----------------|-----------------|--------|
| Phosphoric acid |                 | None   |

Full text of use descriptors: see section 16.

#### 1.3. Details of the supplier of the safety data sheet

PRAYON S.A.  
Rue Joseph Wauters, 144  
B-4480 Engis - Belgique-Belgium  
T +32 (0)4 273 92 11 - F +32 (0)4 273 96 35  
[Reachcustomer@prayon.be](mailto:Reachcustomer@prayon.be) - [www.prayon.be](http://www.prayon.be)

#### 1.4. Emergency telephone number

| Country               | Official advisory body                                                                                          | Address                                                    | Emergency number              |
|-----------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------------|
| ICELAND               | Iceland Poisons Information Centre<br>Landspítali University Hospital                                           | Fossvogi<br>108Reykjavik                                   | +354 525 111<br>+354 543 2222 |
| IRELAND (REPUBLIC OF) | National Poisons Information Centre<br>Beaumont Hospital                                                        | Beaumont Hospital Beaumont Road<br>9Dublin                 | : +353 1 8379964              |
| ISRAEL                | Israel Poisons Information Centre<br>Rambam Medical Centre                                                      | PO Box 9602<br>31096Haifa                                  | +972 4 854 1900               |
| UNITED KINGDOM        | National Poisons Information Service (Belfast Centre)<br>Royal Victoria Hospital                                | Grosvenor Road<br>BT12 6BABelfast                          | 0870 600 6266 (UK only),      |
| UNITED KINGDOM        | National Poisons Information Service (Birmingham Centre)<br>City Hospital                                       | Dudley Road<br>B18 7QHBirmingham                           | 0870 600 6266 (UK only)       |
| UNITED KINGDOM        | National Poisons Information Service (Cardiff Centre)<br>Gwenwyn Ward, Llandough Hospital                       | Penarth<br>CF64 2XXCardiff                                 | 0870 600 6266 (UK only)       |
| UNITED KINGDOM        | NPIS Edinburgh (Scottish Poisons Information Bureau)<br>Royal Infirmary of Edinburgh                            | 51 Little France Crescent<br>EH16 4SAEdinburgh             | 0870 600 6266 (UK only)       |
| UNITED KINGDOM        | Guy's & St Thomas' Poisons Unit<br>Medical Toxicology Unit, Guy's & St Thomas' Hospital Trust                   | Avonley Road<br>SE14 5ERLondon                             | 0870 243 2241                 |
| UNITED KINGDOM        | National Poisons Information Service (Newcastle Centre)<br>Regional Drugs and Therapeutics Centre, Wolfson Unit | Claremont Place<br>Newcastle-upon-Tyne<br>NE1 4LPNewcastle | 0870 600 6266 (UK only)       |

# Phosphoric acid

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

### SECTION 2: Hazards identification

#### 2.1. Classification of the substance or mixture

##### Classification according to Regulation (EC) No. 1272/2008 [CLP]

Skin Corr. 1B

H314

Full text of H-phrases: see section 16

##### Classification according to Directive 67/548/EEC or 1999/45/EC

C; R34

Full text of R-phrases: see section 16

##### Adverse physicochemical, human health and environmental effects

No additional information available

#### 2.2. Label elements

##### Labelling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP)



GHS05

Signal word (CLP)

: Danger

Hazard statements (CLP)

: H314 - Causes severe skin burns and eye damage

Precautionary statements (CLP)

: P260 - Do not breathe dust, fume, gas, mist, vapours, spray.  
P280 - Wear protective gloves, protective clothing, eye protection, face shield.  
P301+P330+P331 - If swallowed: Rinse mouth. Do NOT induce vomiting.  
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing  
P310 - Immediately call a POISON CENTER or doctor/physician  
P303+P361+P353 - IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower  
P234 - Keep only in original container

#### 2.3. Other hazards

This substance/mixture does not meet the PBT criteria of REACH, annex XIII.

This substance/mixture does not meet the vPvB criteria of REACH, annex XIII.

### SECTION 3: Composition/information on ingredients

#### 3.1. Substances

Name : PHOSPHORIC ACID  
CAS No. : 7664-38-2  
EC no : 231-633-2  
EC index no : 015-011-00-6

| Name                 | Product identifier                                                  | %       | Classification according to Directive 67/548/EEC |
|----------------------|---------------------------------------------------------------------|---------|--------------------------------------------------|
| Orthophosphoric acid | (CAS No.)7664-38-2<br>(EC no)231-633-2<br>(EC index no)015-011-00-6 | 30 - 85 | C; R34                                           |

| Name                 | Product identifier                                                  | %       | Classification according to Regulation (EC) No. 1272/2008 [CLP] |
|----------------------|---------------------------------------------------------------------|---------|-----------------------------------------------------------------|
| Orthophosphoric acid | (CAS No.)7664-38-2<br>(EC no)231-633-2<br>(EC index no)015-011-00-6 | 30 - 85 | Skin Corr. 1B, H314                                             |

Full text of R-, H- and EUH-phrases: see section 16

#### 3.2. Mixtures

Not applicable

# Phosphoric acid

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

### SECTION 4: First aid measures

#### 4.1. Description of first aid measures

- First-aid measures after inhalation : If persistent breathing troubles, immediately seek medical attention. Remove victim to fresh air.
- First-aid measures after skin contact : Remove contaminated clothing and shoes. In case of skin contact, immediately wash with suitable product and rinse with plenty of water (20-30 min). Wash contaminated clothing before reuse. Call a doctor.
- First-aid measures after eye contact : With eyelid retractor, rinse thoroughly with water during 20-30 minutes. Call a doctor.
- First-aid measures after ingestion : If swallowed, rinse mouth with water (only if the person is conscious). Do not induce vomiting. Call a doctor.

#### 4.2. Most important symptoms and effects, both acute and delayed

- Symptoms/injuries : The vapour causes slight irritations in eyes, throat and skin.
- Symptoms/injuries after skin contact : Burns upon contact with the skin.

#### 4.3. Indication of any immediate medical attention and special treatment needed

An endoscope or a stomach wash might be considered but might cause several stomach or oesophagus damage.

### SECTION 5: Firefighting measures

#### 5.1. Extinguishing media

- Suitable extinguishing media : Powder. Foam. Water spray.
- Unsuitable extinguishing media : Do not use a heavy water stream.

#### 5.2. Special hazards arising from the substance or mixture

- Fire hazard : Not flammable.
- Explosion hazard : Contact with metals produces hydrogen which may form explosive mixtures with air.
- Reactivity : Reacts with strong bases. Contact with metals may release flammable hydrogen.

#### 5.3. Advice for firefighters

- Firefighting instructions : Use water spray/fog for cooling.
- Protection during firefighting : Wear complete protective anti-acid clothings, gloves and boots. Use an autonomous respiratory protection. SECTION 8.

### SECTION 6: Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

##### 6.1.1. For non-emergency personnel

No additional information available

##### 6.1.2. For emergency responders

- Protective equipment : Spill should be handled by trained cleaning personnel properly equipped with anti-acid protective clothing, gloves and boots (see section 8).
- Emergency procedures : Keep public away from danger area.

#### 6.2. Environmental precautions

Clean up any spills as soon as possible, using an absorbent material to collect it. Prevent entry to sewers and public waters. Avoid soil contamination.

#### 6.3. Methods and material for containment and cleaning up

- Methods for cleaning up : Ventilate area. Transfer in an appropriate container properly labelled in order to set up a future treatment. Neutralize with sodium carbonate, calcium carbonate, or lime. Flush with plenty of water.

#### 6.4. Reference to other sections

See section 8 and 13 for more information.

### SECTION 7: Handling and storage

#### 7.1. Precautions for safe handling

- Precautions for safe handling : Good ventilation of the workplace required. Follow the exposure limits given on this material safety data sheet. Use suitable material. For preference use pumping techniques for unloading and discharging. Provide an adapted retention system. Avoid all contact with this substance. Do not breathe vapours. Never use water or any aqueous agent into tanks or containers. Dilutions or neutralizations are very highly exothermic. Avoid : Spatters. In case of dilution, always pour the acid in water and not the opposite. Do not mix with : incompatible materials (see section 10.5).
- Hygiene measures : Wash hands and other exposed areas with mild soap and water before eat, drink or smoke and when leaving work. When using do not eat, drink or smoke. Remove contaminated clothing and shoes.

# Phosphoric acid

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

### 7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store in dry, cool, well-ventilated area. Keep away from alkalis, sulfides, cyanides and metal powders. Do not store under direct sun light. Store at room temperature above crystallization point. Compatible materials : Stainless steel. High-density polyethylene. glass.

### 7.3. Specific end use(s)

No additional information available

## SECTION 8: Exposure controls/personal protection

### 8.1. Control parameters

| Phosphoric acid(7664-38-2)            |                          |                |
|---------------------------------------|--------------------------|----------------|
| EU                                    | IOELV TWA (mg/m³)        | 1 mg/m³        |
| EU                                    | IOELV STEL (mg/m³)       | 2 mg/m³        |
| EU                                    | Notation                 | DIR 2000/39/CE |
| Belgium                               | Limit value (mg/m³)      | 1 mg/m³        |
| Belgium                               | Short time value (mg/m³) | 2 mg/m³        |
| France                                | VLE (mg/m³)              | 1 mg/m³        |
| France                                | VME (mg/m³)              | 2 mg/m³        |
| Phosphoric acid(7664-38-2)            |                          |                |
| DNEL/DMEL (Workers)                   |                          |                |
| Long-term - local effects, inhalation | 2,92 mg/m³               |                |
| DNEL/DMEL (General population)        |                          |                |
| Long-term - local effects, inhalation | 0,73 mg/m³               |                |
| PNEC (Water)                          |                          |                |
| PNEC aqua (freshwater)                | pH: 6-9                  |                |

### 8.2. Exposure controls

Appropriate engineering controls : Use in closed process (for example in close loop system). Good ventilation of the workplace required. Provide a regular control of the atmosphere. Please refer to the annex (exposure scenarios).

Personal protective equipment : Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Hand protection : Use gloves resistant to chemical products corresponding to EN 374:3". Take advice to gloves' manufacturer .".

Eye protection : Chemical goggles or face shield with safety glasses according to EN 166.

Skin and body protection : Wear protective clothing adapted to the risks of acid projection and acidproof (tests of resistance according to EN 368-369). Wear impervious rubber safety shoes.

Respiratory protection : Use only in well ventilated areas. Where excessive aerosol or vapour may result, wear an approved respiratory protection (with filter corresponding to EN 143)".".

Environmental exposure controls : For preference use pumping techniques for unloading and discharging.

# Phosphoric acid

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according to Regulation (EC) No. 453/2010

### SECTION 9: Physical and chemical properties

#### 9.1. Information on basic physical and chemical properties

|                                            |                                                                                               |
|--------------------------------------------|-----------------------------------------------------------------------------------------------|
| Physical state                             | : Viscous liquid.                                                                             |
| Molecular mass                             | : 98 g/mol                                                                                    |
| Colour                                     | : Colourless.                                                                                 |
| Odour                                      | : Acrid.                                                                                      |
| Odour threshold                            | : No data available                                                                           |
| pH                                         | : 0                                                                                           |
| Relative evaporation rate (butylacetate=1) | : No data available                                                                           |
| Melting point                              | : 30%: -11,8 °C - 50%: -41,9 °C - 62,5%: -85 °C - 70%: -43 °C - 85%: +21,1 °C                 |
| Freezing point                             | : No data available                                                                           |
| Boiling point                              | : 30%: 101,8 °C - 50%: 108 °C - 85%: 158 °C                                                   |
| Flash point                                | : Not flammable                                                                               |
| Self ignition temperature                  | : Not applicable                                                                              |
| Decomposition temperature                  | : No data available                                                                           |
| Flammability (solid, gas)                  | : Not applicable                                                                              |
| Vapour pressure                            | : Not applicable                                                                              |
| Relative vapour density at 20 °C           | : No data available                                                                           |
| Relative density                           | : No data available                                                                           |
| Density                                    | : 30%: (25 °C) 1,1794 g/cm <sup>3</sup> - 50% - 85%:(25 °C) 1,3334 - 1,6850 g/cm <sup>3</sup> |
| Solubility                                 | : Water: 100 %                                                                                |
| Log Pow                                    | : No data available                                                                           |
| Log Kow                                    | : No data available                                                                           |
| Viscosity, kinematic                       | : No data available                                                                           |
| Viscosity, dynamic                         | : 30%-85%: (30 °C) 2.0-32 mPa.s                                                               |
| Explosive properties                       | : Not explosive.                                                                              |
| Oxidising properties                       | : No data available                                                                           |
| Explosive limits                           | : Not explosive                                                                               |

#### 9.2. Other information

|                        |                                                                                  |
|------------------------|----------------------------------------------------------------------------------|
| Other properties       | : Crystallization point = 75% : -20°C / 80% : 4 °C / 81.5% : 7 °C / 85% : 21 °C. |
| Additional information | : Miscible with water                                                            |

### SECTION 10: Stability and reactivity

#### 10.1. Reactivity

Reacts with strong bases. Contact with metals may release flammable hydrogen.

#### 10.2. Chemical stability

Stable under normal conditions of handling and storage.

#### 10.3. Possibility of hazardous reactions

Contact with sulfides and cyanides liberates toxic gas.

#### 10.4. Conditions to avoid

Light (daylight). High temperature.

#### 10.5. Incompatible materials

Alkali. Caustic products. No noble metals.

#### 10.6. Hazardous decomposition products

May liberate toxic gases.

### SECTION 11: Toxicological information

#### 11.1. Information on toxicological effects

|                |                  |
|----------------|------------------|
| Acute toxicity | : Not classified |
|----------------|------------------|

| Phosphoric acid(7664-38-2) |                                             |
|----------------------------|---------------------------------------------|
| LD50 oral rat              | 2600 mg/kg bodyweight OECD 423              |
| LD50 dermal rat            | (No data available specific to the product) |
| LC50 inhalation rat (mg/l) | (No data available specific to the product) |

|                           |                      |
|---------------------------|----------------------|
| Skin corrosion/irritation | : Corrosive<br>pH: 0 |
|---------------------------|----------------------|

# Phosphoric acid

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according to Regulation (EC) No. 453/2010

|                                                    |                                                                                                                                                                            |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Serious eye damage/irritation                      | : Corrosive<br>pH: 0                                                                                                                                                       |
| Respiratory or skin sensitisation                  | : Not classified<br>Not relevant.<br>Corrosive product                                                                                                                     |
| Germ cell mutagenicity                             | : Not mutagenic. OECD 471/473/476                                                                                                                                          |
| Carcinogenicity                                    | : Not a carcinogen suspected agent.                                                                                                                                        |
| Reproductive toxicity                              | : Not classified as toxic to reproduction (EC). Developmental toxicity: NOAEL: $\geq 410$ mg/kg bw, rat, OECD 422. Fertility: NOAEL $\geq 500$ mg/kg bw/day, rat, OECD 422 |
| Specific target organ toxicity (single exposure)   | : Not classified                                                                                                                                                           |
| Specific target organ toxicity (repeated exposure) | : Not classified                                                                                                                                                           |

| Phosphoric acid(7664-38-2)            |                                   |
|---------------------------------------|-----------------------------------|
| NOAEL (oral, rat, 90 days)            | 250 mg/kg bodyweight/day OECD 422 |
| NOAEL (dermal, rat/rabbit, 90 days)   | No data available                 |
| NOAEL (inhalation, rat, gas, 90 days) | No data available                 |

Aspiration hazard : No significant hazards.

## SECTION 12: Ecological information

### 12.1. Toxicity

| Phosphoric acid(7664-38-2) |                                                            |
|----------------------------|------------------------------------------------------------|
| LC50 fish 1                | 3 - 3,25 mg/l (96h) <i>Lepomis macrochirus</i>             |
| EC50 Daphnia 1             | > 100 mg/l (48h) <i>Daphnia magna</i> , OECD 202           |
| ErC50 (algae)              | > 100 mg/l (72h) <i>Desmodesmus subspicatus</i> , OECD 201 |
| NOEC chronic algae         | 100 mg/l (72h) <i>Desmodesmus subspicatus</i> , OECD 201   |

### 12.2. Persistence and degradability

| Phosphoric acid(7664-38-2)    |               |
|-------------------------------|---------------|
| Persistence and degradability | Not relevant. |

### 12.3. Bioaccumulative potential

| Phosphoric acid(7664-38-2) |               |
|----------------------------|---------------|
| Bioaccumulative potential  | Not relevant. |

### 12.4. Mobility in soil

| Phosphoric acid(7664-38-2) |                   |
|----------------------------|-------------------|
| Mobility in soil           | No data available |

### 12.5. Results of PBT and vPvB assessment

| Phosphoric acid(7664-38-2)                                                   |  |
|------------------------------------------------------------------------------|--|
| This substance/mixture does not meet the PBT criteria of REACH, annex XIII.  |  |
| This substance/mixture does not meet the vPvB criteria of REACH, annex XIII. |  |

### 12.6. Other adverse effects

Other adverse effects : None.

## SECTION 13: Disposal considerations

### 13.1. Waste treatment methods

|                           |                                                                                                                                                                                                              |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Waste treatment methods   | : Comply with local regulations for disposal. Neutralize with sodium carbonate, calcium carbonate, or lime.                                                                                                  |
| Additional information    | : When totally empty, containers are recyclable like any other packing. Storage containers must be free of contamination before use. Dispose in a safe manner in accordance with local/national regulations. |
| Ecology - waste materials | : See the European waste catalogue.                                                                                                                                                                          |

## SECTION 14: Transport information

In accordance with ADR / RID / ADNR / IMDG / ICAO / IATA

### 14.1. UN number

UN-No. : 1805

### 14.2. UN proper shipping name

|                                |                                                |
|--------------------------------|------------------------------------------------|
| Proper Shipping Name           | : PHOSPHORIC ACID, LIQUID                      |
| Transport document description | : UN 1805 PHOSPHORIC ACID, LIQUID, 8, III, (E) |

# Phosphoric acid

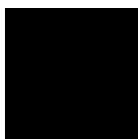
## Safety Data Sheet

according to Regulation (EC) No. 453/2010

### 14.3. Transport hazard class(es)

Class (UN) : 8

Hazard labels (UN) : 8



### 14.4. Packing group

Packing group (UN) : III

### 14.5. Environmental hazards

Other information : No supplementary information available.

### 14.6. Special precautions for user

#### 14.6.1. Overland transport

Hazard identification number (Kemler No.) : 80

Classification code (UN) : C1

Orange plates :



Tunnel restriction code : E

LQ : LQ07

Excepted quantities (ADR) : E1

#### 14.6.2. Transport by sea

Ship Safety Act : Corrosive

Port Regulation Law : Corrosive

MFAG-No. : 154

#### 14.6.3. Air transport

Civil Aeronautics Law : Corrosive

### 14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

## SECTION 15: Regulatory information

### 15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

#### 15.1.1. EU-Regulations

No REACH Annex XVII restrictions

Contains no REACH candidate substance

Other regulations, restrictions and prohibition regulations : Not a Seveso substance. Not an ozone depleting substance. Not a persistent organic pollutant.

#### 15.1.2. National regulations

Water hazard class (WGK) : 1 - slightly hazardous to water

### 15.2. Chemical safety assessment

A Chemical Safety Assessment has been carried out.

## SECTION 16: Other information

Indication of changes:

according to Regulation (EC) No. 1907/2006 (REACH).

Data sources : Reach dossier.

# Phosphoric acid

## Safety Data Sheet

according to Regulation (EC) No. 453/2010

### Abbreviations and acronyms

: ADN: European Agreement concerning international carriage of Dangerous goods by Inland waterways  
ADR: European Agreement concerning international carriage of Dangerous goods by Road  
AF : Assessment factor  
BCF : Bioconcentration factor  
Bw: Body weight  
CAS: Chemical Abstracts Service  
CLP : Classification, labelling, packaging  
CSR: Chemical Safety Report  
DMEL : Derived maximum effect level  
DNEL: Derivative No effect Level  
EC: European Community  
ELV : Emission limit values  
EN: European Norm  
EUH: European Hazard Statement  
EWC : European Waste catalogue  
IATA: International Air Transport Association  
ICAO: International Civil Aviation Organization  
IMDG: International Maritime Dangerous Goods  
LC50: Median lethal concentration  
LD50 : Median lethal dose  
NOAEL : No-observed-adverse-effect-level  
NOEC : No observed effect concentration  
NOEL : No observed effect level  
OEL : Operator exposure level  
PBT: Persistent, bioaccumulative, Toxic  
PEC : Predicted effect level  
PNEC: Predicted No effect Concentration  
REACH : Registration, evaluation and autorisation of chemicals  
RID: Regulations concerning the international carriage of dangerous goods by rail  
STEL: Short Term Exposure Limit  
TWA : Time weighted average  
vPvB: Very persistent, very bioaccumulative.

### Training advice

: None.

### Full text of R-, H- and EUH-phrases::

|               |                                         |
|---------------|-----------------------------------------|
| Skin Corr. 1B | skin corrosion/irritation Category 1B   |
| H314          | Causes severe skin burns and eye damage |
| R34           | Causes burns.                           |
| C             | Corrosive                               |

### SDS EU (REACH Annex II)

*This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.*  
**DISCLAIMER OF LIABILITY** The information in this MSDS was obtained from sources which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use or disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable

**ORTHOPHOSPHORIC ACID****EC number : 231-633-2****CAS number : 7664-38-2****Exposure scenarios**

Réf: version2\_Feb2012

# **SUMMARY OF EXPOSURE SCENARIOS**

## **Orthophosphoric acid**

|                                                                                   |                                                                                                             |                                                               |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | <p><b>ORTHOPHOSPHORIC ACID</b></p> <p><b>EC number : 231-633-2</b></p> <p><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

## Annex: summary of relevant exposure scenarios

|                                                     |    |
|-----------------------------------------------------|----|
| ES2: Industrial use of orthophosphoric acid .....   | 3  |
| ES3: Professional use of orthophosphoric acid ..... | 13 |
| ES4: Consumer use of orthophosphoric acid .....     | 22 |

|                                                                                   |                                                                                                                                                                  |                                                               |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;"><b>EC number : 231-633-2</b><br/><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

## ES2: Industrial use of orthophosphoric acid

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Short title of exposure scenario 2</b>                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Industrial use of orthophosphoric acid                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>2. Description of activities and processes covered in the exposure scenario</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Sector of use (SU)                                                                 | SU 3: Industrial uses: uses of substances as such or in preparations at industrial sites<br>SU 8: Manufacture of bulk, large scale chemicals (including petroleum products)<br>SU4: Manufacture of food products<br>SU 9: Manufacture of fine chemicals<br>SU 10: formulation (mixing) of preparations and/or repackaging (excluding alloys)<br>SU 15: Manufacture of fabricated metal products, except machinery and equipment<br>SU 16: Manufacture of computer, electronic and optical products, electrical equipment<br>SU 17: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Product category (PC)                                                              | PC 0: other<br>PC 1: Adhesives<br>PC 7: Base metals and alloys<br>PC 9a: Coatings and paints, thinners, paint removers<br>PC 9b: Fillers, putties, plasters, modelling clay<br>PC 13: Fuels<br>PC 14: Metal surface treatment products, including galvanic and electroplating products<br>PC 19: Intermediate<br>PC 20: Products such as pH-regulators, flocculants, precipitants, neutralisation agents<br>PC 21: Laboratory chemicals<br>PC 23: Leather tanning, dye, finishing, impregnation and care products<br>PC 24: Lubricants, greases, release products<br>PC 25: Metal working fluids<br>PC 26: Paper and board dye, finishing and impregnation products: including bleaches and other processing aids<br>PC 32: Polymer preparations and compounds<br>PC 34: Textile dyes, finishing and impregnating products: including bleaches and other processing aids<br>PC 35: Washing and cleaning products (including solvent based products)<br>PC 37: Water treatment products<br>PC 39: Cosmetics, personal care products                                            |
| Process category (PROC)                                                            | PROC 1: Use in closed process, no likelihood of exposure.<br>PROC 2: Use in closed, continuous process with occasional controlled exposure.<br>PROC 3: Use in closed batch process (synthesis or formulation).<br>PROC 4: Use in batch and other process (synthesis) where opportunity for exposure arises.<br>PROC 5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact).<br>PROC 7: Industrial spraying.<br>PROC 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.<br>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities.<br>PROC 9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing).<br>PROC 10: Roller application or brushing.<br>PROC 13: Treatment of articles by dipping and pouring.<br>PROC 14: Production of preparations or articles by tableting, compression, extrusion, |

|                                                                                   |                                                                                                                                                          |                                                               |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | <p align="center"><b>ORTHOPHOSPHORIC ACID</b></p> <p align="center"><b>EC number : 231-633-2</b></p> <p align="center"><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

|                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                       | <p>pelletisation.</p> <p>PROC 15: Use as laboratory reagent.</p> <p>PROC 19: Hand-mixing with intimate contact and only PPE available.</p> <p>PROC 22: Potentially closed processing operations with minerals/metals at elevated temperature.</p> <p>PROC 23: Open processing and transfer operations with minerals/metals at elevated temperature.</p>                                                                                                                                 |
| Article category (AC)                                                                                                                                                                                                                                                                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Environmental release category (ERC)                                                                                                                                                                                                                                                                                  | <p>ERC 2 (Formulation of preparations)</p> <p>ERC 3: Formulation in materials.</p> <p>ERC 4: Industrial use of processing aids in processes and products, not becoming part of articles.</p> <p>ERC 6a: Industrial use resulting in manufacture of another substance (use of intermediates).</p> <p>ERC 6b (Industrial use of reactive processing aid)</p> <p>ERC 6d: Industrial use of process regulators for polymerisation processes in production of resins, rubbers, polymers.</p> |
| <b>3. Operational conditions</b>                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>3.1 Operational conditions related with frequency and quantities of use</b>                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Duration of exposure at workplace:                                                                                                                                                                                                                                                                                    | 8 hours/day                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Frequency of exposure at workplace:                                                                                                                                                                                                                                                                                   | Once a day                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Annual amount used per site:                                                                                                                                                                                                                                                                                          | The daily and annual amount/emission per site is not considered to be the main determinant for environmental exposure.                                                                                                                                                                                                                                                                                                                                                                  |
| <b>3.2 Operational conditions related with substance/ product</b>                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Physical state                                                                                                                                                                                                                                                                                                        | Solid / Liquid (including aqueous solutions)                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Concentration of substance in mixture                                                                                                                                                                                                                                                                                 | The concentration of phosphoric acid in industrial application ranges from 10 to 100% and worst case will be taken into account.                                                                                                                                                                                                                                                                                                                                                        |
| <b>3.3 Other relevant operational conditions</b>                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| No information about frequency and duration of the various tasks is available. In the first-tier assessment of exposure a frequency of once a day and an exposure duration of 8 hours was considered. Workers are unlikely to be permanently subject to actual or potential exposure during the entire working shift. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>4. Risk Management Measures</b>                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>4.1 RMMs related to workers</b>                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Organisational measures                                                                                                                                                                                                                                                                                               | <p>The employer must ensure that the required PPE is available and used according to instructions (provide training if necessary). PPE are required when breaching the system or handling the pure substance and concentrated solutions.</p> <p>Safety showers and eye washes are installed to be available in the case of accidental contact.</p>                                                                                                                                      |

|                                                                                   |                                                                                                                                                                  |                                                               |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;"><b>EC number : 231-633-2</b><br/><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

|                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Technical measures                           | <ul style="list-style-type: none"> <li>• Use closed/ automated systems or covering of open containers (e.g. screens) to avoid irritating mists, sprayings and potential splashes. (Good practice)</li> <li>• Transport over pipes, technical barrel filling/emptying of barrel with automatic systems (suction pumps etc.) (Good practice)</li> <li>• Use of pliers, grip arms with long handles with manual use “to avoid direct contact and exposure by splashes (no working over one’s head)” (Good practice)</li> <li>• Store in cool, dry, clean, well ventilate areas. (Good practice).</li> <li>• Local exhaust / general ventilation should be present – see below for processes requiring ventilation.</li> </ul>     |
| Respiratory protection                       | <p>Respiratory protection: Personal Respiratory Equipment (PRE): In situations where aerosols, mists or fogs may be formed it is suggested to wear an all over facemask, containing an appropriate inorganic acid filter or an all-over face mask connected to a fresh air supply (PRE is not required when handling solid phosphoric acid). See below for processes requiring PRE.</p> <p>As modelling tools are likely to produce an over-estimate of the exposure to phosphoric acid, in instances where the company handling the phosphoric acid has workplace monitoring data to show that actual exposures are not a concern it is anticipated that personal respiratory equipment and /or LEV may not be necessary.</p> |
| Hand protection                              | <p>Hand protection is required: Impervious chemical resistant protective gloves are required.</p> <p>Material of gloves. Chloroprene, Neoprene or PVC gloves</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Eye protection                               | <p>Wearing of eye/face protection is required. Goggles or face protection shield should be consistent with EN 166 or equivalent.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Skin and body protection                     | <p>Wearing of suitable protective clothing and rubber boots is required.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Hygiene measures                             | <p>Keep away from foodstuffs, drinks and tobacco. Wash hands before breaks and at end of work. Keep work clothes separate.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>4.2 RMMS related to the environment</b>   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Organisational measures                      | <p>Emissions to the environment must meet the requirements of Council Directive 96/61/EC and national regulations concerning phosphate in industrial water. Regular control of the pH value previous to or during introduction of process wastewaters into open waters is required. In general, discharges should minimise pH changes in receiving surface waters.</p>                                                                                                                                                                                                                                                                                                                                                         |
| Abatement measures related with wastewater   | <p>The efficiency of the process is maximised in such a way that minimal emission of phosphates into the wastewater will occur. In addition, phosphate can be precipitated from the wastewater by addition of metal ions. Phosphoric acid waste should be reused or discharged to the industrial wastewater and further neutralised if needed.</p>                                                                                                                                                                                                                                                                                                                                                                             |
| Abatement measures waste air and solid waste | <p>Phosphoric acid is not expected to be found in the solid waste or to reach the air compartment, due to its low vapour pressure. Therefore, no specific risk management measures for air emissions are provided.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>4.3 Waste related measures</b>            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Type of waste                                | <p>Liquid waste, solid residues, packaging material</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Disposal technique                           | <p>The release of phosphates to wastewater is highly regulated, In addition pH changes in receiving waters should be minimised. The residue of the containers or the used container itself should be disposed in accordance with local and national requirements. See Section 13 of the SDS for more information.</p>                                                                                                                                                                                                                                                                                                                                                                                                          |

|                                                                                   |                                                                                                                                                          |                                                               |
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|  | <p align="center"><b>ORTHOPHOSPHORIC ACID</b></p> <p align="center"><b>EC number : 231-633-2</b></p> <p align="center"><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
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|                                                         |                                                                                                  |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Fraction released to environment during waste treatment | Not determined. The pH of wastewater released from manufacturing sites should be between pH 6-9. |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------|

### 5. Prediction of exposure and comparison of predicted exposure with DNELs (Risk Characterisation)

#### 5.1. Human exposure

|                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                  |                    |                 |                             |        |                               |
|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------|--------------------|-----------------|-----------------------------|--------|-------------------------------|
| Exposure estimation tool(s)                                                               | Workers, inhalation: MEASE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |                  |                    |                 |                             |        |                               |
| Workers (oral)                                                                            | The industrial use of orthophosphoric acid will not result in exposure via the oral route. It is assumed that workers in industrial settings adhere to the principles of good working practice and as such do not eat, smoke or drink near chemicals. Therefore no DNEL or assessment is required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |                  |                    |                 |                             |        |                               |
| Workers (inhalation)<br><br>DNEL/OEL: Worker, long-term, systemic, inhalation: 4.07 mg/m³ | Orthophosphoric acid is corrosive to the eyes. The use of safety goggles is compulsory. Further, some processes require the use of LEV and/or PRE (see below). As modelling tools are likely to produce an over-estimate of the exposure to phosphoric acid, in instances where the company handling the phosphoric acid has workplace monitoring data to show that actual exposures are not a concern it is anticipated that personal respiratory equipment and /or LEV may not be necessary.<br>The risk characterisation ratios (RCR) have only been derived for the long-term DNEL for inhalation. Any acute effects via inhalation are also covered with this risk characterisation. Since phosphoric acid is corrosive to the skin, dermal exposure has been addressed qualitatively in the exposure scenarios and indications on the relevant and required RMM (PPE) have been given. |                       |                  |                    |                 |                             |        |                               |
|                                                                                           | RCR workers, Industrial activities – phosphoric acid, liquid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |                  |                    |                 |                             |        |                               |
|                                                                                           | Process Category (PROC)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | LEV                   | Duration (hours) | PRE (% efficiency) | Content (% w/w) | Inhalation exposure (mg/m3) | RCR    | Conclusion                    |
|                                                                                           | 1 - Use in closed process, no likelihood of exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | No                    | > 4              | No                 | 25 to 100       | 0.04                        | 0.04   | Risk adequately controlled    |
|                                                                                           | 2 - Use in closed, continuous process with occasional controlled exposure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | No                    | > 4              | No                 | 25 to 100       | 4.008                       | 4.008  | RMMs required to control risk |
|                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Yes medium efficiency | > 4              | No                 | 25 to 100       | 0.721                       | 0.721  | Risk adequately controlled    |
|                                                                                           | 3 – use in closed batch process (synthesis or formulation)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No                    | > 4              | No                 | 25 to 100       | 12.025                      | 12.025 | RMMs required to control risk |
|                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Yes medium efficiency | > 4              | No                 | 25 to 100       | 2.164                       | 2.164  | RMMs required to control risk |
|                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Yes medium efficiency | > 4              | 75%                | 25 to 100       | 0.541                       | 0.541  | Risk adequately controlled    |



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|  |                                                                                                                                        |                       |     |      |           |         |         |                               |
|--|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----|------|-----------|---------|---------|-------------------------------|
|  | 4 – use in batch or other process (synthesis) where opportunity for exposure arises                                                    | No                    | > 4 | No   | 25 to 100 | 20.041  | 20.041  | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | No   | 25 to 100 | 3.607   | 3.607   | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | 75%  | 25 to 100 | 0.902   | 0.902   | Risk adequately controlled    |
|  | 5 – Mixing or blending in in batch processes for formulation of preparations and articles (multistage and/or significant contact)      | No                    | > 4 | No   | 25 to 100 | 20.041  | 20.041  | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | No   | 25 to 100 | 3.607   | 3.607   | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | 75%  | 25 to 100 | 0.902   | 0.902   | Risk adequately controlled    |
|  | 7- Industrial spraying. (MEASE)                                                                                                        | No                    | > 4 | No   | 25 to 100 | 400.818 | 400.818 | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | No   | 25 to 100 | 72.147  | 72.147  | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | 75%  | 25 to 100 | 18.037  | 18.037  | RMMs required to control risk |
|  | 7- Industrial spraying. (ART)                                                                                                          | Yes 90% efficiency    | > 4 | 50%* | 25 to 100 | 0.55    | 0.55    | Risk adequately controlled    |
|  | 8a - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. (MEASE) | No                    | > 4 | No   | 25 to 100 | 40.082  | 40.082  | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | No   | 25 to 100 | 7.215   | 7.215   | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | 75%  | 25 to 100 | 1.804   | 1.804   | RMMs required to control risk |
|  | 8a - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. (ART)   | Yes 50% efficiency    | > 4 | No   | 25 to 100 | 0.49    | 0.49    | Risk adequately controlled    |
|  | 8b – transfer of chemicals from/to vessels/large containers at dedicated facilities                                                    | No                    | > 4 | No   | 25 to 100 | 20.041  | 20.041  | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | No   | 25 to 100 | 3.607   | 3.607   | RMMs required to control risk |
|  |                                                                                                                                        | Yes medium efficiency | > 4 | 75%  | 25 to 100 | 0.902   | 0.902   | Risk adequately controlled    |
|  | 9 – transfer of chemicals into small containers (dedicated                                                                             | No                    | > 4 | No   | 25 to 100 | 20.041  | 20.041  | RMMs required to control risk |



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|  |                                                                                                  |                       |     |     |           |        |        |                               |
|--|--------------------------------------------------------------------------------------------------|-----------------------|-----|-----|-----------|--------|--------|-------------------------------|
|  | filling line)                                                                                    | Yes medium efficiency | > 4 | No  | 25 to 100 | 3.607  | 3.607  | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | 75% | 25 to 100 | 0.902  | 0.902  | Risk adequately controlled    |
|  | 10 - Roller application or brushing (MEASE).                                                     | No                    | > 4 | No  | 25 to 100 | 40.082 | 40.082 | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | No  | 25 to 100 | 7.215  | 7.215  | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | 75% | 25 to 100 | 1.804  | 1.804  | RMMs required to control risk |
|  | 10 - Roller application or brushing (ART).                                                       | Yes 50% efficiency    | > 4 | No  | 25 to 100 | 0.55   | 0.55   | Risk adequately controlled    |
|  | 13 - Treatment of articles by dipping and pouring (MEASE)                                        | No                    | > 4 | No  | 25 to 100 | 40.082 | 40.082 | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | No  | 25 to 100 | 7.215  | 7.215  | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | 75% | 25 to 100 | 1.804  | 1.804  | RMMs required to control risk |
|  | 13 - Treatment of articles by dipping and pouring (ART)                                          | Yes 50% efficiency    | > 4 | No  | 25 to 100 | 0.0054 | 0.0054 | Risk adequately controlled    |
|  | 14 - Production of preparations or articles by tableting, compression, extrusion, pelletisation. | No                    | > 4 | No  | 25 to 100 | 20.041 | 20.041 | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | No  | 25 to 100 | 3.607  | 3.607  | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | 75% | 25 to 100 | 0.902  | 0.902  | Risk adequately controlled    |
|  | 15 – use as a laboratory reagent                                                                 | No                    | > 4 | No  | 25 to 100 | 20.041 | 20.041 | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | No  | 25 to 100 | 3.607  | 3.607  | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | 75% | 25 to 100 | 0.902  | 0.902  | Risk adequately controlled    |
|  | 19 - Hand-mixing with intimate contact and only PPE available (MEASE)                            | No                    | > 4 | No  | 25 to 100 | 40.082 | 40.082 | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | No  | 25 to 100 | 7.215  | 7.215  | RMMs required to control risk |
|  |                                                                                                  | Yes medium efficiency | > 4 | 75% | 25 to 100 | 1.804  | 1.804  | RMMs required to control risk |



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|                                                                       |                          |     |    |              |        |        |                                  |
|-----------------------------------------------------------------------|--------------------------|-----|----|--------------|--------|--------|----------------------------------|
| 19 - Hand-mixing with intimate contact and only PPE available (MEASE) | Yes<br>50%<br>efficiency | > 4 | No | 25 to<br>100 | 0.0054 | 0.0054 | Risk<br>adequately<br>controlled |
|-----------------------------------------------------------------------|--------------------------|-----|----|--------------|--------|--------|----------------------------------|

**RCR, workers, Industrial activities, liquid phosphoric acid, aqueous solutions, >25%**

| Process Category (PROC)                                                                                                           | LEV                   | Duration (hours) | PRE (% efficiency)                          | Content (% w/w) | Inhalation exposure (mg/m3) | RCR   | Conclusion                    |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------|---------------------------------------------|-----------------|-----------------------------|-------|-------------------------------|
| 1 - Use in closed process, no likelihood of exposure                                                                              | No                    | > 4              | No                                          | 25 to 100       | 0.001                       | 0.001 | Risk adequately controlled    |
| 2 – used in closed, continuous process with occasional controlled exposure                                                        | No                    | > 4              | No                                          | 25 to 100       | 0.001                       | 0.001 | Risk adequately controlled    |
| 3 – use in closed batch process (synthesis or formulation)                                                                        | No                    | > 4              | No                                          | 25 to 100       | 0.01                        | 0.01  | Risk adequately controlled    |
| 4 – use in batch or other process (synthesis) where opportunity for exposure arises                                               | No                    | > 4              | No                                          | 25 to 100       | 0.05                        | 0.05  | Risk adequately controlled    |
| 5 – Mixing or blending in in batch processes for formulation of preparations and articles (multistage and/or significant contact) | No                    | > 4              | No                                          | 25 to 100       | 0.05                        | 0.05  | Risk adequately controlled    |
| 7 - Industrial spraying.                                                                                                          | No                    | > 4              | No                                          | 25 to 100       | 20                          | 20    | RMMs required to control risk |
|                                                                                                                                   | Yes medium efficiency | > 4              | No                                          | 25 to 100       | 4.4                         | 4.4   | RMMs required to control risk |
|                                                                                                                                   | Yes medium efficiency | > 4              | 75%                                         | 25 to 100       | 1.1                         | 1.1   | RMMs required to control risk |
| 7 - Industrial spraying. (Modelled with ART, conditions as detailed in CSR)                                                       | Yes – primary: 90%    | > 4              | Secondary containment: LEV (50% efficiency) | 25 to 100       | 0.55                        | 0.55  | Risk adequately controlled    |
| 8a -Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities.     | No                    | > 4              | No                                          | 25 to 100       | 0.05                        | 0.05  | Risk adequately controlled    |
| 8b – transfer of chemicals from/to vessels/large containers                                                                       | No                    | > 4              | No                                          | 25 to 100       | 0.01                        | 0.01  | Risk adequately controlled    |



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|                                                                                                 |    |     |    |           |      |      |  |                            |
|-------------------------------------------------------------------------------------------------|----|-----|----|-----------|------|------|--|----------------------------|
| at dedicated facilities                                                                         |    |     |    |           |      |      |  | controlled                 |
| 9 – transfer of chemicals into small containers (dedicated filling line)                        | No | > 4 | No | 25 to 100 | 0.01 | 0.01 |  | Risk adequately controlled |
| 10: Roller application or brushing.                                                             | No | > 4 | No | 25 to 100 | 0.05 | 0.05 |  | Risk adequately controlled |
| 13: Treatment of articles by dipping and pouring                                                | No | > 4 | No | 25 to 100 | 0.01 | 0.01 |  | Risk adequately controlled |
| 14: Production of preparations or articles by tableting, compression, extrusion, pelletisation. | No | > 4 | No | 25 to 100 | 0.01 | 0.01 |  | Risk adequately controlled |
| 15 – use as a laboratory reagent                                                                | No | > 4 | No | 25 to 100 | 0.01 | 0.01 |  | Risk adequately controlled |
| 19: Hand-mixing with intimate contact and only PPE available                                    | No | > 4 | No | 25 to 100 | 0.05 | 0.05 |  | Risk adequately controlled |

### RCR workers, Industrial activities, solid phosphoric acid, low dustiness, >25%

| Process Category (PROC)                                                                                                           | LEV | Duration (hours) | PRE (% efficiency) | Content (% w/w) | Inhalation exposure (mg/m3) | RCR  | Conclusion                 |
|-----------------------------------------------------------------------------------------------------------------------------------|-----|------------------|--------------------|-----------------|-----------------------------|------|----------------------------|
| 1 - Use in closed process, no likelihood of exposure                                                                              | No  | > 4              | No                 | 25 to 100       | 0.01                        | 0.01 | Risk adequately controlled |
| 2 – used in closed, continuous process with occasional controlled exposure                                                        | No  | > 4              | No                 | 25 to 100       | 0.01                        | 0.01 | Risk adequately controlled |
| 3 – use in closed batch process (synthesis or formulation)                                                                        | No  | > 4              | No                 | 25 to 100       | 0.1                         | 0.1  | Risk adequately controlled |
| 4 – use in batch or other process (synthesis) where opportunity for exposure arises                                               | No  | > 4              | No                 | 25 to 100       | 0.5                         | 0.5  | Risk adequately controlled |
| 5 – Mixing or blending in in batch processes for formulation of preparations and articles (multistage and/or significant contact) | No  | > 4              | No                 | 25 to 100       | 0.5                         | 0.5  | Risk adequately controlled |



