CIRIA 736 Risk Assessment

Pentre Agrochemicals Plant Permit Variation Application

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Basis of Report

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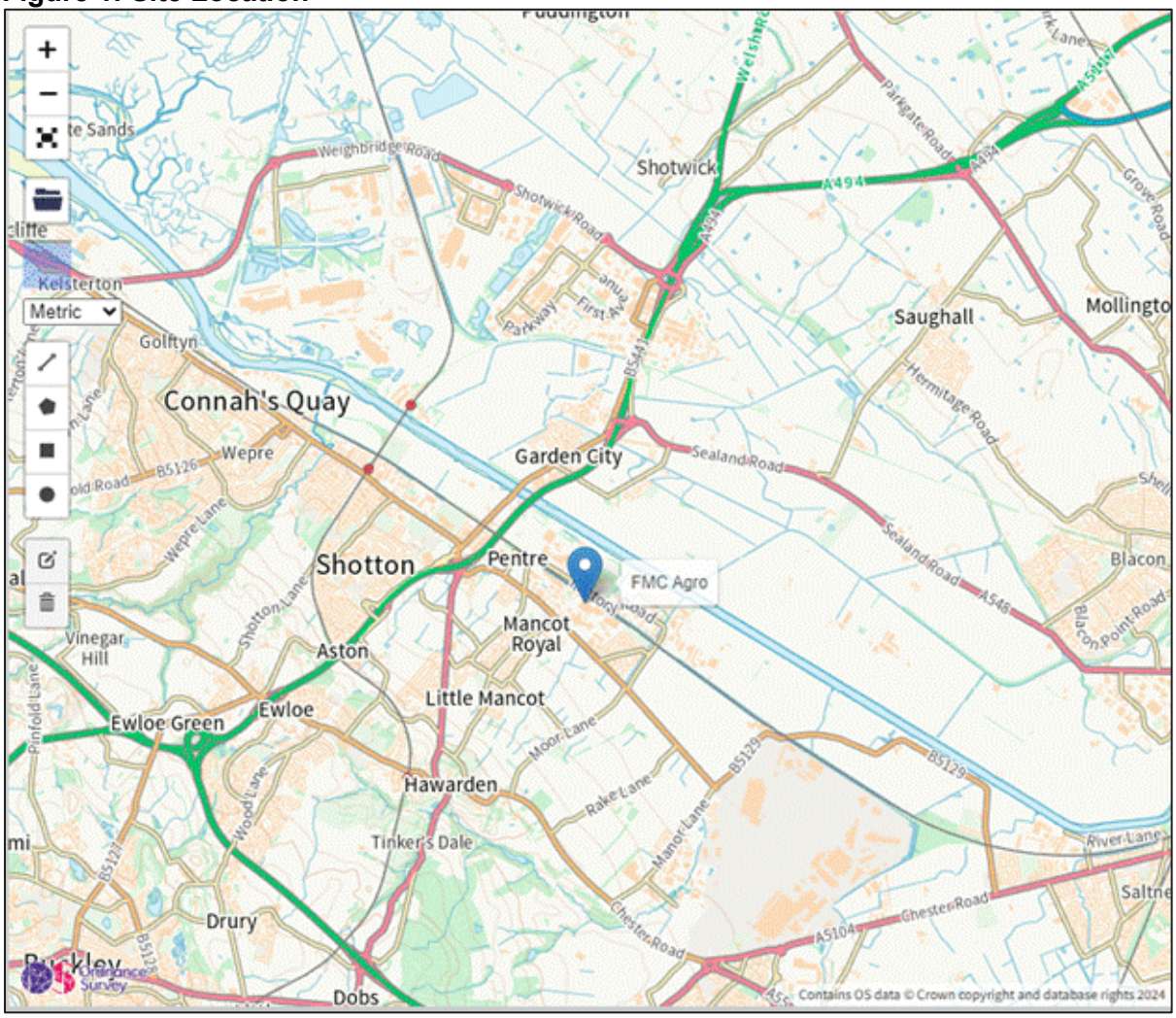
1.0 Introduction

SLR Consulting Ltd (SLR) has been instructed by FMC Agro Ltd (FMC) to prepare a review of secondary and tertiary containment infrastructure for their new Nitric Acid storage tank facility at their premises in Pentre, Deeside as part of the Environmental Permit (EP) variation application

The facility is located on the outskirts of Pentre, Deeside, North Wales, the facility itself is located within a security fenced compound in an industrial park off the B5129 'Chester Road East', its geographical location within the UK is shown in Figure 1.