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|  |                                                                                                                               |                       |     |     |           |       |       |                               |
|--|-------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----|-----|-----------|-------|-------|-------------------------------|
|  | 7 - Industrial spraying.                                                                                                      | No                    | > 4 | No  | 25 to 100 | 1     | 1     | RMMs required to control risk |
|  |                                                                                                                               | Yes medium efficiency | > 4 | No  | 25 to 100 | 0.18  | 0.18  | Risk adequately controlled    |
|  | 8a -Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. | No                    | > 4 | No  | 25 to 100 | 0.5   | 0.5   | Risk adequately controlled    |
|  | 8b – transfer of chemicals from/to vessels/large containers at dedicated facilities                                           | No                    | > 4 | No  | 25 to 100 | 0.1   | 0.1   | Risk adequately controlled    |
|  | 9 – transfer of chemicals into small containers (dedicated filling line)                                                      | No                    | > 4 | No  | 25 to 100 | 0.1   | 0.1   | Risk adequately controlled    |
|  | 10: Roller application or brushing.                                                                                           | No                    | > 4 | No  | 25 to 100 | 0.5   | 0.5   | Risk adequately controlled    |
|  | 13: Treatment of articles by dipping and pouring                                                                              | No                    | > 4 | No  | 25 to 100 | 0.1   | 0.1   | Risk adequately controlled    |
|  | 14: Production of preparations or articles by tableting, compression, extrusion, pelletisation.                               | No                    | > 4 | No  | 25 to 100 | 0.1   | 0.1   | Risk adequately controlled    |
|  | 15 – use as a laboratory reagent                                                                                              | No                    | > 4 | No  | 25 to 100 | 0.1   | 0.1   | Risk adequately controlled    |
|  | 19: Hand-mixing with intimate contact and only PPE available                                                                  | No                    | > 4 | No  | 25 to 100 | 0.5   | 0.5   | Risk adequately controlled    |
|  | 22: Potentially closed processing operations with minerals/metals at elevated temperature.                                    | No                    | > 4 | No  | 25 to 100 | 7     | 7     | RMMs required to control risk |
|  |                                                                                                                               | Yes medium efficiency | > 4 | No  | 25 to 100 | 1.26  | 1.26  | RMMs required to control risk |
|  |                                                                                                                               | Yes medium efficiency | > 4 | 75% | 25 to 100 | 0.315 | 0.315 | Risk adequately controlled    |
|  | 23: Open processing and transfer operations with minerals/metals at elevated temperature.                                     | No                    | > 4 | No  | 25 to 100 | 2     | 2     | RMMs required to control risk |
|  |                                                                                                                               | Yes medium efficiency | > 4 | No  | 25 to 100 | 0.36  | 0.36  | Risk adequately controlled    |

|                                                                                   |                                                                                                                                                                  |                                                               |
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|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;"><b>EC number : 231-633-2</b><br/><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
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|                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| Workers (dermal)                                            | <p>Phosphoric acid is a corrosive substance. For the handling of corrosive substances and formulations immediate dermal contact mainly occurs accidentally (splashes, etc) as wearing of gloves and skin protection is mandatory. Direct contact is forbidden and therefore it is assumed that on the basis of a qualitative assessment of potential dermal exposure that for the purpose of risk assessment dermal exposure can be discounted.</p> <p>Dermal exposure to &gt; 25% phosphoric acid formulations is not quantitatively assessed as phosphoric acid is a very corrosive agent.</p>                                         |
| Indirect exposure via the environment                       | <p>No indirect exposure of humans via the environment is expected for orthophosphoric acid, as the substance can be effectively removed from the wastewater or neutralised. Thus, no assessment of indirect exposure of humans via the environment is performed.</p>                                                                                                                                                                                                                                                                                                                                                                     |
| Consumers                                                   | <p>No direct consumer exposure is anticipated with the manufacture of orthophosphoric acid.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>5.2. Environmental exposure (qualitative assessment)</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Environmental release                                       | <p>The production of orthophosphoric acid can potentially result in aquatic emissions and locally increase the phosphate concentration while decreasing the pH in the aquatic environment.</p> <p>However, the pH of industrial effluents is normally measured frequently and can be neutralized easily.</p>                                                                                                                                                                                                                                                                                                                             |
| Waste water treatment plants (WWTP)                         | <p>Not relevant. Orthophosphoric acid dissociates in <math>H^+</math> and <math>PO_4^{3-}</math> and will be neutralised before reaching WWTP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Aquatic pelagic compartment                                 | <p>The predominant adverse effects of orthophosphoric acid in aquatic systems are pH-related effects, as a result of the acidic nature of orthophosphoric acid. As phosphoric acid is a triprotic acid it will dissociate up to 3 times; releasing a phosphate anion (<math>H_2PO_4^-</math>, <math>HPO_4^{2-}</math> or <math>PO_4^{3-}</math>) and a <math>H^+</math> ion at each dissociation. The fate of the <math>H^+</math> ions (and subsequently the resultant pH) will depend on the chemical composition of the receiving water body; the higher the buffering capacity of the water, the lower the effect on pH will be.</p> |
| Sediments                                                   | <p>Not relevant. Orthophosphoric acid will progressively dissociate in water to give <math>H^+</math> and <math>PO_4^{3-}</math> ions. Due to its high water solubility and low vapour pressure it is predicted that any un-dissociated phosphoric acid will remain in the water phase and will not absorb onto particulate.</p>                                                                                                                                                                                                                                                                                                         |
| Soil and groundwater                                        | <p>Not relevant. Orthophosphoric acid entering soil and ground water will be partially neutralised, dispersed and diluted. There will be no absorption of phosphoric acid on particulate matter or surfaces. The dissociation product of orthophosphoric acid, phosphate ions may absorb onto soil but will not result in toxicity as these are essential nutrients.</p>                                                                                                                                                                                                                                                                 |
| Atmospheric compartment                                     | <p>Not relevant. Orthophosphoric acid release is negligible, due to its low vapour pressure.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Secondary poisoning                                         | <p>Bioaccumulation in organisms is not relevant for orthophosphoric acid.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;">EC number : 231-633-2<br/>CAS number : 7664-38-2</p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
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## ES3: Professional use of orthophosphoric acid

|                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Short title of exposure scenario 3</b>                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Professional use of orthophosphoric acid                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>2. Description of activities and processes covered in the exposure scenario</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Sector of use (SU)                                                                 | SU 1: Agriculture, forestry and fishing<br>SU 19: Hand-mixing with intimate contact<br>SU 22: Professional uses: public domain<br>SU 24: Scientific research and development                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Product category (PC)                                                              | PC 9a: Coatings and paints, thinners, paint removers<br>PC 9b: Fillers, putties, plasters, modelling clay<br>PC 12: Fertilisers<br>PC 14: Metal surface treatment products, including galvanic and electroplating products<br>PC 15: Non-metal-surface treatment products<br>PC 21: Laboratory chemicals<br>PC 31: Polishes and wax blends<br>PC 35: Washing and cleaning products (including solvent based products)<br>PC 37: Water treatment chemicals<br>PC 38: Welding and soldering products (with flux coatings or flux cores), flux products                                                                                                                                                                                                                                                   |
| Process category (PROC)                                                            | PROC 5: Mixing or blending in batch processes (multistage and/or significant contact)<br>PROC 8a: Transfer of chemicals from/to vessels/ large containers at non dedicated facilities<br>PROC 8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC 9: transfer of substance or preparation into small containers (dedicated filling line including weighing)<br>PROC 10: Roller application or brushing<br>PROC 11: Non industrial spraying<br>PROC 13: Treatment of articles by dipping and pouring<br>PROC 15: Use as a laboratory reagent<br>PROC 19: Hand-mixing with intimate contact (only PPE available)<br>PROC 25: Other hot work operations with metals                                                          |
| Article category (AC)                                                              | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Environmental release category (ERC)                                               | ERC 8a: Wide dispersive indoor use of processing aids in open systems<br>ERC 8b: Wide dispersive indoor use of reactive substances in open systems<br>ERC 8c: Wide dispersive indoor use resulting in inclusion into or onto a matrix<br>ERC 8e: Wide dispersive outdoor use of reactive substances in open systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>3. Operational conditions</b>                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>3.1 Operational conditions related with frequency and quantities of use</b>     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Duration of exposure at workplace:                                                 | <p>Detergents and cleaning products:</p> <p>Phosphoric acid is used during the production phase of various cleaning products, although often the amount in the end products is limited due to its reactivity. The phosphoric acid that is used in professional formulation interacts with the other ingredients in the acid-base reactions. Therefore, free phosphoric acid left in the final product is limited.</p> <p>The amount used per professional workers varies from activity to activity. The operational conditions related to the frequency, duration and amount of use taken from the exposure scenarios provided by the International Association for Soaps, Detergents and Maintenance Products (AISE 2009) describe professional uses of phosphoric acid where duration is shorter</p> |
| Frequency of exposure at workplace:                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

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|  | <p align="center"><b>ORTHOPHOSPHORIC ACID</b></p> <p align="center"><b>EC number : 231-633-2</b></p> <p align="center"><b>CAS number : 7664-38-2</b></p> | <p align="center"><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
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|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                   | <p>than 4h. For professional use of cleaning agents, the AISE exposure scenario gives a frequency of 80 applications per day and a duration of 0.1 minutes per application for spraying and a frequency of 8 applications per day and a duration of 60 minutes per application for brushing.</p> <p>No information on the concentration of phosphoric acid in the final products is available; therefore a worst-case approach will be taken. The concentration of solid phosphoric in detergent products is assumed to be &gt;25% whereas the concentration in liquids products is assumed to be between 5 and 25%.</p> <p>Fertilizers:<br/>No information about the duration and frequency of tasks is available. In the first tier assessment a frequency of once per day with an exposure duration of &gt;4 hours is considered as a worst case. No information on concentration is available; therefore a worst-case approach will be taken. The concentration of solid phosphoric in detergent products is assumed to be &gt;25% whereas the concentration in liquids products is assumed to be between 5 and 25%.</p> <p>Construction and building applications:<br/>No information about the duration and frequency of tasks is available. In the first tier assessment a frequency of once per day with an exposure duration of &gt;4 hours is considered as a worst case. No information on concentration is available; therefore a worst-case approach will be taken. The concentration of solid phosphoric in construction products is assumed to be &gt;25% whereas the concentration in liquids products is assumed to be between 5 and 25%.</p> <p>Metal surface treatment and soldering flux:<br/>No information about the duration and frequency of tasks is available. In the first tier assessment a frequency of once per day with an exposure duration of &gt;4 hours is considered as a worst case. No information on concentration is available; therefore a worst-case approach will be taken. The concentration of solid phosphoric in used in metal surface treatment is assumed to be &gt;25%. The concentration in liquids products for metal surface treatment and soldering flux is assumed to be 5-25%.</p> |
| Annual amount used per site:                                                                                                                      | The daily and annual amount/emission per site is not considered to be the main determinant for environmental exposure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>3.2 Operational conditions related with substance/ product</b>                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Physical state                                                                                                                                    | Solid / Liquid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Concentration of substance in mixture                                                                                                             | See above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>3.3 Other relevant operational conditions</b>                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| The amount used per professional workers varies from activity to activity. The maximum duration >4 h/day was considered as worst case assumption. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>4. Risk Management Measures</b>                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>4.1 RMMs related to workers</b>                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Organisational measures                                                                                                                           | Professional users should wear appropriate personal protection equipment, such as gloves and safety glasses during processes. The employer must ensure that the required PPE is                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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|                          |                                                                                                                                                                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          | <p>available and used according to instructions (provide training if necessary).</p> <p>Safety showers and eye washes are installed to be available in the case of accidental contact.</p>                                                                                            |
| Technical measures       | <ul style="list-style-type: none"> <li>Use closed/ automated systems or covering of open containers (e.g. screens) to avoid irritating mists, sprayings and potential splashes. (Good practice)</li> <li>Store in cool, dry, clean, well ventilate areas. (Good practice).</li> </ul> |
| Respiratory protection   | Personal respiratory equipment (PRE): In case of dust or aerosol formation (e.g. spraying): use respiratory protection with approved filter.                                                                                                                                          |
| Hand protection          | <p>Hand protection is required: Impervious chemical resistant protective gloves are required.</p> <p>Material of gloves. Chloroprene, Neoprene or PVC gloves</p>                                                                                                                      |
| Eye protection           | Wearing of eye/face protection is required as substance is corrosive. Goggles or face protection shield should be consistent with EN 166 or equivalent.                                                                                                                               |
| Skin and body protection | Wearing of suitable protective clothing and rubber boots is recommended.                                                                                                                                                                                                              |
| Hygiene measures         | Keep away from foodstuffs, drinks and tobacco. Wash hands before breaks and at end of work. Keep work clothes separate.                                                                                                                                                               |

#### **4.2 RMMs related to the environment**

|                                              |                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Organisational measures                      | Procedural and/or control technologies are required to minimise emissions and the resulting exposure during cleaning and maintenance procedures.                                                                                                                                                                                                                 |
| Abatement measures related to wastewater     | Different rules apply to professional users regarding control of their effluents. It is required that the flow of release to municipal wastewater or to surface water do not cause significant in pH changes. It is then dependant whether or not discharging is done to municipal wastewater equipped with sewage treatment plant or not.                       |
| Abatement measures waste air and solid waste | <p>Orthophosphoric acid is not expected to be found in the solid waste nor to reach the air compartment, due to its low vapour pressure. Therefore, no specific risk management measures for air emissions are provided.</p> <p>For release to soil for fertilizer uses, the pH will be naturally neutralized by the medium before reaching the groundwater.</p> |

#### **4.3 Waste related measures**

|                                                         |                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type of waste                                           | Liquid waste, solid residues, packaging material                                                                                                                                                                                                                                                               |
| Disposal technique                                      | The release of phosphates to wastewater is highly regulated, In addition pH changes in receiving waters should be minimised. The residue of the containers or the used container itself should be disposed in accordance with local and national requirements. See Section 13 of the SDS for more information. |
| Fraction released to environment during waste treatment | Not determined. The pH of wastewater released from manufacturing sites should be between pH 6-9.                                                                                                                                                                                                               |

#### **5. Prediction of exposure and comparison of predicted exposure with DNELs (Risk Characterisation)**

##### **5.1. Human exposure**

|                                                                                   |                                                                                                                                                          |                                                                              |
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|                                                                                |                                                                                                                                       |          |                       |                  |                    |                 |                             |        |                               |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|------------------|--------------------|-----------------|-----------------------------|--------|-------------------------------|
| Exposure estimation tool(s)                                                    | Workers, inhalation / dermal, TIER 1 (all uses): MEASE<br>Workers, inhalation / dermal, TIER 2 (spray applications): UK POEM          |          |                       |                  |                    |                 |                             |        |                               |
| Workers (oral)                                                                 | The professional uses of orthophosphoric acid will not notably contribute to the oral intake of phosphates.                           |          |                       |                  |                    |                 |                             |        |                               |
| Workers (inhalation)<br><br>DNEL /OEL : Worker, long-term, inhalation: 1 mg/m³ | RCR, worker exposure to phosphoric acid from professional uses. – Tier 1                                                              |          |                       |                  |                    |                 |                             |        |                               |
|                                                                                | Process Category (PROC)                                                                                                               | Location | LEV                   | Duration (hours) | PRE (% efficiency) | Content (% w/w) | Inhalation exposure (mg/m3) | RCR    | Conclusion                    |
|                                                                                | H3PO4, liquid, low volatility                                                                                                         |          |                       |                  |                    |                 |                             |        |                               |
|                                                                                | 5 - Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact).       | Indoors  | No                    | > 4              | No                 | 5 to 25         | 24.049                      | 24.049 | RMMs required to control risk |
|                                                                                |                                                                                                                                       | Indoors  | Yes Medium efficiency | > 4              | No                 | 5 to 25         | 5.411                       | 5.411  | RMMs required to control risk |
|                                                                                |                                                                                                                                       | Indoors  | Yes Medium efficiency | > 4              | 90%                | 5 to 25         | 0.541                       | 0.541  | Risk adequately controlled    |
|                                                                                |                                                                                                                                       | Outdoors | Ventilation effect    | > 4              | No                 | 5 to 25         | 17.135                      | 17.135 | RMMs required to control risk |
|                                                                                |                                                                                                                                       | Outdoors | Ventilation effect    | > 4              | 95%                | 5 to 25         | 0.857                       | 0.857  | Risk adequately controlled    |
|                                                                                | 8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities. (MEASE) | Indoors  | No                    | > 4              | No                 | 5 to 25         | 60.123                      | 60.123 | RMMs required to control risk |
|                                                                                |                                                                                                                                       | Indoors  | Yes Medium efficiency | > 4              | No                 | 5 to 25         | 13.528                      | 13.528 | RMMs required to control risk |
|                                                                                |                                                                                                                                       | Indoors  | Yes Medium efficiency | > 4              | 95%                | 5 to 25         | 0.676                       | 0.676  | Risk adequately controlled    |
|                                                                                |                                                                                                                                       | Outdoors | Ventilation effect    | > 4              | No                 | 5 to 25         | 42.837                      | 42.837 | RMMs required to control risk |
|                                                                                |                                                                                                                                       | Outdoors | Ventilation effect    | > 4              | 95%                | 5 to 25         | 2.142                       | 2.142  | RMMs required to control risk |
|                                                                                | PROC 8a - Transfer of substance or preparation (charging/discharging) from/to vessels/large                                           | Outdoors | Ventilation effect    | > 4              | No                 | 5 to 25         | 0.54                        | 0.54   | Risk adequately controlled    |



# ORTHOPHOSPHORIC ACID

EC number : 231-633-2

CAS number : 7664-38-2

## Exposure scenarios

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|  |                                                                                                                            |          |                       |     |     |         |        |        |                               |
|--|----------------------------------------------------------------------------------------------------------------------------|----------|-----------------------|-----|-----|---------|--------|--------|-------------------------------|
|  | containers at non-dedicated facilities. (ART)                                                                              |          |                       |     |     |         |        |        |                               |
|  | 8b - Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities. | Indoors  | No                    | > 4 | No  | 5 to 25 | 24.049 | 24.049 | RMMs required to control risk |
|  |                                                                                                                            | Indoors  | Yes Medium efficiency | > 4 | No  | 5 to 25 | 5.411  | 5.411  | RMMs required to control risk |
|  |                                                                                                                            | Indoors  | Yes Medium efficiency | > 4 | 90% | 5 to 25 | 0.541  | 0.541  | Risk adequately controlled    |
|  |                                                                                                                            | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 17.135 | 17.135 | RMMs required to control risk |
|  |                                                                                                                            | Outdoors | Ventilation effect    | > 4 | 95% | 5 to 25 | 0.857  | 0.857  | Risk adequately controlled    |
|  | 9 - Transfer of substance or preparation into small containers (dedicated filling line, including weighing).               | Indoors  | No                    | > 4 | No  | 5 to 25 | 24.049 | 24.049 | RMMs required to control risk |
|  |                                                                                                                            | Indoors  | Yes Medium efficiency | > 4 | No  | 5 to 25 | 5.411  | 5.411  | RMMs required to control risk |
|  |                                                                                                                            | Indoors  | Yes Medium efficiency | > 4 | 90% | 5 to 25 | 0.541  | 0.541  | Risk adequately controlled    |
|  |                                                                                                                            | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 17.135 | 17.135 | RMMs required to control risk |
|  |                                                                                                                            | Outdoors | Ventilation effect    | > 4 | 95% | 5 to 25 | 0.857  | 0.857  | Risk adequately controlled    |
|  | 10 - Roller application or brushing. (MEASE)                                                                               | Indoors  | No                    | > 4 | No  | 5 to 25 | 60.123 | 60.123 | RMMs required to control risk |
|  |                                                                                                                            | Indoors  | Yes Medium efficiency | > 4 | No  | 5 to 25 | 13.528 | 13.528 | RMMs required to control risk |
|  |                                                                                                                            | Indoors  | Yes Medium efficiency | > 4 | 95% | 5 to 25 | 0.676  | 0.676  | Risk adequately controlled    |
|  |                                                                                                                            | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 42.837 | 42.837 | RMMs required to control risk |
|  |                                                                                                                            | Outdoors | Ventilation effect    | > 4 | 95% | 5 to 25 | 2.142  | 2.142  | RMMs required to              |



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## Exposure scenarios

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|  |                                                                |          |                       |     |     |         |         |         |                               |
|--|----------------------------------------------------------------|----------|-----------------------|-----|-----|---------|---------|---------|-------------------------------|
|  |                                                                |          |                       |     |     |         |         |         | control risk                  |
|  | 10 - Roller application or brushing. (ART)                     | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 0.59    | 0.59    | Risk adequately controlled    |
|  | 11 - Non industrial spraying.                                  | Indoors  | No                    | > 4 | No  | 5 to 25 | 240.491 | 240.491 | RMMs required to control risk |
|  |                                                                | Indoors  | Yes Medium efficiency | > 4 | No  | 5 to 25 | 54.11   | 54.11   | RMMs required to control risk |
|  |                                                                | Indoors  | Yes Medium efficiency | > 4 | 95% | 5 to 25 | 2.709   | 2.709   | RMMs required to control risk |
|  |                                                                | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 171.35  | 171.35  | RMMs required to control risk |
|  |                                                                | Outdoors | Ventilation effect    | > 4 | 95% | 5 to 25 | 8.567   | 8.567   | RMMs required to control risk |
|  | 13 - Treatment of articles by dipping and pouring.             | Indoors  | No                    | > 4 | No  | 5 to 25 | 24.049  | 24.049  | RMMs required to control risk |
|  |                                                                | Indoors  | Yes Medium efficiency | > 4 | No  | 5 to 25 | 5.411   | 5.411   | RMMs required to control risk |
|  |                                                                | Indoors  | Yes Medium efficiency | > 4 | 90% | 5 to 25 | 0.541   | 0.541   | Risk adequately controlled    |
|  |                                                                | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 17.135  | 17.135  | RMMs required to control risk |
|  |                                                                | Outdoors | Ventilation effect    | > 4 | 95% | 5 to 25 | 0.857   | 0.857   | Risk adequately controlled    |
|  | 15 – Use as a laboratory reagent                               | Indoors  | No                    | > 4 | No  | 5 to 25 | 12.025  | 12.025  | RMMs required to control risk |
|  |                                                                | Indoors  | Yes Medium efficiency | > 4 | No  | 5 to 25 | 2.706   | 2.706   | RMMs required to control risk |
|  |                                                                | Indoors  | Yes Medium efficiency | > 4 | 95% | 5 to 25 | 0.676   | 0.676   | Risk adequately controlled    |
|  | 19 - Hand-mixing with intimate contact and only PPE available. | Indoors  | No                    | > 4 | No  | 5 to 25 | 0.3     | 0.3     | Risk adequately controlled    |
|  |                                                                | Outdoors | Ventilation effect    | > 4 | No  | 5 to 25 | 0.3     | 0.3     | Risk adequately controlled    |

|                                                                                   |                                                                                                                                                    |                                                               |
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|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|------------------------------------------------------------------------------|-------------------|
|                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              | controlled        |
| <b>Tier 2 exposure assessment and RCR, professional worker exposure to phosphoric acid from spraying applications</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
|                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Tractor-mounted/trailed boom sprayer: hydraulic nozzles | Tractor-mounted/trailed boom sprayer: rotary atomisers | Tractor-mounted/trailed broadcast air-assisted sprayer: 500 L/ha | Hand-held sprayer (15 L tank): hydraulic nozzles. Outdoor, low level target | Hand-held rotary atomiser equipment (2.5 L tank). Outdoor, low level target | Hand-held rotary atomiser equipment (2.5 L tank). Outdoor, high level target | Unit              |
| Spray Application                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Long-term exposure concentration of a.s.                                                                              | 0.06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.03                                                    | 0.3                                                    | 0.12                                                             | 0.06                                                                        | 0.06                                                                        |                                                                              | mg/m <sup>3</sup> |
| RCR                                                                                                                   | 0.06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0.03                                                    | 0.3                                                    | 0.12                                                             | 0.06                                                                        | 0.06                                                                        |                                                                              |                   |
| Conclusion                                                                                                            | Risk adequately controlled for all spray applications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Workers (dermal)                                                                                                      | No systemic toxicity effects are expected due to the inorganic nature of the substance however local effects may occur but these effects will not be dose-dependent but will depend on the concentration of the substance present in the mixture/solution used in a specific application. It is therefore recommended that the appropriate PPE is used.                                                                                                                                                                                                                                                                                                            |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Indirect exposure via the environment                                                                                 | No indirect exposure of humans via the environment is expected for orthophosphoric acid. Thus, no assessment of indirect exposure of humans via the environment is required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Consumers                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| <b>5.2. Environmental exposure (qualitative assessment)</b>                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Environmental release                                                                                                 | The production of orthophosphoric acid can potentially result in aquatic emissions and locally increase the phosphate concentration while decreasing the pH in the aquatic environment.<br><br>However, the pH of industrial effluents is normally measured frequently and can be neutralized easily.                                                                                                                                                                                                                                                                                                                                                              |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Waste water treatment plants (WWTP)                                                                                   | Not relevant. Orthophosphoric acid dissociates in H <sup>+</sup> and PO <sub>4</sub> <sup>3-</sup> and will be neutralised before reaching WWTP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Aquatic pelagic compartment                                                                                           | The predominant adverse effects of orthophosphoric acid in aquatic systems are pH-related effects, as a result of the acidic nature of orthophosphoric acid. As phosphoric acid is a triprotic acid it will dissociate up to 3 times; releasing a phosphate anion (H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> , HPO <sub>4</sub> <sup>2-</sup> or PO <sub>4</sub> <sup>3-</sup> ) and a H <sup>+</sup> ion at each dissociation. The fate of the H <sup>+</sup> ions (and subsequently the resultant pH) will depend on the chemical composition of the receiving water body; the higher the buffering capacity of the water, the lower the effect on pH will be. |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Sediments                                                                                                             | Not relevant. Orthophosphoric acid will progressively dissociate in water to give H <sup>+</sup> and PO <sub>4</sub> <sup>3-</sup> ions. Due to its high water solubility and low vapour pressure it is predicted that any un-dissociated phosphoric acid will remain in the water phase and will not absorb onto particulate.                                                                                                                                                                                                                                                                                                                                     |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |
| Soil and groundwater                                                                                                  | Not relevant. Orthophosphoric acid entering soil and ground water will be partially neutralised, dispersed and diluted. There will be no absorption of phosphoric acid on particulate matter or surfaces. The dissociation product of orthophosphoric acid, phosphate ions may absorb onto soil but will not result in toxicity as these are essential                                                                                                                                                                                                                                                                                                             |                                                         |                                                        |                                                                  |                                                                             |                                                                             |                                                                              |                   |

|                                                                                   |                                                                                                                                                                  |                                                               |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;"><b>EC number : 231-633-2</b><br/><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

|                         |                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------|
|                         | nutrients.                                                                                |
| Atmospheric compartment | Not relevant. Orthophosphoric acid release is negligible, due to its low vapour pressure. |
| Secondary poisoning     | Bioaccumulation in organisms is not relevant for orthophosphoric acid.                    |

## ES4: Consumer use of orthophosphoric acid

|                                                                                    |                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Short title of exposure scenario 4</b>                                       |                                                                                                                                                                                                                                                                                                            |
| Consumer use of orthophosphoric acid                                               |                                                                                                                                                                                                                                                                                                            |
| <b>2. Description of activities and processes covered in the exposure scenario</b> |                                                                                                                                                                                                                                                                                                            |
| Sector of use (SU)                                                                 | SU 21:                                                                                                                                                                                                                                                                                                     |
| Product category (PC)                                                              | PC 12: Fertilisers<br>PC 31: Polishes and wax blends<br>PC 35: Washing and cleaning products (including solvent based products)<br>PC 38: Welding and soldering products (with flux coatings or flux cores)., flux products<br>PC 39: Cosmetics, personal care products                                    |
| Process category (PROC)                                                            | Not applicable                                                                                                                                                                                                                                                                                             |
| Article category (AC)                                                              | Not applicable                                                                                                                                                                                                                                                                                             |
| Environmental release category (ERC)                                               | ERC 8a: Wide dispersive indoor use of processing aids in open systems<br>ERC 8b: Wide dispersive indoor use of reactive substances in open systems<br>ERC 8d: Wide dispersive outdoor use of processing aids in open systems<br>ERC 8e: Wide dispersive outdoor use of reactive substances in open systems |
| <b>3. Operational conditions</b>                                                   |                                                                                                                                                                                                                                                                                                            |

|                                                                                   |                                                                                                                                                          |                                                                              |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
|  | <p align="center"><b>ORTHOPHOSPHORIC ACID</b></p> <p align="center"><b>EC number : 231-633-2</b></p> <p align="center"><b>CAS number : 7664-38-2</b></p> | <p align="center"><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|

### **3.1 Operational conditions related with frequency and quantities of use**

Phosphoric acid is typically present in consumer products in low concentrations. The main uses are listed below and included in this exposure scenario.

- Use in polishes and waxes: use of polishes in spray, and waxes/cream for floor, furniture, shoes, where phosphoric acid is co-formulant
- Use as washing and cleaning agent: use of household washing and cleaning products containing phosphoric acid to remove mineral deposits and hard water stains (lime scale removers, typical concentration of phosphoric acid in the product: 5-15%)
- Use of household fertilizers containing phosphoric acid: use of liquid and soluble liquid or solid fertilizers. It includes transfer, loading, unloading, dilution operations and surface spreading of minor quantities for indoor/ outdoor home fertilizer use.
- Use phosphoric acid in batteries: electrolyte system, fuel cells and other closed systems.
- Use as additive in cosmetics and use as a food additive. These applications are not included in this exposure scenario as food/ feed applications are covered under Regulation (EC) N°1935/2004 and cosmetics under Directive 76/768/CEE.

Phosphoric acid is not provided as such to consumers and general public. In addition, this scenario does not cover phosphoric acid present in consumer products at a concentration of >25%.

### **3.2 Operational conditions related with substance/ product**

|                                       |                |
|---------------------------------------|----------------|
| Physical state                        | Solid / Liquid |
| Concentration of substance in mixture | See above.     |

## **4. Risk Management Measures**

### **4.1 RMMS related to Consumers**

|                                                                                   |                                                                                                                                                                  |                                                                                           |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;"><b>EC number : 231-633-2</b><br/><b>CAS number : 7664-38-2</b></p> | <p style="text-align: center;"><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|

Consumer products should be intrinsically safe, therefore products containing phosphoric acid should be designed to avoid accidents and in case an accident occurs, instructions should be available how to minimise the effects. Risk management measures in place relate to the design of the consumer product and to consumers use.

Measures related to the design of the product

- It is required to use acid resistant labelling and packaging in order to avoid auto-damage and loss of the label integrity, under normal use and storage of the product. The lack of quality of the package provokes the physical loss of information on hazards and use instructions.
- It is required that household chemicals, containing phosphoric acid at  $\geq 10\%$  should be provided with a child-resistant fastening (currently applied) and a tactile warning of danger (Adaptation to Technical Progress of the Directive 1999/45/EC, annex IV, Part A and Article 15(2) of Directive 67/548 in the case of, respectively, dangerous preparations and substances intended for domestic use). This would prevent accidents by children and other sensitive groups of society.
- It is required that recommended use instructions, and product information should always be provided to the consumers. This will considerably reduce the risk of misuse. For reducing the number of accidents in which (young) children or elderly people are involved, it should be advisable to use these products in the absence of children or other potential sensitive groups. To prevent improper use of phosphoric acid, instructions for use should contain a warning against dangerous mixtures.

#### **PPE required under regular conditions of consumer use**

Protective equipment measures: product related design measures are required. These include specific dispensers and pumps specifically designed to prevent splashes/spills/exposure to occur.

For consumer products containing phosphoric acid (concentration  $< 10\%$ ) it is recommended to wear hand protection, long sleeves to prevent splashes and eye protection.

#### **4.2 RMMS related to the environment**

There are no specific risk management measures related to environment.

|                                          |                                             |
|------------------------------------------|---------------------------------------------|
| Abatement measures related to wastewater | No specific abatement measures recommended. |
|------------------------------------------|---------------------------------------------|

|                                              |                                             |
|----------------------------------------------|---------------------------------------------|
| Abatement measures waste air and solid waste | No specific abatement measures recommended. |
|----------------------------------------------|---------------------------------------------|

#### **4.3 Waste related measures**

It is anticipated that empty containers will end up in the municipal waste.

Batteries: this material and its container must be disposed of in a safe way (e.g. by returning to a public recycling facility). Batteries should be recycled as much as possible (e.g. by returning to a public recycling facility). It is not anticipated that consumers will be exposed to phosphoric acid in batteries.

### **5. Prediction of exposure and comparison of predicted exposure with DNELs (Risk Characterisation)**

#### **5.1. Human exposure**

|                                                                                   |                                                                                                                                                                  |                                                               |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
|  | <p style="text-align: center;"><b>ORTHOPHOSPHORIC ACID</b></p> <p style="text-align: center;"><b>EC number : 231-633-2</b><br/><b>CAS number : 7664-38-2</b></p> | <p><b>Exposure scenarios</b></p> <p>Réf: version2_Feb2012</p> |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|

| Exposure estimation tool(s)                                                                              | Consumers, inhalation, TIER 2 (spray applications, fertilisers): UK POEM<br>Consumers, inhalation, TIER 2 (spray applications, fertilisers): ConsExpo                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                      |                                      |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------|----------------------------|------------|---------------------------------------------------------------------------------|------|-------|----------------------------|---------------------------------------------------------------------------|--------|-------|----------------------------|-----------------------------------------------------------------------|-------|-------|----------------------------|
| Consumer (oral)                                                                                          | The consumer uses of orthophosphoric acid will not notably contribute to the oral intake of phosphates.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                      |                                      |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
| Consumers (inhalation)<br><br><i>DNEL<br/>:General population, long-term, inhalation:<br/>0.73 mg/m³</i> | <p>The consumer exposure assessment will consider a worst-case approach (i.e. uses that are likely to result in the highest exposure). The uses to be assessed are:</p> <ul style="list-style-type: none"><li>- Use in lime scale removers; phosphoric acid present at concentrations of 5-15%.</li><li>- Consumer spray applications of fertilisers (max concentration of phosphoric acid: 10%).</li></ul> <p>All other consumer uses are considered to be safe if the above uses give an RCR of &lt;1. On the basis that the above scenarios represent a worst-case for inhalation exposure.</p> <p>Consumer exposure to phosphoric acid resulting from the spray application of liquid fertilizers was predicted using the UK POEM model (UK HSE). The duration of spraying was considered to be 30 minutes/day. The inhalation volume of the consumer was considered to be 26 m³/day, the body weight used in the model was 60 kg. No inhalation is expected during the mixing and loading of liquid fertilisers.</p> <p>Inhalation exposure to phosphoric acid in lime scale remover applications (phosphoric acid present in the formulation at ≤15%) was estimated using the Cons Expo software (RIVM., 2006). The product was selected as default product: cleaning and washing product (application liquid), and the types of product bathroom cleaning agent and toilet cleaner were assessed (The Soap and Detergent Association (SDA) states that 'phosphoric acid can dissolve calcium and metal salts; they find use in tub, tile, sink and toilet bowl cleaners') in order to ascertain the worst case in terms of exposure to phosphoric acid in lime scale removal and cleaning applications.</p> <p>Default parameters of the model were used to characterise the use conditions (frequency: 4 times a year for bathroom cleaners, 260 times a year for toilet cleaners as discussed in the Cleaning Products Fact Sheet, RIVM report 320104003). The following product information was used: 15% of phosphoric acid, duration of 20 minutes; 110g product/application</p> <p><b>Exposure assessment and RCR, consumer exposure to phosphoric acid (spray applications and toilet clear / lime scale removal applications)</b></p> |                                      |                                      |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|                                                                                                          | <table><tr><th>Consumer use</th><th>Inhalation exposure estimate (mg/m³)</th><th>RCR</th><th>Conclusion</th></tr><tr><td>Private spraying of liquid fertiliser (phosphoric acid concentration up to 10%)</td><td>0.01</td><td>0.014</td><td>Risk adequately controlled</td></tr><tr><td>Use of liquid bathroom cleaners (phosphoric acid concentration up to 15%)</td><td>0.0687</td><td>0.094</td><td>Risk adequately controlled</td></tr><tr><td>Use of toilet cleaners (phosphoric acid concentration up to 15%) w/w)</td><td>0.085</td><td>0.116</td><td>Risk adequately controlled</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Consumer use                         | Inhalation exposure estimate (mg/m³) | RCR                        | Conclusion | Private spraying of liquid fertiliser (phosphoric acid concentration up to 10%) | 0.01 | 0.014 | Risk adequately controlled | Use of liquid bathroom cleaners (phosphoric acid concentration up to 15%) | 0.0687 | 0.094 | Risk adequately controlled | Use of toilet cleaners (phosphoric acid concentration up to 15%) w/w) | 0.085 | 0.116 | Risk adequately controlled |
|                                                                                                          | Consumer use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Inhalation exposure estimate (mg/m³) | RCR                                  | Conclusion                 |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|                                                                                                          | Private spraying of liquid fertiliser (phosphoric acid concentration up to 10%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0.01                                 | 0.014                                | Risk adequately controlled |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|                                                                                                          | Use of liquid bathroom cleaners (phosphoric acid concentration up to 15%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.0687                               | 0.094                                | Risk adequately controlled |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
| Use of toilet cleaners (phosphoric acid concentration up to 15%) w/w)                                    | 0.085                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0.116                                | Risk adequately controlled           |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                                      |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                                      |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |
|                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |                                      |                            |            |                                                                                 |      |       |                            |                                                                           |        |       |                            |                                                                       |       |       |                            |

|                                                                                   |                                                                                                                                                          |                                                               |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Consumers<br>(dermal)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Local effects of phosphoric acid can be managed by using the recommended PPE.                                                                                                  |
| Indirect<br>exposure via<br>the<br>environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No indirect exposure of humans via the environment is expected for orthophosphoric acid<br>Thus, no assessment of indirect exposure of humans via the environment is required. |
| <b>5.2. Environmental exposure (qualitative assessment)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                |
| <p>Consumer uses relates to already diluted products, which will further be neutralized quickly in the sewer, well before reaching a WWTP or surface water.</p> <p>Orthophosphoric acid used in batteries: there is no environmental release as batteries are sealed articles with a long service life. After use, batteries should be recycled.</p> <p>If disposed as municipal waste, orthophosphoric acid is not expected to cause a significant pH effect to the environment when incinerated or land filled.</p> |                                                                                                                                                                                |



**PRODUCT: SODIUM HYPOCHLORITE (HYPO) REVISION: 4 DATED: 26/02/11 PAGE 1 OF 8**

| PRODUCT SPECIFICATION                        |                                                         |                     |                  |
|----------------------------------------------|---------------------------------------------------------|---------------------|------------------|
| Product Name                                 | Sodium Hypochlorite Solution, 14-15% Available Chlorine |                     |                  |
| Alternative Name                             | Bleach Liquor                                           |                     |                  |
| Specification Reference                      | SH150PG01 (07/05)                                       |                     |                  |
|                                              | Units                                                   | Specification Range | Typical Analysis |
| Available Chlorine                           | % w/w                                                   | >14.0               | 14.8             |
| Density at 20°C                              | kg/litre                                                | 1.24 – 1.27         | 1.26             |
| Sodium Hypochlorite                          | % w/w                                                   | 14.7 minimum        | 15.5             |
| Sodium Hydroxide                             | % w/w                                                   | 0.2 – 1.0           | 0.7              |
| Sodium Carbonate                             | % w/w                                                   | <1.5                | 0.4              |
| Total Alkalinity as NaOH                     | % w/w                                                   | 0.3 - 1.8           | 1.0              |
| Iron, Fe                                     | ppm                                                     | <2                  | 0.4              |
| <b>Methods of Analysis</b>                   |                                                         |                     |                  |
| Methods of analysis are given in BS4426:1969 |                                                         |                     |                  |

The strength specification is that at the time of supply. Sodium Hypochlorite solution is inherently unstable and slowly loses strength, producing Sodium Chloride and Oxygen, therefore time/light/foreign matter all contribute (sometimes to significant effect) to a reduction in strength. We recommend no more than 2-3 months stock on hand in cool/dark storage conditions.

#### NOTES

##### Exclusion of Liability

Information contained in this publication is accurate to the best of the knowledge and belief of Tennants.

Any information or advice obtained from Tennants otherwise than by means of this publication and whether relating to Tennants materials or other materials, is also given in good faith. However, it remains at all times the responsibility of the customer to ensure that Tennants materials are suitable for the particular purpose intended.

Tennants accepts no liability whatsoever (except as otherwise provided by law) arising out of the use of information supplied, the application, adaptation or processing of the products described herein, the use of other materials in lieu of Tennants materials or the use of Tennants materials in conjunction with such other materials.

##### Health and Safety

A Material Safety Data Sheet has been issued describing the health, safety and environmental properties of this product, identifying the potential hazards and giving advice on the handling precautions and emergency procedures. This must be consulted fully before handling, storage and use.



PRODUCT: SODIUM HYPOCHLORITE (HYPO) REVISION: 4 DATED: 26/02/11 PAGE 2 OF 8

## SAFETY DATA SHEET

### 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY

#### 1.1 Product Identifier

|                           |                                                  |
|---------------------------|--------------------------------------------------|
| Trade Name                | Sodium hypochlorite 14 – 15% (All grades)        |
| Substance Name            | sodium hypochlorite, solution 10 – 15% Cl active |
| Index Number              | 017-011-00-1                                     |
| CAS Number                | 7681-52-9                                        |
| EINECS Number             | 231-668-3                                        |
| REACH Registration Number | 01-2119488154-34-XXXX                            |

#### 1.2 Relevant identified uses of the substance or mixture and uses advised against

|                      |                                                                                                                                |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Identified use(s)    | At this time we do not yet have information on identified uses. They will be included in this safety data sheet when available |
| Uses advised against | At this time we do not yet have information on use restriction. They will be included in this safety data sheet when available |

#### 1.3 Details of the supplier of the safety data sheet

Tennants Distribution Limited  
Hazelbottom Road  
Cheetham  
Manchester  
M8 0GR  
Tel: 44(0)161 205 4454  
Fax: 44(0) 161 203 4298  
Email: [msds@tennantsdistribution.com](mailto:msds@tennantsdistribution.com)

#### 1.4 Emergency telephone number

Tel: 44(0)844 335 0001 (24 hours)

### 2. HAZARDS IDENTIFICATION

#### 2.1 Classification of the substance or mixture

##### 2.1.1 Regulation 1272/2008 (CLP)

| Hazard Class           | Hazard Category | Target Organs | Hazard Statements |
|------------------------|-----------------|---------------|-------------------|
| Skin corrosion         | Category 1B     |               | H314              |
| Acute aquatic toxicity | Category 1      |               | H400              |

For the full text of the H-Statements mentioned in this Section, see Section 16

##### 2.1.2 EEC Directive 67/548/EEC & Directive 1999/45/EC

|                                   |              |
|-----------------------------------|--------------|
| Hazard symbol/Category of danger  | Risk phrases |
| Corrosive (C)                     | R34, R31     |
| Dangerous for the environment (N) | R50          |

#### 2.2 Label elements

##### 2.2.1

Hazard Pictogram



According to Regulation (EC) No. 1272/2008 (CLP).

Signal word(s)

Danger.

Hazard statement(s)

H314; Causes severe skin burns and eye damage.

Precautionary statement(s)

H400: Very toxic to aquatic life  
P260: Do not breathe vapour  
P273: Avoid release to the environment  
P280: Wear protective gloves/protective clothing/eye protection/face protection  
P301 + P330 + P331: If SWALLOWED: rinse mouth. Do NOT induce vomiting  
P303 + P361 + P353: If ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower



**PRODUCT: SODIUM HYPOCHLORITE (HYPO) REVISION: 4 DATED: 26/02/11 PAGE 3 OF 8**

P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do so. Continue rinsing

**Additional Labelling:**

EUH031: Contact with acids liberates toxic gas

**Hazardous components which must be listed on the label:**

Sodium hypochlorite, solution

**2.3 Other hazards**

No other information is available

**3. COMPOSITION/INFORMATION ON INGREDIENTS**

**Substances**

- **Chemical nature:** Sodium hypochlorite  
Aqueous solution

| Chemical Name                 | Identification Number |              | Amount (%)   |
|-------------------------------|-----------------------|--------------|--------------|
| Sodium hypochlorite, solution | Index Number          | 017-011-00-1 | >= 10 - <=15 |
|                               | CAS No.               | 7681-52-9    |              |
|                               | EC No.                | 231-668-3    |              |
| Sodium hydroxide              | Index Number          | 011-002-00-6 | >=0 - <5     |
|                               | CAS No.               | 1310-73-2    |              |
|                               | EC No.                | 215-185-5    |              |

See section 16 for the full text of the R, H- and EUH-phrases declared above  
Occupational exposure limits, if available, are listed in section 8

**4. FIRST AID MEASURES**

**4.1 Description of first aid measures**

**General Advice**

Take off contaminated clothing immediately

**Inhalation**

In case of accident by inhalation: remove casualty to fresh air and keep at rest. If breathing is irregular or has stopped, administer artificial respiration. Call a physician immediately

**Skin contact**

Wash off immediately with soap and plenty of water. If irritation appears or if the contamination is important, seek medical advice

**Eye contact**

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Consult an eye specialist immediately. Go to an ophthalmic hospital if possible

**Ingestion**

Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. If swallowed, do not induce vomiting – seek medical advice. If a person vomits, when lying on their back, place them in the recovery position

**4.2 Most important symptoms and effects, both acute and delayed**

Inhalation may provoke the following symptoms: Cough, headache, lung oedema

Effects: Risk of serious damage to the lungs (by aspiration)

**4.3 Indication of any immediate medical attention and special treatment needed**

Treat symptomatically. Later control for pneumonia and lung oedema

**5. FIRE FIGHTING MEASURES**

**5.1 Extinguishing Media**

Suitable extinguishing media: Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. The product itself does not burn

Unsuitable extinguishing media: Exempt

**5.2 Special hazards arising from the substance or mixture**

Fire may cause evolution of: Chlorine, Hydrogen chlorine gas, chlorine oxides

**5.3 Advice for fire-fighters**

In the event of fire, wear self contained breathing apparatus. Wear appropriate body protection (full protective suit)  
Further information: Cool closed containers exposed to fire with water spray. Heating will cause a pressure rise –with risk of bursting. Collect contaminated fire extinguishing water separately. This must not be discharged into drains



**PRODUCT: SODIUM HYPOCHLORITE (HYPO) REVISION: 4 DATED: 26/02/11 PAGE 4 OF 8**

|                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| <b>6. ACCIDENTAL RELEASE MEASURES</b>                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                              |
| <b>6.1 Personal precautions, protective equipment and emergency procedures</b>                                                                                                                                                                                                                                                                                                                                                   |                                                                                                              |
| Use personal protective equipment. Wear respiratory protection. Keep people away from and upwind of spill/leak. Provide adequate ventilation. Danger of slipping if spilled. Avoid contact with skin and eyes. Do not breathe vapour                                                                                                                                                                                             |                                                                                                              |
| <b>6.2 Environmental precautions</b>                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                              |
| Do not flush into surface water or sanitary sewer system. Avoid subsoil penetration. If the product contaminates rivers and lakes or drains inform respective authorities. If material reaches soil inform authorities responsible for such cases                                                                                                                                                                                |                                                                                                              |
| <b>6.3 Methods and material for containment and cleaning up</b>                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                              |
| Method and materials for containment and cleaning up: Absorb with liquid binding material (sand, diatomite, acid binders, universal binders). Keep in suitable, closed container for disposal                                                                                                                                                                                                                                    |                                                                                                              |
| Further information: Treat recovered material as described in Section 13 Disposal Considerations                                                                                                                                                                                                                                                                                                                                 |                                                                                                              |
| <b>6.4 Reference to other sections</b>                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                              |
| For personal protection see Section 8                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                              |
| <b>7. HANDLING AND STORAGE</b>                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                              |
| <b>7.1 Precautions for safe handling</b>                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                              |
| <b>Advice on safe handling:</b> Do not keep the container sealed. Handle and open container with care. Ensure adequate ventilation. Use personal protective equipment. Avoid contact with the skin and eyes. Do not breathe vapours or spray mist. M Use respirator with appropriate filter if vapours or aerosol are released. Emergency eye wash fountains and emergency showers should be available in the immediate vicinity |                                                                                                              |
| <b>Hygiene measures:</b> Keep away from food, drink and animal feedingstuffs. Smoking, eating and drinking should be prohibited in the application area. Wash hands before breaks and at the end of workday. Take off immediately all contaminated clothing immediately. Avoid contact with the skin and the eyes. Do not breathe vapour or spray mist                                                                           |                                                                                                              |
| <b>7.2 Conditions for safe storage, including any incompatibilities</b>                                                                                                                                                                                                                                                                                                                                                          |                                                                                                              |
| <b>Requirements for storage:</b> Keep in an area equipped with alkali resistant flooring. Keep only in the original container. Store in a receptacle equipped with a vent                                                                                                                                                                                                                                                        |                                                                                                              |
| <b>Advice on protection against fire and explosion:</b> The product is not flammable. Normal measures for preventive fire protection                                                                                                                                                                                                                                                                                             |                                                                                                              |
| <b>Further information on storage conditions:</b> Keep in a well-ventilated place. Protect against light. Store in a cool place. Do not keep the container sealed                                                                                                                                                                                                                                                                |                                                                                                              |
| <b>Advice on common storage:</b> Keep away from food, drink and animal feedingstuffs. Do not store together with acids and ammonium salts                                                                                                                                                                                                                                                                                        |                                                                                                              |
| <b>German storage class:</b> 8B: Non-combustible substances, corrosive                                                                                                                                                                                                                                                                                                                                                           |                                                                                                              |
| <b>7.3 Specific end use(s)</b>                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                              |
| No information available                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                              |
| <b>8. EXPOSURE CONTROLS/PERSONAL PROTECTION</b>                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                              |
| <b>8.1 Control parameters</b>                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                              |
| <b>Sodium Hydroxide CAS No. 1310-73-2</b>                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                              |
| Regulatory Basis                                                                                                                                                                                                                                                                                                                                                                                                                 | UK EH40 Workplace Exposure Limits (WEL's)                                                                    |
| Regulatory List                                                                                                                                                                                                                                                                                                                                                                                                                  | EH40 WEL                                                                                                     |
| Value Type                                                                                                                                                                                                                                                                                                                                                                                                                       | Short Term Exposure Limit                                                                                    |
| Value                                                                                                                                                                                                                                                                                                                                                                                                                            | 2 mg/m <sup>3</sup>                                                                                          |
| <b>Chlorine CAS No. 7782-50-5</b>                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                              |
| Regulatory Basis                                                                                                                                                                                                                                                                                                                                                                                                                 | EU. Indicative Exposure and Directives relating to work exposure to chemical, physical and biological agents |
| Regulatory List                                                                                                                                                                                                                                                                                                                                                                                                                  | EU ELV                                                                                                       |
| Value Type                                                                                                                                                                                                                                                                                                                                                                                                                       | Short Term Exposure Limit (STEL):                                                                            |
| Value                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.5 ppm                                                                                                      |
| Value                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.5 mg/m <sup>3</sup>                                                                                        |
| Remarks                                                                                                                                                                                                                                                                                                                                                                                                                          | Indicative                                                                                                   |
| Regulatory Basis                                                                                                                                                                                                                                                                                                                                                                                                                 | UK EH40 Workplace Exposure Limit (WEL)                                                                       |
| Regulatory List                                                                                                                                                                                                                                                                                                                                                                                                                  | EH40 WEL                                                                                                     |
| Value Type                                                                                                                                                                                                                                                                                                                                                                                                                       | Short Term Exposure Limit (STEL)                                                                             |
| Value                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.5 ppm                                                                                                      |
| Value                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.5 mg/m <sup>3</sup>                                                                                        |
| <b>DN(M)EL/PNEC</b>                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                              |
| <b>DN(M)EL's</b>                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                              |
| Currently we do not have any information from our supplier about this                                                                                                                                                                                                                                                                                                                                                            |                                                                                                              |
| <b>Predicted No Effect Concentrations (PNEC):</b>                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                              |
| Currently we do not have any information from our supplier about this                                                                                                                                                                                                                                                                                                                                                            |                                                                                                              |



**PRODUCT: SODIUM HYPOCHLORITE (HYPO) REVISION: 4 DATED: 26/02/11 PAGE 5 OF 8**

|                                                                                                                                                                                                                                                                                                                                                               |                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| <b>8.2 Exposure controls</b>                                                                                                                                                                                                                                                                                                                                  |                                                                       |
| <b>Appropriate engineering controls</b>                                                                                                                                                                                                                                                                                                                       |                                                                       |
| Refer to protective measures listed in sections 7 and 8                                                                                                                                                                                                                                                                                                       |                                                                       |
| <b>Respiratory protection</b>                                                                                                                                                                                                                                                                                                                                 |                                                                       |
| Advice: Use respirator with appropriate filter if vapours or aerosol are released.                                                                                                                                                                                                                                                                            |                                                                       |
| Recommended Filter type: Combination filter: B-P2. Combination filter: B-P3                                                                                                                                                                                                                                                                                   |                                                                       |
| <b>Hand protection</b>                                                                                                                                                                                                                                                                                                                                        |                                                                       |
| Advice: The glove material has to be impermeable and resistant to the product/the substance/the preparation. Take note of the information given by the producer concerning permeability and breakthrough times, and of the special workplace conditions (mechanical strain, duration of contact). Protective gloves should be replaced at first signs of wear |                                                                       |
| <b>Gloves material</b>                                                                                                                                                                                                                                                                                                                                        |                                                                       |
| Butyl rubber. Gloves: 8h. Glove thickness: 0.5 mm                                                                                                                                                                                                                                                                                                             |                                                                       |
| Polychloroprene: Gloves: 8h. Glove thickness: 0.5 mm                                                                                                                                                                                                                                                                                                          |                                                                       |
| <b>Eye protection</b>                                                                                                                                                                                                                                                                                                                                         |                                                                       |
| Tightly fitting safety goggles                                                                                                                                                                                                                                                                                                                                |                                                                       |
| <b>Skin protection</b>                                                                                                                                                                                                                                                                                                                                        |                                                                       |
| Alkali resistant protective clothing                                                                                                                                                                                                                                                                                                                          |                                                                       |
| <b>Hygiene Measures</b>                                                                                                                                                                                                                                                                                                                                       |                                                                       |
| Avoid contact with the skin and the eyes                                                                                                                                                                                                                                                                                                                      |                                                                       |
| Use barrier cream regularly                                                                                                                                                                                                                                                                                                                                   |                                                                       |
| Provide adequate ventilation                                                                                                                                                                                                                                                                                                                                  |                                                                       |
| Wear suitable gloves and eye/face protection                                                                                                                                                                                                                                                                                                                  |                                                                       |
| <b>Protective Measures</b>                                                                                                                                                                                                                                                                                                                                    |                                                                       |
| General industrial hygiene practice                                                                                                                                                                                                                                                                                                                           |                                                                       |
| <b>Environmental exposure controls</b>                                                                                                                                                                                                                                                                                                                        |                                                                       |
| Do not flush into surface water or sanitary sewer system. Avoid subsoil penetration. If the product contaminates rivers and lakes or drains inform respective authorities. If material reaches soil inform authorities responsible for such cases                                                                                                             |                                                                       |
| <b>9. PHYSICAL AND CHEMICAL PROPERTIES</b>                                                                                                                                                                                                                                                                                                                    |                                                                       |
| <b>9.1 Information on basic physical and chemical properties</b>                                                                                                                                                                                                                                                                                              |                                                                       |
| Appearance                                                                                                                                                                                                                                                                                                                                                    | Liquid                                                                |
| Colour                                                                                                                                                                                                                                                                                                                                                        | Yellowish green                                                       |
| Odour                                                                                                                                                                                                                                                                                                                                                         | Slight chlorine                                                       |
| Odour Threshold                                                                                                                                                                                                                                                                                                                                               | Currently we do not have any information from our supplier about this |
| pH in water solution                                                                                                                                                                                                                                                                                                                                          | >11                                                                   |
| Freezing point                                                                                                                                                                                                                                                                                                                                                | -17°C                                                                 |
| Boiling point/boiling range                                                                                                                                                                                                                                                                                                                                   | 110°C                                                                 |
| Flash point                                                                                                                                                                                                                                                                                                                                                   | Not applicable                                                        |
| Evaporation rate                                                                                                                                                                                                                                                                                                                                              | Currently we do not have any information from our supplier about this |
| Flammability (solid, gas)                                                                                                                                                                                                                                                                                                                                     | Does not ignite                                                       |
| Lower explosion limit                                                                                                                                                                                                                                                                                                                                         | Not applicable                                                        |
| Upper explosion limit                                                                                                                                                                                                                                                                                                                                         | Not applicable                                                        |
| Vapour pressure                                                                                                                                                                                                                                                                                                                                               | Currently we do not have any information from our supplier about this |
| Relative vapour density                                                                                                                                                                                                                                                                                                                                       | >1.0 (Air = 1.0)                                                      |
| Density                                                                                                                                                                                                                                                                                                                                                       | 1.2 – 1.3 g/cm <sup>3</sup>                                           |
| Water solubility                                                                                                                                                                                                                                                                                                                                              | Completely soluble                                                    |
| Partition coefficient/n-octanol/water                                                                                                                                                                                                                                                                                                                         | Currently we do not have any information from our supplier about this |
| Thermal decomposition                                                                                                                                                                                                                                                                                                                                         | Not applicable                                                        |
| Viscosity, dynamic                                                                                                                                                                                                                                                                                                                                            | 3.45 mPa.s 20°C (Aqueous solution, 15%)                               |
| Explosive properties                                                                                                                                                                                                                                                                                                                                          | Not explosive                                                         |
| Oxidising properties                                                                                                                                                                                                                                                                                                                                          | Currently we do not have any information from our supplier about this |
| <b>9.2 Other information</b>                                                                                                                                                                                                                                                                                                                                  |                                                                       |
| No further information available                                                                                                                                                                                                                                                                                                                              |                                                                       |
| <b>10. STABILITY AND REACTIVITY</b>                                                                                                                                                                                                                                                                                                                           |                                                                       |
| <b>10.1 Reactivity</b>                                                                                                                                                                                                                                                                                                                                        |                                                                       |
| Advice: This product is a very reactive substance that can react with many inorganic and organic compounds                                                                                                                                                                                                                                                    |                                                                       |
| <b>10.2 Chemical stability</b>                                                                                                                                                                                                                                                                                                                                |                                                                       |
| Advice: Decomposes on heating. Decomposes on exposure to light                                                                                                                                                                                                                                                                                                |                                                                       |



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**10.3 Possibility of hazardous reactions**

Hazardous reactions: May develop chlorine if mixed with acidic solutions

**10.4 Conditions to avoid**

Heat

**10.5 Incompatible materials**

Materials to avoid: Acids, ammonium compounds, acetic anhydride, organic materials, hydrogen peroxide, metal salts, copper, nickel, iron

**10.6 Hazardous decomposition products**

Hazardous decomposition products: Hydrogen chloride gas, chlorine, chlorine oxides

**11. TOXICOLOGICAL INFORMATION**

**11.1 Information on toxicological effects**

**Component: Sodium Hypochlorite solution 10 – 15% Cl active CAS No. 7681-52-9**

**Acute Toxicity**

**Oral**

Value Type: LD50 Value: 2900 – 3400 mg/kg Species: Mouse

Remarks: Cause serious burns with severe pains, vomiting, pains in the stomach, possibly shock and damaged kidneys. The burn may occur even if only small amounts have been swallowed

**Inhalation**

Value Type: LD50 Value: >10.5 mg/l Species: Rat

**Dermal**

Value Type: LD50 Value: >2000 mg/kg Species: Rabbit

**Irritation**

**Skin**

Species: Rabbit. Result: Severe skin irritation. Method: OECD Test Guideline 404.

Species: Human. Result: Corrosive effect

**Eyes**

Species: Rabbit. Result: Corrosive effects. Remarks: Risk of serious damage to eyes

**Sensitisation**

Species: Guinea pig. Result: Not sensitising

**Further information**

All numerical values for acute toxicity are calculated on the pure substances. If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the oesophagus and the stomach. Handle in accordance with good industrial hygiene and safety practice

**12. ECOLOGICAL INFORMATION**

**12.1 Acute Toxicity**

**Component: Sodium hypochlorite, solution 10 – 15% Cl active**

**Fish**

Species: Pimephales promelas. Exposure time: 96h. Value type: LC50. Value: 0.22 – 0.62 mg/l

Toxicity to daphnia and other aquatic invertebrates

Species: Daphnia magna. Exposure time: 96h. Value type: EC50. Value: 2.1 mg/l

**Algae**

Species: Desmodesmus subspicatus (green algae). 24h..Value type: EC50. Value: 28 mg/l

**12.2 Persistence and degradability**

**Component: Sodium hypochlorite, solution 10 – 15% Cl active**

**Persistence:**

No data available

**Biodegradability:**

Remarks: The methods for determining the biological degradability are not applicable to inorganic substances

**12.3 Bio accumulative potential**

Remarks: Bioaccumulation is not expected

**12.4 Mobility in soil**

Remarks: The product is mobile in water environment

**12.5 Results of PBT and vPvB assessment**

Remarks: No data available

**12.6 Other adverse effects**

**Additional ecological information:**

All numerical values for ecotoxicity effects are calculated on the pure substances

Do not flush into surface water or sanitary sewer system



**PRODUCT: SODIUM HYPOCHLORITE (HYPO) REVISION: 4 DATED: 26/02/11 PAGE 7 OF 8**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>13. DISPOSAL CONSIDERATIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                         |
| <b>13.1 Waste treatment methods</b><br><b>Product:</b><br>Disposal together with normal waste is not allowed. Special disposal required according to local regulations. Do not let product enter drains. Contact waste disposal services.<br><b>Contaminated Packaging:</b><br>Empty contaminated packaging thoroughly. They can be recycled after thorough and proper cleaning. Packagings that cannot be cleaned are to be disposed of in the same manner as the product<br><b>European Waste Catalogue Number:</b><br>No waste code according to the European Waste Catalogue can be assigned for this product, as the intended use dictates the assignment. The waste code is established in consultation with the regional waste disposer                                                                                                                            |                                                                         |
| <b>14. TRANSPORT INFORMATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                         |
| <b>14.1 UN Number</b><br>ADR<br>RID<br>IMDG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1791<br>1791<br>1791                                                    |
| <b>14.2 UN Proper Shipping Name</b><br>ADR<br>RID<br>IMDG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | HYPOCHLORITE SOLUTION<br>HYPOCHLORITE SOLUTION<br>HYPOCHLORITE SOLUTION |
| <b>14.3 Transport hazard class</b><br>ADR-Class<br>(Labels, Classification Code; Hazard Identification No; Tunnel restriction code)<br>RID-Class<br>(Labels, Classification Code; Hazard Identification No.)<br>IMDG-Class<br>(Labels; Ems)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8<br>8; C9; 80; (E)<br>8<br>8; C9; 80<br>8<br>8; F-A, S-B               |
| <b>14.4 Packing group</b><br>ADR<br>RID<br>IMDG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | III<br>III<br>III                                                       |
| <b>14.5 Environmental</b><br>Labelling according to 5.2.1.8 ADR<br>Labelling according to 5.2.1.8 ADR<br>Labelling according to 5.2.1.6.3 IMDG<br>Classification as environmentally hazardous according to 2.9.3 IMDG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Fish and tree<br>Fish and tree<br>Fish and tree<br>Yes                  |
| <b>14.6 Special precautions for users</b><br>Note: Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                         |
| <b>14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code</b><br>Note: Note applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                         |
| <b>15. REGULATORY INFORMATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                         |
| <b>15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                         |
| <b>15.2 Chemical safety assessment</b><br>Currently we do not have any information from our supplier about this                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                         |
| <b>16. OTHER INFORMATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                         |
| <b>Full text of R Phrases referred to under sections 2 and 3</b><br>R31: Contact with acids liberates toxic gas<br>R34: Causes burns<br>R50: Very toxic to aquatic organisms<br><b>Full text of H-Statements referred to under sections 2 and 3</b><br>H314: Causes severe skin burns and eye damage<br>H400: Very toxic to aquatic life<br><b>Further information</b><br><b>Other information:</b><br>Restricted to professional users. Attention - Avoid exposure – obtain special instructions before use<br>The information provided in this Safety Data Sheet is correct to our knowledge at the date of its revision. The information given only describes the product with regard to safety arrangements and is not to be considered as a warranty or quality specification and does not constitute a legal relationship. The information contained in this Safety |                                                                         |



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Data Sheet relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

**Source of key data used to compile the data sheet**

Supplier information

**Modifications from last revision**

The Safety Data Sheets have been revised throughout in accordance with Regulation (EC) No. 1907/2006 and amendments

**Date:** 18/01/11

**SAFETY DATA SHEET according to Regulation (EC) No. 1907/2006****Sulphuric acid >51 - <96%**

Version 7.0

Print Date 2013/05/03

Revision date / valid from 2013/05/03

**MSDS code: MSUL051****Section 1: Identification of the substance/mixture and of the company/undertaking****1.1. Product identifier**

Trade name : Sulphuric acid >51 - <96%  
Substance name : sulphuric acid  
Index-No. : 016-020-00-8  
CAS-No. : 7664-93-9  
EC-No. : 231-639-5  
Registration number : 01-2119458838-20-xxxx

**1.2. Relevant identified uses of the substance or mixture and uses advised against**

Use of the Substance/Mixture : Identified use: See table in front of appendix for a complete overview of identified uses.  
Uses advised against : At this moment we have not identified any uses advised against

**1.3. Details of the supplier of the safety data sheet**

Company : Brenntag UK & Ireland  
Albion House, Rawdon Park  
GB LS19 7XX Leeds Yeadon  
Telephone : +44 (0) 113 3879 200  
Telefax : +44 (0) 113 3879 280  
E-mail address : msds@brenntag.co.uk

**1.4. Emergency telephone number**

Emergency telephone number : Emergency only telephone number (open 24 hours):  
+44 (0) 1865 407333 (N.C.E.C. Culham)

**Section 2: Hazards identification****2.1. Classification of the substance or mixture****Classification according to Regulation (EC) No 1272/2008**

| REGULATION (EC) No 1272/2008 |                 |               |                   |
|------------------------------|-----------------|---------------|-------------------|
| Hazard class                 | Hazard category | Target Organs | Hazard statements |
| Corrosive to metals          | Category 1      | ---           | H290              |
| Skin corrosion               | Category 1A     | ---           | H314              |

## Sulphuric acid >51 - <96%

For the full text of the H-Statements mentioned in this Section, see Section 16.

### Classification according to EU Directives 67/548/EEC or 1999/45/EC

| Directive 67/548/EEC or 1999/45/EC |              |
|------------------------------------|--------------|
| Hazard symbol / Category of danger | Risk phrases |
| Corrosive (C)                      | R35          |

For the full text of the R-phrases mentioned in this Section, see Section 16.

### Most important adverse effects

|                                 |   |                                                |
|---------------------------------|---|------------------------------------------------|
| Human Health                    | : | See section 11 for toxicological information.  |
| Physical and chemical hazards   | : | See section 9 for physicochemical information. |
| Potential environmental effects | : | See section 12 for environmental information.  |

## 2.2. Label elements

### Labelling according to Regulation (EC) No 1272/2008

|                          |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hazard symbols           | : |                                                                                                                                                                                                                                                                                                                                                                                                 |
| Signal word              | : | Danger                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Hazard statements        | : | H290 May be corrosive to metals.<br>H314 Causes severe skin burns and eye damage.                                                                                                                                                                                                                                                                                                                                                                                                  |
| Precautionary statements | : |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Prevention               | : | P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.                                                                                                                                                                                                                                                                                                                                                                                                 |
| Response                 | : | P301 + P330 + P331 IF SWALLOWED: rinse mouth. Do NOT induce vomiting.<br>P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.<br>P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.<br>P310 Immediately call a POISON CENTER or doctor/ physician.<br>P390 Absorb spillage to prevent material damage. |

## Sulphuric acid >51 - <96%

**Hazardous components which must be listed on the label:**

II • sulphuric acid

### 2.3. Other hazards

For Results of PBT and vPvB assessment see section 12.5.

## Section 3: Composition/information on ingredients

### 3.1. Substances

Chemical nature : Aqueous solution

| Hazardous components | Amount [%]              | Classification<br>(REGULATION (EC) No 1272/2008) |                      | Classification<br>(67/548/EEC) |
|----------------------|-------------------------|--------------------------------------------------|----------------------|--------------------------------|
|                      |                         | Hazard class /<br>Hazard category                | Hazard<br>statements |                                |
| sulphuric acid       |                         |                                                  |                      |                                |
| Index-No.            | : 016-020-00-8          | Skin Corr.1A                                     | H314                 | Corrosive; C; R35              |
| CAS-No.              | : 7664-93-9             |                                                  |                      |                                |
| EC-No.               | : 231-639-5             | > 51 - < 96                                      |                      |                                |
| Registration         | : 01-2119458838-20-xxxx |                                                  |                      |                                |
| C&L-No.              | : 02-2119752444-38-0000 |                                                  |                      |                                |

For the full text of the R-phrases mentioned in this Section, see Section 16.

For the full text of the H-Statements mentioned in this Section, see Section 16.

## Section 4: First aid measures

### 4.1. Description of first aid measures

General advice : Take off all contaminated clothing immediately.

If inhaled : In case of accident by inhalation: remove casualty to fresh air and keep at rest. If breathing is irregular or stopped, administer artificial respiration. Call a physician immediately.

In case of skin contact : First swab the concentrated acid with dry pulp or textile; because the acid reacts vigorously with water and with strong evolution of heat. Wash off with plenty of water. Immediate medical treatment is necessary as untreated wounds from corrosion of the skin heal slowly and with difficulty.

In case of eye contact : Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Consult an eye specialist immediately. Go to an ophthalmic hospital if possible.

## Sulphuric acid >51 - <96%

If swallowed : Clean mouth with water and drink afterwards plenty of water. Never give anything by mouth to an unconscious person. Do NOT induce vomiting. Call a physician immediately.

### 4.2. Most important symptoms and effects, both acute and delayed

Symptoms : See Section 11 for more detailed information on health effects and symptoms.

Effects : See Section 11 for more detailed information on health effects and symptoms.

### 4.3. Indication of any immediate medical attention and special treatment needed

Treatment : Treat symptomatically.

## Section 5: Firefighting measures

### 5.1. Extinguishing media

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. The product itself does not burn.

Unsuitable extinguishing media : No information available.

### 5.2. Special hazards arising from the substance or mixture

Specific hazards during firefighting : May decompose in a fire giving off toxic fumes, Hazardous decomposition products, Sulphur oxides, Reacts exothermic with water

### 5.3. Advice for firefighters

Special protective equipment for firefighters : In the event of fire, wear self-contained breathing apparatus. Wear appropriate body protection (full protective suit)

Further information : Collect contaminated fire extinguishing water separately. This must not be discharged into drains. Cool closed containers exposed to fire with water spray.

## Section 6: Accidental release measures

### 6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions : Use personal protective equipment. Provide adequate ventilation. Avoid contact with skin and eyes. Do not breathe vapours or spray mist.

### 6.2. Environmental precautions

Environmental precautions : Do not flush into surface water or sanitary sewer system. Avoid subsoil penetration. If the product contaminates rivers and lakes or drains inform respective authorities. Local authorities should be advised if significant spillages cannot be

## Sulphuric acid >51 - <96%

contained.

### 6.3. Methods and materials for containment and cleaning up

Methods and materials for containment and cleaning up : Neutralize with soda and flush with plenty of water. Taking into account local regulations the product may be disposed of as waste water after neutralisation. Clean-up methods - small spillage: Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders). Keep in suitable, closed containers for disposal.

Further information : Treat recovered material as described in the section "Disposal considerations".

### 6.4. Reference to other sections

See Section 1 for emergency contact information.  
See Section 8 for information on personal protective equipment.  
See Section 13 for waste treatment information.

## Section 7: Handling and storage

### 7.1. Precautions for safe handling

Advice on safe handling : Keep container tightly closed. Use personal protective equipment. Avoid contact with the skin and the eyes. Do not breathe vapours or spray mist. Emergency eye wash fountains and emergency showers should be available in the immediate vicinity. When diluting, always add the product to water. Never add water to the product.

Hygiene measures : Keep away from food, drink and animal feedingstuffs. Smoking, eating and drinking should be prohibited in the application area. Wash hands before breaks and at the end of workday. Take off all contaminated clothing immediately. Avoid contact with skin, eyes and clothing. Do not breathe vapours or spray mist.

### 7.2. Conditions for safe storage, including any incompatibilities

Requirements for storage areas and containers : Keep in an area equipped with acid resistant flooring. Store in original container.

Advice on protection against fire and explosion : The product is not flammable. Normal measures for preventive fire protection. Gives off hydrogen by reaction with metals. Risk of explosion.

Further information on storage conditions : Keep tightly closed in a dry and cool place. Keep in a well-ventilated place. Product is hygroscopic.

Advice on common storage : Keep away from food, drink and animal feedingstuffs. Keep away from combustible material.

### 7.3. Specific end use(s)

## Sulphuric acid >51 - <96%

Specific use(s) : Identified use: See table in front of appendix for a complete overview of identified uses.

### Section 8: Exposure controls/personal protection

#### 8.1. Control parameters

|                                                 |                       |                                    |
|-------------------------------------------------|-----------------------|------------------------------------|
| <b>Component:</b>                               | <b>sulphuric acid</b> | <b>CAS-No.</b><br><b>7664-93-9</b> |
| <b>Other Occupational Exposure Limit Values</b> |                       |                                    |

EU ELV, Time Weighted Average (TWA):, Mist.  
0.05 mg/m<sup>3</sup>  
Indicative

EH40 WEL, Time Weighted Average (TWA):  
0.05 mg/m<sup>3</sup>  
Mist.  
Thoracic fraction.

ELV (IE), Time Weighted Average (TWA):, Mist.  
0.05 mg/m<sup>3</sup>  
Indicative OELV

#### 8.2. Exposure controls

##### Appropriate engineering controls

Refer to protective measures listed in sections 7 and 8.

##### Personal protective equipment

###### *Respiratory protection*

Advice : Required if vapours or aerosol are released.  
Recommended Filter type:  
Combination filter:E-P2

###### *Hand protection*

Advice : The glove material has to be impermeable and resistant to the product / the substance / the preparation.  
Take note of the information given by the producer concerning permeability and break through times, and of special workplace conditions (mechanical strain, duration of contact).  
Protective gloves should be replaced at first signs of wear.  
The following materials are suitable:

Material : Fluorinated rubber  
Break through time :  $\geq 8$  h  
Glove thickness : 0.5 mm

**Sulphuric acid >51 - <96%**

Material : butyl-rubber  
Break through time :  $\geq 2$  h  
Glove thickness : 0.5 mm

*Eye protection*

Advice : Tightly fitting safety goggles

*Skin and body protection*

Advice : Acid resistant protective clothing.

**Environmental exposure controls**

General advice : Do not flush into surface water or sanitary sewer system.  
Avoid subsoil penetration.  
If the product contaminates rivers and lakes or drains inform respective authorities.  
Local authorities should be advised if significant spillages cannot be contained.

**Section 9: Physical and chemical properties****9.1. Information on basic physical and chemical properties**

Form : liquid

Colour : colourless  
or  
slight  
coloured

Odour : odourless

Odour Threshold : no data available

pH :  $< 1$  (20 °C)

Solidification point : ca. 8 °C

Boiling point/boiling range : ca. 290 °C

Flash point : not applicable

Evapouration rate : no data available

Flammability (solid, gas) : The product is not flammable.

Upper explosion limit : not applicable

Lower explosion limit : not applicable

## Sulphuric acid >51 - <96%

|                                        |                                  |
|----------------------------------------|----------------------------------|
| Vapour pressure                        | : < 0.01 hPa (20 °C)             |
| Relative vapour density                | : 3.4                            |
| Density                                | : 1.84 g/cm <sup>3</sup> (20 °C) |
| Water solubility                       | : completely miscible            |
| Partition coefficient: n-octanol/water | : no data available              |
| Auto-ignition temperature              | : not applicable                 |
| Thermal decomposition                  | : ca. 338 °C                     |
| Viscosity, dynamic                     | : 21 mPa.s                       |
| Viscosity, kinematic                   | : no data available              |
| Explosivity                            | : Product is not explosive.      |
| Oxidizing properties                   | : no data available              |

### 9.2. Other information

|                     |                       |
|---------------------|-----------------------|
| Molecular Weight    | : 98.1 g/mol          |
| Corrosion to metals | : Corrosive to metals |

## Section 10: Stability and reactivity

### 10.1. Reactivity

|        |                           |
|--------|---------------------------|
| Advice | : Is corrosive to metals. |
|--------|---------------------------|

### 10.2. Chemical stability

|        |                                   |
|--------|-----------------------------------|
| Advice | : Stable under normal conditions. |
|--------|-----------------------------------|

### 10.3. Possibility of hazardous reactions

|                     |                                                                            |
|---------------------|----------------------------------------------------------------------------|
| Hazardous reactions | : Gives off hydrogen by reaction with metals. Reacts exothermic with water |
|---------------------|----------------------------------------------------------------------------|

### 10.4. Conditions to avoid

|                       |                                                      |
|-----------------------|------------------------------------------------------|
| Conditions to avoid   | : Reacts with the following substances: Bases, Water |
| Thermal decomposition | : ca. 338 °C                                         |

### 10.5. Incompatible materials

|                    |                                                     |
|--------------------|-----------------------------------------------------|
| Materials to avoid | : Organic materials, Bases, Reducing agents, Metals |
|--------------------|-----------------------------------------------------|

## Sulphuric acid >51 - <96%

### 10.6. Hazardous decomposition products

Hazardous decomposition : Sulphur oxides, Stable under recommended storage conditions.  
products

## Section 11: Toxicological information

### 11.1. Information on toxicological effects

#### Further information

Other relevant : If ingested, severe burns of the mouth and throat, as well as a  
toxicity information danger of perforation of the oesophagus and the stomach.

**Component:** sulphuric acid

**CAS-No.**  
7664-93-9

#### Acute toxicity

##### Oral

LD50 Oral : 2140 mg/kg (rat, male and female) (OECD Test Guideline 401)

##### Inhalation

no data available

##### Dermal

no data available

#### Irritation

##### Skin

Result : Very corrosive (rabbit)

##### Eyes

Result : Very corrosive (rabbit)  
Risk of serious damage to eyes.

#### Sensitisation

Result : no data available

#### CMR effects

#### CMR Properties

## Sulphuric acid >51 - <96%

|                       |   |                                                         |
|-----------------------|---|---------------------------------------------------------|
| Carcinogenicity       | : | Animal testing did not show any carcinogenic effects.   |
| Mutagenicity          | : | It is not considered mutagenic.                         |
| Teratogenicity        | : | Did not show teratogenic effects in animal experiments. |
| Reproductive toxicity | : | Animal testing did not show any effects on fertility.   |

### Specific Target Organ Toxicity

#### Single exposure

|        |   |                                                                                                |
|--------|---|------------------------------------------------------------------------------------------------|
| remark | : | The substance or mixture is not classified as specific target organ toxicant, single exposure. |
|--------|---|------------------------------------------------------------------------------------------------|

#### Repeated exposure

|        |   |                                                                                                  |
|--------|---|--------------------------------------------------------------------------------------------------|
| remark | : | The substance or mixture is not classified as specific target organ toxicant, repeated exposure. |
|--------|---|--------------------------------------------------------------------------------------------------|

### Other toxic properties

#### Aspiration hazard

No aspiration toxicity classification

## Section 12: Ecological information

### 12.1. Toxicity

|                   |                       |                                    |
|-------------------|-----------------------|------------------------------------|
| <b>Component:</b> | <b>sulphuric acid</b> | <b>CAS-No.</b><br><b>7664-93-9</b> |
|-------------------|-----------------------|------------------------------------|

#### Acute toxicity

##### Fish

|      |   |                                  |
|------|---|----------------------------------|
| LC50 | : | 42 mg/l (Gambusia affinis; 96 h) |
|------|---|----------------------------------|

#### Toxicity to daphnia and other aquatic invertebrates

|      |   |                                               |
|------|---|-----------------------------------------------|
| EC50 | : | 29 mg/l (Daphnia magna; 24 h)                 |
| EC50 | : | 70 - 80 mg/l (Crangon crangon (shrimp); 48 h) |

##### algae



no data available

## Sulphuric acid >51 - <96%

### Bacteria

EC50 : 58 mg/l (activated sludge; 120 h)

### 12.2. Persistence and degradability

|                   |                       |                  |
|-------------------|-----------------------|------------------|
| <b>Component:</b> | <b>sulphuric acid</b> | <b>CAS-No.</b>   |
|                   |                       | <b>7664-93-9</b> |

#### Persistence and degradability

##### Persistence

Result : no data available

##### Biodegradability

Result : The methods for determining the biological degradability are not applicable to inorganic substances.

### 12.3. Bioaccumulative potential

|                   |                       |                  |
|-------------------|-----------------------|------------------|
| <b>Component:</b> | <b>sulphuric acid</b> | <b>CAS-No.</b>   |
|                   |                       | <b>7664-93-9</b> |

#### Bioaccumulation

Result : no data available

### 12.4. Mobility in soil

|                   |                       |                  |
|-------------------|-----------------------|------------------|
| <b>Component:</b> | <b>sulphuric acid</b> | <b>CAS-No.</b>   |
|                   |                       | <b>7664-93-9</b> |

#### Mobility

: no data available

### 12.5. Results of PBT and vPvB assessment

|                   |                       |                  |
|-------------------|-----------------------|------------------|
| <b>Component:</b> | <b>sulphuric acid</b> | <b>CAS-No.</b>   |
|                   |                       | <b>7664-93-9</b> |

#### Results of PBT and vPvB assessment

Result : not applicable

## Sulphuric acid >51 - <96%

### 12.6. Other adverse effects

#### Additional ecological information

Result : Harmful effects to aquatic organisms due to pH-shift.  
Neutralization is normally necessary before waste water is discharged into water treatment plants.  
Do not flush into surface water or sanitary sewer system.

## Section 13: Disposal considerations

### 13.1. Waste treatment methods

Product : Disposal together with normal waste is not allowed. Special disposal required according to local regulations. Do not let product enter drains. Contact waste disposal services.

Contaminated packaging : Empty contaminated packagings thoroughly. They can be recycled after thorough and proper cleaning. Packagings that cannot be cleaned are to be disposed of in the same manner as the product.

European Waste Catalogue Number : No waste code according to the European Waste Catalogue can be assigned for this product, as the intended use dictates the assignment. The waste code is established in consultation with the regional waste disposer.

## Section 14: Transport information

### 14.1. UN number

1830

### 14.2. UN proper shipping name

ADR : SULPHURIC ACID with more than 51% acid  
RID : SULPHURIC ACID with more than 51% acid  
IMDG : SULPHURIC ACID WITH MORE THAN 51% ACID

### 14.3. Transport hazard class(es)

ADR-Class : 8  
(Labels; Classification Code; Hazard identification No; Tunnel restriction code) 8; C1; 80; (E)  
RID-Class : 8  
(Labels; Classification Code; Hazard identification No) 8; C1; 80  
IMDG-Class : 8  
(Labels; EmS) 8; F-A, S-B

## Sulphuric acid >51 - <96%

### 14.4. Packaging group

ADR : II  
RID : II  
IMDG : II

### 14.5. Environmental hazards

Labeling according to 5.2.1.8 ADR : no  
Labeling according to 5.2.1.8 RID : no  
Labeling according to 5.2.1.6.3 IMDG : no  
Classification as environmentally hazardous according to 2.9.3 IMDG : no  
Classified as "P" according to 2.10 IMDG : no

### 14.6. Special precautions for user

Not applicable.

### 14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

IMDG : Not applicable.

## Section 15: Regulatory information

### 15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

:

#### Notification status

##### sulphuric acid:

| Regulatory List | Notification | Notification number |
|-----------------|--------------|---------------------|
| AICS            | YES          |                     |
| DSL             | YES          |                     |
| INV (CN)        | YES          |                     |
| ENCS (JP)       | YES          | (1)-430             |
| ISHL (JP)       | YES          | (1)-430             |
| TSCA            | YES          |                     |
| EINECS          | YES          | 231-639-5           |
| KECI (KR)       | YES          | 97-1-405            |
| KECI (KR)       | YES          | KE-32570            |
| PICCS (PH)      | YES          |                     |

### 15.2. Chemical Safety Assessment

A Chemical Safety Assessment has been carried out for this substance.

## Section 16: Other information

**Sulphuric acid >51 - <96%****Full text of R-phrases referred to under sections 2 and 3.**

R35 Causes severe burns.

**Full text of H-Statements referred to under sections 2 and 3.**

H290 May be corrosive to metals.

H314 Causes severe skin burns and eye damage.

**Further information**

Other information : Restricted to professional users. Attention - Avoid exposure - obtain special instructions before use. The information provided in this Safety Data Sheet is correct to our knowledge at the date of its revision. The information given only describes the products with regard to safety arrangements and is not to be considered as a warranty or quality specification and does not constitute a legal relationship.  
The information contained in this Safety Data Sheet relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text

|| Indicates updated section.