Figure 1: Site Location



Natural Resources Wales (NRW) require any stored potentially polluting liquids are provided with adequate secondary (or tertiary) containment to standards set out in the best practice guidance contained with the CIRIA report C736 – *Containment systems for the prevention of pollution* (hereafter referred to as C736). This report reviews how the containment provisions at the facility align with the requirements of C736.

For ease of reference in the remainder of the report a schematic layout of the site is presented below as Figure 2.

Figure 2: Schematic Site Layout

1.1 Summary of Site Activities

The Pentre Agrochemicals Plant installation is located on Rectors Lane, Pentre, Deeside. The site produces inorganic chemicals and consists of a manufacturing and filling plant, together with formulation development facilities and a quality control laboratory.

The EP variation application relates solely to the replacement of an existing nitric acid storage tank with a new bunded tank, and the replacement of an existing water scrubber with a new water scrubber unit for the abatement of potential nitric acid fume within air displaced from the bulk storage tank and nitrogen dioxide extracted from the Mixer 3 plant. No other changes are proposed at the site. The new equipment is proposed to be located on the hardstanding area, adjacent to the roofed building along its northern edge.

Bulk delivery of liquid nitric acid will occur 18 times per year, with bulk delivery HGV tankers arriving from the public highway to the site via the site entrance and security lodge. Tankers will then cross the hardstanding area using an approved route to the nitric acid tank.

Tanker will offload nitric acid, using an approved risk assessment and method statement procedure, into the new bulk storage tank before closing all valves, decoupling and leaving site. All such activities will be supervised by suitably trained FMC personnel.

The hardstanding area is a kerbed concrete apron with water drainage features. Flooring consists of a ground bearing concrete slab, which provides tertiary containment for any liquid spills internal to the buildings or externally on the yard. The floor is laid to falls and is installed with drains to direct liquids into a water collection sump. This is a holding area for rainwater or potentially if there is a spill (originally constructed as lorry loading ramps). FMC have an established procedure for dealing with collected water and/or spills from these sumps;

- A sample is taken by operators and retained by the laboratory;
- The onsite laboratory staff test pH and check for oil / colour / odour;
- If the water sample passes the tests (i.e. it is uncontaminated rainwater, a form is issued and signed by the laboratory and a senior member of site management;

- Once the form is signed a key is issued to allow the discharge pump to be switched on, water is then discharged to the nearby Sandycroft Ditch;
- If the collected liquid is 'out of specification' (i.e. contaminated) it is removed from site by road tanker, a contract exists with Veolia (hazardous waste disposal company) who send in tankers to empty the sump / site drainage and take the contaminated liquid offsite for suitably permitted disposal;
- This pump is locked off at all times other than pumping out using this procedure.

The site drainage sump has the capacity to store 37,778 litres, the tertiary containment for the site has a total capacity of 1.4 million litres (so 1.362 million litres in excess of the volume held in the sump)[1].

The concrete floor is unlikely to have been specifically constructed as a water retaining concrete structure It is more likely to have been constructed as a simple load bearing hardstanding similar in principle to 200mm thickness of RC40 concrete with a single layer of reinforcement mesh to the top face constructed off a suitable thickness of compacted type 1 aggregate plus blinding. This overall construction detail is common for this type of facility and subject to ground conditions being suitable SLR would have no concerns about its structural capacity or impermeability.

Full joint details have not been provided for the floor, but based on the information available the joint layout and details appear to follow normal good practice, with a combination of partial continuity, induced, and dowelled joints throughout the slab.

In the absence of joint details, SLR cannot determine if waterbar of any description has been used for the floor slab details. However, as the external area does not store standing liquid but is just required to be 'impermeable' then normal joints sealants would be expected to be adequate.