## Sulphuric acid >51 - <96%

| No. | Short title                                                        | Main User Group (SU) | Sector of Use (SU)     | Product Category (PC) | Process Category (PROC)   | Environmental Release Category (ERC) | Article Category (AC) | Specified |
|-----|--------------------------------------------------------------------|----------------------|------------------------|-----------------------|---------------------------|--------------------------------------|-----------------------|-----------|
| 1   | Use as an intermediate                                             | 3                    | 4, 6b, 8, 9, 14        | 19                    | 1, 2, 3, 4, 8a, 8b, 9     | 6a                                   | NA                    | ES679     |
| 2   | Formulation & (re)packing of substances and mixtures               | 3                    | 10                     | NA                    | 1, 3, 5, 8a, 8b, 9        | 2                                    | NA                    | ES689     |
| 3   | Use in laboratories                                                | 22                   | NA                     | 21                    | 15                        | 8a, 8b                               | NA                    | ES906     |
| 4   | Use for extractions and processing of minerals, ores               | 3                    | 2a, 14                 | 20, 40                | 2, 3, 4                   | 4, 6b                                | NA                    | ES784     |
| 5   | Use as processing aid                                              | 3                    | 4, 5, 6b, 8, 9, 11, 23 | 20                    | 1, 2, 3, 4, 8a, 8b, 9, 13 | 6b                                   | NA                    | ES782     |
| 6   | Use in electrolytic processes                                      | 3                    | 14, 15, 17             | 14, 20                | 1, 2, 8b, 9, 13           | 5, 6b                                | NA                    | ES788     |
| 7   | Use in the process of surface treatments, purification and etching | 3                    | 2a, 14, 15, 16         | 14, 15                | 1, 2, 3, 4, 8a, 8b, 9, 13 | 6b                                   | NA                    | ES786     |
| 8   | Use in gas treatment                                               | 3                    | 8                      | 20                    | 1, 2, 8b                  | 7                                    | NA                    | ES790     |
| 9   | Use in production of sulphuric acid contained batteries            | 3                    | NA                     | NA                    | 2, 3, 4, 9                | 2, 5                                 | NA                    | ES792     |
| 10  | Use in recycling of sulphuric acid contained batteries             | 3                    | NA                     | NA                    | 2, 4, 5, 8a               | 1                                    | NA                    | ES794     |
| 11  | Use in maintenance of sulphuric acid contained batteries           | 22                   | NA                     | NA                    | 19                        | 8b, 9b                               | NA                    | ES798     |

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 1: Use as an intermediate

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Sectors of end-use               | SU4: Manufacture of food products<br>SU6b: Manufacture of pulp, paper and paper products<br>SU8: Manufacture of bulk, large scale chemicals (including petroleum products)<br>SU9: Manufacture of fine chemicals<br>SU14: Manufacture of basic metals, including alloys                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Chemical product category        | PC19: Intermediate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |
| Environmental Release Categories | ERC6a: Industrial use resulting in manufacture of another substance (use of intermediates)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Activity                         | Note: this Exposure Scenario is only relevant for an appropriated use according to the quality grade of the substance delivered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

### 2.1 Contributing scenario controlling environmental exposure for: ERC6a

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | The substance is used up in the process                                                                              |
| Amount used                                                                                                                                                                                                                                                    | Annual amount per site                            | 300000 ton(s)/year                                                                                                   |
| Frequency and duration of use                                                                                                                                                                                                                                  | Continuous exposure                               | 365 days/year                                                                                                        |
| Environment factors not influenced by risk management                                                                                                                                                                                                          | Flow rate of receiving surface water              | 18,000 m3/d                                                                                                          |
|                                                                                                                                                                                                                                                                | Dilution Factor (River)                           | 10                                                                                                                   |
|                                                                                                                                                                                                                                                                | Dilution Factor (Coastal Areas)                   | 100                                                                                                                  |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Air                                               | Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation |
|                                                                                                                                                                                                                                                                | Water                                             | The wastewater neutralisation process is extremely efficient with almost total neutralisation achieved               |
|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                      |
| Conditions and measures related to sewage treatment plant                                                                                                                                                                                                      | Type of Sewage Treatment Plant                    | On-site waste water treatment                                                                                        |
|                                                                                                                                                                                                                                                                | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                                                                                           |
|                                                                                                                                                                                                                                                                | Sludge Treatment                                  | Incineration or in a landfill                                                                                        |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9

|                         |                                                   |                                         |
|-------------------------|---------------------------------------------------|-----------------------------------------|
| Product characteristics | Concentration of the Substance in Mixture/Article | The substance is used up in the process |
|-------------------------|---------------------------------------------------|-----------------------------------------|

## Sulphuric acid >51 - <96%

|                                                                                        |                                                                                                                                                                                                                         |                        |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                                                        | Physical Form (at time of use)                                                                                                                                                                                          | liquid                 |
|                                                                                        | Vapour pressure                                                                                                                                                                                                         | 0.06 hPa               |
| Amount used                                                                            | Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration.                                                                                     |                        |
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                        | 220 days/year          |
|                                                                                        | Exposure duration per day                                                                                                                                                                                               | 480 min                |
|                                                                                        | Intermittent contact is expected                                                                                                                                                                                        |                        |
| Human factors not influenced by risk management                                        | Breathing volume                                                                                                                                                                                                        | 10 m <sup>3</sup> /day |
|                                                                                        | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup>    |
|                                                                                        | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                        |
| Other operational conditions affecting workers exposure                                | Outdoors not close to buildings(PROC1, PROC2, PROC8a, PROC8b)                                                                                                                                                           |                        |
|                                                                                        | Outdoors near to buildings(PROC3, PROC4)                                                                                                                                                                                |                        |
|                                                                                        | Indoors, any sized room, with good natural ventilation(PROC9)                                                                                                                                                           |                        |
|                                                                                        | Process may involve high temperature (50 - 150°C)(PROC1, PROC2, PROC3, PROC4)                                                                                                                                           |                        |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |                        |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                        |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system(except PROC8a)                                                                                                                                                                               |                        |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC1, PROC3, PROC8b)                                                                                                                                                          |                        |
|                                                                                        | Complete segregation(PROC1, PROC2)                                                                                                                                                                                      |                        |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |                        |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |                        |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                        |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                        |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure       | RCR    |
|-----------------------|---------------------|----------------------|-------|-------------------------|--------|
| ERC6a                 | ---                 | Fresh water          | PEC   | 0.2µg/L                 | 0.08   |
| ERC6a                 | ---                 | Marine water         | PEC   | 0.03µg/L                | 0.12   |
| ERC6a                 | ---                 | Fresh water sediment | PEC   | 0.0018µg/kg             | 0.0009 |
| ERC6a                 | ---                 | Marine sediment      | PEC   | 0.0026µg/kg             | 0.0013 |
| ERC6a                 | ---                 | Soil                 | PEC   | 0.92µg/kg               | ---    |
| ERC6a                 | ---                 | Air                  | PEC   | 0.0032µg/m <sup>3</sup> | ---    |

#### Workers

Advanced REACH Tool (ART model)

## Sulphuric acid >51 - <96%

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure       | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC1                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0094ng/m <sup>3</sup> | --- |
| PROC2                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.092ng/m <sup>3</sup>  | --- |
| PROC3                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.42µg/m <sup>3</sup>   | --- |
| PROC4                 | 90th percentile value | Worker - inhalative, long-term - systemic | 14µg/m <sup>3</sup>     | --- |
| PROC8a                | 90th percentile value | Worker - inhalative, long-term - systemic | 23µg/m <sup>3</sup>     | --- |
| PROC8b                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0048µg/m <sup>3</sup> | --- |
| PROC9                 | 90th percentile value | Worker - inhalative, long-term - systemic | 2.8µg/m <sup>3</sup>    | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 2: Formulation & (re)packing of substances and mixtures

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Sectors of end-use               | SU 10: Formulation [mixing] of preparations and/ or re-packaging (excluding alloys)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |
| Environmental Release Categories | ERC2: Formulation of preparations                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 2.1 Contributing scenario controlling environmental exposure for: ERC2

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98%                                                                           |
| Amount used                                                                                                                                                                                                                                                    | Annual amount per site                            | 300000 ton(s)/year                                                                                                   |
|                                                                                                                                                                                                                                                                | Annual amount used per region                     | 3 Million tonnes/year                                                                                                |
| Frequency and duration of use                                                                                                                                                                                                                                  | Continuous exposure                               | 365 days/year                                                                                                        |
| Environment factors not influenced by risk management                                                                                                                                                                                                          | Flow rate of receiving surface water              | 18,000 m3/d                                                                                                          |
|                                                                                                                                                                                                                                                                | Dilution Factor (River)                           | 10                                                                                                                   |
|                                                                                                                                                                                                                                                                | Dilution Factor (Coastal Areas)                   | 100                                                                                                                  |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Air                                               | Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation |
|                                                                                                                                                                                                                                                                | Water                                             | The wastewater neutralisation process is extremely efficient with almost total neutralisation achieved               |
|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                      |
| Conditions and measures related to sewage treatment plant                                                                                                                                                                                                      | Type of Sewage Treatment Plant                    | On-site waste water treatment                                                                                        |
|                                                                                                                                                                                                                                                                | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                                                                                           |
|                                                                                                                                                                                                                                                                | Sludge Treatment                                  | Incineration or in a landfill                                                                                        |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC3, PROC5, PROC8a, PROC8b, PROC9

|                         |                                                                             |                                            |
|-------------------------|-----------------------------------------------------------------------------|--------------------------------------------|
| Product characteristics | Concentration of the Substance in Mixture/Article                           | Concentration of substance in product: 98% |
|                         | Physical Form (at time of use)                                              | liquid                                     |
|                         | Vapour pressure                                                             | 0.06 hPa                                   |
| Amount used             | Worker exposure considered to be negligible due to the specialized systems. |                                            |

## Sulphuric acid >51 - <96%

|                                                                                        |                                                                                                                                                                                                                         |                        |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                        | 220 days/year          |
|                                                                                        | Exposure duration per day                                                                                                                                                                                               | 480 min                |
|                                                                                        | Intermittent contact is expected                                                                                                                                                                                        |                        |
| Human factors not influenced by risk management                                        | Breathing volume                                                                                                                                                                                                        | 10 m <sup>3</sup> /day |
|                                                                                        | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup>    |
|                                                                                        | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                        |
| Other operational conditions affecting workers exposure                                | Outdoors not close to buildings(PROC1, PROC8a, PROC8b)                                                                                                                                                                  |                        |
|                                                                                        | Outdoors near to buildings(PROC3)                                                                                                                                                                                       |                        |
|                                                                                        | Indoors, any sized room, with good natural ventilation(PROC5, PROC9)                                                                                                                                                    |                        |
|                                                                                        | Process may involve high temperature (50 - 150°C)(PROC1, PROC3)                                                                                                                                                         |                        |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |                        |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                        |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system(except PROC5)                                                                                                                                                                                |                        |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC1, PROC3, PROC5, PROC8b)                                                                                                                                                   |                        |
|                                                                                        | Complete segregation(PROC1)                                                                                                                                                                                             |                        |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |                        |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |                        |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                        |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                        |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure       | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------------|---------|
| ERC2                  | ---                 | Fresh water          | PEC   | 0.0443µg/L              | 0.01772 |
| ERC2                  | ---                 | Marine water         | PEC   | 0.0064µg/L              | 0.02568 |
| ERC2                  | ---                 | Fresh water sediment | PEC   | 0.0038µg/kg             | 0.00192 |
| ERC2                  | ---                 | Marine sediment      | PEC   | 0.0005µg/kg             | 0.00028 |
| ERC2                  | ---                 | Soil                 | PEC   | 0.2µg/kg                | ---     |
| ERC2                  | ---                 | Air                  | PEC   | 0.0007µg/m <sup>3</sup> | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure       | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC1                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0009ng/m <sup>3</sup> | --- |
| PROC3                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.42µg/m <sup>3</sup>   | --- |

### ***Sulphuric acid >51 - <96%***

|        |                       |                                           |                         |     |
|--------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC5  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.016mg/m <sup>3</sup>  | --- |
| PROC8a | 90th percentile value | Worker - inhalative, long-term - systemic | 0.023mg/m <sup>3</sup>  | --- |
| PROC8b | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0004µg/m <sup>3</sup> | --- |
| PROC9  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0028mg/m <sup>3</sup> | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

#### **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 3: Use in laboratories

|                                  |                                                                                                                                                  |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)                                          |
| Chemical product category        | PC21: Laboratory chemicals                                                                                                                       |
| Process categories               | PROC15: Use as laboratory reagent                                                                                                                |
| Environmental Release Categories | ERC8a: Wide dispersive indoor use of processing aids in open systems<br>ERC8b: Wide dispersive indoor use of reactive substances in open systems |

### 2.1 Contributing scenario controlling environmental exposure for: ERC8a, ERC8b

|                                                           |                                                   |                                            |
|-----------------------------------------------------------|---------------------------------------------------|--------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98% |
| Amount used                                               | Annual amount per site                            | 5000 ton(s)/year                           |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                              |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                |
|                                                           | Dilution Factor (River)                           | 10                                         |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                        |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant           |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                 |
|                                                           | Sludge Treatment                                  | Incineration or in a landfill              |

### 2.2 Contributing scenario controlling worker exposure for: PROC15

|                                                                             |                                                                                                                                                                                                                         |                                            |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Product characteristics                                                     | Concentration of the Substance in Mixture/Article                                                                                                                                                                       | Concentration of substance in product: 98% |
|                                                                             | Physical Form (at time of use)                                                                                                                                                                                          | liquid                                     |
|                                                                             | Vapour pressure                                                                                                                                                                                                         | 0.06 hPa                                   |
| Amount used                                                                 | Worker exposure considered to be negligible due to the specialized systems.                                                                                                                                             |                                            |
| Frequency and duration of use                                               | Frequency of use                                                                                                                                                                                                        | 220 days/year                              |
|                                                                             | Exposure duration per day                                                                                                                                                                                               | 480 min                                    |
|                                                                             | Intermittent contact is expected                                                                                                                                                                                        |                                            |
| Human factors not influenced by risk management                             | Breathing volume                                                                                                                                                                                                        | 10 m3/day                                  |
|                                                                             | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup>                        |
|                                                                             | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                                            |
| Other operational conditions affecting workers exposure                     | Indoors, any sized room, with good natural ventilation                                                                                                                                                                  |                                            |
|                                                                             | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                                            |
| Organisational measures to prevent /limit releases, dispersion and exposure | Only properly trained and authorised personal shall handle the substance<br>Substance-handling procedures shall be well documented and strictly supervised                                                              |                                            |
|                                                                             | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                                            |
| Conditions and measures related to personal protection, hygiene             | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                                            |

## Sulphuric acid >51 - <96%

and health evaluation

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------|---------|
| ERC8a                 | ---                 | Fresh water          | PEC   | 0.138µg/L         | 0.05520 |
| ERC8a                 | ---                 | Marine water         | PEC   | 0.0074µg/L        | 0.02956 |
| ERC8a                 | ---                 | Fresh water sediment | PEC   | 0.011µg/kg        | 0.00580 |
| ERC8a                 | ---                 | Marine sediment      | PEC   | 0.639ng/kg        | 0.00032 |
| ERC8a                 | ---                 | Soil                 | PEC   | 0.134µg/kg        | ---     |
| ERC8a                 | ---                 | Air                  | PEC   | 0.48ng/m3         | ---     |
| ERC8b                 | ---                 | Fresh water          | PEC   | 2.12ng/L          | 0.00085 |
| ERC8b                 | ---                 | Marine water         | PEC   | 0.0666ng/L        | 0.00026 |
| ERC8b                 | ---                 | Fresh water sediment | PEC   | 0.183ng/kg        | 0.00009 |
| ERC8b                 | ---                 | Marine sediment      | PEC   | 0.0058ng/kg       | 0.00000 |
| ERC8b                 | ---                 | Soil                 | PEC   | 0.134ng/kg        | ---     |
| ERC8b                 | ---                 | Air                  | PEC   | 0.0048ng/m3       | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------|-----|
| PROC15                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.023µg/m³        | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 4: Use for extractions and processing of minerals, ores

|                                  |                                                                                                                                                                                                                                          |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                 |
| Sectors of end-use               | SU2a: Mining (without offshore industries)<br>SU14: Manufacture of basic metals, including alloys                                                                                                                                        |
| Chemical product category        | PC20: Products such as ph-regulators, flocculants, precipitants, neutralization agents<br>PC40: Extraction agents                                                                                                                        |
| Process categories               | PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises |
| Environmental Release Categories | ERC4: Industrial use of processing aids in processes and products, not becoming part of articles<br>ERC6b: Industrial use of reactive processing aids                                                                                    |

### 2.1 Contributing scenario controlling environmental exposure for: ERC4, ERC6b

|                                                           |                                                   |                                            |
|-----------------------------------------------------------|---------------------------------------------------|--------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98% |
| Amount used                                               | Annual amount per site                            | 438 ton(s)/year                            |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                              |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                |
|                                                           | Dilution Factor (River)                           | 10                                         |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                        |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant           |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                 |
|                                                           | Sludge Treatment                                  | Metal recovery, incineration or landfill   |

### 2.2 Contributing scenario controlling worker exposure for: PROC2, PROC3, PROC4

|                                                         |                                                                                                                                                                         |                                            |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Product characteristics                                 | Concentration of the Substance in Mixture/Article                                                                                                                       | Concentration of substance in product: 98% |
|                                                         | Physical Form (at time of use)                                                                                                                                          | liquid                                     |
|                                                         | Vapour pressure                                                                                                                                                         | 0.06 hPa                                   |
| Amount used                                             | Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration.                                     |                                            |
| Frequency and duration of use                           | Frequency of use                                                                                                                                                        | 220 days/year                              |
|                                                         | Exposure duration per day                                                                                                                                               | 480 min                                    |
|                                                         | Intermittent contact is expected                                                                                                                                        |                                            |
| Human factors not influenced by risk management         | Breathing volume                                                                                                                                                        | 10 m3/day                                  |
|                                                         | Exposed skin surface                                                                                                                                                    | 480 cm <sup>2</sup>                        |
|                                                         | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases |                                            |
| Other operational conditions affecting workers exposure | Outdoors not close to buildings(PROC2)                                                                                                                                  |                                            |

## Sulphuric acid >51 - <96%

|                                                                                        |                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                        | Outdoors near to buildings(PROC3, PROC4)                                                                                                                                                                                |
|                                                                                        | Process may involve high temperature (50 - 150°C)                                                                                                                                                                       |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system(PROC2, PROC4)                                                                                                                                                                                |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC2)                                                                                                                                                                         |
|                                                                                        | Complete segregation(PROC2)                                                                                                                                                                                             |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |
|                                                                                        |                                                                                                                                                                                                                         |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure       | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------------|---------|
| ERC4                  | ---                 | Fresh water          | PEC   | 0.025µg/L               | 0.01000 |
| ERC4                  | ---                 | Marine water         | PEC   | 0.0036µg/L              | 0.01424 |
| ERC4                  | ---                 | Fresh water sediment | PEC   | 0.0021µg/kg             | 0.00106 |
| ERC4                  | ---                 | Marine sediment      | PEC   | 0.0003µg/kg             | 0.00015 |
| ERC4                  | ---                 | Soil                 | PEC   | 0.112µg/kg              | ---     |
| ERC4                  | ---                 | Air                  | PEC   | 0.0004µg/m <sup>3</sup> | ---     |
| ERC6b                 | ---                 | Fresh water          | PEC   | 0.026ng/L               | 0.00001 |
| ERC6b                 | ---                 | Marine water         | PEC   | 0.0037ng/L              | 0.00001 |
| ERC6b                 | ---                 | Fresh water sediment | PEC   | 0.0000µg/kg             | 0.00000 |
| ERC6b                 | ---                 | Marine sediment      | PEC   | 0.0000µg/kg             | 0.00000 |
| ERC6b                 | ---                 | Soil                 | PEC   | 0.0001µg/kg             | ---     |
| ERC6b                 | ---                 | Air                  | PEC   | 0.0000µg/m <sup>3</sup> | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure      | RCR |
|-----------------------|-----------------------|-------------------------------------------|------------------------|-----|
| PROC2                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.092ng/m <sup>3</sup> | --- |
| PROC3                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.42µg/m <sup>3</sup>  | --- |
| PROC4                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.014mg/m <sup>3</sup> | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

***Sulphuric acid >51 - <96%*****4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 5: Use as processing aid

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Sectors of end-use               | SU4: Manufacture of food products<br>SU5: Manufacture of textiles, leather, fur<br>SU6b: Manufacture of pulp, paper and paper products<br>SU8: Manufacture of bulk, large scale chemicals (including petroleum products)<br>SU9: Manufacture of fine chemicals<br>SU11: Manufacture of rubber products<br>SU23: Electricity, steam, gas water supply and sewage treatment                                                                                                                                                                                                                                                                                                                                                                         |
| Chemical product category        | PC20: Products such as ph-regulators, flocculants, precipitants, neutralization agents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)<br>PROC13: Treatment of articles by dipping and pouring |
| Environmental Release Categories | ERC6b: Industrial use of reactive processing aids                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Activity                         | Note: this Exposure Scenario is only relevant for an appropriated use according to the quality grade of the substance delivered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

### 2.1 Contributing scenario controlling environmental exposure for: ERC6b

|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98%                                                                           |
| Amount used                                                                                                                                                                                                                                                    | Annual amount per site                            | 100000 ton(s)/year                                                                                                   |
| Frequency and duration of use                                                                                                                                                                                                                                  | Continuous exposure                               | 365 days/year                                                                                                        |
| Environment factors not influenced by risk management                                                                                                                                                                                                          | Flow rate of receiving surface water              | 18,000 m3/d                                                                                                          |
|                                                                                                                                                                                                                                                                | Dilution Factor (River)                           | 10                                                                                                                   |
|                                                                                                                                                                                                                                                                | Dilution Factor (Coastal Areas)                   | 100                                                                                                                  |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Air                                               | Exhaust gases may be treated by scrubbers or emissions may be measured and controlled according to local legislation |
|                                                                                                                                                                                                                                                                | Water                                             | The wastewater neutralisation process is extremely efficient with almost total neutralisation achieved               |
|                                                                                                                                                                                                                                                                |                                                   |                                                                                                                      |
| Conditions and measures related to sewage treatment plant                                                                                                                                                                                                      | Type of Sewage Treatment Plant                    | On-site waste water treatment                                                                                        |
|                                                                                                                                                                                                                                                                | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                                                                                           |
|                                                                                                                                                                                                                                                                | Sludge Treatment                                  | Incineration or in a landfill                                                                                        |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4,

## Sulphuric acid >51 - <96%

### PROC8a, PROC8b, PROC9, PROC13

|                                                                                        |                                                                                                                                                                                                                         |                                            |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Product characteristics                                                                | Concentration of the Substance in Mixture/Article                                                                                                                                                                       | Concentration of substance in product: 98% |
|                                                                                        | Physical Form (at time of use)                                                                                                                                                                                          | liquid                                     |
|                                                                                        | Vapour pressure                                                                                                                                                                                                         | 0.06 hPa                                   |
| Amount used                                                                            | Worker contact is generally very low as most operations are remotely controlled and sampling/analysis events are of short duration.                                                                                     |                                            |
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                        | 220 days/year                              |
|                                                                                        | Exposure duration per day                                                                                                                                                                                               | 480 min                                    |
|                                                                                        | Intermittent contact is expected                                                                                                                                                                                        |                                            |
| Human factors not influenced by risk management                                        | Breathing volume                                                                                                                                                                                                        | 10 m3/day                                  |
|                                                                                        | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup>                        |
|                                                                                        | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                                            |
| Other operational conditions affecting workers exposure                                | Outdoors not close to buildings(PROC1, PROC2, PROC8a, PROC8b)                                                                                                                                                           |                                            |
|                                                                                        | Outdoors near to buildings(PROC3, PROC4)                                                                                                                                                                                |                                            |
|                                                                                        | Indoors, any sized room, with good natural ventilation(PROC9, PROC13)                                                                                                                                                   |                                            |
|                                                                                        | Process may involve high temperature (50 - 150°C)(PROC1, PROC2, PROC3, PROC4)                                                                                                                                           |                                            |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |                                            |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                                            |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system(except PROC8a, PROC13)                                                                                                                                                                       |                                            |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC1, PROC2, PROC3, PROC8b)                                                                                                                                                   |                                            |
|                                                                                        | Complete segregation(PROC1, PROC2)                                                                                                                                                                                      |                                            |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |                                            |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |                                            |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                                            |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                                            |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------|---------|
| ERC6b                 | ---                 | Fresh water          | PEC   | 0.0059µg/L        | 0.00236 |
| ERC6b                 | ---                 | Marine water         | PEC   | 0.0009µg/L        | 0.00344 |
| ERC6b                 | ---                 | Fresh water sediment | PEC   | 0.0005µg/kg       | 0.00026 |
| ERC6b                 | ---                 | Marine sediment      | PEC   | 0.074ng/kg        | 0.00004 |
| ERC6b                 | ---                 | Soil                 | PEC   | 0.027µg/kg        | ---     |

## Sulphuric acid >51 - <96%

|       |     |     |     |                         |     |
|-------|-----|-----|-----|-------------------------|-----|
| ERC6b | --- | Air | PEC | 0.0000µg/m <sup>3</sup> | --- |
|-------|-----|-----|-----|-------------------------|-----|

### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure       | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC1                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0094ng/m <sup>3</sup> | --- |
| PROC2                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.092ng/m <sup>3</sup>  | --- |
| PROC3                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.42µg/m <sup>3</sup>   | --- |
| PROC4                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.014mg/m <sup>3</sup>  | --- |
| PROC8a                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.023mg/m <sup>3</sup>  | --- |
| PROC8b                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0048µg/m <sup>3</sup> | --- |
| PROC9                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0028mg/m <sup>3</sup> | --- |
| PROC13                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.016mg/m <sup>3</sup>  | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 6: Use in electrolytic processes

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                          |
| Sectors of end-use               | SU14: Manufacture of basic metals, including alloys<br>SU15: Manufacture of fabricated metal products, except machinery and equipment<br>SU17: General manufacturing, e.g. machinery, equipment, vehicles, other transport equipment                                                                                                                                                                                                              |
| Chemical product category        | PC14: Metal surface treatment products, including galvanic and electroplating products<br>PC20: Products such as ph-regulators, flocculants, precipitants, neutralization agents                                                                                                                                                                                                                                                                  |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)<br>PROC13: Treatment of articles by dipping and pouring |
| Environmental Release Categories | ERC5: Industrial use resulting in inclusion into or onto a matrix<br>ERC6b: Industrial use of reactive processing aids                                                                                                                                                                                                                                                                                                                            |

### 2.1 Contributing scenario controlling environmental exposure for: ERC5, ERC6b

|                                                           |                                                   |                                               |
|-----------------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 95-98% |
| Amount used                                               | Annual amount per site                            | 2306 ton(s)/year                              |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                                 |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                   |
|                                                           | Dilution Factor (River)                           | 10                                            |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                           |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant              |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                    |
|                                                           | Sludge Treatment                                  | Metal recovery, incineration or landfill      |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC8b, PROC9, PROC13

|                                                 |                                                   |                                               |
|-------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| Product characteristics                         | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 95-98% |
|                                                 | Physical Form (at time of use)                    | liquid                                        |
|                                                 | Vapour pressure                                   | 0.06 hPa                                      |
| Amount used                                     | Worker exposure should be low and controlled      |                                               |
| Frequency and duration of use                   | Frequency of use                                  | 220 days/year                                 |
|                                                 | Exposure duration per day                         | 480 min                                       |
|                                                 | Intermittent contact is expected                  |                                               |
| Human factors not influenced by risk management | Breathing volume                                  | 10 m3/day                                     |
|                                                 |                                                   |                                               |

## Sulphuric acid >51 - <96%

|                                                                                        |                                                                                                                                                                                                                         |                     |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
|                                                                                        | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup> |
|                                                                                        | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                     |
| Other operational conditions affecting workers exposure                                | Outdoors not close to buildings(PROC1, PROC2, PROC8a, PROC8b)                                                                                                                                                           |                     |
|                                                                                        | Indoors, any sized room, with good natural ventilation(PROC9, PROC13)                                                                                                                                                   |                     |
|                                                                                        | Process may involve high temperature (50 - 150°C)(PROC1, PROC2)                                                                                                                                                         |                     |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |                     |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                     |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system(except PROC13)                                                                                                                                                                               |                     |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC1, PROC8b)                                                                                                                                                                 |                     |
|                                                                                        | Complete segregation(PROC1, PROC2)                                                                                                                                                                                      |                     |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |                     |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |                     |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                     |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                     |
|                                                                                        | Wear respiratory protection (Efficiency: 90 %)(PROC13)                                                                                                                                                                  |                     |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure       | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------------|---------|
| ERC5                  | ---                 | Fresh water          | PEC   | 0.0681µg/L              | 0.02724 |
| ERC5                  | ---                 | Marine water         | PEC   | 0.0099µg/L              | 0.03948 |
| ERC5                  | ---                 | Fresh water sediment | PEC   | 0.0059µg/kg             | 0.00294 |
| ERC5                  | ---                 | Marine sediment      | PEC   | 0.0008µg/kg             | 0.00043 |
| ERC5                  | ---                 | Soil                 | PEC   | 0.309µg/kg              | ---     |
| ERC5                  | ---                 | Air                  | PEC   | 0.0011µg/m <sup>3</sup> | ---     |
| ERC6b                 | ---                 | Fresh water          | PEC   | 0.136ng/L               | 0.00005 |
| ERC6b                 | ---                 | Marine water         | PEC   | 0.0197ng/L              | 0.00008 |
| ERC6b                 | ---                 | Fresh water sediment | PEC   | 0.0118ng/kg             | 0.00001 |
| ERC6b                 | ---                 | Marine sediment      | PEC   | 0.0017ng/kg             | 0.00000 |
| ERC6b                 | ---                 | Soil                 | PEC   | 0.618ng/kg              | ---     |
| ERC6b                 | ---                 | Air                  | PEC   | 0.0022ng/m <sup>3</sup> | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure       | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC1                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0094ng/m <sup>3</sup> | --- |

### ***Sulphuric acid >51 - <96%***

|        |                       |                                           |                         |     |
|--------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC2  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.092ng/m <sup>3</sup>  | --- |
| PROC8b | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0048µg/m <sup>3</sup> | --- |
| PROC9  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0028mg/m <sup>3</sup> | --- |
| PROC13 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.47mg/m <sup>3</sup>   | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

#### **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 7: Use in the process of surface treatments, purification and etching

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Sectors of end-use               | SU2a: Mining (without offshore industries)<br>SU14: Manufacture of basic metals, including alloys<br>SU15: Manufacture of fabricated metal products, except machinery and equipment<br>SU16: Manufacture of computer, electronic and optical products, electrical equipment                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Chemical product category        | PC14: Metal surface treatment products, including galvanic and electroplating products<br>PC15: Non-metal-surface treatment products                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing)<br>PROC13: Treatment of articles by dipping and pouring |
| Environmental Release Categories | ERC6b: Industrial use of reactive processing aids                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

#### 2.1 Contributing scenario controlling environmental exposure for: ERC6b

|                                                           |                                                   |                                            |
|-----------------------------------------------------------|---------------------------------------------------|--------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98% |
| Amount used                                               | Annual amount per site                            | 10000 ton(s)/year                          |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                              |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                |
|                                                           | Dilution Factor (River)                           | 10                                         |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                        |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant           |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                 |
|                                                           | Sludge Treatment                                  | Incineration or in a landfill              |

#### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC3, PROC4, PROC8a, PROC8b, PROC9, PROC13

|                         |                                                                                                                        |                                            |
|-------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Product characteristics | Concentration of the Substance in Mixture/Article                                                                      | Concentration of substance in product: 98% |
|                         | Physical Form (at time of use)                                                                                         | liquid                                     |
|                         | Vapour pressure                                                                                                        | 0.06 hPa                                   |
| Amount used             | Worker exposure considered to be negligible due to the specialized systems and closed nature of the production process |                                            |

## Sulphuric acid >51 - <96%

|                                                                                        |                                                                                                                                                                                                                         |                     |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Frequency and duration of use                                                          | Frequency of use                                                                                                                                                                                                        | 220 days/year       |
|                                                                                        | Exposure duration per day                                                                                                                                                                                               | 480 min             |
|                                                                                        | Intermittent contact is expected                                                                                                                                                                                        |                     |
| Human factors not influenced by risk management                                        | Breathing volume                                                                                                                                                                                                        | 10 m3/day           |
|                                                                                        | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup> |
|                                                                                        | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                     |
| Other operational conditions affecting workers exposure                                | Outdoors not close to buildings(PROC1, PROC2, PROC8a, PROC8b)                                                                                                                                                           |                     |
|                                                                                        | Outdoors near to buildings(PROC3, PROC4)                                                                                                                                                                                |                     |
|                                                                                        | Indoors, any sized room, with good natural ventilation(PROC9, PROC13)                                                                                                                                                   |                     |
|                                                                                        | Process may involve high temperature (50 - 150°C)(PROC1, PROC2, PROC3, PROC4)                                                                                                                                           |                     |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |                     |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                     |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system(except PROC8a, PROC13)                                                                                                                                                                       |                     |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC1, PROC2, PROC3, PROC8b)                                                                                                                                                   |                     |
|                                                                                        | Complete segregation(PROC1, PROC2)                                                                                                                                                                                      |                     |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |                     |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |                     |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                     |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                     |
|                                                                                        |                                                                                                                                                                                                                         |                     |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------|---------|
| ERC6b                 | ---                 | Fresh water          | PEC   | 0.591ng/L         | 0.00024 |
| ERC6b                 | ---                 | Marine water         | PEC   | 0.0856ng/L        | 0.00034 |
| ERC6b                 | ---                 | Fresh water sediment | PEC   | 0.051ng/kg        | 0.00003 |
| ERC6b                 | ---                 | Marine sediment      | PEC   | 0.0074ng/kg       | 0.00000 |
| ERC6b                 | ---                 | Soil                 | PEC   | 2.68ng/kg         | ---     |
| ERC6b                 | ---                 | Air                  | PEC   | 0.0096ng/m3       | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------|-----|
| PROC1                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0094ng/m3       | --- |
| PROC2                 | 90th percentile value | Worker - inhalative, long-                | 0.0920ng/m3       | --- |

### ***Sulphuric acid >51 - <96%***

|        |                       | term - systemic                           |                         |     |
|--------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC3  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.42µg/m <sup>3</sup>   | --- |
| PROC4  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.014mg/m <sup>3</sup>  | --- |
| PROC8a | 90th percentile value | Worker - inhalative, long-term - systemic | 0.023mg/m <sup>3</sup>  | --- |
| PROC8b | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0048µg/m <sup>3</sup> | --- |
| PROC9  | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0028mg/m <sup>3</sup> | --- |
| PROC13 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.016mg/m <sup>3</sup>  | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

#### **4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario**

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 8: Use in gas treatment

|                                  |                                                                                                                                                                                                                                                                         |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                |
| Sectors of end-use               | SU8: Manufacture of bulk, large scale chemicals (including petroleum products)                                                                                                                                                                                          |
| Chemical product category        | PC20: Products such as ph-regulators, flocculants, precipitants, neutralization agents                                                                                                                                                                                  |
| Process categories               | PROC1: Use in closed process, no likelihood of exposure<br>PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC8b: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities |
| Environmental Release Categories | ERC7: Industrial use of substances in closed systems                                                                                                                                                                                                                    |

### 2.1 Contributing scenario controlling environmental exposure for: ERC7

|                                                                                                                                                                                                                                                                |                                                   |                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------|
| Product characteristics                                                                                                                                                                                                                                        | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98%                                  |
| Amount used                                                                                                                                                                                                                                                    | Annual amount per site                            | 30000 ton(s)/year                                                           |
| Frequency and duration of use                                                                                                                                                                                                                                  | Continuous exposure                               | 365 days/year                                                               |
| Environment factors not influenced by risk management                                                                                                                                                                                                          | Flow rate of receiving surface water              | 18,000 m3/d                                                                 |
|                                                                                                                                                                                                                                                                | Dilution Factor (River)                           | 10                                                                          |
|                                                                                                                                                                                                                                                                | Dilution Factor (Coastal Areas)                   | 100                                                                         |
| Technical conditions and measures at process level (source) to prevent release<br>Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil<br>Organizational measures to prevent/limit release from the site | Water                                             | Spent acid solutions are neutralized to circumneutral pH prior to discharge |
|                                                                                                                                                                                                                                                                |                                                   |                                                                             |
| Conditions and measures related to sewage treatment plant                                                                                                                                                                                                      | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant                                            |
|                                                                                                                                                                                                                                                                | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                                                  |
|                                                                                                                                                                                                                                                                | Sludge Treatment                                  | Incineration or in a landfill                                               |

### 2.2 Contributing scenario controlling worker exposure for: PROC1, PROC2, PROC8b

|                                                 |                                                   |                                            |
|-------------------------------------------------|---------------------------------------------------|--------------------------------------------|
| Product characteristics                         | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98% |
|                                                 | Physical Form (at time of use)                    | liquid                                     |
|                                                 | Vapour pressure                                   | 0.06 hPa                                   |
| Amount used                                     | Worker exposure should be low and controlled      |                                            |
| Frequency and duration of use                   | Frequency of use                                  | 220 days/year                              |
|                                                 | Exposure duration per day                         | 480 min                                    |
|                                                 | Intermittent contact is expected                  |                                            |
| Human factors not influenced by risk management | Breathing volume                                  | 10 m3/day                                  |
|                                                 | Exposed skin surface                              | 480 cm <sup>2</sup>                        |

## Sulphuric acid >51 - <96%

|                                                                                        |                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                        | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |
| Other operational conditions affecting workers exposure                                | Outdoors not close to buildings                                                                                                                                                                                         |
|                                                                                        | Process may involve high temperature (50 - 150°C)                                                                                                                                                                       |
|                                                                                        | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                                                                    |
|                                                                                        | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |
| Technical conditions and measures to control dispersion from source towards the worker | Use vapour recovery system                                                                                                                                                                                              |
|                                                                                        | Provide local exhaust ventilation (LEV).(PROC1, PROC8b)                                                                                                                                                                 |
|                                                                                        | Complete segregation(PROC1, PROC2)                                                                                                                                                                                      |
| Organisational measures to prevent /limit releases, dispersion and exposure            | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |
|                                                                                        | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |
|                                                                                        | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |
| Conditions and measures related to personal protection, hygiene and health evaluation  | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------|---------|
| ERC7                  | ---                 | Fresh water          | PEC   | 0.0886µg/L        | 0.03544 |
| ERC7                  | ---                 | Marine water         | PEC   | 0.0128µg/L        | 0.05120 |
| ERC7                  | ---                 | Fresh water sediment | PEC   | 0.0076µg/kg       | 0.00383 |
| ERC7                  | ---                 | Marine sediment      | PEC   | 0.0011µg/kg       | 0.00056 |
| ERC7                  | ---                 | Soil                 | PEC   | 0.0029mg/kg       | ---     |
| ERC7                  | ---                 | Air                  | PEC   | 0.0014µg/m³       | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------|-----|
| PROC1                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0094ng/m3       | --- |
| PROC2                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.092ng/m3        | --- |
| PROC8b                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0048µg/m³       | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

***Sulphuric acid >51 - <96%***

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 9: Use in production of sulphuric acid contained batteries

|                                  |                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                   |
| Process categories               | PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC3: Use in closed batch process (synthesis or formulation)<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC9: Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |
| Environmental Release Categories | ERC2: Formulation of preparations<br>ERC5: Industrial use resulting in inclusion into or onto a matrix                                                                                                                                                                                                                                                     |

### 2.1 Contributing scenario controlling environmental exposure for: ERC2, ERC5

|                                                           |                                                   |                                            |
|-----------------------------------------------------------|---------------------------------------------------|--------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 98% |
| Amount used                                               | Annual amount per site                            | 2500 ton(s)/year                           |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                              |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                |
|                                                           | Dilution Factor (River)                           | 10                                         |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                        |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant           |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                 |
|                                                           | Sludge Treatment                                  | Incineration or in a landfill              |

### 2.2 Contributing scenario controlling worker exposure for: PROC2, PROC3, PROC4, PROC9

|                                                                |                                                                                                                                                                         |                                            |
|----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Product characteristics                                        | Concentration of the Substance in Mixture/Article                                                                                                                       | Concentration of substance in product: 98% |
|                                                                | Physical Form (at time of use)                                                                                                                                          | liquid                                     |
|                                                                | Vapour pressure                                                                                                                                                         | 0.06 hPa                                   |
| Amount used                                                    | Worker exposure should be low and controlled                                                                                                                            |                                            |
| Frequency and duration of use                                  | Frequency of use                                                                                                                                                        | 220 days/year                              |
|                                                                | Exposure duration per day                                                                                                                                               | 480 min                                    |
|                                                                | Intermittent contact is expected                                                                                                                                        |                                            |
| Human factors not influenced by risk management                | Breathing volume                                                                                                                                                        | 10 m3/day                                  |
|                                                                | Exposed skin surface                                                                                                                                                    | 480 cm <sup>2</sup>                        |
|                                                                | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases |                                            |
| Other operational conditions affecting workers exposure        | Indoors, any sized room, with good natural ventilation                                                                                                                  |                                            |
|                                                                | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                    |                                            |
|                                                                | Due to the nature of the substance the process should be kept as contained as possible                                                                                  |                                            |
| Organisational measures to prevent /limit releases, dispersion | Only properly trained and authorised personal shall handle the substance                                                                                                |                                            |
|                                                                | Substance-handling procedures shall be well documented and strictly                                                                                                     |                                            |

## Sulphuric acid >51 - <96%

|                                                                                       |                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| and exposure                                                                          | supervised                                                                                                                                                                                                              |
|                                                                                       | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |
| Conditions and measures related to personal protection, hygiene and health evaluation | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure       | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------------|---------|
| ERC2                  | ---                 | Fresh water          | PEC   | 0.0369µg/L              | 0.01476 |
| ERC2                  | ---                 | Marine water         | PEC   | 0.0054µg/L              | 0.02144 |
| ERC2                  | ---                 | Fresh water sediment | PEC   | 0.0032µg/kg             | 0.00160 |
| ERC2                  | ---                 | Marine sediment      | PEC   | 0.0005µg/kg             | 0.00023 |
| ERC2                  | ---                 | Soil                 | PEC   | 0.166µg/kg              | ---     |
| ERC2                  | ---                 | Air                  | PEC   | 0.0006µg/m <sup>3</sup> | ---     |
| ERC5                  | ---                 | Fresh water          | PEC   | 0.0788µg/L              | 0.03152 |
| ERC5                  | ---                 | Marine water         | PEC   | 0.0107µg/L              | 0.04280 |
| ERC5                  | ---                 | Fresh water sediment | PEC   | 0.0064µg/kg             | 0.00319 |
| ERC5                  | ---                 | Marine sediment      | PEC   | 0.0009µg/kg             | 0.00046 |
| ERC5                  | ---                 | Soil                 | PEC   | 0.335µg/kg              | ---     |
| ERC5                  | ---                 | Air                  | PEC   | 0.0012µg/m <sup>3</sup> | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure       | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------------|-----|
| PROC2                 | 90th percentile value | Worker - inhalative, long-term - systemic | 1.4µg/m <sup>3</sup>    | --- |
| PROC3                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.014mg/m <sup>3</sup>  | --- |
| PROC4                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0012mg/m <sup>3</sup> | --- |
| PROC9                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0012mg/m <sup>3</sup> | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.

Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.

Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that

***Sulphuric acid >51 - <96%***

risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 10: Use in recycling of sulphuric acid contained batteries

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 3: Industrial uses: Uses of substances as such or in preparations at industrial sites                                                                                                                                                                                                                                                                                                                                                         |
| Process categories               | PROC2: Use in closed, continuous process with occasional controlled exposure<br>PROC4: Use in batch and other process (synthesis) where opportunity for exposure arises<br>PROC5: Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)<br>PROC8a: Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities |
| Environmental Release Categories | ERC1: Manufacture of substances                                                                                                                                                                                                                                                                                                                                                                                                                  |

### 2.1 Contributing scenario controlling environmental exposure for: ERC1

|                                                           |                                                   |                                                  |
|-----------------------------------------------------------|---------------------------------------------------|--------------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 25% - 40% |
| Amount used                                               | Annual amount per site                            | 2500 ton(s)/year                                 |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                                    |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                      |
|                                                           | Dilution Factor (River)                           | 10                                               |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                              |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant                 |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                       |
|                                                           | Sludge Treatment                                  | Incineration or in a landfill                    |

### 2.2 Contributing scenario controlling worker exposure for: PROC2, PROC4, PROC5, PROC8a

|                                                         |                                                                                                                                                                         |                                                  |
|---------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Product characteristics                                 | Concentration of the Substance in Mixture/Article                                                                                                                       | Concentration of substance in product: 25% - 40% |
|                                                         | Physical Form (at time of use)                                                                                                                                          | liquid                                           |
|                                                         | Vapour pressure                                                                                                                                                         | 0.06 hPa                                         |
| Amount used                                             | Worker exposure considered to be negligible due to the specialized systems.                                                                                             |                                                  |
| Frequency and duration of use                           | Frequency of use                                                                                                                                                        | 220 days/year                                    |
|                                                         | Exposure duration per day                                                                                                                                               | 480 min                                          |
|                                                         | Intermittent contact is expected                                                                                                                                        |                                                  |
| Human factors not influenced by risk management         | Breathing volume                                                                                                                                                        | 10 m3/day                                        |
|                                                         | Exposed skin surface                                                                                                                                                    | 480 cm <sup>2</sup>                              |
|                                                         | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases |                                                  |
| Other operational conditions affecting workers exposure | Indoors, any sized room, with good natural ventilation                                                                                                                  |                                                  |
|                                                         | Room size and ventilation rate are not relevant as workers work in a control room, with no direct contact to the installations housing the material.                    |                                                  |
|                                                         | Due to the nature of the substance the process should be kept as contained as possible                                                                                  |                                                  |
| Technical conditions and                                | Provide local exhaust ventilation (LEV).                                                                                                                                |                                                  |

## Sulphuric acid >51 - <96%

|                                                                                       |                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| measures to control dispersion from source towards the worker                         |                                                                                                                                                                                                                         |
| Organisational measures to prevent /limit releases, dispersion and exposure           | Only properly trained and authorised personal shall handle the substance                                                                                                                                                |
|                                                                                       | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |
|                                                                                       | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |
| Conditions and measures related to personal protection, hygiene and health evaluation | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------|---------|
| ERC1                  | ---                 | Fresh water          | PEC   | 0.0074µg/L        | 0.00295 |
| ERC1                  | ---                 | Marine water         | PEC   | 0.0011µg/L        | 0.00428 |
| ERC1                  | ---                 | Fresh water sediment | PEC   | 0.0638ng/kg       | 0.00032 |
| ERC1                  | ---                 | Marine sediment      | PEC   | 0.0093ng/kg       | 0.00005 |
| ERC1                  | ---                 | Soil                 | PEC   | 0.0335µg/kg       | ---     |
| ERC1                  | ---                 | Air                  | PEC   | 0.0001µg/m³       | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure | RCR |
|-----------------------|-----------------------|-------------------------------------------|-------------------|-----|
| PROC2                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.0012mg/m³       | --- |
| PROC4                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.004mg/m³        | --- |
| PROC5                 | 90th percentile value | Worker - inhalative, long-term - systemic | 0.013mg/m³        | --- |
| PROC8a                | 90th percentile value | Worker - inhalative, long-term - systemic | 0.006mg/m³        | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

## Sulphuric acid >51 - <96%

### 1. Short title of Exposure Scenario 11: Use in maintenance of sulphuric acid contained batteries

|                                  |                                                                                                                                                |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Main User Groups                 | SU 22: Professional uses: Public domain (administration, education, entertainment, services, craftsmen)                                        |
| Process categories               | PROC19: Hand-mixing with intimate contact and only PPE available                                                                               |
| Environmental Release Categories | ERC8b: Wide dispersive indoor use of reactive substances in open systems<br>ERC9b: Wide dispersive outdoor use of substances in closed systems |

#### 2.1 Contributing scenario controlling environmental exposure for: ERC8b, ERC9b

|                                                           |                                                   |                                                  |
|-----------------------------------------------------------|---------------------------------------------------|--------------------------------------------------|
| Product characteristics                                   | Concentration of the Substance in Mixture/Article | Concentration of substance in product: 25% - 40% |
| Amount used                                               | Annual amount per site                            | 2500 ton(s)/year                                 |
| Frequency and duration of use                             | Continuous exposure                               | 365 days/year                                    |
| Environment factors not influenced by risk management     | Flow rate of receiving surface water              | 18,000 m3/d                                      |
|                                                           | Dilution Factor (River)                           | 10                                               |
|                                                           | Dilution Factor (Coastal Areas)                   | 100                                              |
| Conditions and measures related to sewage treatment plant | Type of Sewage Treatment Plant                    | Municipal sewage treatment plant                 |
|                                                           | Flow rate of sewage treatment plant effluent      | 2,000 m3/d                                       |
|                                                           | Sludge Treatment                                  | Incineration or in a landfill                    |

#### 2.2 Contributing scenario controlling worker exposure for: PROC19

|                                                                                       |                                                                                                                                                                                                                         |                                                  |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Product characteristics                                                               | Concentration of the Substance in Mixture/Article                                                                                                                                                                       | Concentration of substance in product: 25% - 40% |
|                                                                                       | Physical Form (at time of use)                                                                                                                                                                                          | liquid                                           |
|                                                                                       | Vapour pressure                                                                                                                                                                                                         | 2.14 hPa                                         |
| Amount used                                                                           | Worker exposure considered to be negligible due to the specialized systems.                                                                                                                                             |                                                  |
| Frequency and duration of use                                                         | Frequency of use                                                                                                                                                                                                        | 220 days/year                                    |
|                                                                                       | Exposure duration per day                                                                                                                                                                                               | 480 min                                          |
|                                                                                       | Intermittent contact is expected                                                                                                                                                                                        |                                                  |
| Human factors not influenced by risk management                                       | Breathing volume                                                                                                                                                                                                        | 10 m3/day                                        |
|                                                                                       | Exposed skin surface                                                                                                                                                                                                    | 480 cm <sup>2</sup>                              |
|                                                                                       | Please note that due to the corrosive nature of the substance dermal exposure is not considered relevant for risk characterization as it must be prevented in all cases                                                 |                                                  |
| Other operational conditions affecting workers exposure                               | Indoors, any sized room, with good natural ventilation                                                                                                                                                                  |                                                  |
|                                                                                       | Due to the nature of the substance the process should be kept as contained as possible                                                                                                                                  |                                                  |
| Organisational measures to prevent /limit releases, dispersion and exposure           | Only properly trained and authorised personnel shall handle the substance                                                                                                                                               |                                                  |
|                                                                                       | Substance-handling procedures shall be well documented and strictly supervised                                                                                                                                          |                                                  |
|                                                                                       | Workers involved in sampling and transfer of materials to road tankers are trained in the procedures and protective equipment is intended to cope with the worst case scenario, in order to minimize exposure and risks |                                                  |
| Conditions and measures related to personal protection, hygiene and health evaluation | Workers wear protective clothing (face/eye protection, helmet, anti-acid gloves, boots and protective coverall)                                                                                                         |                                                  |

## Sulphuric acid >51 - <96%

### 3. Exposure estimation and reference to its source

#### Environment

EUSES V2.1 tier 2

| Contributing Scenario | Specific conditions | Compartment          | Value | Level of Exposure | RCR     |
|-----------------------|---------------------|----------------------|-------|-------------------|---------|
| ERC8b                 | ---                 | Fresh water          | PEC   | 0.001µg/L         | 0.00424 |
| ERC8b                 | ---                 | Marine water         | PEC   | 0.333ng/L         | 0.00133 |
| ERC8b                 | ---                 | Fresh water sediment | PEC   | 0.914ng/kg        | 0.00046 |
| ERC8b                 | ---                 | Marine sediment      | PEC   | 0.0288ng/kg       | 0.00001 |
| ERC8b                 | ---                 | Soil                 | PEC   | 0.671ng/kg        | ---     |
| ERC8b                 | ---                 | Air                  | PEC   | 0.002ng/m3        | ---     |
| ERC9b                 | ---                 | Fresh water          | PEC   | 0.003µg/L         | 0.01340 |
| ERC9b                 | ---                 | Marine water         | PEC   | 1.85ng/L          | 0.00740 |
| ERC9b                 | ---                 | Fresh water sediment | PEC   | 2.89ng/kg         | 0.00140 |
| ERC9b                 | ---                 | Marine sediment      | PEC   | 0.16ng/kg         | 0.00008 |
| ERC9b                 | ---                 | Soil                 | PEC   | 0.003µg/kg        | ---     |
| ERC9b                 | ---                 | Air                  | PEC   | 0.12ng/m3         | ---     |

#### Workers

Advanced REACH Tool (ART model)

| Contributing Scenario | Specific conditions   | Exposure routes                           | Level of Exposure      | RCR |
|-----------------------|-----------------------|-------------------------------------------|------------------------|-----|
| ---                   | 90th percentile value | Worker - inhalative, long-term - systemic | 0.002mg/m <sup>3</sup> | --- |

The ECETOC exposure estimation is considered to be unsatisfactory and is not considered relevant for the risk characterisation purposes.

### 4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the Exposure Scenario

Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures.  
 Predicted exposures are not expected to exceed the DN(M)EL when the Risk Management Measures/Operational Conditions outlined in Section 2 are implemented.  
 Where other Risk Management Measures/Operational Conditions are adopted, then users should ensure that risks are managed to at least equivalent levels.

**SUBSTANCE/PREPARATION SAFETY DATA SHEET****1.0 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING****1.1 Identification of the substance or preparation**

Trufloc® TAC40

**1.2 Use of the substance/preparation**

The preparation is used for the treatment of industrial waste water (effluent).

**1.3 Company/Undertaking Information**

Atana Ltd, Hydrus House, Dromintee Road, Hilltop Industrial Estate, Bardon Hill, Coalville, Leicestershire, LE67 1TX Tel +44 (0) 1530 830020 Fax +44 (0) 1530 832310

If you have queries regarding this MSDS please email [victoria.cartwright@atana.co.uk](mailto:victoria.cartwright@atana.co.uk)

**1.4 Emergency telephone**

24 hour emergency telephone number 0778 2354001 – Atana, Ltd David Garton

**2.0 HAZARDS IDENTIFICATION****Hazards to human health**

This preparation is not classed as hazardous.

**3.0 COMPOSITION/INFORMATION ON INGREDIENTS****3.1 General description**

A preparation containing 60% polyaluminium chloride hydroxide sulphate (PAC) 10% solution and 40% cationic water-soluble polymer.

**3.2 Hazardous ingredients (please see Section 15.0 for more details)**

| International chemical identification           | Content in preparation | Hazard information  |            |
|-------------------------------------------------|------------------------|---------------------|------------|
| Polyaluminium chloride hydroxide sulphate (PAC) | 10%                    | <b>CAS number</b>   | 39290-78-3 |
|                                                 |                        | <b>Index number</b> |            |

|                                |                           |                            |                |
|--------------------------------|---------------------------|----------------------------|----------------|
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To the best of our knowledge, the information contained herein is accurate. However, neither the named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

**Atana Limited**

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 Registered in England No. 04345865

**EINECS** 254-400-7

**Class** Xi; R36/38

#### 4.0 FIRST AID MEASURES

|                     |                                                                                                                                                                                                                                                    |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inhalation</b>   | If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Obtain medical attention immediately. Keep under medical surveillance for 48 hours if exposure to fumes is suspected.      |
| <b>Ingestion</b>    | Do NOT induce vomiting unless directed to do so by a medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt and waistband. Get medical attention immediately.                 |
| <b>Skin contact</b> | In case of contact, immediately flush skin for at least 15 minutes with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Obtain medical attention if irritation persists. |
| <b>Eye contact</b>  | In case of contact, immediately flush eyes with a copious amount of water for at least 15 minutes. Obtain medical attention.                                                                                                                       |

#### 5.0 FIRE-FIGHTING MEASURES

|                                                       |                                                                                                 |
|-------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>Suitable extinguishing media</b>                   | Small – Use dry chemical powder.<br>Large – Use water spray, fog or foam. Do not use water jet. |
| <b>Special exposure hazards</b>                       | Thermal - Hydrogen chloride (HCl), oxygen, hydrogen chloride generation.                        |
| <b>Special protective equipment for fire-fighters</b> | Self-contained positive pressure breathing apparatus (SCBA) and full turn out gear.             |

#### 6.0 ACCIDENTAL RELEASE MEASURES

|                             |                                                                                                                                                                                                                                                                                          |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Personal precautions</b> | Splash goggles, protective overall/suit, boots, gloves. Select appropriate PPE for size of spillage. Avoid contact with skin, eyes, or clothing. Use normal personal hygiene and housekeeping. Take caution with the surfaces affected, they become very slippery if contact with water. |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                |                           |                            |                |
|--------------------------------|---------------------------|----------------------------|----------------|
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Registered in England No. 04345865

## Environmental precautions

Stop leak if without risk. Absorb with dry earth, sand or other non combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapour drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Dispose of according to local and national regulations. *Neutralize with soda ash.*

## 7.0 HANDLING AND STORAGE

### 7.1 Handling

Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers may still contain significant residual amounts of product. Ground all electrical equipment containing the product. Do not ingest. Do not breathe gas/fumes/vapour/spray. Never add water to this product. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or label. Keep away from compatibles such as oxidizing agents, alkalis.

### 7.2 Storage

Keep container tightly closed. Keep container in a cool, well-ventilated area. Avoid extreme temperatures (especially below 0 °C). We recommend to keep it within the temperature range of 0 – 30 °C. Do not store above 40° C (104° F). Use original container or store in most rubbers, plastic – PVC or PE, lead ebonite coated steel (4mm min) glass fibre. Do not store in copper, mild steel or zinc.

### 7.3 Specific use(s)

The substance is used for the treatment of industrial waste water (effluent).

## 8.0 EXPOSURE CONTROLS/PERSONAL PROTECTION

### 8.1 EH40 / 2005 Workplace exposure limits

Not available.

### 8.2 Exposure controls

#### 8.2.1 Occupational exposure controls

#### Technical measures / precautions

Provide adequate natural or exhaust ventilation. Ensure eyewash stations and safety showers are close to the handling locations.

#### Respiratory

Wear an appropriate respirator when ventilation is inadequate.

|                                |                           |                            |                |
|--------------------------------|---------------------------|----------------------------|----------------|
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## Atana Limited

Hydrus House, Dromintee Road, Hilltop Industrial Estate, Bardon Hill, Coalville, Leicestershire, LE67 1TX  
Tel: +44 (0) 1530 830020 Fax: +44 (0) 1530 832310 Email: [enquiries@atana.co.uk](mailto:enquiries@atana.co.uk)  
Registered in England No. 04345865

**equipment****Hand protection** PVC or rubber gloves.**Eye protection** Chemical goggles.**Clothing** Protective overall/suit.**9.0 PHYSICAL AND CHEMICAL PROPERTIES****9.1 General information****Appearance** Green. Yellow liquid.**Odour** Weak.**9.2 Important health, safety and environmental information****Specific gravity** 1.23 g/cm<sup>3</sup>**pH** 1.5 – 2.5 approx.**Water solubility** In all proportions.**Freezing point** 0°C approx.**Boiling point** 100°C approx.**10.0 STABILITY AND REACTIVITY****10.1 Conditions to avoid** Extreme temperatures: specially close to 0° C.**10.2 Materials to avoid** Reactive with oxidizing agents, alkalis.**10.3 Hazardous decomposition products** Hydrogen chloride (HCl), oxygen, hydrogen chlorine, CO, CO<sub>2</sub> and NO<sub>x</sub>.**11.0 TOXICOLOGICAL INFORMATION****Acute and chronic effects** PAC component = Acute - oral toxicity (LD<sub>50</sub>): 11800 mg/kg (Rat).

PAC component = Chronic - Repeated or prolonged contact with spray mist may produce chronic eye irritation and sever skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation

|                                |                           |                            |                |
|--------------------------------|---------------------------|----------------------------|----------------|
| Document<br>Trufloc® TAC40.doc | Issue date<br>August 2009 | Issue number<br>REACH1 VCG | Page<br>4 of 5 |
|--------------------------------|---------------------------|----------------------------|----------------|

To the best of our knowledge, the information contained herein is accurate. However, neither the named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

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leading to frequent attacks of bronchial infection.

Polymer component = Oral (LD50, mouse): > 2000 mg /Kg (OECD 401 method). Inhalation: The product is not expected to be toxic by inhalation. Eyes irritation: Irritant. Dermal irritation: Light irritant. Sensitization: Not known. Additional information: Can be irritating for respiratory tracks.

## 12.0 ECOLOGICAL INFORMATION

**12.1 Ecotoxicity** PAC component = In water (EC50): > 100 mg/l 48 hours (Daphnia).

Polymer component = Acute toxicity on fish: LC50 between 1-10 mg/li. High concentrations can alter pH. It is dangerous for fish's life.

## 13.0 DISPOSAL CONSIDERATIONS

Dispose of residual / unused product and packaging in line with local and national regulations.

## 14.0 TRANSPORT INFORMATION (ADR 2009)

This preparation is not classed as hazardous under ADR 2009.

## 15.0 REGULATORY INFORMATION

**Labelling** Not applicable.

**16.0 Relevant risk and safety phrases** S26 Avoid contact with eyes.  
S39 Use protection for eyes and skin.  
R36 Irritating to eyes.  
R38 Irritating to skin.

**Date of amendment Reason for amendment**

|                                |                           |                            |                |
|--------------------------------|---------------------------|----------------------------|----------------|
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## **APPENDIX D**

## **DRAINAGE PLANS AND EA INDICATIVE FLOOD MAP**



**Waste networks:**

-  Foul chamber
-  Surface water chamber
-  Combined chamber
-  Combined sewer overflow
-  Special purpose chamber
-  Treatment works
-  Pumping station
-  Outfall
-  LPH
-  Lamphole
-  Storm Overflow
-  Rising main
-  Gravity sewer
-  Private sewer
-  Private sewer subject to Sect. 104 adaptation agreement
-  Private Sewer Transfer
-  Lateral Drain
-  Inspection Chamber

NB: Sewer symbol colour indicates the type.

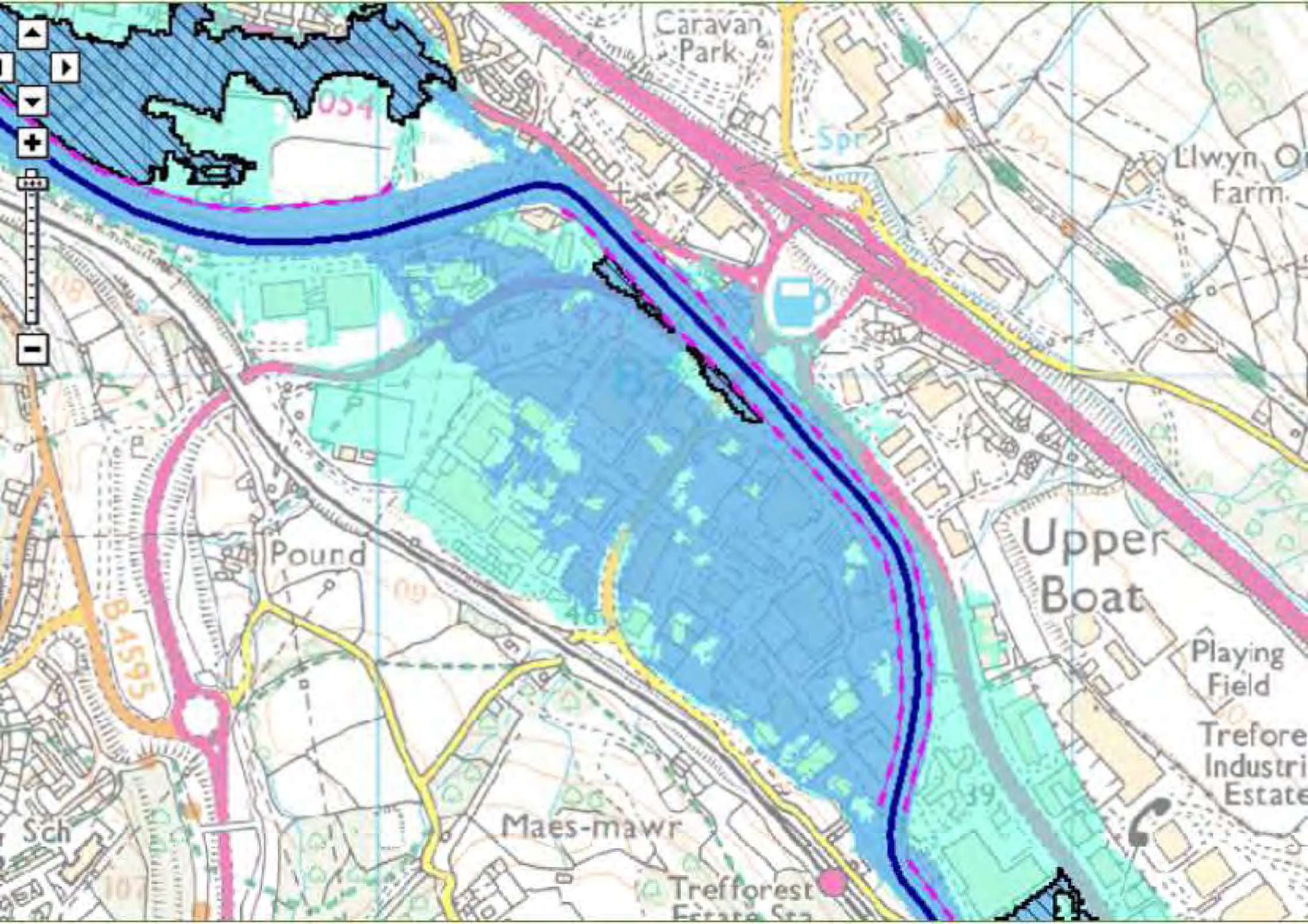
RED - Combined  
GREEN - Surface water  
BROWN - Foul  
Purple - Former S24 sewers (for indicative purposes only)

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases, pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

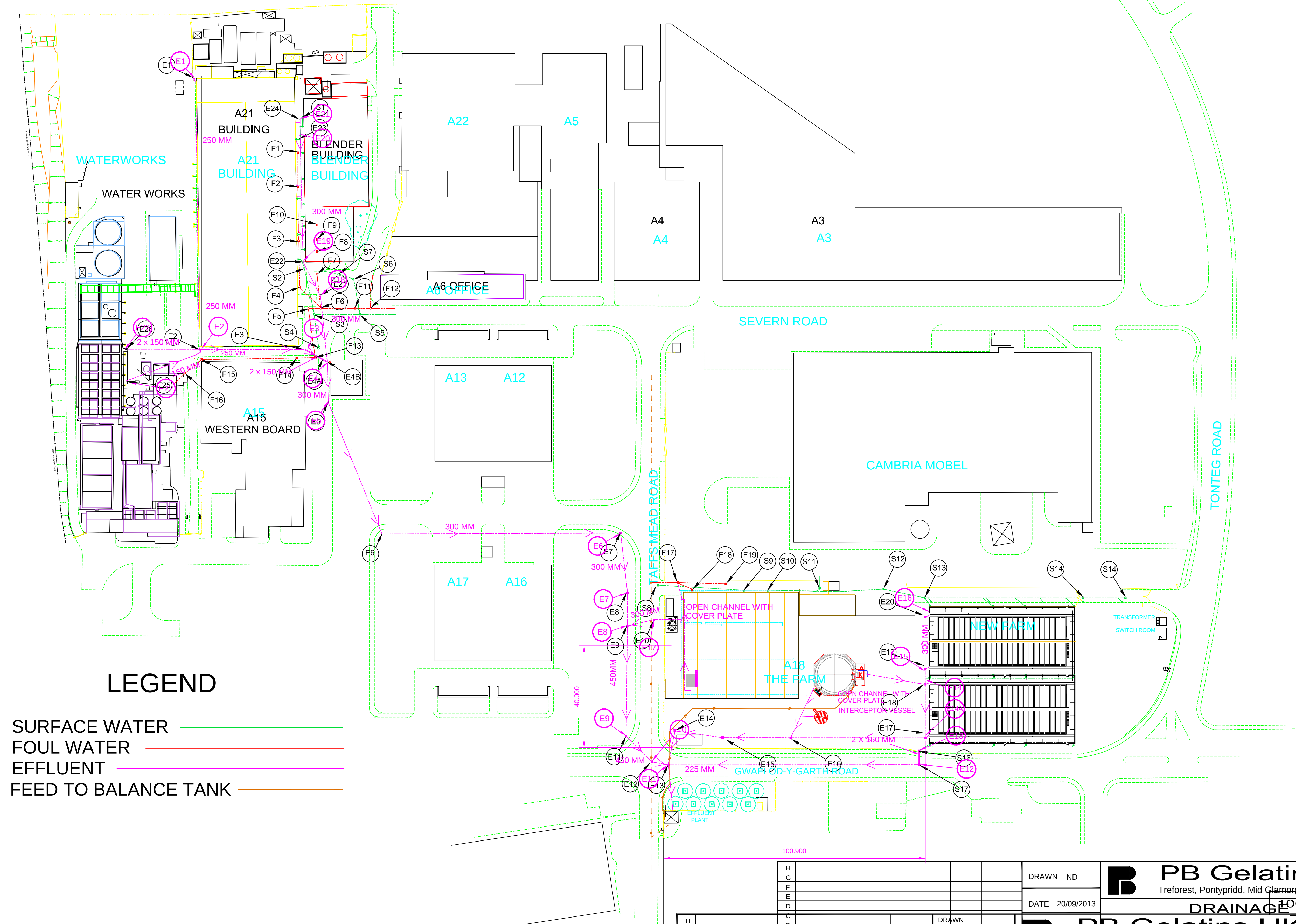
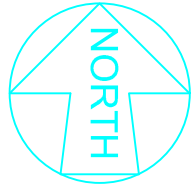
EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref: ST102868  
Map scale: 1:2,500  
Printed by: MW  
Printed on: 13.10.14

Map Ref: ST102868  
Map scale: 1:2,500  
Printed by: MW  
Printed on: 13.10.14



DO NOT SCALE - IF IN DOUBT ASK



LEGEND

- SURFACE WATER ———
- FOUL WATER ———
- EFFLUENT ———
- FEED TO BALANCE TANK ———

|                                      |  |  |  |                 |  |                                                |  |
|--------------------------------------|--|--|--|-----------------|--|------------------------------------------------|--|
| H<br>G<br>F<br>E<br>D<br>C<br>B<br>A |  |  |  | DRAWN ND        |  | PB Gelatir                                     |  |
|                                      |  |  |  | DATE 20/09/2013 |  | Treforest, Pontypridd, Mid Glamorgan           |  |
|                                      |  |  |  | DRAWN JM        |  | 1000 SERIES                                    |  |
|                                      |  |  |  | DATE 11/1/99    |  | PB Gelatins UK Ltd                             |  |
|                                      |  |  |  | CHECKED PC      |  | Treforest, Pontypridd, Mid Glamorgan. CF37 5SU |  |
|                                      |  |  |  | APPROVED PC     |  | EFFLUENT DRAIN                                 |  |
| REVISIONS                            |  |  |  | BY              |  | MANHOLE DETAILS                                |  |
|                                      |  |  |  | DATE            |  | SCALE 1:750 @ A1 SIZE                          |  |
|                                      |  |  |  |                 |  | PBG:1013                                       |  |
|                                      |  |  |  |                 |  | REV                                            |  |

## **APPENDIX E**

## **PATHWAY HAZARD AND SITE RISK ASSESSMENTS**

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A18 Phosphoric**

**Receptor: River Taff**

| Pathways                                                                                                       | Hazard Rating Justification                                                                                                                                                                                                                        | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment walls and drainage features are likely to intercept runoff.                                                                                                                            | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Infiltration                                                                                                   | Surrounding areas are hard paved. Containment walls and drainage features are likely to intercept runoff.                                                                                                                                          | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in road adjacent to storage facilities. Majority of spillage likely to be contained by site walls and prevalent industrial effluent channel drainage gullies in area.                                               | MODERATE      | Structural failure, failure of outlet pipe, fire damage, jetting failure.                                                                                                       | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                   | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Pathway likely to intercept majority of most spillages. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank or pipework. Operational failure.                                                                                                                    | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated on concrete plinth. Large rates of dilution would be provided.                                                                                                 | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A18 Phosphoric**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                         | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Surrounding areas are hard paved. Containment walls and drainage features are likely to intercept runoff.                                                                                                                                                             | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Infiltration                                                                                                   | Surrounding areas are hard paved. Containment walls and drainage features are likely to intercept runoff.                                                                                                                                                             | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in road adjacent to storage facilities. Majority of spillage likely to be contained by site walls and prevalent industrial effluent channel drainage gullies in area. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure, failure of outlet pipe, fire damage, jetting failure.                                                                                                       | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                   | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                   | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                   | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A18 Sulphuric**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                      | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment walls and drainage features are likely to intercept runoff.                                                                                                                            | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Infiltration                                                                                                   | Surrounding areas are hard paved. Containment walls and drainage features are likely to intercept runoff.                                                                                                                                          | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in road adjacent to storage facilities. Majority of spillage likely to be contained by site walls and prevalent industrial effluent channel drainage gullies in area.                                               | MODERATE      | Structural failure, failure of outlet pipe, fire damage, jetting failure.                                                                                                       | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                   | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Pathway likely to intercept majority of most spillages. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank or pipework. Operational failure.                                                                                                                    | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated on concrete plinth. Large rates of dilution would be provided.                                                                                                 | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A18 Sulphuric**

**Receptor: Soils + Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                         | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Surrounding areas are hard paved. Containment walls and drainage features are likely to intercept runoff.                                                                                                                                                             | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Infiltration                                                                                                   | Surrounding areas are hard paved. Containment walls and drainage features are likely to intercept runoff.                                                                                                                                                             | LOW           | Structural failure, failure of outlet pipe, fire damage                                                                                                                         | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in road adjacent to storage facilities. Majority of spillage likely to be contained by site walls and prevalent industrial effluent channel drainage gullies in area. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure, failure of outlet pipe, fire damage, jetting failure.                                                                                                       | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                   | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                   | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                   | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: W. Works Truefloc TAC40**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                              | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                    | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                      | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in the yard area adjacent to the storage facility could convey spillages directly to the river some 670m away.                                                                                                              | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                           | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area could intercept flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank or pipework. Operational failure.                                                                                                                    | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated on concrete plinth. Large rates of dilution would be provided.                                                                                                         | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: W. Works Truefloc TAC40**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                  | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Surrounding areas are soft landscaped and provide a direct pathway for infiltration into the ground.                                                                                                           | HIGH          | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | Surrounding areas are soft landscaped and provide a direct pathway for infiltration into the ground.                                                                                                           | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in the yard area adjacent to the storage facility could convey spillages directly to the river some 670m away. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                            | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                            | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                            | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Caustic**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                              | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                    | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                      | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in the yard area adjacent to the storage facility could convey spillages directly to the river some 670m away.                                                                                                              | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                           | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area could intercept flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containing effluent. Operational failure.                                                                                       | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated within redundant water treatment works which by examination would be well above fluvial flood levels.                                                                  | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Caustic**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                  | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Surrounding areas are soft landscaped and provide a direct pathway for infiltration into the ground.                                                                                                           | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Infiltration                                                                                                   | Surrounding areas are soft landscaped and provide a direct pathway for infiltration into the ground.                                                                                                           | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in the yard area adjacent to the storage facility could convey spillages directly to the river some 670m away. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                            | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                            | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                            | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Caustic Day Tank**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                              | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                    | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                      | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in the yard area adjacent to the storage facility could convey spillages directly to the river some 670m away.                                                                                                              | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                           | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area could intercept flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containing effluent. Operational failure.                                                                                       | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated within redundant water treatment works which by examination would be well above fluvial flood levels.                                                                  | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Caustic Day Tank**

**Receptor: Soils and groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                  | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Surrounding areas are soft landscaped and provide a direct pathway for infiltration into the ground.                                                                                                           | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Infiltration                                                                                                   | Surrounding areas are soft landscaped and provide a direct pathway for infiltration into the ground.                                                                                                           | HIGH          | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies in the yard area adjacent to the storage facility could convey spillages directly to the river some 670m away. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund. Operational failure and failure of tertiary containment during filling operation.                                                          | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                            | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                            | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                            | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Deioniser Effluent (Diluted HCl)**

**Pathway: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                              | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                    | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                      | LOW           | Structural failure of tank and bund, or pipework containing inventory. Operational failure and failure of tertiary containment during filling operation.                        | MODERATE         |
| Surface water drainage                                                                                         | Surface water drainage gullies are present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop.                                                    | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                           | LOW           | Structural failure of tank and bund, or pipework containing inventory.                                                                                                          | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area could intercept flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containing effluent. Operational failure and failure of tertiary containment during filling operation.                          | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated on concrete plinth. Large rates of dilution would be provided.                                                                                                         | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Deioniser Effluent (Diluted HCl)**

### **Pathway: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                             | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | There are areas of soft landscaped ground in close proximity to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                | MODERATE      | Structural failure of tank and bund or pipework containing inventory.                                                                                                           | LOW              |
| Infiltration                                                                                                   | There are areas of soft landscaped ground in close proximity to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                | MODERATE      | Structural failure of tank and bund or pipework containing inventory.                                                                                                           | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies area present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                       | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 HCl**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                              | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                    | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                      | LOW           | Structural failure of tank and bund, or pipework containing inventory. Operational failure and failure of tertiary containment during filling operation.                        | MODERATE         |
| Surface water drainage                                                                                         | Surface water drainage gullies are present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop.                                                    | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                           | LOW           | Structural failure of tank and bund, or pipework containing inventory.                                                                                                          | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area could intercept flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containing effluent. Operational failure .                                                                                      | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and tank is elevated on concrete plinth. Large rates of dilution would be provided.                                                                                                         | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 HCl**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                             | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | There are areas of soft landscaped ground directly adjacent to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                 | MODERATE      | Structural failure of tank and bund or pipework containing inventory.                                                                                                           | LOW              |
| Infiltration                                                                                                   | There are areas of soft landscaped ground directly adjacent to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                 | MODERATE      | Structural failure of tank and bund or pipework containing inventory.                                                                                                           | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies area present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund, or pipework containing effluent and tertiary containment system.                                                                           | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Industrial effluent drainage exists above ground and is susceptible to damage.                                                                                                                                                                                            | MODERATE      | Damage to effluent pipework above ground                                                                                                                                        | MODERATE         |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                       | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Hydrogen Peroxide**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                                    | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                                          | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                                            | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies are present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop.                                                                          | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                                                 | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and maholes in the area would likely intercept the majority of flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containnig effluent. Operational failure.                                                                                       | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and the tank is elevated on a concrete plinth. Large rates of dilution would be provided.                                                                                                                         | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational faiulre etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Hydrogen Peroxide**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                             | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | There are areas of soft landscaped ground directly adjacent to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                 | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | There are areas of soft landscaped ground directly adjacent to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                 | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies area present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                       | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Acetic Acid**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                                    | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                                          | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                                            | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies are present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop.                                                                          | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                                                 | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and maholes in the area would likely intercept the majority of flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containnig effluent. Operational failure.                                                                                       | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and the tank is elevated on a concrete plinth. Large rates of dilution would be provided.                                                                                                                         | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational faiulre etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Acetic Acid**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                             | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | There are areas of soft landscaped ground directly adjacent to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                 | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | There are areas of soft landscaped ground directly adjacent to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                 | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies area present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                       | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Phosphoric Acid**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                                     | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                                           | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                                             | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies are present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop.                                                                           | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                                                  | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area would likely intercept the majority of flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containing effluent. Operational failure.                                                                                       | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and the tank is elevated on a concrete plinth. Large rates of dilution would be provided.                                                                                                                          | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: A21 Phosphoric Acid**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                             | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | There are areas of soft landscaped ground in close proximity to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Infiltration                                                                                                   | There are areas of soft landscaped ground in close proximity to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                | MODERATE      | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies area present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                       | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: Lime (hydrated)**

**Receptor: River Taff**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                                     | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | Long drainage pathway which is relatively flat. Containment kerbs and drainage features are likely to intercept runoff.                                                                                                                                                           | LOW           | Structural failure of tank, and collection and transfer system, or remote containment tank                                                                                      | LOW              |
| Infiltration                                                                                                   | A long route through the ground exists. Flow rates would be very low, dilution and dispersal rates would be very high                                                                                                                                                             | LOW           | Structural failure of tank, and collection and transfer system, or remote containment tank.                                                                                     | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies are present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop.                                                                           | MODERATE      | Structural failure of tank, and collection and transfer system, or remote containment tank.                                                                                     | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | Foul water manholes in the area, but no surface furniture. Potential for overflow from site pump station into foul sewer. High dilution rates and treatment would be provided before release to the environment.                                                                  | LOW           | Structural failure of tank and bund.                                                                                                                                            | LOW              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | Surface gullies and manholes in the area would likely intercept the majority of flows. Neutralisation and dilution would be provided through PB Gelatins DAF treatment plant. Further dilution and treatment would be provided by public WWTW's before release to the environment | LOW           | Structural failure of tank and bund or pipework containing effluent. Operational failure.                                                                                       | MODERATE         |
| Flooding                                                                                                       | Area at >1:100 year flood risk, but flood defences are present and the tank is elevated on a concrete plinth. Large rates of dilution would be provided.                                                                                                                          | MODERATE      | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **PB Gelatins Review of Chemical Storage Facilities - Pathway Hazard Assessment + Site Risk Rating Assessment**

**Source: Lime (hydrated)**

**Receptor: Soils and Groundwater**

| Pathways                                                                                                       | Justification                                                                                                                                                                                                                                                             | Hazard Rating | Storage Failure Mechanism                                                                                                                                                       | Site Risk Rating |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Direct runoff                                                                                                  | There are areas of soft landscaped ground in close proximity to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                | MODERATE      | Structural failure of tank, and collection and transfer system, or remote containment tank                                                                                      | LOW              |
| Infiltration                                                                                                   | There are areas of soft landscaped ground in close proximity to the storage facility. The majority of any spill would most likely be intercepted by effluent sewers, but in sufficient quantities a pathway could develop.                                                | MODERATE      | Structural failure of tank, and collection and transfer system, or remote containment tank                                                                                      | LOW              |
| Surface water drainage                                                                                         | Surface water drainage gullies area present in the road outside the site. Effluent gullies would most likely intercept the majority of a spillage, but in sufficient quantities a pathway could develop. Large dilution would be provided prior to reaching the receptor. | LOW           | Structural failure of tank, and collection and transfer system, or remote containment tank                                                                                      | LOW              |
| Foul water drainage including treatment through the public treatment works                                     | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Industrial effluent sewers including treatment through the PB Gelatins DAF before release to public foul sewer | N/A                                                                                                                                                                                                                                                                       | N/A           | N/A                                                                                                                                                                             | N/A              |
| Flooding                                                                                                       | Large rates of dilution would be provided and contaminated water would be dispersed over a large area in quantities unlikely to provide significant pollution risk.                                                                                                       | LOW           | Flood water causes structural failure or damage to primary and secondary containment or pipework containing inventory. Flooding occurs at some time as operational failure etc. | LOW              |

## **APPENDIX F**

## **SUMMARY OF ENVIRONMENTAL RISK ASSESSMENTS AND INVENTORY CLASSIFICATIONS**

## PB Gelatins Review of Chemical Storage Facilities - Summary of Environmental Risk Assessments and Inventory Classifications

| Source         | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|----------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A18 Phosphoric | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | MODERATE                   |                          |
|                |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                |                      | Runoff        | LOW                   | Soils, bedrock and groundwater | MODERATE               | MODERATE           | LOW              | LOW                        |                          |
|                |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

| Source        | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|---------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A18 Sulphuric | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|               |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|               |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|               |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | MODERATE                   |                          |
|               |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|               |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|               |                      | Runoff        | LOW                   | Soils, bedrock and groundwater | MODERATE               | MODERATE           | LOW              | LOW                        |                          |
|               |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|               |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|               |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|               |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|               |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

## PB Gelatins Review of Chemical Storage Facilities - Summary of Environmental Risk Assessments and Inventory Classifications

| Source                  | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|-------------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| W.W. Truefloc<br>TAC 40 | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                         |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                         |                      | S.W. Drainage | HIGH                  |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                         |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                         |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                         |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                         |                      | Runoff        | HIGH                  | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                         |                      | Infiltration  | HIGH                  |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                         |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                         |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                         |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                         |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

| Source      | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|-------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Caustic | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|             |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|             |                      | S.W. Drainage | HIGH                  |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|             |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|             |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|             |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|             |                      | Runoff        | HIGH                  | Soils, bedrock and groundwater | MODERATE               | HIGH               | MODERATE         | MODERATE                   |                          |
|             |                      | Infiltration  | HIGH                  |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|             |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|             |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|             |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|             |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

## PB Gelatins Review of Chemical Storage Facilities - Summary of Environmental Risk Assessments and Inventory Classifications

| Source               | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|----------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Caustic Day tank | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                      |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                      |                      | S.W. Drainage | HIGH                  |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                      |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                      |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                      |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                      |                      | Runoff        | HIGH                  | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                      |                      | Infiltration  | HIGH                  |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                      |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                      |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                      |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                      |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

| Source                 | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|------------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Deioniser effluent | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                        |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | MODERATE         | LOW                        |                          |
|                        |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                        |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                        |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | Runoff        | MODERATE              | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | Infiltration  | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                        |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                        |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                        |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

## PB Gelatins Review of Chemical Storage Facilities - Summary of Environmental Risk Assessments and Inventory Classifications

| Source                 | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|------------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Deioniser effluent | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 3                  |
|                        |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | MODERATE         | LOW                        |                          |
|                        |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                        |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                        |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | Runoff        | MODERATE              | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | Infiltration  | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                        |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                        |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                        |                      | I.E. Drainage | MODERATE              |                                |                        | HIGH               | MODERATE         | HIGH                       |                          |
|                        |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

| Source                | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|-----------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Hydrogen Peroxide | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                       |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                       |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                       |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                       |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                       |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                       |                      | Runoff        | MODERATE              | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                       |                      | Infiltration  | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                       |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                       |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                       |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                       |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

## PB Gelatins Review of Chemical Storage Facilities - Summary of Environmental Risk Assessments and Inventory Classifications

| Source          | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|-----------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Acetic Acid | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                 |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                 |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                 |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                 |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                 |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                 |                      | Runoff        | MODERATE              | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                 |                      | Infiltration  | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                 |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                 |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                 |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                 |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

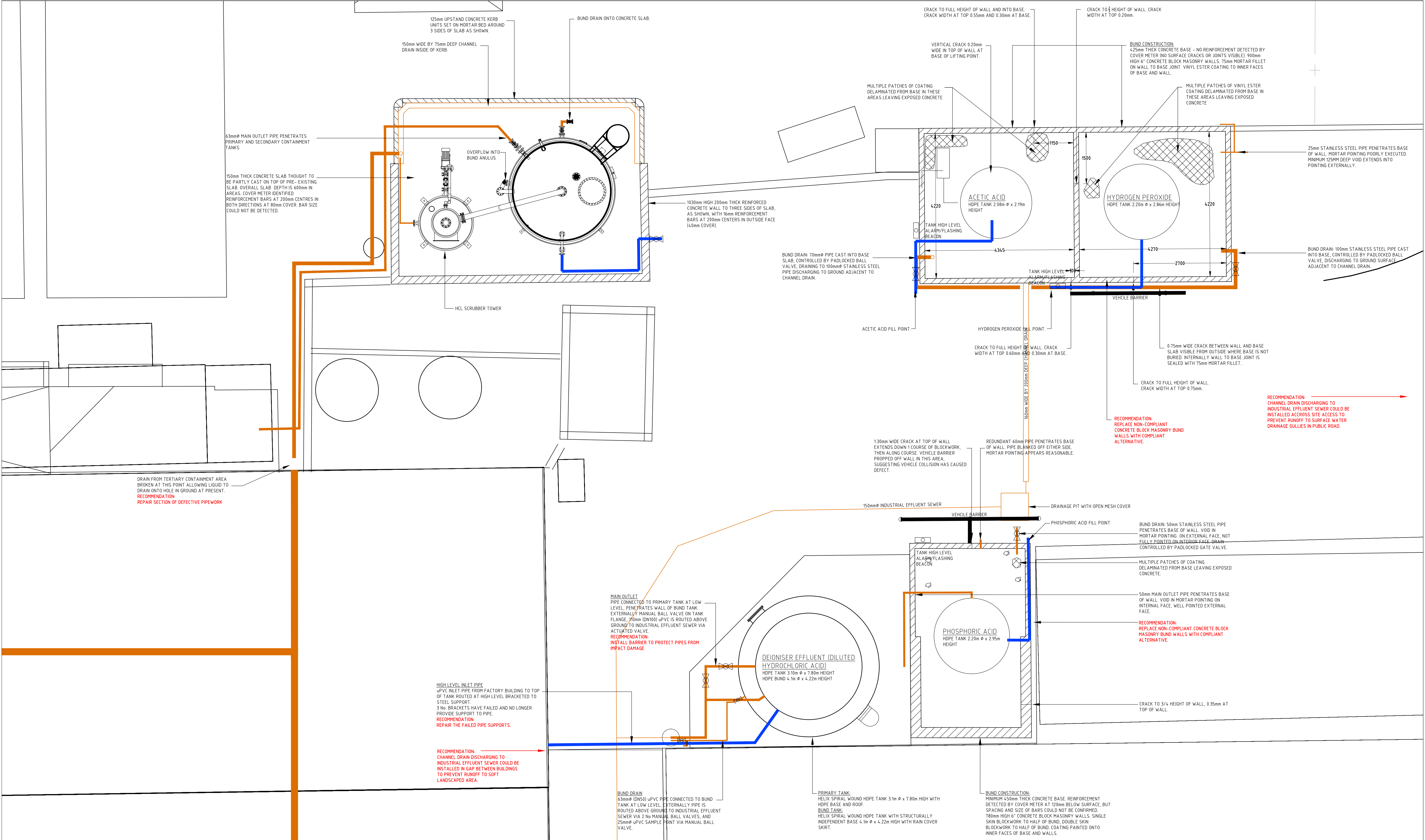
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|---------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A21 Phosphoric Acid | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                     |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                     |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                     |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                     |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                     |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                     |                      | Runoff        | MODERATE              | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                     |                      | Infiltration  | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                     |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                     |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                     |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                     |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

## PB Gelatins Review of Chemical Storage Facilities - Summary of Environmental Risk Assessments and Inventory Classifications

| Source            | Source Hazard Rating | Pathway       | Pathway Hazard Rating | Receptor                       | Receptor Hazard Rating | Site Hazard Rating | Site Risk Rating | Overall Site Hazard Rating | Inventory Classification |
|-------------------|----------------------|---------------|-----------------------|--------------------------------|------------------------|--------------------|------------------|----------------------------|--------------------------|
| A18 Hydrated Lime | HIGH                 | Runoff        | LOW                   | River Taff                     | MODERATE               | MODERATE           | LOW              | LOW                        | Class 2                  |
|                   |                      | Infiltration  | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                   |                      | S.W. Drainage | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                   |                      | F.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                   |                      | I.E. Drainage | LOW                   |                                |                        | MODERATE           | MODERATE         | MODERATE                   |                          |
|                   |                      | Flooding      | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                   |                      | Runoff        | MODERATE              | Soils, bedrock and groundwater | MODERATE               | HIGH               | LOW              | MODERATE                   |                          |
|                   |                      | Infiltration  | MODERATE              |                                |                        | HIGH               | LOW              | MODERATE                   |                          |
|                   |                      | S.W. Drainage | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |
|                   |                      | F.W. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                   |                      | I.E. Drainage | N/A                   |                                |                        | N/A                | N/A              | N/A                        |                          |
|                   |                      | Flooding      | LOW                   |                                |                        | MODERATE           | LOW              | LOW                        |                          |

## **APPENDIX G**

## **BASELINE SURVEY DRAWINGS**



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REPORT ISSUE

DATE

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NOTES

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TIM SULLIVAN

ASSISTANT--

JAMES PETTIFER

DRAWN DATE--

OCTOBER 2014

SCALE & SHEET SIZE--

1:50 @ A1

PRELIMINARY

CLIENT

PB GELATINS

PROJECT

REVIEW OF SITE CHEMICAL STORAGE FACILITIES

DRAWING TITLE

RECORD OF ACETIC ACID, HYDROGEN PEROXIDE, PHOSPHORIC ACID, HCDROCHLORIC ACID AND DEIONISER EFFLUENT (DILUTE HCL) STORAGE FACILITIES