Where floor joints are damaged, SLR would recommend that they be repaired as part of normal site maintenance works as access to areas becomes available and that the site operator ensures regular visual inspections of the floors and perimeter kerbing. More detailed inspections should be completed by a competent Engineer at intervals of approximately 5 years, with subsequent inspections schedule to reflect the condition of the elements.

As such, with the exception of the new nitric acid tank itself, the full facility is essentially tertiary contained and this containment is sufficient for potential issues such as containment of incidental spills, leaks from pipework and from any tank loading activities. The Nitric Acid tank is proposed to be provided with a local secondary containment bund.

[1] FMC COMAH SAFETY REPORT, Issued JULY 2023. (SLR Consulting Ltd)

2.0 Containment Risk Assessment

Presented below is a classification of the FMC facility in terms of its required CIRIA C736 Bund classification, followed by a gap analysis between what has been installed at the site and the best practice guidance contained in CIRIA C736. Thereafter a programme of works is presented to reduce the risks posed by the facility to as low as reasonably practicable.

2.1 C736 Containment Classification

The CIRIA C736 guidance requires that existing commercial and industrial facilities are assessed for containment (bund) classification. C736 provides a risk assessment approach to support a three-tier risk-based classification system for secondary and tertiary containment. Chapter 2 of C736 provides the risk assessment approach.

The risk assessment approach recommends using a "Source, Receptor, Pathway" model. The source is the inventory stored at the site, the receptors are the ground and groundwater under the site and nearby surface waters, along with any other environmentally sensitive locations nearby to the site, and the pathway is:

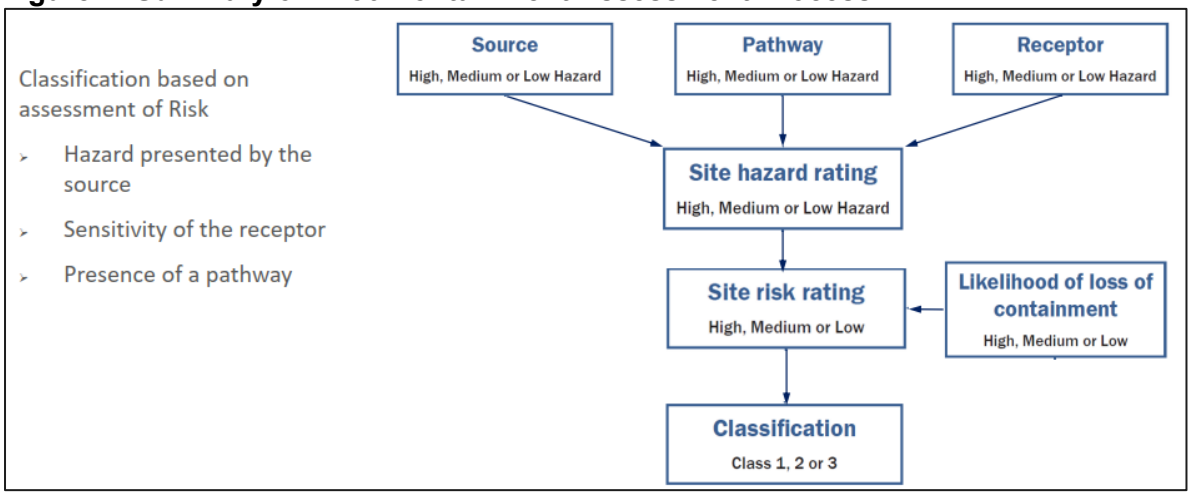
- through any permeable soils on site;
- breaches in hard standing's present on site; and
- drainage systems within the site discharging to the public sewer, and / or storm water drainage and overland runoff from the site to surrounding ground, stormwater drainage or surface water systems.

CIRIA also considers the requirement to contain contaminated firewater (if flammable inventory is stored).

C736 recognises that where flammable inventory is stored, it is often impractical to provide sufficient secondary containment local to the primary containment to cater for the firefighting and cooling water that might be applied during an incident. Tertiary containment provides a further level of protection should the secondary containment be overwhelmed by firefighting and cooling water or should the primary and/or secondary containment fail for other reasons.