Waste to Value (AD/Biogaz)

Industrial Effluent Treatment

Sewage Treatment

Fixed Risk Management/SEDS

Design Consultancy

Service and Maintenance

H2OK Systems Ltd, Nanjertick Court, Alton, Truro, Cornwall TR4 9DZ (01872) 542100

Unit 16 Avonbank Industrial Centre, West Town Road, Bristol, BS11 9DE (01173) 148441

Email: info@h2ok.co.uk

www.h2ok.co.uk

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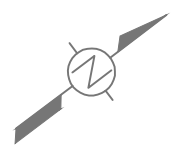
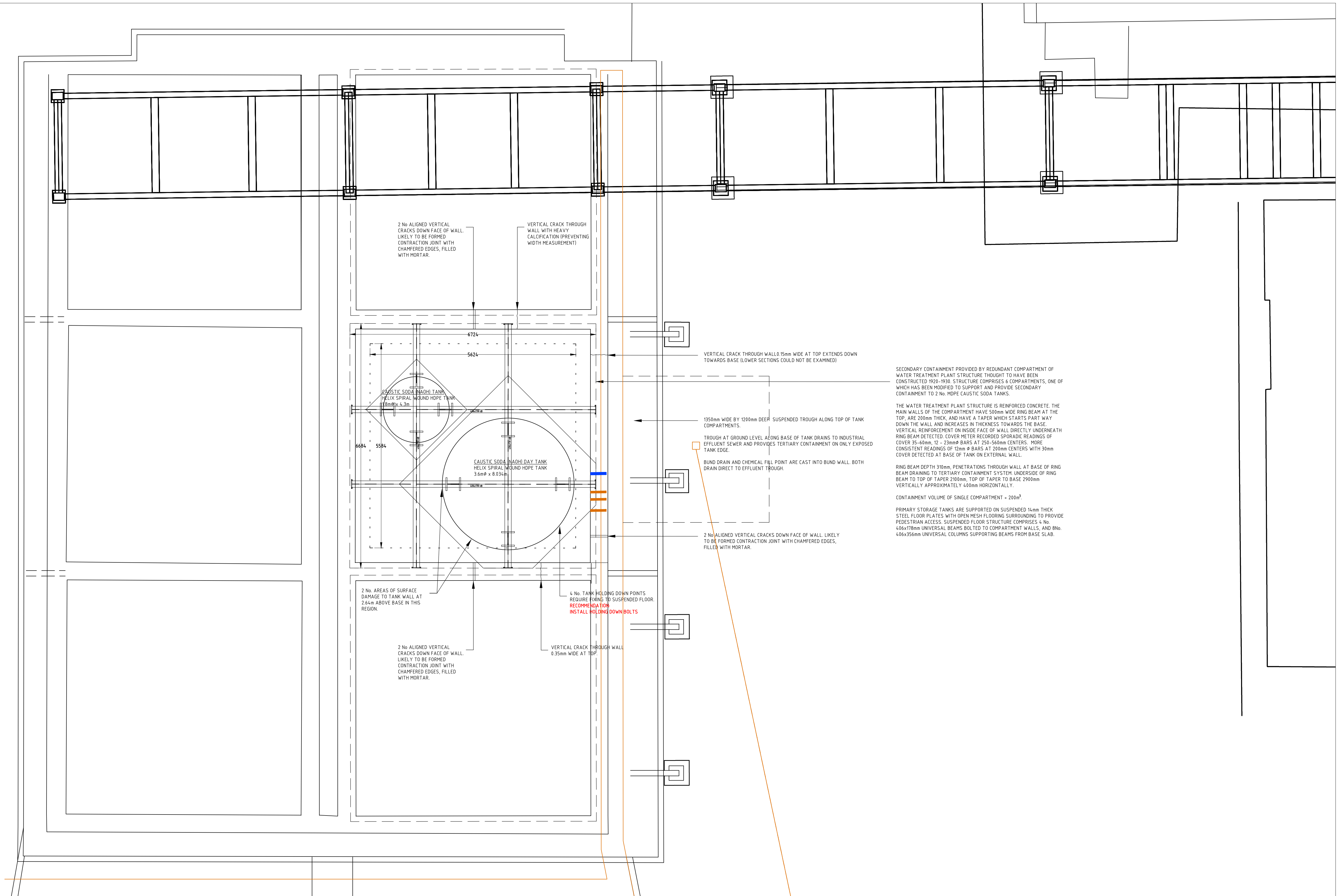
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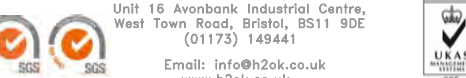
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PROJECT  
REVIEW OF SITE CHEMICAL STORAGE FACILITIES

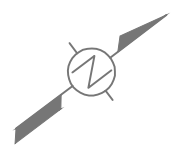
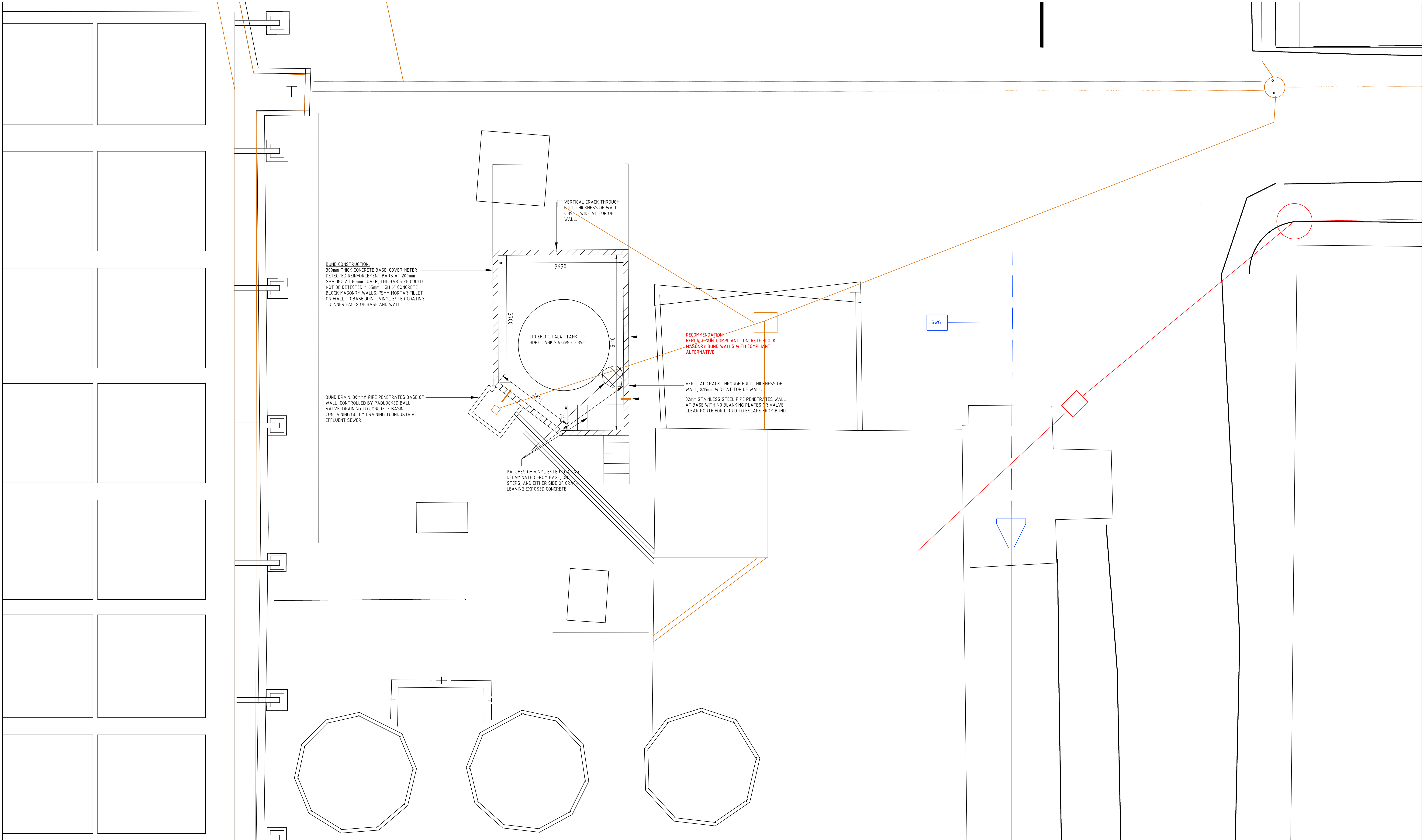
DRAWING TITLE  
RECORD OF A21 CAUSTIC AND CAUSTIC DAY TANK STORAGE FACILITIES



H2OK Systems Ltd, Hanjarrick Court, Allat, Truro, Cornwall TR4 8BU (01872) 542100  
Unit 16 Jansbank Industrial Centre, West Town Road, Brixton, BS11 9DE (01173) 148443  
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|               |                                             |
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| CLIENT        | PB GELATINS                                 |
| PROJECT       | REVIEW OF SITE CHEMICAL STORAGE FACILITIES  |
| DRAWING TITLE | RECORD OF TRUEFLOC TAC40 STORAGE FACILITIES |



- Waste to Value (AD) Biogas
- Industrial Effluent Treatment
- Sewage Treatment

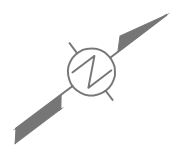
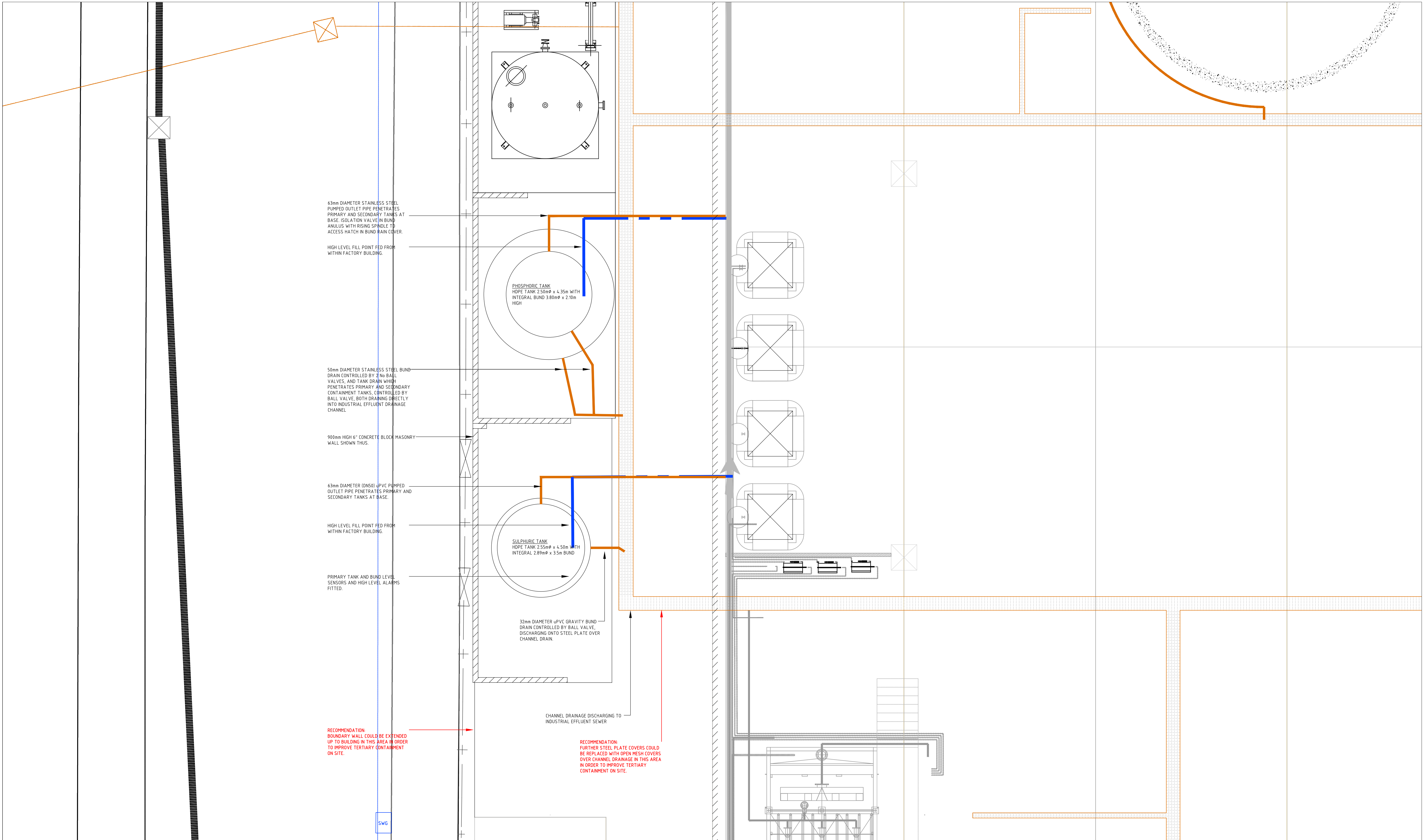


- Asset Risk Management (ARM)
- Design Consultancy
- Service and Maintenance

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PRELIMINARY

CLIENT  
PB GELATINS

PROJECT  
REVIEW OF SITE CHEMICAL STORAGE FACILITIES

DRAWING TITLE  
RECORD OF A18 PHOSPHORIC AND SULPHURIC ACID STORAGE FACILITIES



Waste to Water (AD) Wagon  
Industrial Effluent Treatment  
Storage Structures

H2Ok Systems Ltd, Nanjarrick Court, Allat, Truro,  
Cornwall TR4 9SU (01872) 542100  
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ISO 9001  
ISO 14001



Asset Risk Management (ARM)  
Design Consultancy  
Service and Maintenance

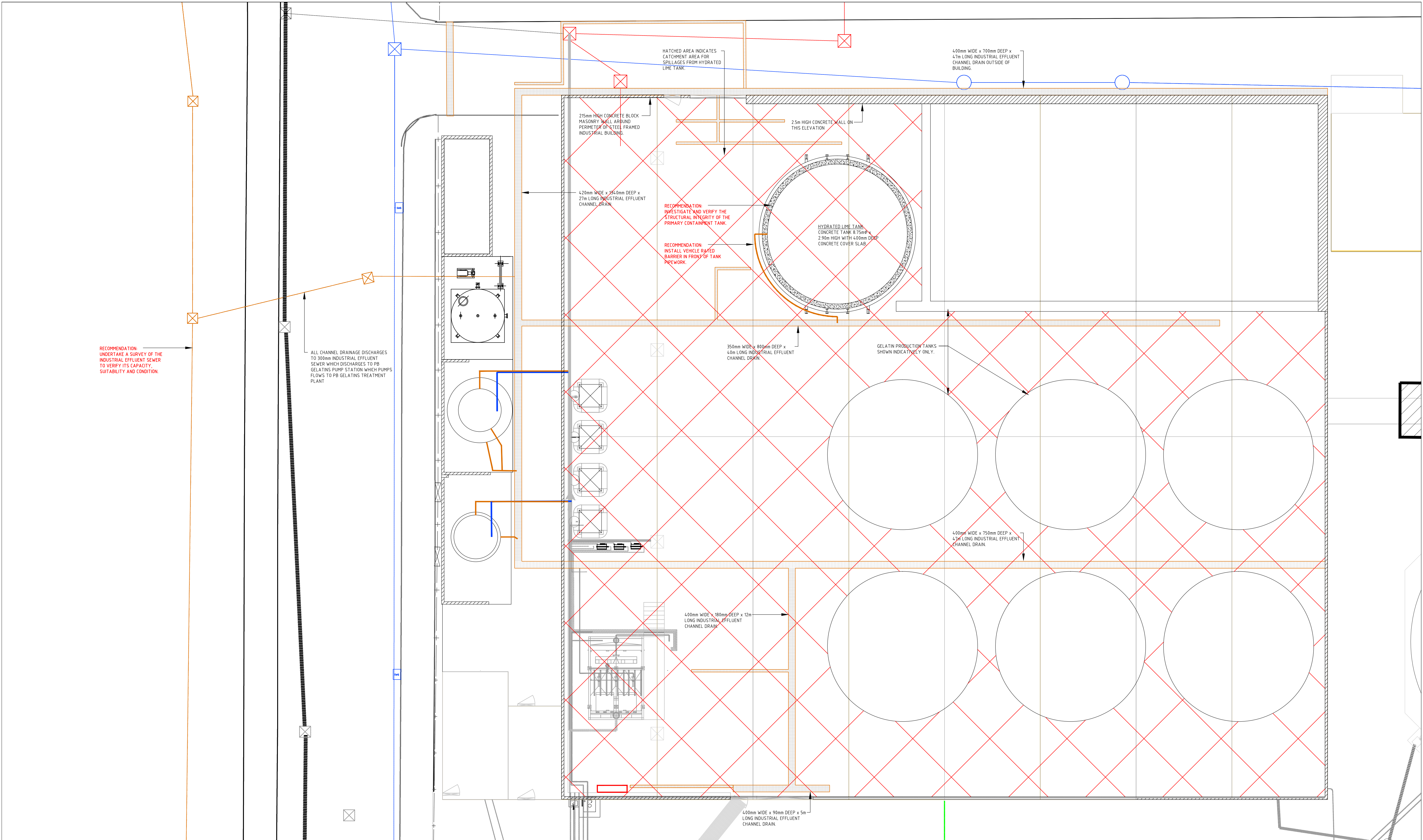
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RECOMMENDATION:  
UNDERTAKE A SURVEY OF THE  
INDUSTRIAL EFFLUENT SEWER  
TO VERIFY ITS CAPACITY,  
SUITABILITY AND CONDITION.

ALL CHANNEL DRAINAGE DISCHARGES  
TO 300mm INDUSTRIAL EFFLUENT  
SEWER WHICH DISCHARGES TO PB  
GELATINS PUMP STATION WHICH PUMPS  
FLOWS TO PB GELATINS TREATMENT  
PLANT

HATCHED AREA INDICATES  
CATCHMENT AREA FOR  
SPILLAGES FROM HYDRATED  
LIME TANK

400mm WIDE x 700mm DEEP x  
4.7m LONG INDUSTRIAL EFFLUENT  
CHANNEL DRAIN OUTSIDE OF  
BUILDING.

215mm HIGH CONCRETE BLOCK  
MASONRY WALL AROUND  
PERIMETER OF STEEL FRAMED  
INDUSTRIAL BUILDING

2.5m HIGH CONCRETE WALL ON  
THIS ELEVATION

420mm WIDE x 750mm DEEP x  
27m LONG INDUSTRIAL EFFLUENT  
CHANNEL DRAIN

RECOMMENDATION:  
INVESTIGATE AND VERIFY THE  
STRUCTURAL INTEGRITY OF THE  
PRIMARY CONTAINMENT TANK

RECOMMENDATION:  
INSTALL VEHICLE RATED  
BARRIER IN FRONT OF TANK  
PREWORK

HYDRATED LIME TANK  
CONCRETE TANK 8.75m x  
2.90m HIGH WITH 400mm DEEP  
CONCRETE COVER SLAB

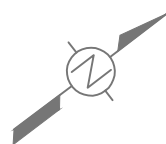
350mm WIDE x 800mm DEEP x  
4.0m LONG INDUSTRIAL EFFLUENT  
CHANNEL DRAIN

GELATIN PRODUCTION TANKS  
SHOWN INDICATIVELY ONLY.

400mm WIDE x 750mm DEEP x  
4.7m LONG INDUSTRIAL EFFLUENT  
CHANNEL DRAIN

400mm WIDE x 180mm DEEP x 12m  
LONG INDUSTRIAL EFFLUENT  
CHANNEL DRAIN

400mm WIDE x 90mm DEEP x 5m  
LONG INDUSTRIAL EFFLUENT  
CHANNEL DRAIN



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copied or amended for any purpose whatsoever without  
written approval.

CLIENT  
PB GELATINS

PROJECT MANAGER:- TIM SULLIVAN  
ASSISTANT:- JAMES PETTIFER  
DRAWN DATE:- NOVEMBER 2014  
SCALE & SHEET SIZE:- 1:100 @ A1

PROJECT  
REVIEW OF SITE CHEMICAL STORAGE  
FACILITIES

DRAWING TITLE  
RECORD OF HYDRATED LIME STORAGE  
FACILITIES

PRELIMINARY

|          |      |      |     |              |
|----------|------|------|-----|--------------|
| 17.01.14 | JP   | TS   | A   | REPORT ISSUE |
| DATE     | DRWN | CHKD | REV | NOTES        |



- Waste to Value (AD/Biogas)
- Industrial Effluent Treatment
- Sewage Treatment

- Flood Risk Management / SUDS
- Design Consultancy
- Service and Maintenance

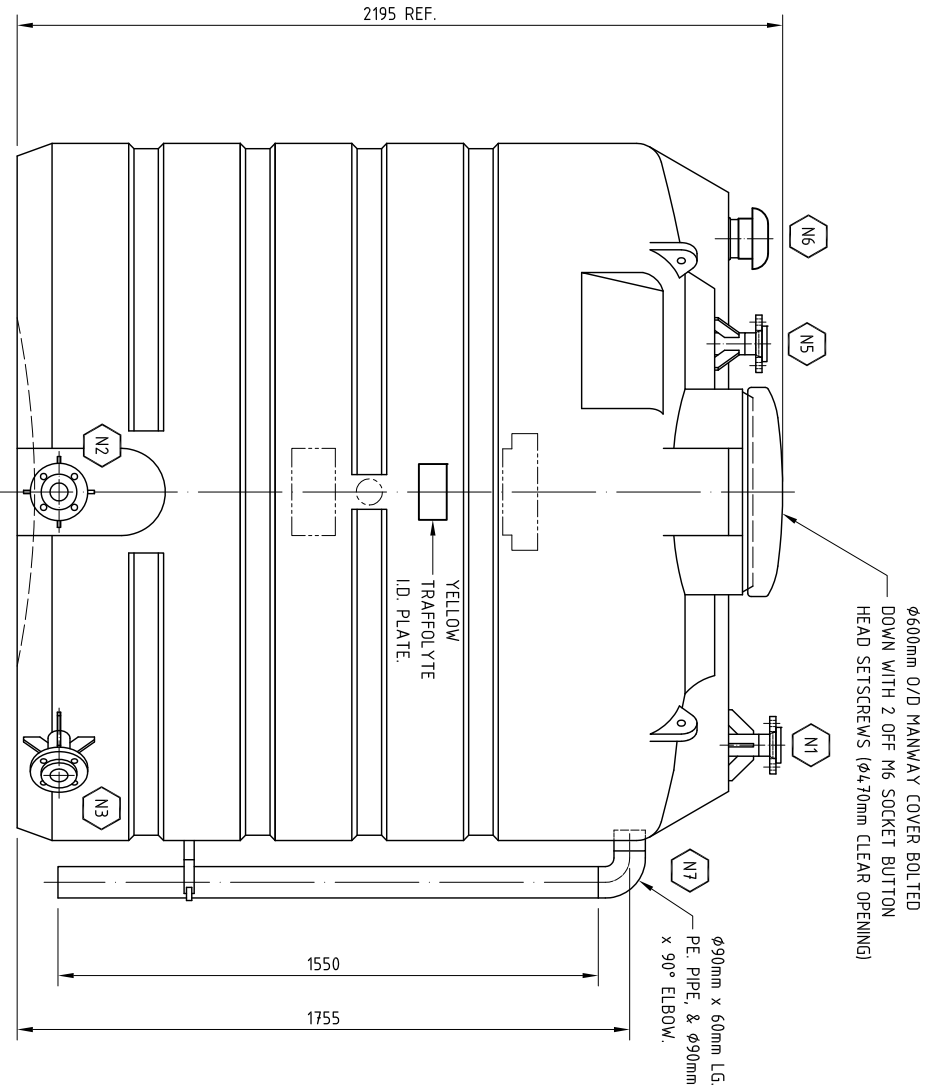
H2OK Systems Ltd, Nanjertick Court, Alley, Truro,  
Cornwall TR4 9DZ (01872) 542100  
Unit 16 Avonbank Industrial Centre,  
West Town Road, Bristol, BS11 9DE  
(01173) 148441  
Email: info@h2ok.co.uk  
www.h2ok.co.uk



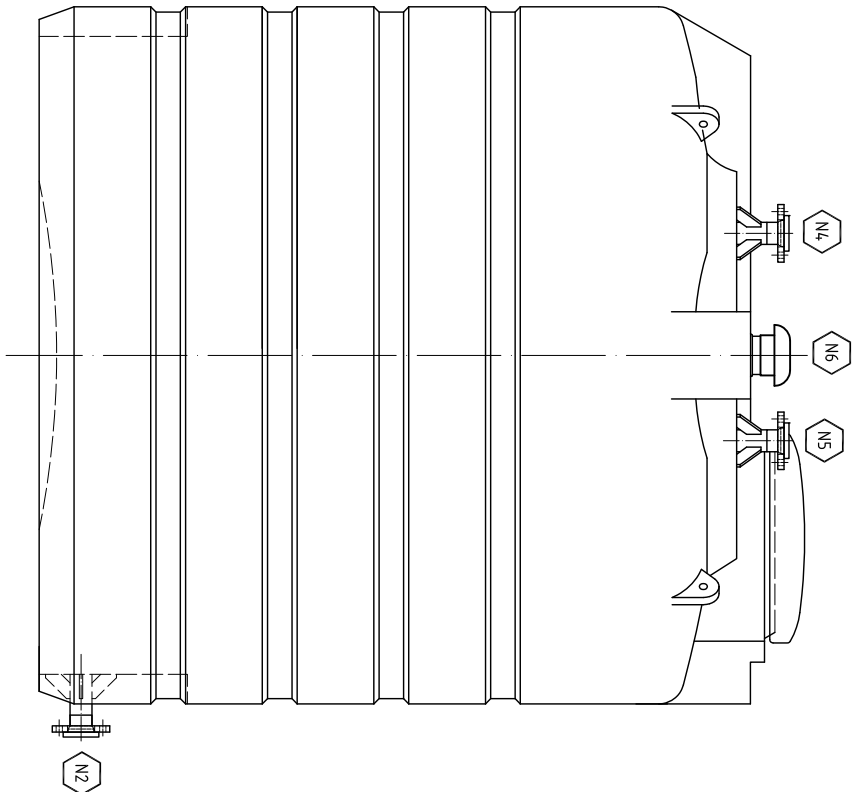
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|---------------------------|---------------------|-----------|
| PROJECT No.<br>J-5016-CIE | DRAWING No.<br>3005 | REV.<br>A |
|---------------------------|---------------------|-----------|

## **APPENDIX H**

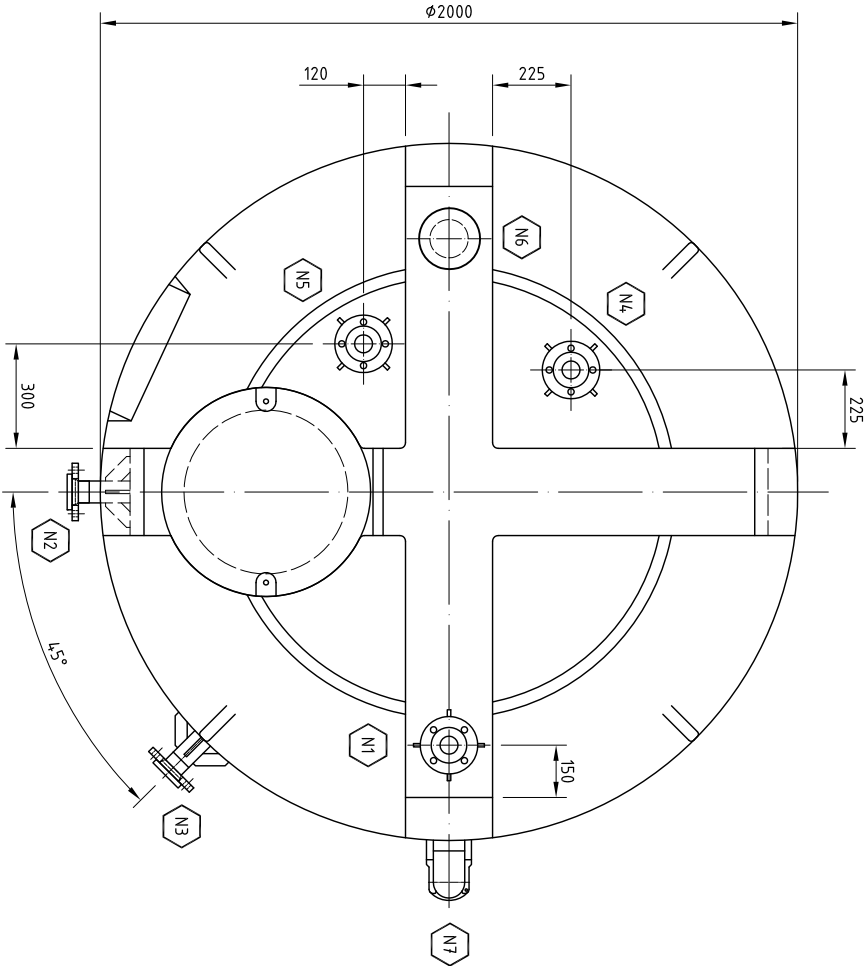
## **TANK AND TRANSFER SYSTEM DETAILS**



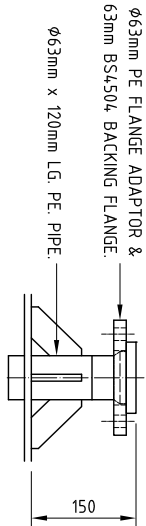
FRONT ELEVATION



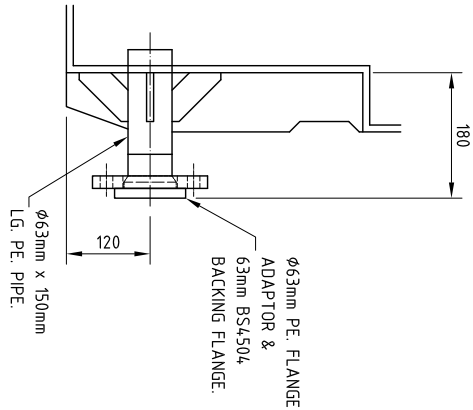
SIDE ELEVATION



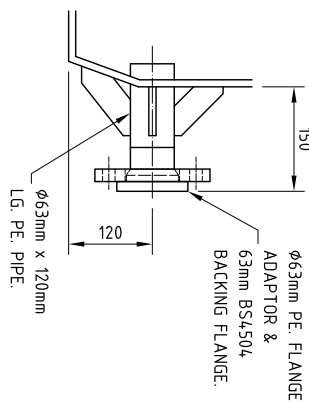
GROUND FLOOR PLAN



DETAIL AT N1, N4 & N5



DETAIL AT N2



DETAIL AT N3

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CONSENT IN WRITING OF BALMORAL GROUP LTD, ABERDEEN



FIRST ANGLE PROJECTION



THIRD ANGLE PROJECTION

ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE - DO NOT SCALE  
IF IN DOUBT - ASK

| ITEM | DESCRIPTION                                                     |
|------|-----------------------------------------------------------------|
| N1   | Ø2" (63mm O/D) FLANGED INLET                                    |
| N2   | Ø2" (63mm O/D) FLANGED BOTTOM.                                  |
| N3   | Ø2" (63mm O/D) FLANGED DRAIN.                                   |
| N4   | Ø2" (63mm O/D) FLANGED FITTING FOR CUSTOMER'S INSTRUMENTATION.  |
| N5   | Ø2" (63mm O/D) FLANGED FITTING FOR CUSTOMER'S HIGH LEVEL ALARM. |
| N6   | Ø110mm COWLED VENT.                                             |
| N7   | Ø3" (90mm O/D) OVERFLOW C/W DOWNPIPE.                           |

CONTENTS : 80% ACETIC ACID - S.G. : 1.074 MAX.

FLANGES TO BS4504 PN16

|       |                |    |     |     |          |
|-------|----------------|----|-----|-----|----------|
|       |                |    |     |     |          |
| 02    | OVERFLOW ADDED | KG | TM  |     | 04/10/10 |
| 01    | FIRST ISSUE    | KG | TM  |     | 06/09/10 |
| ISSUE | MODIFICATION   | BY | CHK | APV | DATE     |

BALMORAL TANKS

Balmoral Park, Lonsston, Aberdeen AB12 3QY, Scotland  
Telephone +44 (0)1224 859000 Fax +44 (0)1224 859059  
E-mail group@balmoral.co.uk



CLIENT  
PB GELATINS LTD.

(QUOTE REF. C-MH-001049 Reva) (NSP 0678)

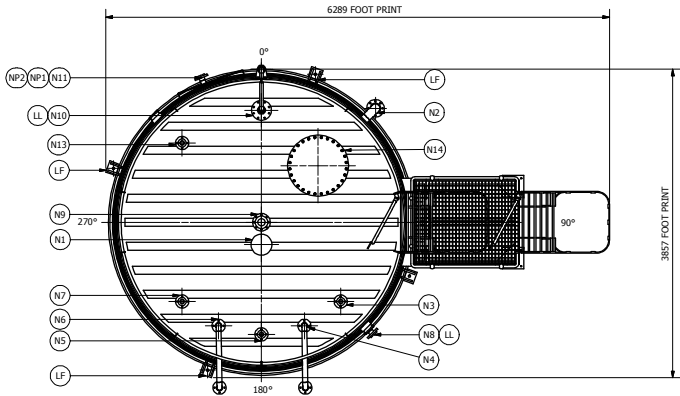
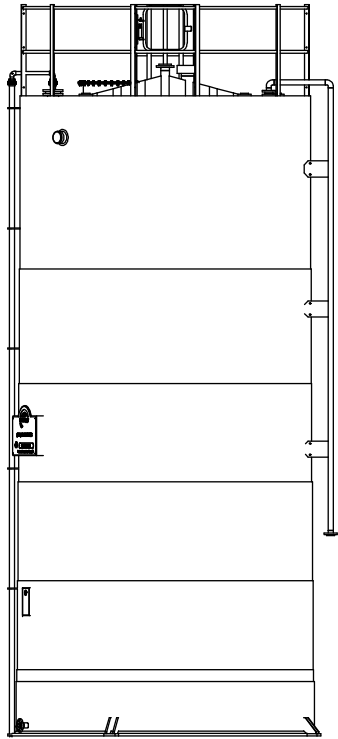
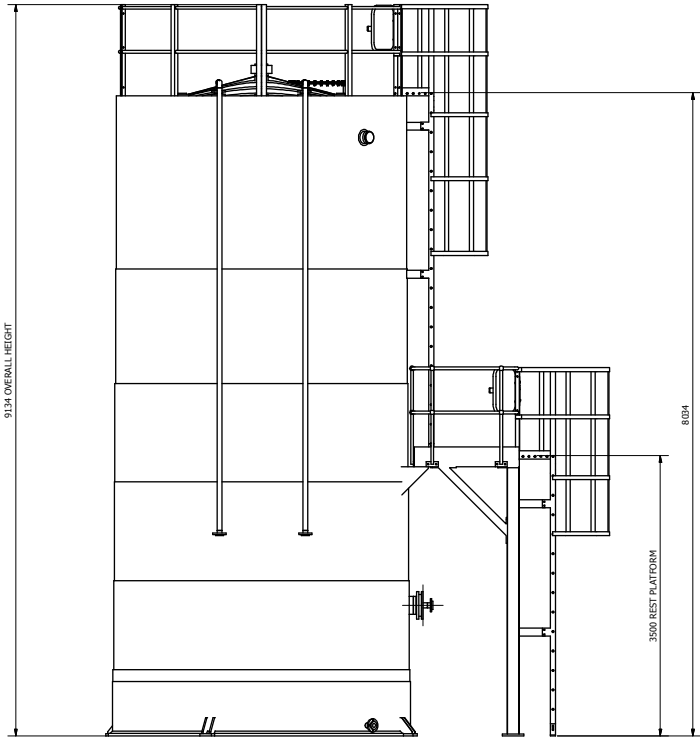
DRAWING TITLE

C5455 CHEMICAL TANK - SERIES : 1

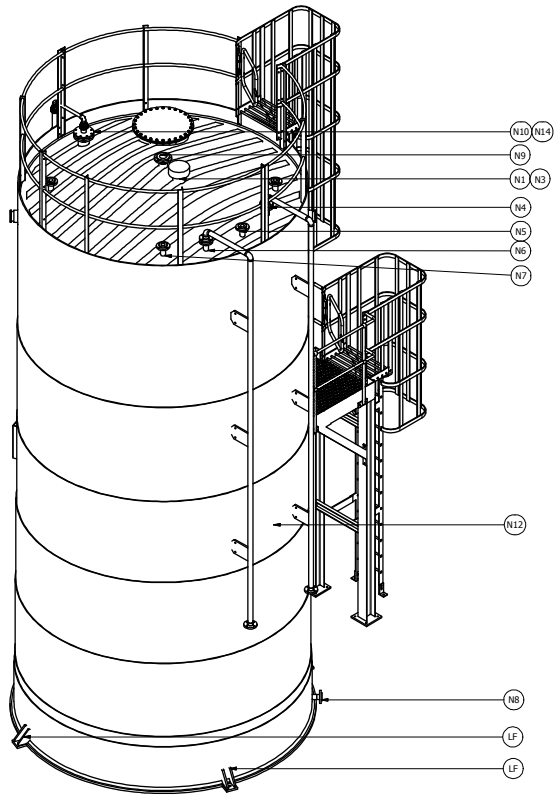
COLOUR : NATURAL

|                      |                          |             |                       |
|----------------------|--------------------------|-------------|-----------------------|
| DRAWN BY<br>K Gibson | CHECKED BY<br>T. Mackley | APPROVED BY | DRAWING No.<br>572-01 |
|----------------------|--------------------------|-------------|-----------------------|

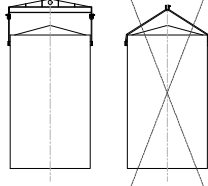
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|---------------|------------------------|------------------|---------|
| SCALE<br>1:15 | DATE<br>September 2010 | SHEET SIZE<br>A2 | JOB No. |
|---------------|------------------------|------------------|---------|



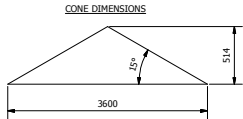
ALWAYS REFER TO PLAN VIEW  
FOR TRUE ORIENTATIONS



FABRICATION NOTES



NOTE:- ALL PLASTIC TANKS  
TO BE LIFTED USING  
SUITABLY RATED LIFTING BEAM



| TANK BARREL DIMENSIONS |            |
|------------------------|------------|
| SIZES                  | DIMENSIONS |
| BARREL HEIGHT          | 7964 mm    |
| BARREL I/D             | 3600 mm    |

LADDERS AND REST PLATFORM  
TO BE GALVANISED MILD STEEL

| PARTS LIST |                                                        |           |           |           |
|------------|--------------------------------------------------------|-----------|-----------|-----------|
| REF        | DESCRIPTION                                            | SIZE (NB) | SIZE (OD) | DRILLINGS |
| N1         | MUSHROOM VENT                                          | 150MM     | 160MM     | FIXED     |
| N2         | OVERFLOW                                               | 100MM     | 110MM     | FIXED     |
| N3         | INLET 1                                                | 50MM      | 63MM      | PN16      |
| N4         | INLET 2                                                | 50MM      | 63MM      | PN16      |
| N5         | INLET 3                                                | 50MM      | 63MM      | PN16      |
| N6         | INLET 4                                                | 50MM      | 63MM      | PN16      |
| N7         | INLET 5                                                | 50MM      | 63MM      | PN16      |
| N8         | OUTLET                                                 | 50MM      | 63MM      | PN16      |
| N9         | ULTRASONIC                                             | 100MM     | 110MM     | PN16      |
| N10        | CAT & MOUSE                                            | 125MM     | 140MM     | PN16      |
| N11        | DRAIN                                                  | 50MM      | 63MM      | PN16      |
| N12        | PUDDLE FLANGE (COMPLETE WITH 63MM O/D PN16 CONNECTION) | 200MM     | 225MM     | PN16      |
| N13        | WIDING RETURN                                          | 50MM      | 63MM      | PN16      |
| N14        | TOP MANWAY                                             | 600MM     | 630MM     | M12 BOLTS |

| PARTS LIST CONTINUED |                       |           |           |           |                |
|----------------------|-----------------------|-----------|-----------|-----------|----------------|
| REF                  | DESCRIPTION           | SIZE (NB) | SIZE (OD) | DRILLINGS | ANGLE          |
| LL                   | LIFTING LUG           | LARGE     | LARGE     | 2 OFF     | 135, 315       |
| LF                   | LOCATION FOOT         | CR STD    | CR STD    | 4 OFF     | 20,110,200,290 |
| NP1                  | DESIGN DATA NAMEPLATE | A4        | A4        | 1 OFF     | 340            |
| NP2                  | LOGO NAMEPLATE        | A1        | A1        | 1 OFF     | 340            |
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GENERAL TOLERANCE +10mm -10mm