The assessment should be concluded as per the guidance in C736, summarised as follows in Figure 1.

Figure 1: Summary of C736 Containment Assessment Process



The main output of the Risk Assessment process is the definition of a bund class.

Class 1 bunds are acceptable for low hazard materials - this is for small volumes and/or lightly contaminated liquids or liquids stored in low-risk settings.

Class 2 bunds are the most common type of bunding, for medium hazard materials - this is for storage of more 'industrial' volumes (typically more than a few hundred cubic metres) of contaminating liquids in medium risk settings.

Class 3 bunds are for the very highest hazards - this is for larger volumes and/or very highly contaminating liquids and for less risky inventories in highly sensitive settings.

Once the bund Class has been defined, other design factors need to be considered, for example:

- Layout: For Class 3 bunding the potential for jetting is a greater consideration than for Class 1 bunds;
- Materials: Some materials of construction are not permitted for the higher bund classes, for example blockwork is only considered as recognised good practice (RGP) for Class 1 bunds;
- Bund Drainage: For Class 2 and 3 bunds it isn't considered RGP to allow bunds to drain under gravity, they should instead be provided with a means of pumped removal of rainwater and / or spilt inventory;
- Pipework: Penetrations through bund walls or floors is only allowed for Class 1 bunds;
- Impermeability Testing: Leak detection of all joints and penetrations is only a requirement for Class 2 and 3 bunds; and
- Leak detection: For the highest risk categories primary leak detection systems are considered RGP.

Volume requirement is the main design consideration for bunds and can result in significant cost and/or land take. The traditional '110% (or 25%)' rule of thumb' is not used in the C736 guidance. C736 asks designers to consider what volume has to be contained, as a minimum, this is 100% of the primary storage volume for a single tank and if relevant for multiple tanks, based on credible failure scenarios.

Generally, the *brimful* capacity should be adopted but n*ominal* or *tank rated capacity* may be appropriate if high integrity overfill protection is in place and this is agreed with Regulators.
In addition, an allowance for rainfall to accumulate should then be made (if the secondary or tertiary containment is not roofed) in the build up to, during and aftermath of a spill for the duration of time that clean-up could last (this is likely to be several days).

Finally, an allowance for firefighting and cooling water needs to include if any inventory is flammable.

When making rainfall calculations the 10% Annual Exceedance Probability (annual probability of 10% maximum rainfall amount) rainfall is used to calculate the additional volume of bund storage required. Good practice, unless otherwise justified, is to allow for:

- 24 hours of rainfall preceding the incident, plus
- Rainfall generated for the duration of the incident; plus
- Eight days of rainfall volume (or another appropriate period) to allow for emptying and disposal from the bund.

A typical rainfall period is therefore 10 days. Rainfall amounts are usually taken from the Flood Estimation Handbook (the figures in the C736 guidance document itself is for first estimates only).

2.2 Source (Inventory)

The volumes and an outline description of the primary liquid storage vessels that may hold potentially polluting liquids at the facility is detailed below in Table 1.

Table 1: Inventory Volumes

Location	Tank Description	Tank Construction	Dimensions	Gross Volume m^3
External Yard	Nitric Acid Tank	Stainless Steel	3.7m high 3.0m diameter	26

To establish the source term's risk, the volume of inventory in storage and its potential environmental effects, should it be allowed to escape into the environment, needs to be considered.

The inventory in storage is non-flammable, therefore firefighting water is not considered further in this assessment.

2.2.1 Source Risk

Nitric acid is highly corrosive and a strong oxidant. The immediate impacts of a breach of containment could potentially be severe, especially posing a risk to staff and visitors of the site.

In the environment it is likely to become quickly diluted and is unlikely to pose any significant long term environmental risk since it does not bioaccumulate or persist in the environment for any significant length of time.

However, given the immediate safety risk posed by the chemical, but the lack of long term or bioaccumulative effects, the nitric acid stored at the site is considered to have a **medium** source hazard rating.