DRAWING PRODUCED USING AUTODESK

INVENTOR

DO NOT ALTER MANUALLY

DO NOT SCALE - IF IN DOUBT ASK

ALL DIMENSIONS IN MILLIMETRES UNLESS STATED

ALWAYS REFER TO PLAN VIEW  
FOR CORRECT ORIENTATION

ALL WELDS TO BE  
6x3mm CORD WELDS UNLESS STATED

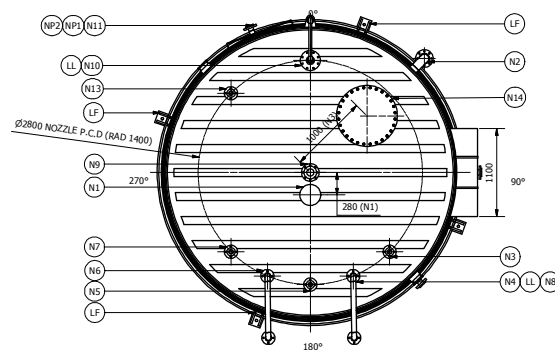
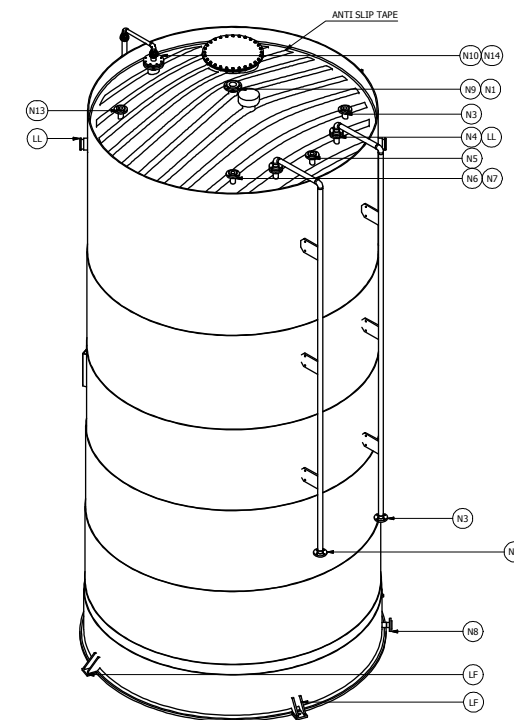
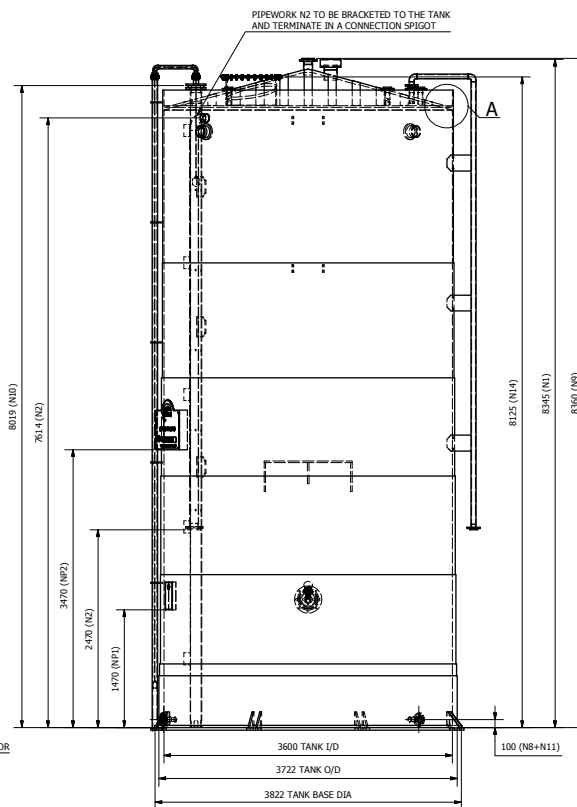
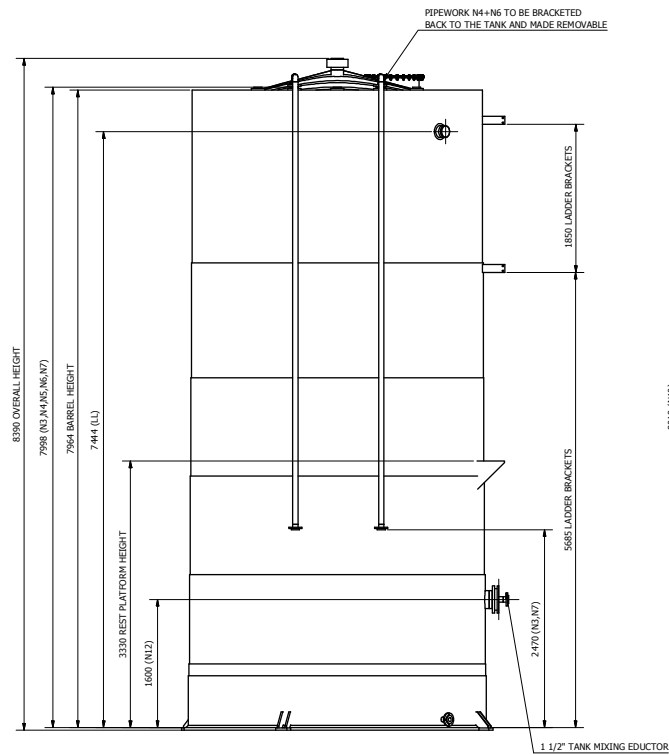
| DESIGN DATA           |                    |
|-----------------------|--------------------|
| DESIGN CODE           | BS EN 12573        |
| DESIGN PRESSURE       | ATMOSPHERIC        |
| OPERATING PRESSURE    | ATMOSPHERIC        |
| CONTENTS              | 25% CAUSTIC        |
| SPECIFIC GRAVITY      | 1.3                |
| DESIGN TEMPERATURE    | 50C                |
| OPERATING TEMPERATURE | AMBIENT            |
| WORKING CAPACITY      | 20M3               |
| MAXIMUM CAPACITY      | 77M3               |
| BASE                  | 30                 |
| LID                   | 30                 |
| BACKING RINGS         | PN16               |
| GASKETS               | EPDM               |
| FASTENERS             | A2 STAINLESS STEEL |

| APPROVED                                                                                                                                                                          |             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| WORKING DRAWING                                                                                                                                                                   |             |
| SIGNED:                                                                                                                                                                           | NAME: DATE: |
| THE INFORMATION ON THIS DRAWING IS STRICTLY CONFIDENTIAL<br>TO CHEM-RESIST GROUP LTD AND SHALL NOT BE DISCLOSED TO A THIRD<br>PARTY WITHOUT PRIOR WRITTEN CONSENT ©COPYRIGHT 1998 |             |
| INSPECTION AND TESTING                                                                                                                                                            |             |
| BSEN ISO 9001 QUALITY ASSURANCE IN PROCESS INSPECTION<br>TANK TO BE FILLED WITH WATER FOR 24 HOURS MINIMUM                                                                        |             |

| DRAWING No TITLE |                                                |
|------------------|------------------------------------------------|
| RELATED DRAWINGS |                                                |
| REVISIONS        |                                                |
| REV              | AMENDMENT                                      |
| 1                | PRELIMINARY ISSUE                              |
| 2                | UP-DATED FOLLOWING CLIENT COMMENTS ON 24/07/13 |
| 3                | UP-DATED FOLLOWING CLIENT COMMENTS ON 25/07/13 |

|                                    |  |
|------------------------------------|--|
| JOB No: S012050                    |  |
| CLIENT: PB GELATINS                |  |
| TITLE: GA OF CAUSTIC DILUTION TANK |  |
| DRAWN BY: JOE HIRST                |  |
| DATE: 19/07/13                     |  |
| CE No: 17235                       |  |
| MATERIAL: PE100                    |  |
| SCALE: N/A                         |  |
| PLOT: A1                           |  |
| SHEET 1 OF 1                       |  |

TANK DRY WEIGHT APPROX. 3400KGS



ALL NOZZLES UP TO AND INCLUDING 110MM O/D  
TO HAVE 3 EQUALLY SPACED GUSSETS

ALWAYS REFER TO PLAN VIEW  
FOR TRUE ORIENTATIONS

| PARTS LIST |                                                        |           |           |            |       |     |                       |           |           |           |              |
|------------|--------------------------------------------------------|-----------|-----------|------------|-------|-----|-----------------------|-----------|-----------|-----------|--------------|
| REF.       | DESCRIPTION                                            | SIZE (NB) | SIZE (OD) | DRILLINGS  | ANGLE |     |                       |           |           |           |              |
| N1         | MUSHROOM VENT                                          | 150MM     | 160MM     | FIXED      | 180   |     |                       |           |           |           |              |
| N2         | OVERFLOW                                               | 100MM     | 110MM     | FIXED      | 45    |     |                       |           |           |           |              |
| N3         | INLET 1                                                | 50MM      | 63MM      | PN16       | 135   | REF | DESCRIPTION           | SIZE (NB) | SIZE (OD) | DRILLINGS | ANGLE        |
| N4         | INLET 2                                                | 50MM      | 63MM      | PN16       | 157.5 | LL  | LIFTING LUG           | LARGE     | LARGE     | 2 OFF     | 135 315      |
| N5         | INLET 3                                                | 50MM      | 63MM      | PN16       | 180   | LF  | LOCATION FOOT         | CS STD.   | CS STD.   | 4 OFF     | 20,10,20,290 |
| N6         | INLET 4                                                | 50MM      | 63MM      | PN16       | 202.5 | NP1 | DESIGN DATA NAMEPLATE | A4        | A4        | 1 OFF     | 340          |
| N7         | INLET 5                                                | 50MM      | 63MM      | PN16       | 225   | NP2 | LOGO NAMEPLATE        | A1        | A1        | 1 OFF     | 340          |
| N8         | OUTLET                                                 | 50MM      | 63MM      | PN16       | 135   |     |                       |           |           |           |              |
| N9         | ULTRASONIC                                             | 100MM     | 110MM     | PN16       | CTR   |     |                       |           |           |           |              |
| N10        | CAT & MOUSE                                            | 125MM     | 140MM     | PN16       | 0     |     |                       |           |           |           |              |
| N11        | DRUM                                                   | 50MM      | 63MM      | PN16       | 337.5 |     |                       |           |           |           |              |
| N12        | PUDDLE FLANGE (COMPLETE WITH 63MM O/D PN16 CONNECTION) | 200MM     | 225MM     | PN16       | 90    |     |                       |           |           |           |              |
| N13        | MIXING RETURN                                          | 50MM      | 63MM      | PN16       | 315   |     |                       |           |           |           |              |
| N14        | TOP MANIFOLD                                           | 600MM     | 630MM     | M12 ISO TS |       |     |                       |           |           |           |              |

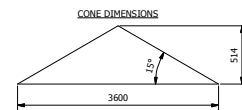
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|                                                                                                                                                                                    |       |                                                                                                                                |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------------------|--|
| <div style="text-align: center;"> <h1>APPROVED</h1> <h2>WORKING DRAWING</h2> </div>                                                                                                |       | <div style="text-align: center;">  </div> |  |
|                                                                                                                                                                                    |       | <div style="text-align: center;">  </div> |  |
| SIGNED:                                                                                                                                                                            | NAME: | DATE:                                                                                                                          |  |
| <p>THE INFORMATION ON THIS DRAWING IS STRICTLY CONFIDENTIAL TO CHEM-RESIST GROUP LTD AND SHALL NOT BE DISCLOSED TO A THIRD PARTY WITHOUT PRIOR WRITTEN CONSENT ©COPYRIGHT 1998</p> |       |                                                                                                                                |  |
| <h3>INSPECTION AND TESTING</h3>                                                                                                                                                    |       |                                                                                                                                |  |
| <p>BSEN ISO 9001 QUALITY ASSURANCE IN PROCESS INSPECTION<br/>PANK TO BE FILLED WITH WATER FOR 24 HOURS MINIMUM</p>                                                                 |       |                                                                                                                                |  |

[illegible]

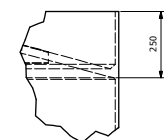
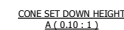
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|---------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  |  | Britannia House<br>Lockney<br>Ravenshoe Industrial Estate<br>Donbury<br>West Yorkshire<br>WF12 3JG<br>England<br>Tel: +44 (0) 1924 494666<br>Fax: +44 (0) 1924 400334<br>Email: enquiry@chemresist.com<br>WWW: www.chemresist.com |  |
|                                                                                       |  | JOB No: S012050      CE No: 17235      MAT: PE100<br>CLIENT: PB GELATINS                                                                                                                                                          |  |
| TITLE<br>GA OF TANK ASSEMBLY                                                          |  | SCALE: N/A<br>PLOT:                                                                                                                                                                                                               |  |
| DRAWN BY: JOE HURST      DRG No: S012050-WD01-R2<br>DATE: 01/07/2013                  |  | SHEET NO: 06 OF 06                                                                                                                                                                                                                |  |

#### FABRICATION NOTES



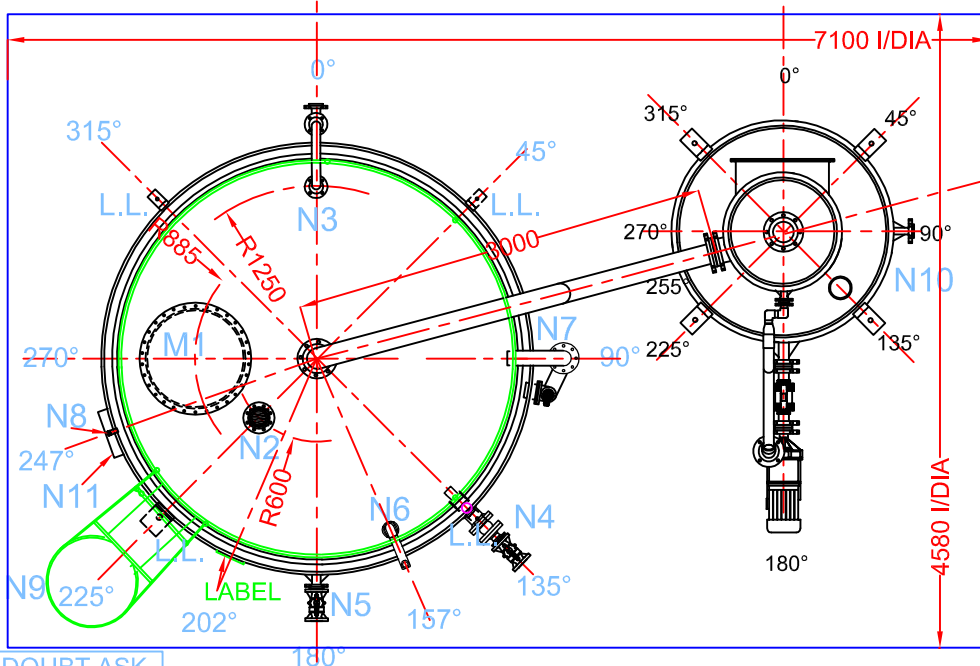
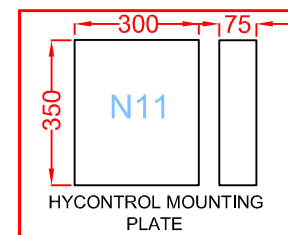
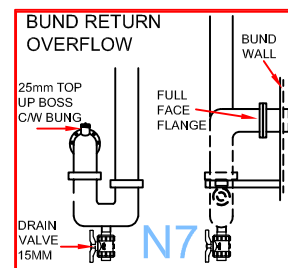
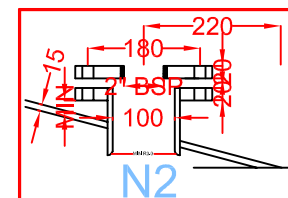
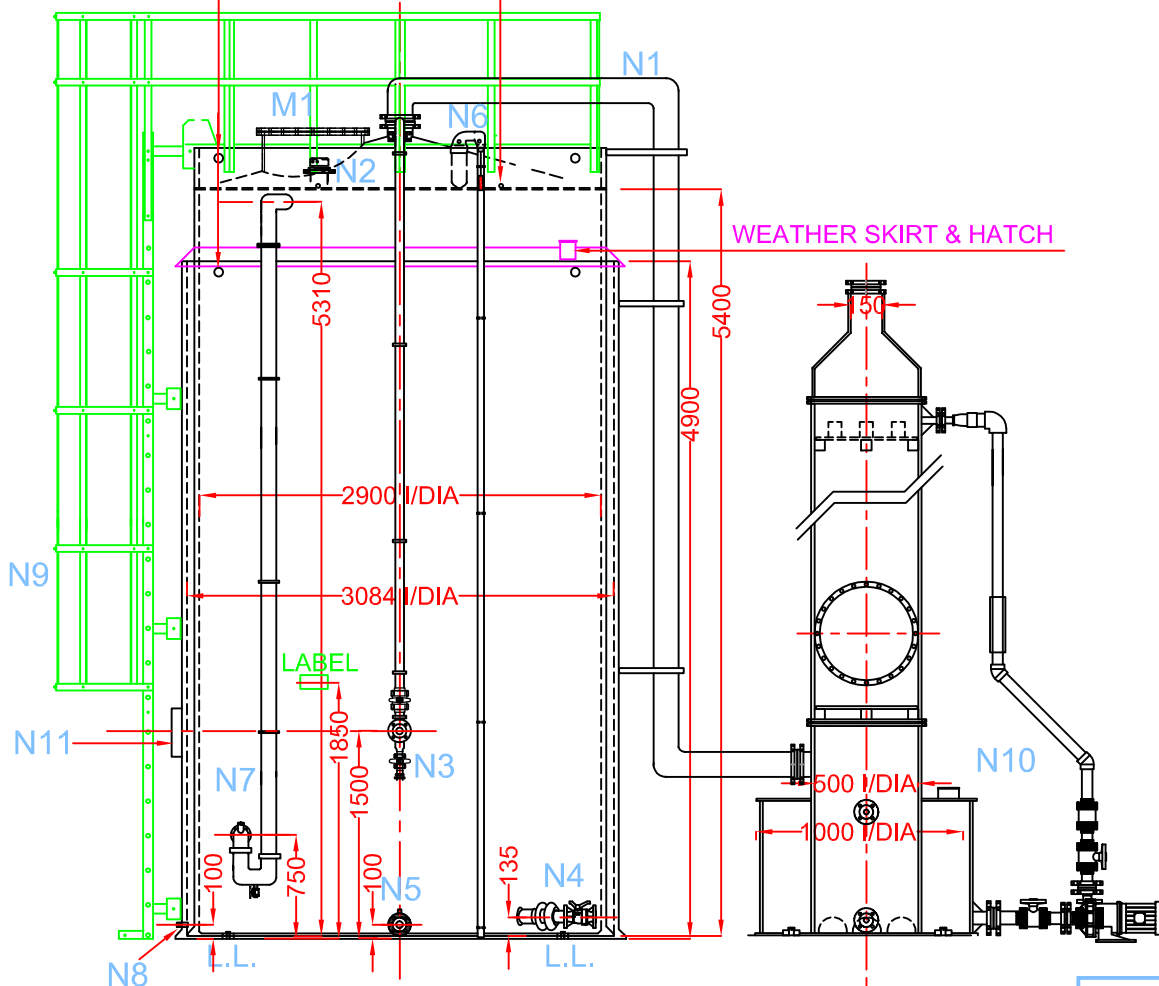
| TANK BARREL DIMENSIONS |            |
|------------------------|------------|
| SIZES                  | DIMENSIONS |
| BARREL HEIGHT          | 7964 mm    |
| BARREL I/D             | 3600 mm    |

ALL NOZZLES UP TO AND INCLUDING 110MM O/D  
TO HAVE 3 EQUALLY SPACED GUSSETS



LIFTING EYES

DRAIN HOLES



TAKE PLAN VIEW AS TRUE  
ORIENTATION OF ALL  
CONNECTIONS.

BUND WALL

DRAWING ISSUED FOR  
APPROVAL ONLY.

IF IN DOUBT, ASK.

| No.  | SIZE       | STD         | DESCRIPTION                                 |
|------|------------|-------------|---------------------------------------------|
| M1   | 700 mm NB  | ALLI / STD  | BOLTED MANWAY                               |
| N1   | 150 mm NB  | ALLI / STD  | FLANGED VENT TO SCRUBBER                    |
| N2   | 100 mm NB  | BS4504-NP16 | INSTRUMENT FLANGE C/W 2" BSP THREADED BOSS  |
| N3   | 50 mm NB   | BS4504-NP16 | INLET FLANGE C/W FILL LINE & VALVES         |
| N4   | 50 mm NB   | BS4504-NP16 | OUTLET FLANGE C/W FLEXI CONNECTOR & VALVE   |
| N5   | 50 mm NB   | BS4504-NP16 | BUND DRAIN C/W VALVE                        |
| N6   | GAUGE      | ALLI / STD  | EXTENDED GRADUATED FLOAT LEVEL INDICATOR    |
| N7   | 100 mm NB  | ALLI / STD  | EXTERNAL OVERFLOW C/W LUTE BEND TO BUND     |
| N8   | 20 mm NB   | ALLI / STD  | BSP PARALLEL BOSS CONNECTION FOR BUND ALARM |
| N9   | LADDER     | ALLI / STD  | GRP LADDER & HANDRAILING                    |
| N10  | BVS3       | ALLI / STD  | BULK VENT SCRUBBER UNIT                     |
| N11  | 300X350X75 | ALLI / STD  | HYCONTROL DISPLAY SUPPORT BRACKET           |
| L.L. | LUGS       | ALLI / STD  | LOCATING LUGS FOR M20 BOLTING               |
| L.E. | EYES       | ALLI / STD  | 4 No LIFTING EYES WITH 60 mm DIA EYES       |

CHECKED BY:  
**P. TAYLOR**

DATE:  
**14.05.14**

MANUFACTURING TOLERANCE:  
± 5mm at 18 ° C

CUSTOMER'S ORDER No.  
**4500014771**

SCALE:  
**DO NOT SCALE**

Approved for manufacture by:

DATE:

WORKING VOLUME:  
**32M3**

DRAWN BY:  
**G. W. HAYES**

MATERIAL:  
**HDPE**



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LIQUID SOLUTIONS  
www.helixtanks.co.uk

17, RIDGEWAY, QUINTON BUSINESS PARK, BIRMINGHAM, B32 1AF  
TEL: 0121 506 0100. FAX: 0121 422 1771  
www.helixtanks.com E-MAIL: gary.hayes@schoellerallibert.com

CUSTOMER:  
**PB GELATINS UK Ltd**

SITE:  
**PONTYPRIDD**

TANK OPERATING TEMPERATURE:  
**OUTSIDE AMBIENT**

DUTY:  
**36% HYDROCHLORIC ACID**

DRG. No:

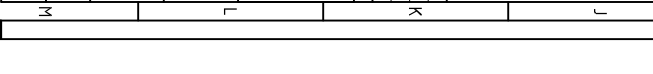
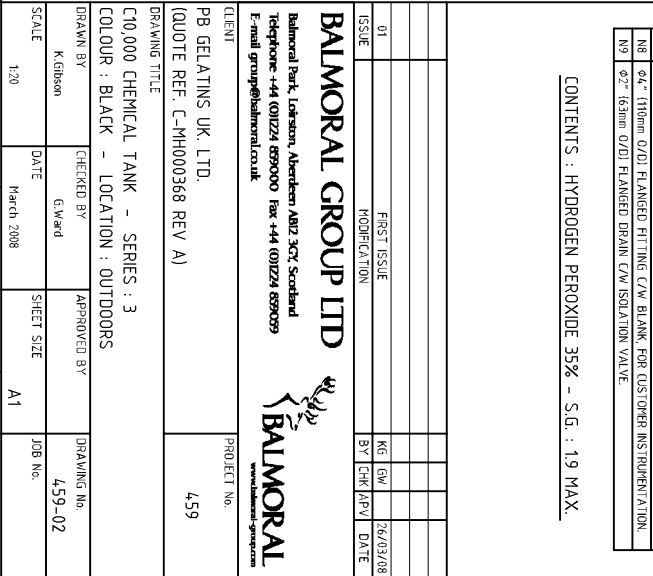
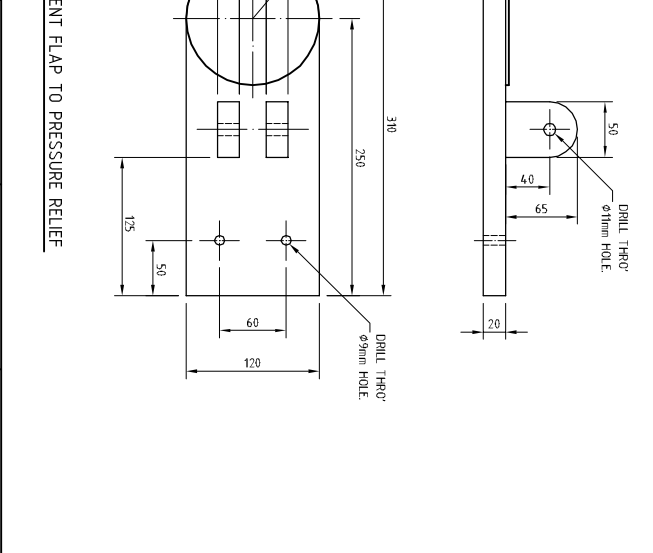
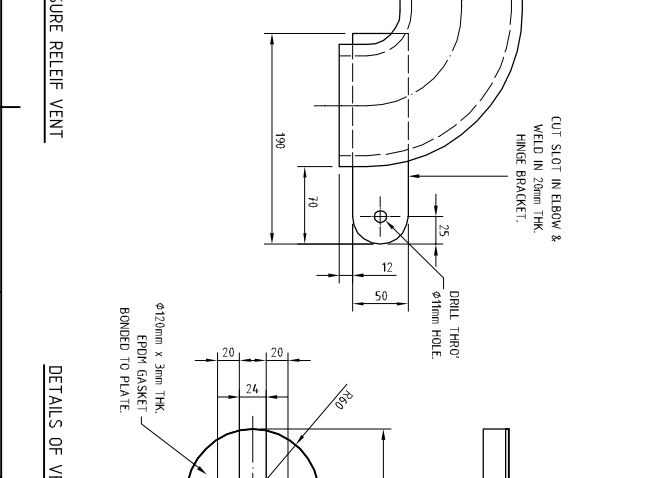
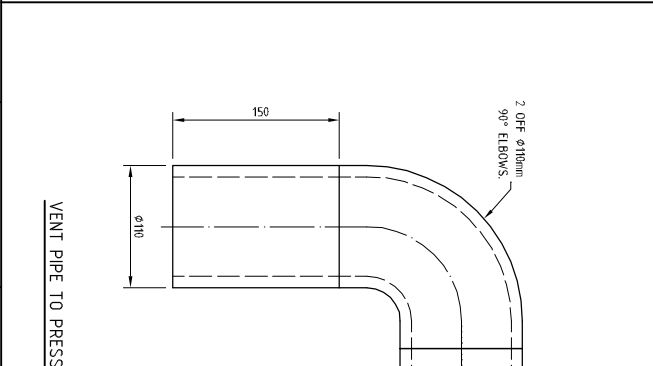
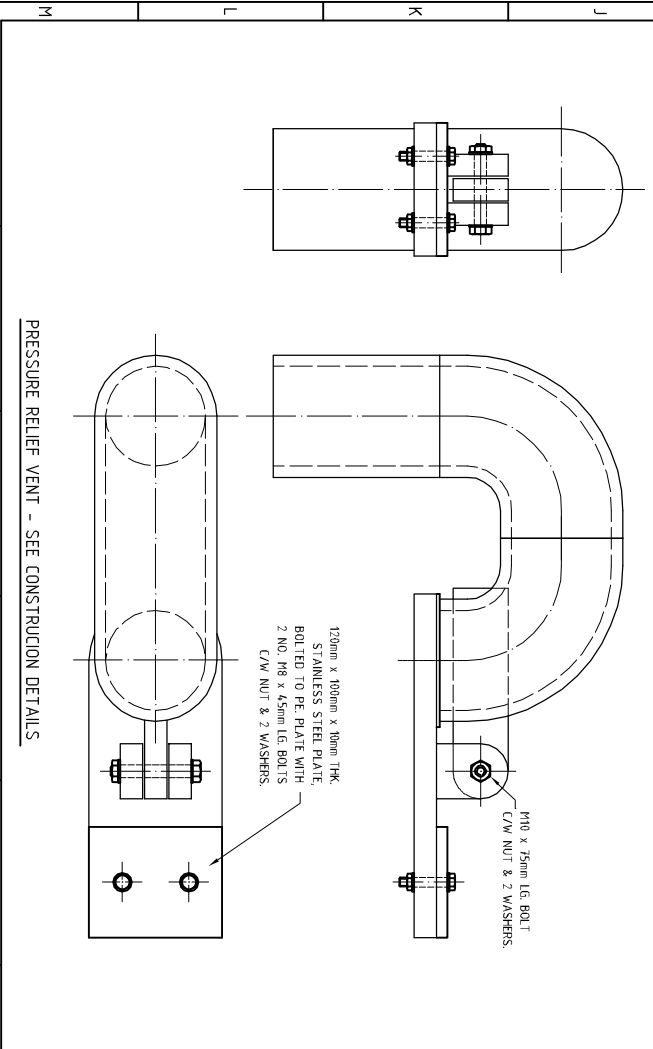
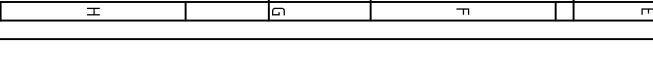
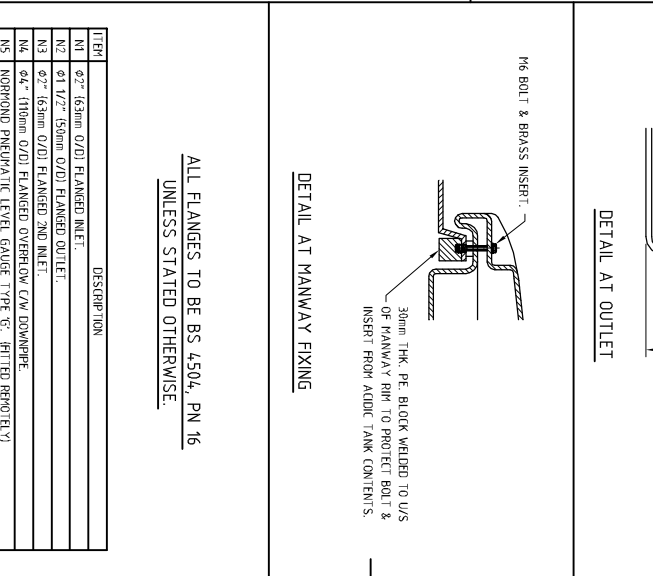
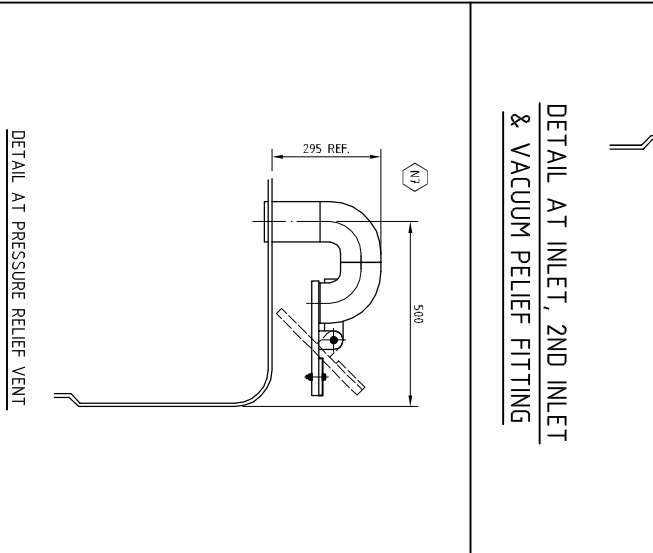
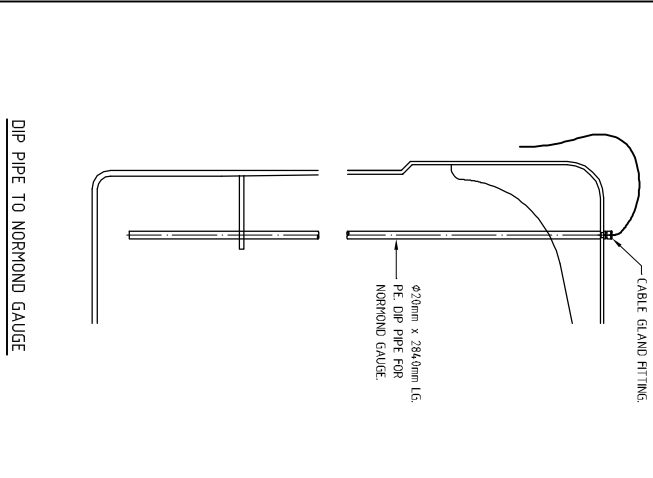
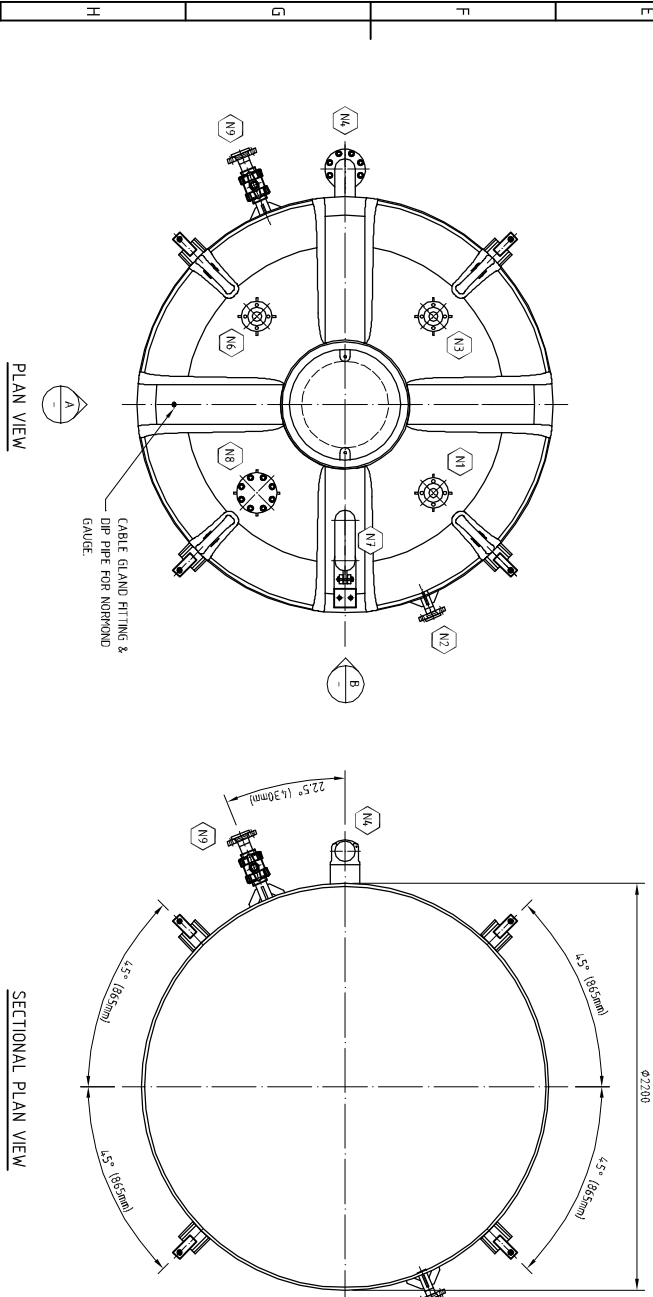
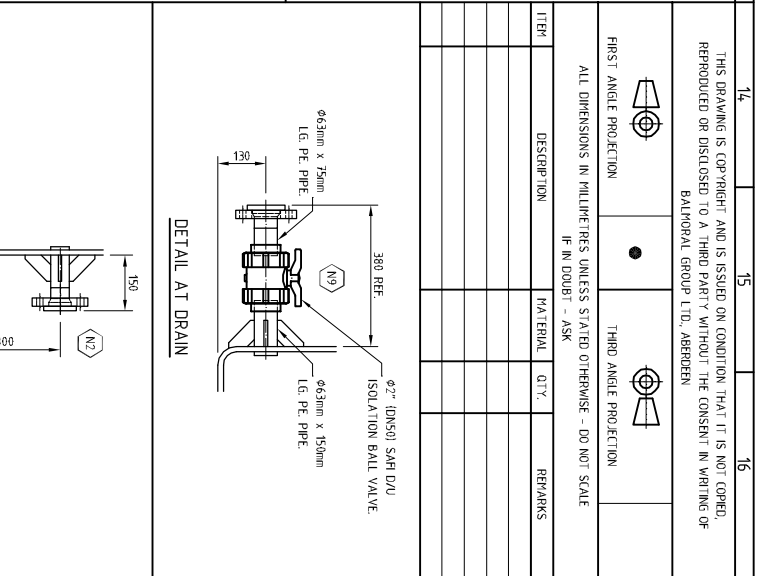
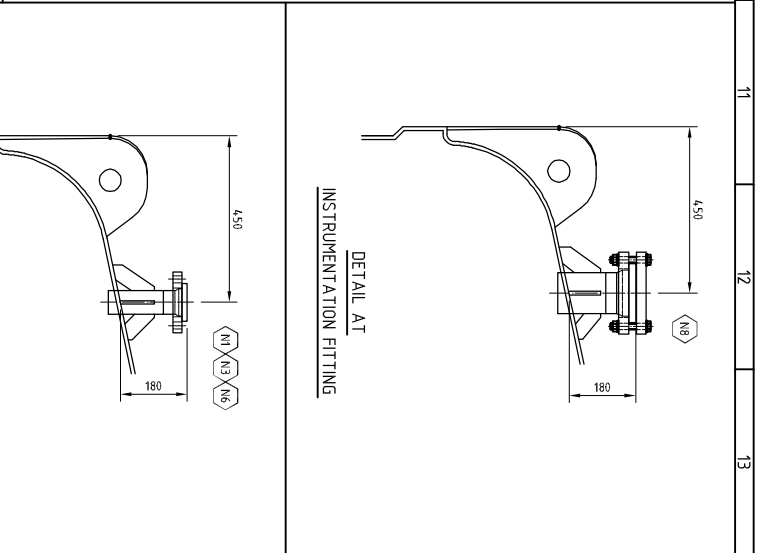
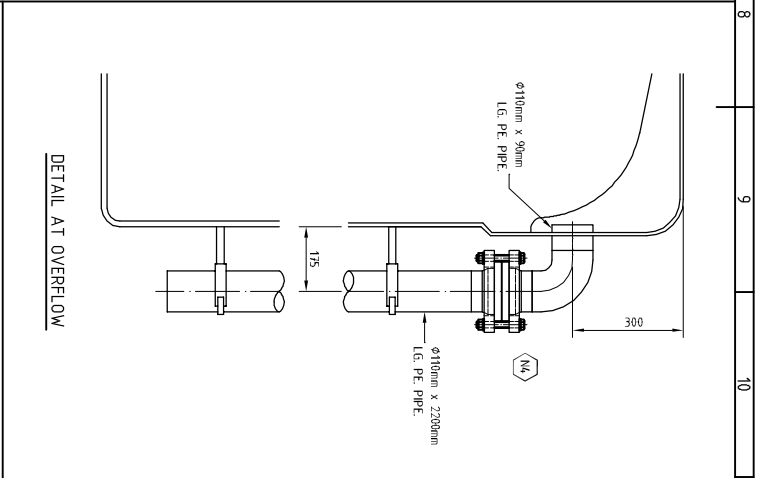
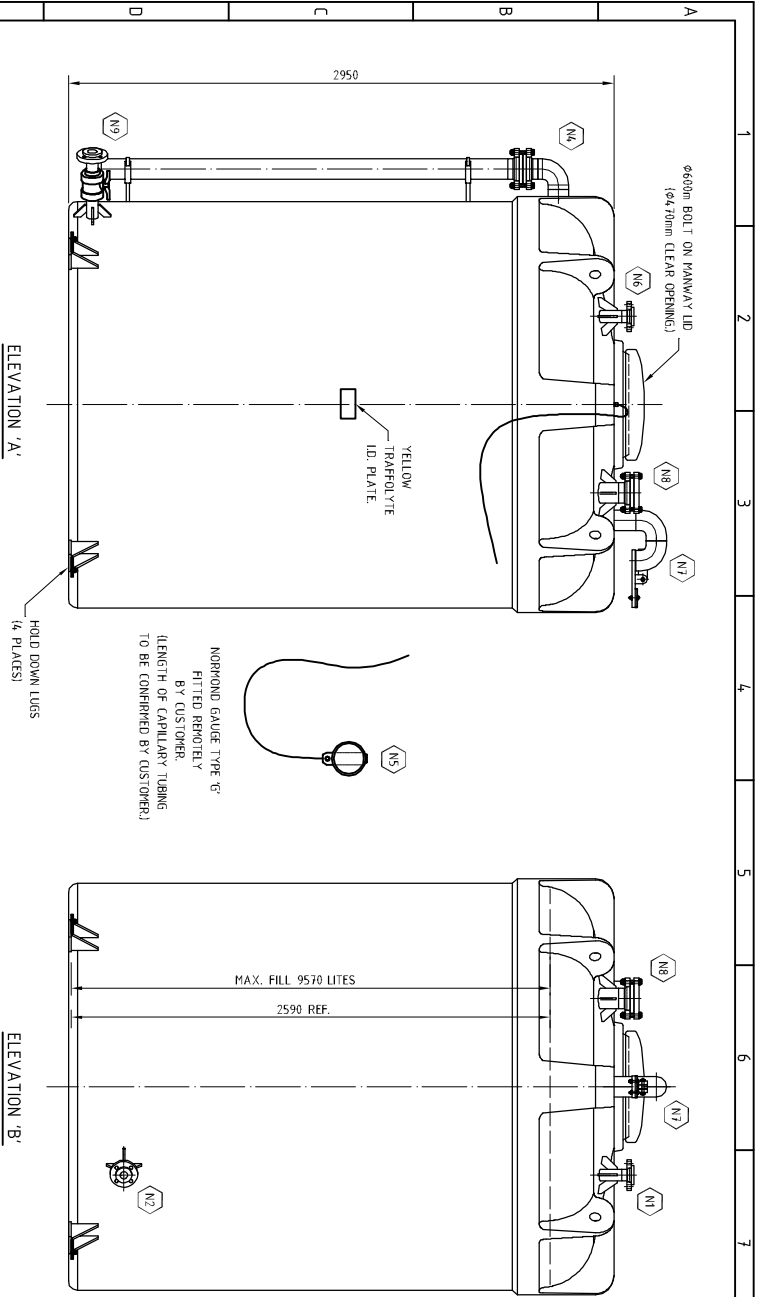
**H9074**

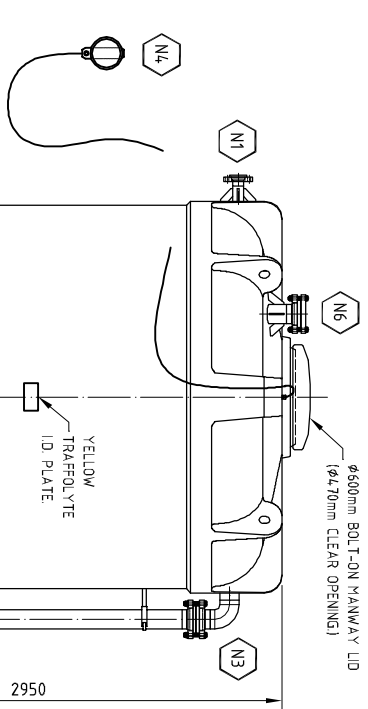
ISSUE:  
**C**

DATE DRAWN:  
**14.05.2014**

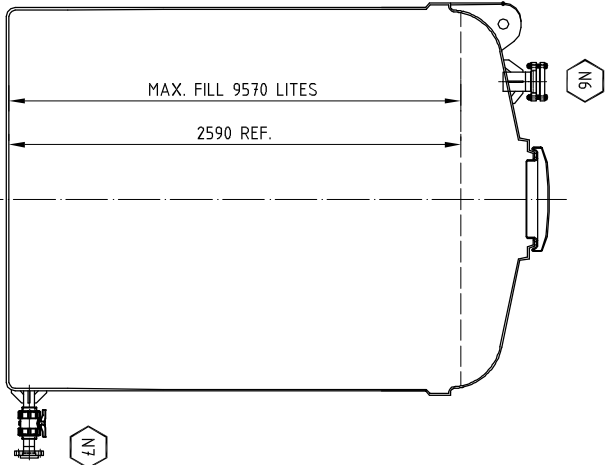
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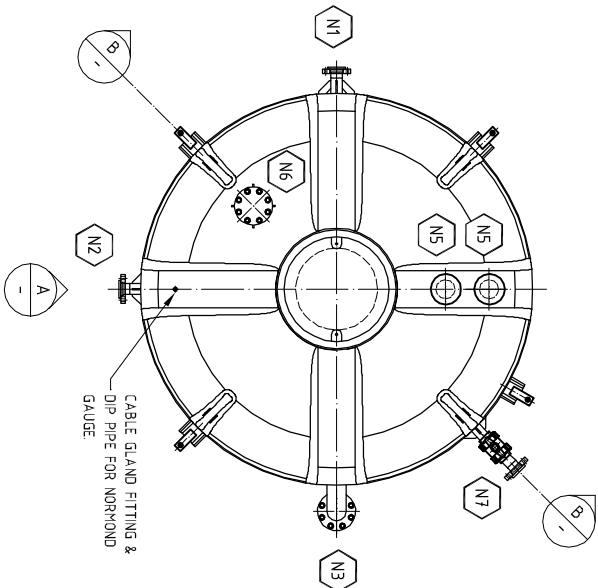




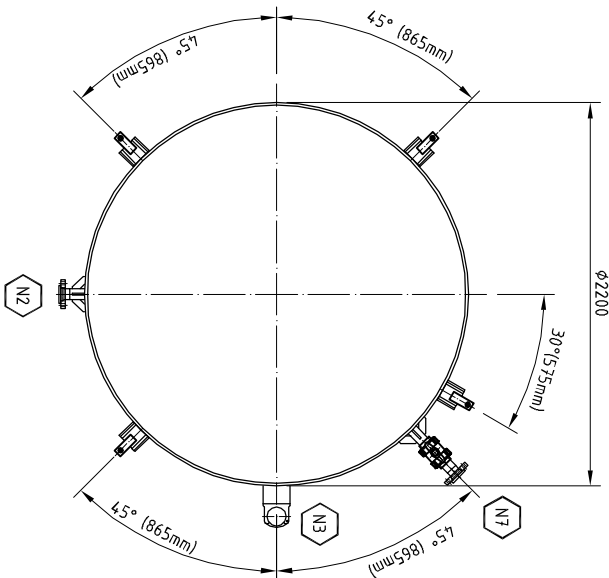
ELEVATION 'A'



SECTION B-B



PLAN VIEW

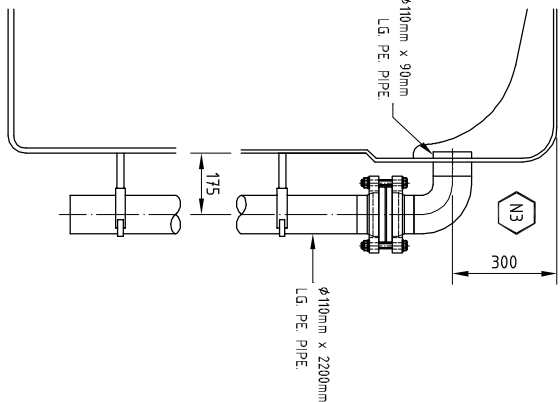


SECTIONAL PLAN VIEW

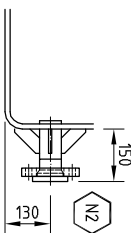
ALL FLANGES TO BE BS 4504, PN 16  
UNLESS STATED OTHERWISE.

| ITEM | DESCRIPTION                                                                  |
|------|------------------------------------------------------------------------------|
| N1   | Ø2" (63mm O/D) FLANGED INLET.                                                |
| N2   | Ø2" (63mm O/D) FLANGED OUTLET.                                               |
| N3   | Ø4" (110mm O/D) FLANGED OVERFLOW C/W DOWNPIPE.                               |
| N4   | NORMOND PNEUMATIC LEVEL GAUGE TYPE 'G'                                       |
| N5   | Ø110mm COWLED VENT.                                                          |
| N6   | Ø4" (110mm O/D) FLANGED FITTING C/W BLANK, (FOR CUSTOMER'S INSTRUMENTATION). |
| N7   | Ø2" (63mm O/D) FLANGED DRAIN C/W ISOLATION VALVE.                            |

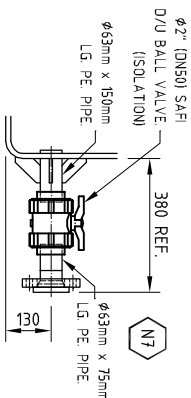
CONTENTS : 75% PHOSPHORIC ACID - S.G. : 1.59 MAX.



DETAIL AT OVERFLOW



DETAIL AT OUTLET



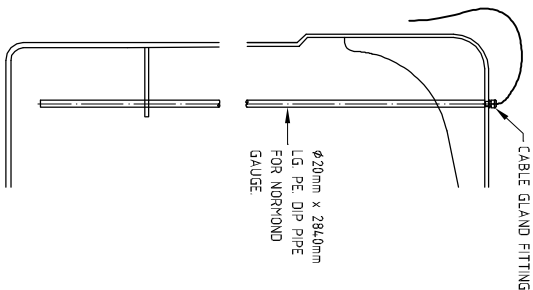
DETAIL AT DRAIN

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CONSENT IN WRITING OF BALMORAL GROUP LTD., ABERDEEN

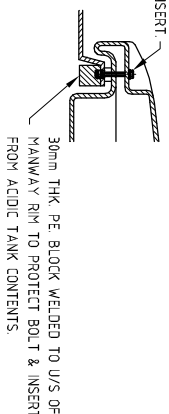


ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE - DO NOT SCALE  
IF IN DOUBT - ASK

| ITEM | DESCRIPTION | MATERIAL | QTY. | REMARKS |
|------|-------------|----------|------|---------|
|      |             |          |      |         |
|      |             |          |      |         |
|      |             |          |      |         |
|      |             |          |      |         |



DIP PIPE TO NORMOND GAUGE



DETAIL AT MANWAY FIXING

| ISSUE | FIRST ISSUE | MODIFICATION | KG | GW | DATE     |
|-------|-------------|--------------|----|----|----------|
| 01    |             |              |    |    | 26/03/08 |

BALMORAL GROUP LTD

Balmoral Park, Levenshaye, Aberdeen AB12 3QY, Scotland  
Telephone +44 (0)1224 859000 Fax +44 (0)1224 859059  
E-mail group@balmoral.co.uk

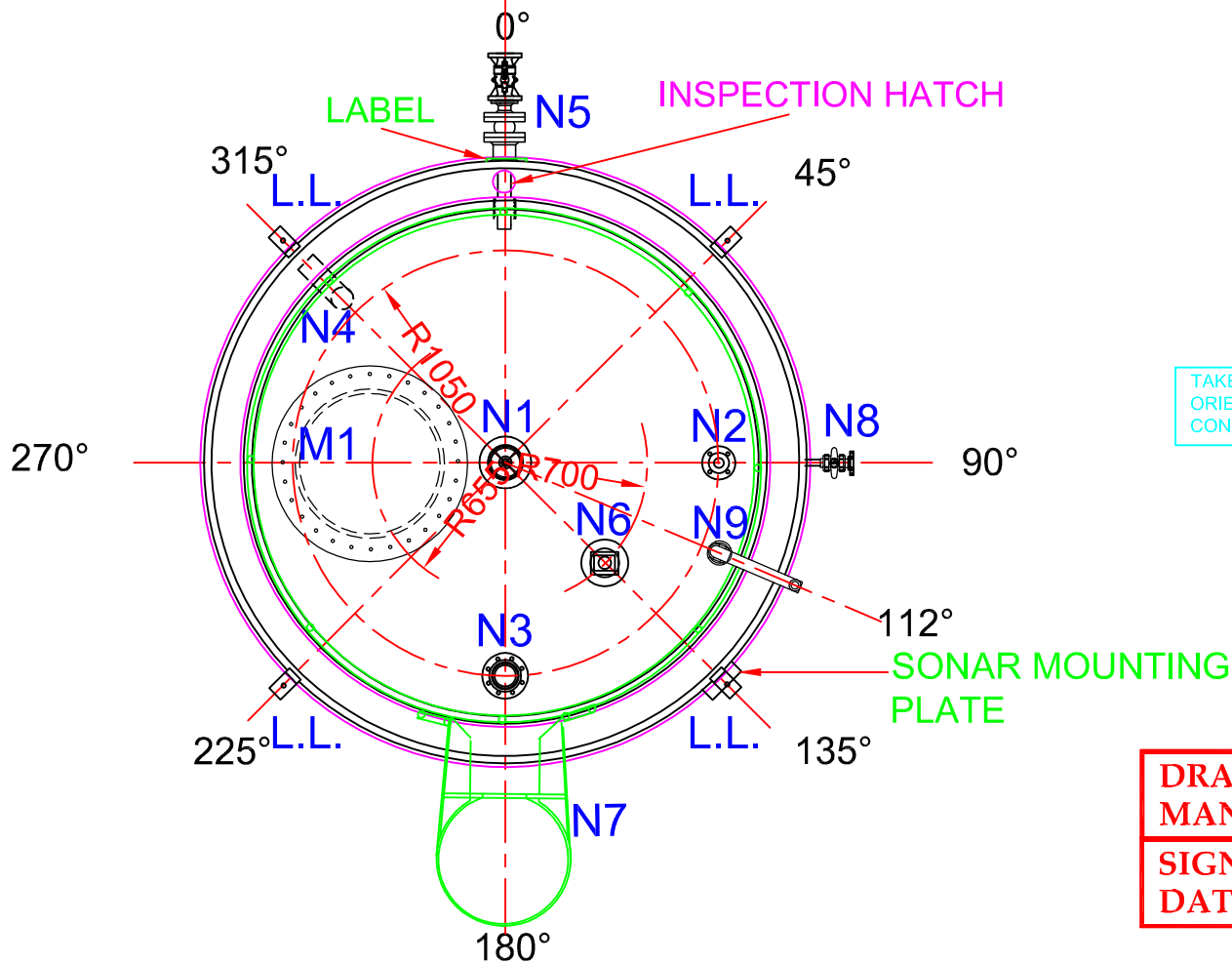
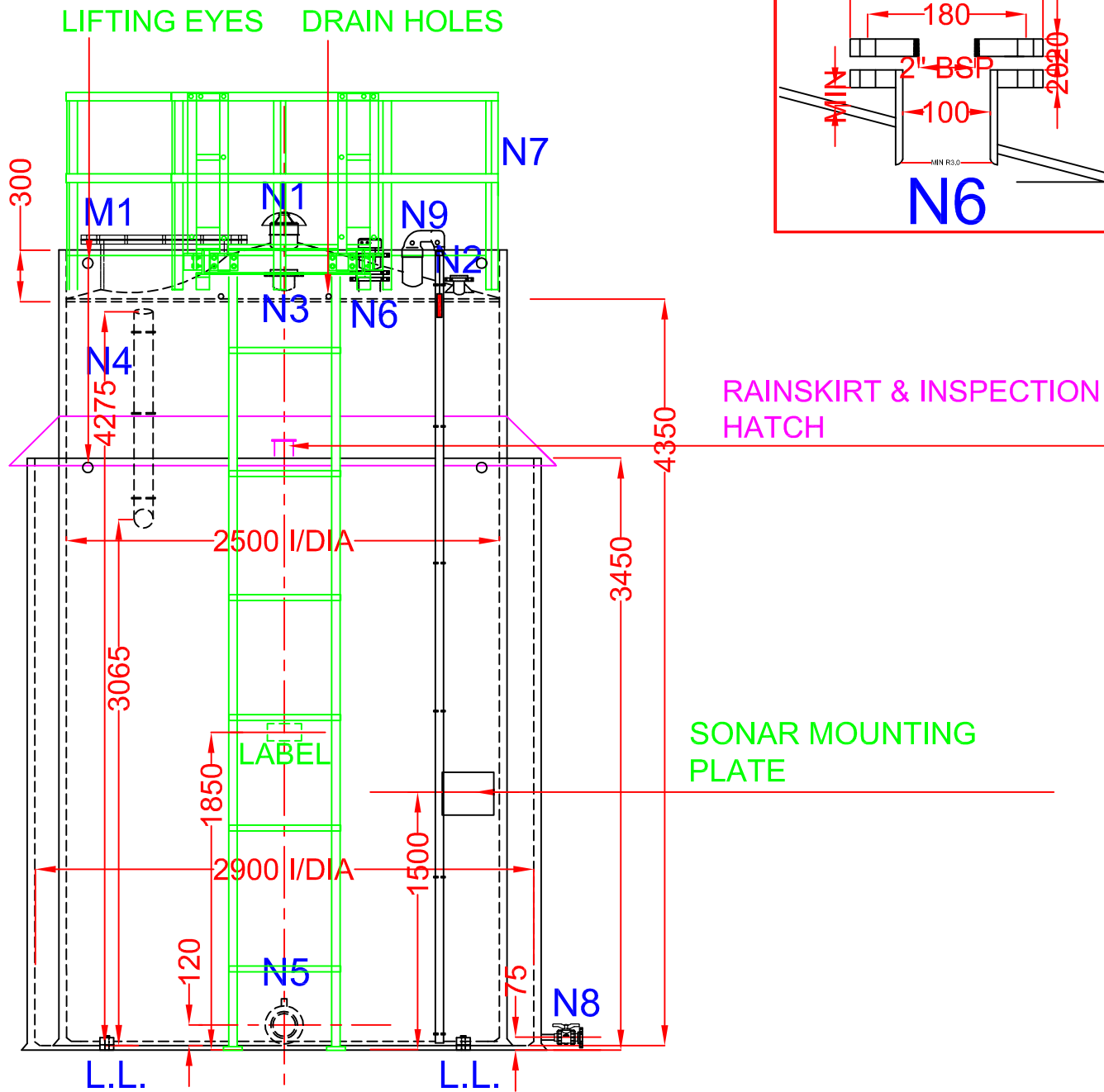
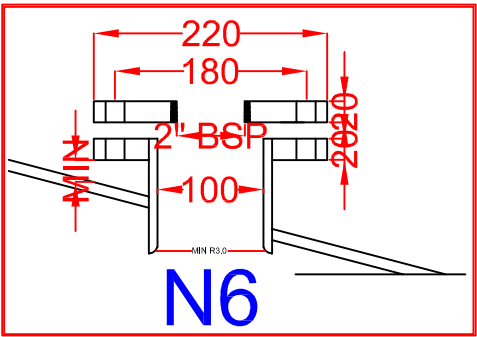
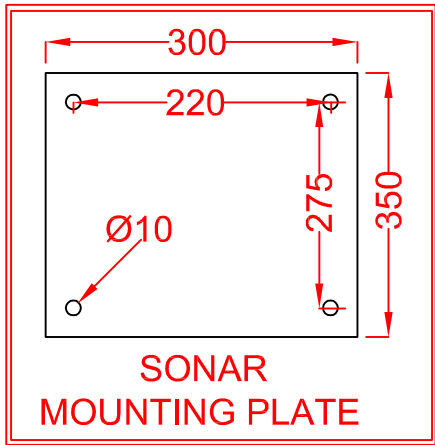


CLIENT  
PB GELATINS UK LTD.  
(QUOTE REF. C-MH000368 REV A)  
PROJECT No. 459

DRAWING TITLE  
C10,000 CHEMICAL TANK - SERIES : 3  
COLOUR : BLACK - LOCATION : OUTDOORS

DRAWN BY K.Gibson  
CHECKED BY G.Ward  
APPROVED BY  
DRAWING No. 459-01

SCALE 1:30  
DATE March 2008  
SHEET SIZE A2  
JOB No.



TAKE PLAN VIEW AS TRUE  
ORIENTATION OF ALL  
CONNECTIONS.

IF IN DOUBT,ASK.

DRAWING ISSUED FOR  
MANUFACTURE.  
SIGNED...NEIL DAVIES...  
DATE.....12.03.2012.....

| No.  | SIZE      | STD         | DESCRIPTION                          |
|------|-----------|-------------|--------------------------------------|
| M1   | 700 mm NB | ALLI / STD  | BOLTED MANWAY                        |
| N1   | 150 mm NB | ALLI / STD  | MUSHROOM VENT                        |
| N2   | 50 mm NB  | BS4504-NP16 | FLANGED INLET                        |
| N3   | 100 mm NB | BS4504-NP16 | INSTRUMENT FLANGE C/W BLANK          |
| N4   | 100 mm NB | ALLI / STD  | INTERNAL OVERFLOW TO BUND SPACE      |
| N5   | 50 mm NB  | BS4504-NP16 | FLANGED OUTLET C/W FLEX CONN & VALVE |
| N6   | 100 mm NB | BS4504-NP16 | HYCONTROL DIGITAL DISPLAY UNIT       |
| N7   | LADDER    | ALLI / STD  | GRP HANDRAILING & ACCESS LADDER      |
| N8   | 25 mm NB  | BS4504-NP16 | BUND DRAIN C/W VALVE & BLANK PLATE   |
| N9   | GAUGE     | ALLI / STD  | EXTENDED FLOAT LEVEL INDICATOR       |
|      |           |             |                                      |
|      |           |             |                                      |
| L.L. | LUGS      | ALLI / STD  | 4 OFF LOCATING LUGS FOR M20 BOLTING  |
| L.E  | EYES      | ALLI / STD  | 4 OFF LIFTING EYES 32mm DIA          |

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CHECKED BY:  
P. TAYLOR

DATE:  
12.03.2012

MANUFACTURING TOLERANCE:  
± 5mm at 18 ° C

CUSTOMER'S ORDER No.  
18303

SCALE:  
DO NOT SCALE

Approved for manufacture:  
NEIL DAVIES

DATE: 12.03.2012

WORKING VOLUME:  
20M3

DRAWN BY:  
G. W. HAYES

MATERIAL:  
HDPE



**HELIX**  
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ADDRESS:  
17, RIDGEWAY, QUINTON BUSINESS PARK, BIRMINGHAM, B32 1AF.  
TEL: 0121 506 0100. FAX: 0121 422 1771  
[www.helixtanks.com](http://www.helixtanks.com) E-MAIL: [gary.hayes@linpacallibert.com](mailto:gary.hayes@linpacallibert.com)

CUSTOMER:  
P.B. GELATINS

SITE:  
TREFOREST

TANK OPERATING TEMPERATURE:  
OUTSIDE AMBIENT

DUTY:  
77% SULPHURIC ACID

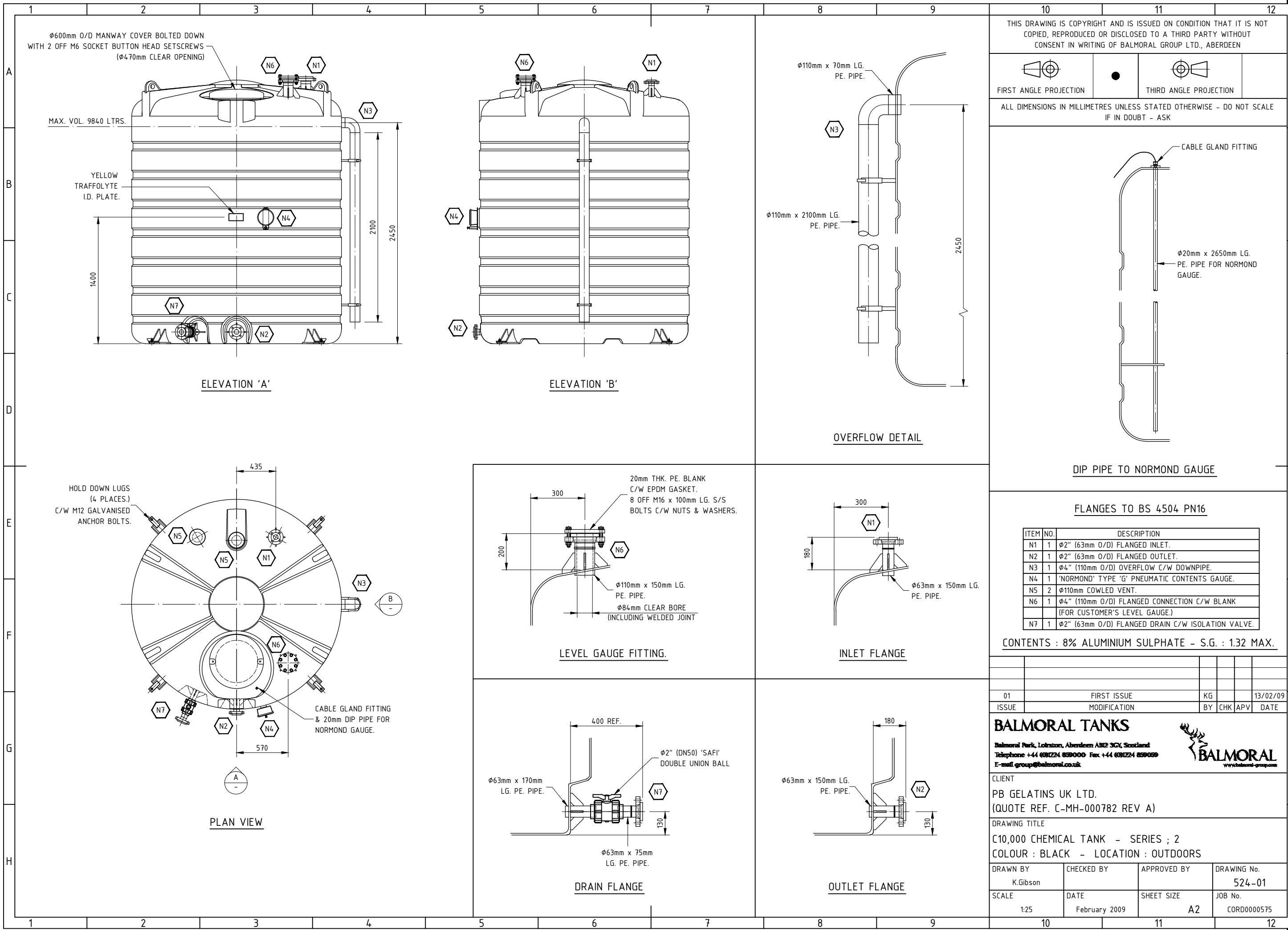
DRG. No:  
H7049

REF:

ISSUE:

C

DATE DRAWN:  
12.03.2012



## **APPENDIX I**

## **BASELINE SURVEY PHOTOGRAPHS**



Photo 4.3.1: Truefloc TAc40 – Crack in concrete block masonry wall



Photo 4.3.2: Truefloc TAc40 – Crack in concrete block masonry wall



**Photo 4.3.3 : Truefloc TAC40 – Unsealed Penetration through bund wall**



**Photo 4.4.1 : Caustic Tank – Holding down bolts missing at base of tank**



Photo 4.4.2 : Caustic Tank – Crack through wall (1) viewed from above

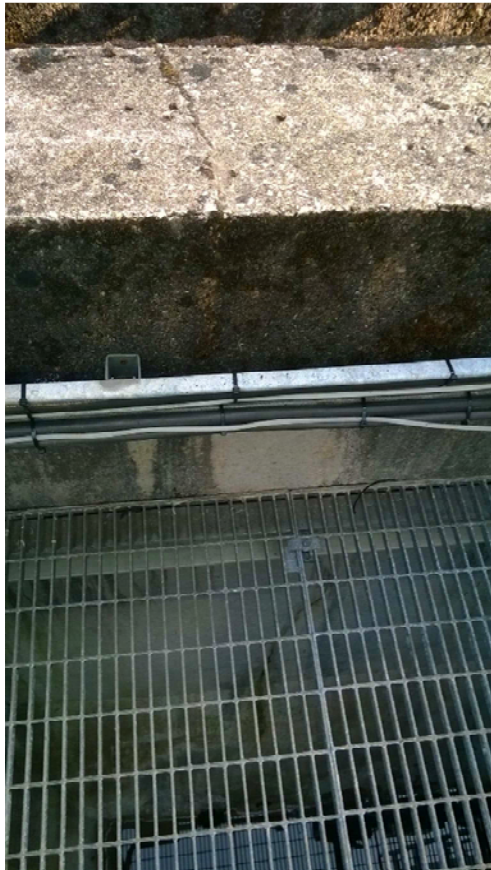


Photo 4.4.3 : Caustic Tank – Crack through wall (2)

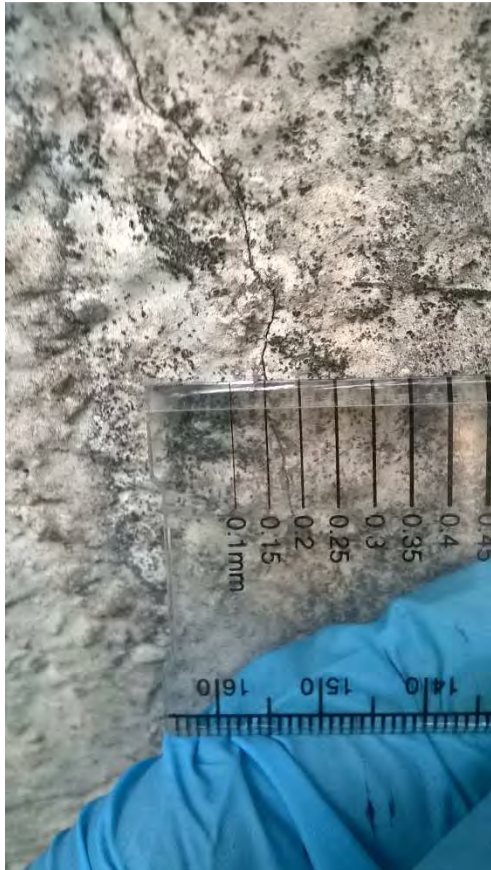


Photo 4.4.4 : Caustic Tank – Crack through wall (3)



Photo 4.4.5 : Caustic Tank – Contraction joint (1)



Photo 4.4.6 : Caustic Tank – Contraction joint (2)



Photo 4.4.7 : Caustic Tank – Contraction joint (3)



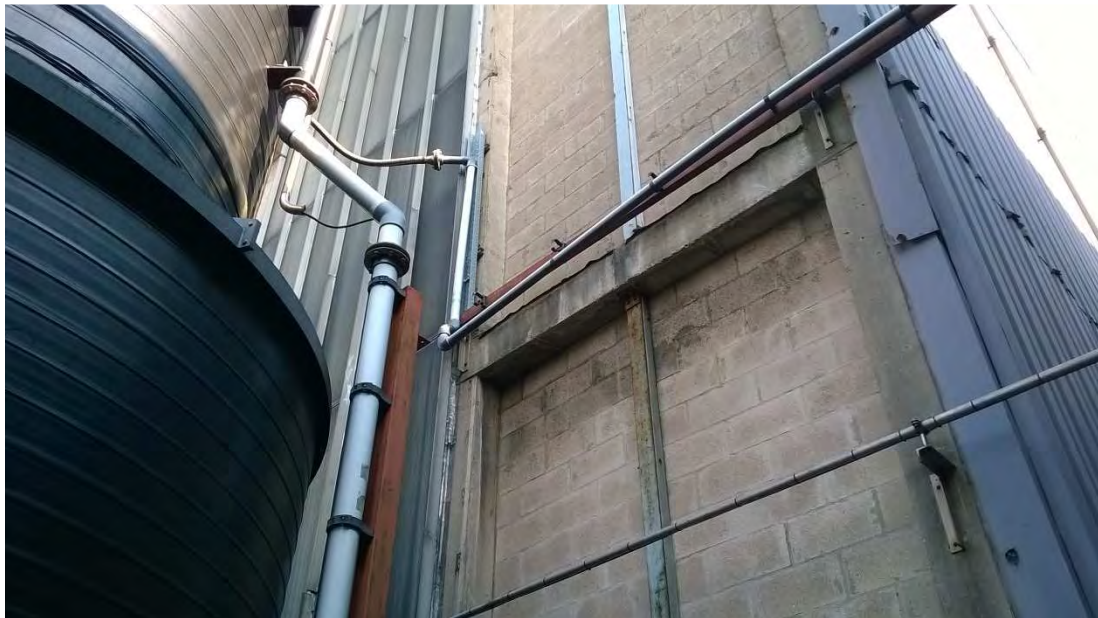
**Photo 4.5.1: Caustic Day Tank – Damage to tank wall (1)**



**Photo 4.5.2: Caustic Day Tank – Damage to tank wall (2)**



**Photo 4.5.3 : Caustic Day Tank – Damage to tank wall (3)**



**Photo 4.6.1 : Deioniser Tank – Defective pipe brackets on high level inlet pipe**



Photo 4.7.1: Hydrochloric Acid Tank Tertiary Containment Drainage – Damaged/missing section of drainage



Photo 4.8.1: Hydrogen Peroxide – Crack in concrete block masonry wall (1)



Photo 4.8.2: Hydrogen Peroxide – Crack in concrete block masonry wall (2)

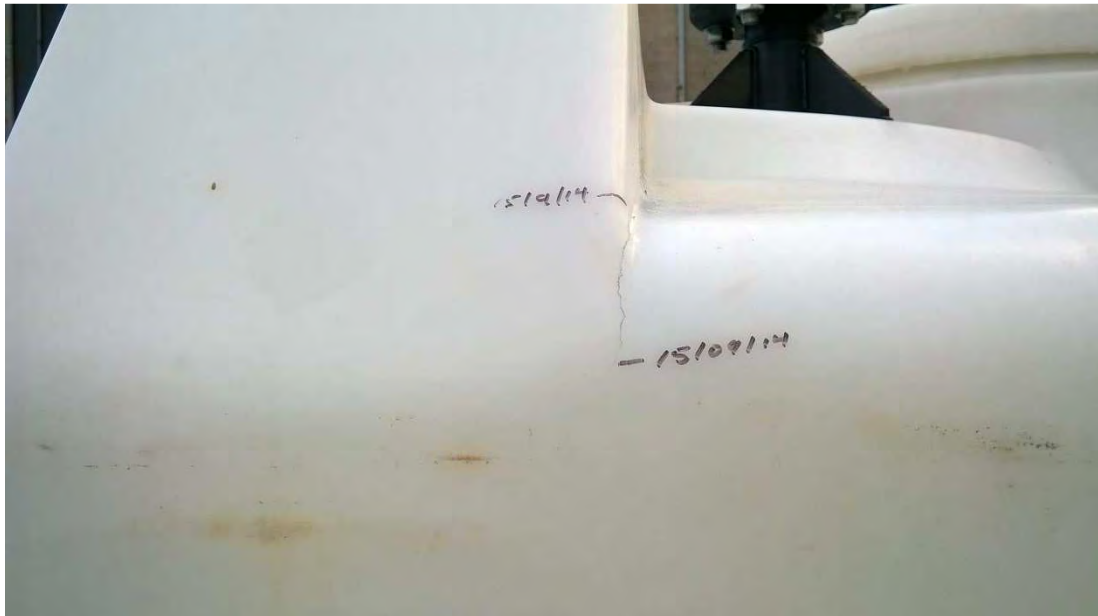


Photo 4.9.1: Acetic Acid – Crack in primary tank wall



Photo 4.9.2: Acetic Acid – Crack in concrete block masonry wall (1)

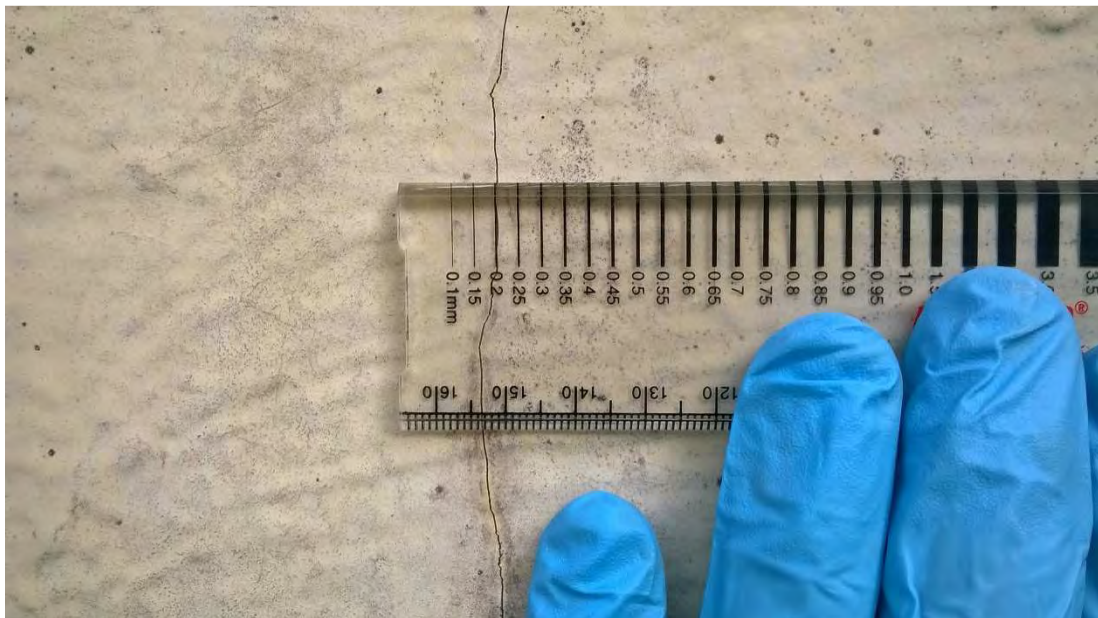


Photo 4.9.3: Acetic Acid – Crack in concrete block masonry wall (2)



Photo 4.9.4: Acetic Acid – Crack in concrete block masonry wall (3)



Photo 4.10.1: Phosphoric Acid – Crack in concrete block masonry wall (1)



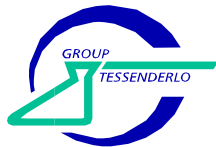
Photo 4.10.2: Phosphoric Acid – Crack in concrete block masonry wall (2)



Photo 4.10.3: Phosphoric Acid – Crack in concrete block masonry wall (3)

## **APPENDIX J**

## **MAINTENANCE AND INSPECTION INSTRUCTIONS**

**QA Procedures: 8.16****Issue No: 2****Page 1 of 2****Date of Issue: 23<sup>rd</sup> July 2010****Work Instruction No. MWI 031****Title: Chemical Storage Bund Inspection****PB Gelatins UK Ltd****Engineering Work Instructions**

The bulk chemicals are stored at various locations throughout the PB Gelatins site, and require weekly inspections with the results entered onto the record sheet.

Bulk chemical storage locations.

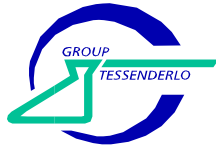
| Bulk Chemical       | Location    | ID Number    |
|---------------------|-------------|--------------|
| Truefloc® TAC40     | Water Works | <b>BC 02</b> |
| Caustic Soda 20%    | Water Works | <b>BC 03</b> |
| Caustic Soda 20%    | Water Works | <b>BC 04</b> |
| Phosphoric Acid 75% | Rear A21    | <b>BC 07</b> |
| Hydrogen Peroxide   | Rear A21    | <b>BC 08</b> |
| Acetic Acid         | Rear A21    | <b>BC 10</b> |

**Recommended Equipment**

- Drain valve padlock key
- Ph indicator dye
- Chemical resistant gauntlets
- Full face visor
- Chemical suit
- Sample jar
- Chemical Storage Bund Inspection Record Sheet MWR 031

**Procedure**

1. Check if there is any liquid present in the bund.
2. If there is liquid present within the bund, check the ph of the solution by using the indicator dye. (note: indicator dye is an irritant – wear chemical resistant gloves)
3. If there is no colour change, the dye indicates that the liquid is of neutral ph, proceed to step 4. If there is a colour change, inform maintenance supervisor immediately and proceed to **Sampling Procedure**



**QA Procedures: 8.16**

**Issue No: 2**

**Page 2 of 2**

**Date of Issue: 23<sup>rd</sup> July 2010**

**Work Instruction No. MWI 031**

**Title: Chemical Storage Bund Inspection**

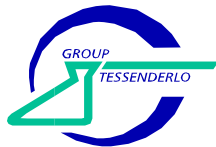
**PB Gelatins UK Ltd**

**Engineering Work Instructions**

4. Remove the padlock from the drain valve and drain the bund.
5. Once the bund is drained, remove any debris contained within. Do not enter the bund - use the tool provided.
6. Close drain valve and replace padlock.
7. Carry out visual inspection of concrete base, ensuring that there are no surface defects or plant growth
8. Carry out visual inspection of bund walls, checking for signs of cracks, bulges or staining.
9. Carry out visual inspection of tank walls, checking for signs of cracks, bulges or staining
10. Check for evidence of increasing gaps where storage vessel sits on the concrete base
11. Carry out visual inspection of ancillary equipment and pipe work for leaks.
12. Ensure that the storage vessel drain valve is locked off
13. Check that the chemical delivery point is clearly identified.
14. Check the operation of water supply and hose.
15. Check that access ladder and working platform is firmly fixed and free from defects
16. Report any defect found to the maintenance manager.

### Sampling Procedure

1. To carry out the sampling procedure, chemical resistant gauntlets, chemical suit and visor must be worn.
2. Remove padlock from the bund drain valve.
3. Remove the lid from the sample jar.
4. Slowly open the drain valve and collect a sample of the liquid.
5. Close bund drain valve.
6. Securely fit the lid back on the sample jar.
7. Replace the padlock on the bund drain valve.
8. Wash any discharged liquid down the effluent drain.
9. Clearly mark the sample jar with the bulk chemical name.
10. Contact the maintenance manager, to have sample titration tested in the laboratory.
11. The bund cannot be drained until the titration test results are confirmed and appropriate action is determined.

**QA Procedures: 8.16****Issue No: 2****Page 1 of 2****Date of Issue: 27<sup>th</sup> February 2013****Engineering Work Instructions****Work Instruction No. MWI 032****Title: Chemical Storage Bund Inspection (integral bund)****PB Gelatins UK Ltd**

The bulk chemicals are stored at various locations throughout the PB Gelatins site, and require weekly inspections with the results entered onto the record sheet.

Bulk chemical storage locations with integral bunds.

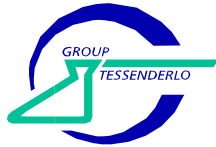
| Bulk Chemical         | Location | ID Number    |
|-----------------------|----------|--------------|
| Phosphoric Acid 75%   | A18      | <b>BC 01</b> |
| Hydrochloric Acid 32% | Rear A21 | <b>BC 05</b> |
| Recovered Acid <10%   | Rear A21 | <b>BC 06</b> |
| Sulphuric Acid 75%    | A18      | <b>BC 11</b> |

**Recommended Equipment**

- Drain valve padlock key
- Ph indicator dye
- ⊖ Chemical resistant gauntlets
- Full face visor
- Chemical suit
- Sample jar
- Chemical Storage Bund Inspection Record Sheet MWR 031

**Procedure**

1. To carry out the bund inspection, chemical resistant suit, gauntlets and visor must be worn. Remove padlock from the bund drain valve.
2. Remove the lid from the sample jar.
3. Slowly open the drain valve and collect a sample of the liquid.
4. Close bund drain valve.
  1. Check the ph of the solution by using the indicator dye. (note: indicator dye is an irritant – wear chemical resistant gloves)
  2. If there is no colour change, the dye indicates that the liquid is of neutral ph, proceed to step 7. If there is a colour change, inform maintenance supervisor immediately and proceed to **Sampling Procedure**
  3. Open the drain valve and drain the bund.



**QA Procedures: 8.16**

**Issue No: 2**

**Page 2 of 2**

**Date of Issue: 27<sup>th</sup> February 2013**

**Engineering Work Instructions**

**Work Instruction No. MWI 032**

**Title: Chemical Storage Bund Inspection (integral bund)**

**PB Gelatins UK Ltd**

4. Once the discharge has stopped, close drain valve and replace the padlock.
5. Carry out visual inspection of concrete base, ensuring that there are no surface defects or plant growth
6. Carry out visual inspection of bund walls, checking for signs of cracks, bulges or staining.
7. Carry out visual inspection of tank walls, checking for signs of cracks, bulges or staining
8. Check for evidence of increasing gaps where storage tank sits on the concrete base
9. Carry out visual inspection of ancillary equipment and pipe work for leaks.
10. Ensure that the storage vessel drain valve is locked off
11. Check that the chemical delivery point is clearly identified.
12. Check the operation of water supply and hose.
13. Check that access ladder and working platform is firmly fixed and free from defects
14. Report any defect found to the maintenance manager.

### Sampling Procedure

1. Chemical resistant suit, gauntlets and visor must be worn during sampling
2. Rinse the sample jar out with clean water.
3. Slowly open the drain valve and collect another sample of the liquid.
4. Close bund drain valve.
5. Securely fit the lid back on the sample jar.
6. Replace the padlock on the bund drain valve.
7. Wash any discharged liquid down the effluent drain.
8. Clearly mark the sample jar with the bulk chemical name.
9. Contact the maintenance manager, to have sample titration tested in the laboratory.
10. The bund cannot be drained until the titration test results are confirmed and appropriate action is determined.



**QA Procedures:8.16**

**Issue No: 1**

**Date of Issue: 19th June 2006**

**Maintenance Work Record No. MWR 031**

**Title: Chemical Storage Bund Inspection**

**Engineering Work Instructions**

**Tank No: BC 01**

**Contents: Phosphoric Acid 75%**

| Check                                                                                | Comment |
|--------------------------------------------------------------------------------------|---------|
| Is liquid present in bund                                                            |         |
| Is pH test positive<br>(if yes contact engineering manager immediately)              |         |
| Result of titration test carried out on liquid in bund                               |         |
| Bund drained and clear of debris                                                     |         |
| Is bund base / concrete base free from surface defects                               |         |
| Evidence of increasing gap between base of tank or bund and concrete base            |         |
| Are bulges, splits, crazing, discolouration or cracks evident in tank and bund walls |         |
| Is staining visible on exterior surface of tank                                      |         |
| Is tank vertical with no signs of leaning                                            |         |
| Tank and bund drains locked off                                                      |         |
| Ancillary equipment free from leaks                                                  |         |
| Delivery point clearly identified and locked off                                     |         |
| Water supply and hose operational                                                    |         |
| Access ladder, work platform in good condition                                       |         |
| Additional comments                                                                  |         |
|                                                                                      |         |

Signed:

Date:

## **APPENDIX K**

## **RECORD OF LATEST HDPE TANK INSPECTIONS**

## Bulk storage tanks annual Inspection report

|                       |                                           |
|-----------------------|-------------------------------------------|
| Site/location:        | <b>Treforest</b>                          |
| This inspection date: | <b>15<sup>th</sup> September 2014</b>     |
| Next Inspection date: | <b>September 2015</b>                     |
| Inspected by:         | <b>Roger Andrews – Schoeller Allibert</b> |

|    | Tank number                                 | BC01            | BC02            | BC03    | BC04    | BC05 | BC06     | BC07       | BC08              | BC10        | BC11               |
|----|---------------------------------------------|-----------------|-----------------|---------|---------|------|----------|------------|-------------------|-------------|--------------------|
|    | Duty                                        | Phosphoric Acid | Truefloc TAC 40 | Caustic | Caustic | HCl  | Effluent | Phosphoric | Hydrogen Peroxide | Acetic acid | Sulphuric acid 77% |
| 1. | <b>Tank/Bund Shell</b>                      | A               | A               | B       | A       | A    | A        | A          | B                 | B           | A                  |
| 2. | <b>Outlet &amp; flexible connection</b>     | A               | A               | A       | A       | A    | A        | A          | A                 | A           | A                  |
| 3. | <b>Tank flanges, gaskets &amp; joints</b>   | A               | A               | A       | A       | A    | A        | A          | A                 | A           | A                  |
| 4. | <b>Pipework &amp; support brackets</b>      | A               | A               | B       | A       | A    | A        | A          | A                 | B           | A                  |
| 5. | <b>Tank vent/ducting &amp; overflow</b>     | A               | A               | A       | A       | A    | A        | A          | A                 | A           | A                  |
| 6. | <b>Base, Plinth or concrete bund</b>        | A               | A               | A       | A       | A    | A        | A          | A                 | A           | A                  |
| 7. | <b>Tanker connections<br/>Fill or drain</b> | A               | A               | A       | A       | A    | A        | A          | A                 | A           | A                  |

Tank Rating **A** = Good working order/ acceptable **B** = Remedial action maybe required **C** = Needs urgent attention



## Bulk storage tanks annual Inspection report Cont.

External visual inspections were carried out in accordance with H&SE guidance note PM 86. Generally all tanks appear to be in good serviceable condition. The exceptions that were identified as condition “B” are listed below and these defects require remedial action.

Tank BC 03 – Caustic soda tank. It was noted that the upper ladder support brackets welded to the tank shell had begun to pull away and a circumferential crack in the tank shell was beginning to propagate. This needs remedial action. See picture A

Tank BC10 – Acetic acid tank. A vertical crack in the upper tank shell was identified adjacent to one of the lifting bosses moulded into the tank top. This was dated and the extent of the crack was marked with a sharpie marker on the tank. This crack maybe benign and only in the surface “skin” of the rotational moulding. This is not a high stress area of the shell, but the defect should be monitored to see if the crack propagates, if so the tank will require replacement. See picture B

Tank BC08 – Hydrogen peroxide tank. A surface crack was identified in the tank shell. It seems that this are of the shell had been “buffed” at some point following moulding. This surface crack is limited to a small area in the upper shell and does not appear to be a structural defect. This should be monitored on a regular basis

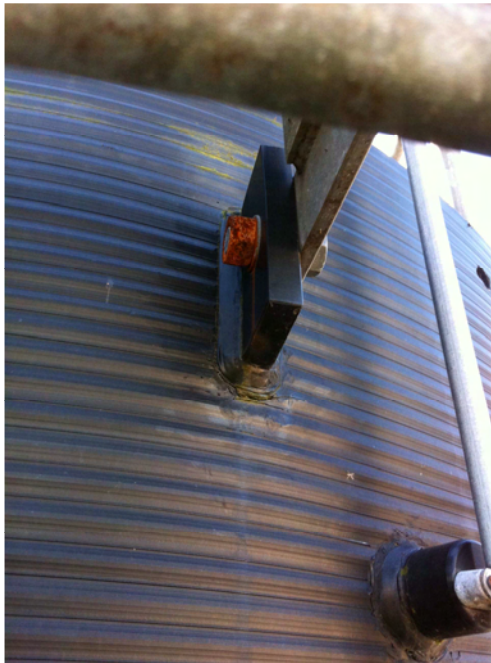


Photo A



Photo B

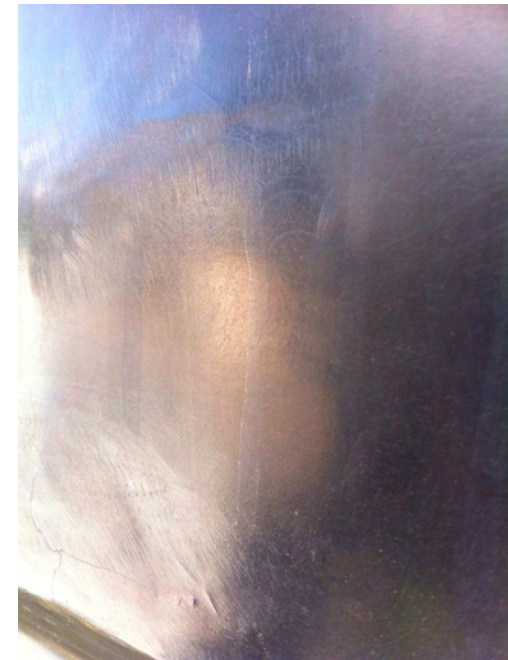


Photo C

## Bulk storage tanks annual Inspection report Cont.

### General observations.

All tanks are being regularly monitored as part of the on-site periodic inspection regime. Some minor housekeeping items need to be addressed.

1. The recently installed caustic soda tank BC04 had some flange blanks missing on the roof nozzles.
2. Not all tanks are bolted down (best practice)





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