2.3 Pathways

There are several conceivable pathways for escaped inventory to reach a receptor (ground, surface water or groundwater). The main pathways to consider in the context of the FMC Agro facility are:

- Leakage from containment systems to ground / groundwater through defects in containment engineering;
- Spills from product delivery activities leading to surface run-off / overload flow to drains and ultimately surface waters; and
- Spills from product usage activities leading to surface run-off / overload flow to drains and ultimately surface waters.

2.3.1 General

The FMC Agro facility, centred at NGR SJ 32877 67596, is located off Factory Road, Pentre, CH5 2DH.

The site is located within an established industrial park, on essentially level ground at approximately 7mAOD with the tidal River Dee banks around 500m to the northeast of the site's perimeter.

The site itself is constructed as an impermeable concrete slab floor off which are constructed light industrial buildings occupying much to the southeast quarter of the site. The remaining site is external yard areas. All site surfaces fall at around 1:100 towards drainage features in the yard that all discharge to a collection sump (see description at Section 1.1). The external hardstanding's are all provided with minimum 150mm high kerbing around the outer perimeter with the exception of the site entrance (which is at the highpoint of any falls on the slab floor). As described previously in Section 1.1 all yard drainage is held on site in a sump prior to testing prior to release either as clean water or disposal in tankers if contaminated. Roof drainage is collected via separately piped drains and discharged from site.

The land surrounding the facility is predominantly light industrial and the northeastern perimeter is bound by a railway line.

2.3.2 Geology, Hydrogeology, Hydrology and Ecology

2.3.2.1 Geology

British Geological Survey information, obtained from the BGS Geology Viewer (BGS Geology Viewer - British Geological Survey) and accessed in May 2024, indicates the site is underlain by Mudstone, sandstone and conglomerate, a sedimentary bedrock formed between 319 and 308 million years ago during the Carboniferous period.
Superficial geology is reported as Clay, silt and sand, a sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period.

2.3.3 Pathway Risk

Should inventory escape containment, pathways to receptors are of medium length. Liquid could escape overland and eventually percolate to groundwater through the made ground beneath the site and then through the bedrock geology. Similarly overland flow could result in contaminating liquids entering drain systems or local streams / ditches that eventually feed to the nearby River Dee.
The bedrock geology is mixed in terms of having some lower permeability elements (mudstones) but also some more permeable strata (sandstones). Discharge off site through drains and ditch systems is possible but would take some time and a reasonable volume of spilt inventory to reach controlled waters, there would be reasonable time for such a discharge to be noticed and interventions put in place to impound any losses for clean-up and remediation.
As such, pathways are assessed as have a **medium** hazard rating.

2.4 Receptors

Receptors likely to be affected by any loss of inventory from the site are the local groundwater and surface water systems. Other local amenities are also considered.

2.4.1 Hydrogeology

Information obtained from the DEFRA Magic Map site (Magic Map Application (defra.gov.uk) and accessed in May 2024, indicates that the geology beneath the site contains a Secondary A aquifer, that is defined as “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”.
The groundwater vulnerability map did not identify any specific features.

2.4.2 Hydrology

The MAGIC map revealed that the nearest surface water feature to the site is the Sandycroft ditch immediately to the east of the site boundary that feeds to the tidal river Dee approximately 500m to the northeast of the site. The site is shown to not be in an area sensitive to ammonia pollution and there are no special protection zones or other drinking water related protected areas within 500m of the site.
The Flood Warning Information Service[2], accessed in May 2024, shows that the site has very low probability of flooding from rivers and the sea (less than 0.1% chance each year) and that there is a low risk of surface water flooding (0.1 - 1% chance each year).

[2] Government Digital Service. *Long term flood risk assessment for locations in Wales*. Accessed online at: Natural Resources Wales / Check your flood risk by postcode

2.4.3 Other

The River Dee, approximately 500m from the site, is listed as a Site of Special Scientific Interest (SSSI) and Special Area of Conservation.

2.4.4 Receptor Risk

If nitric acid were to escape containment, there is a possibility of contamination of local water courses. However, receiving watercourses would significantly dilute any contamination meaning the effect on the receptor would be negligible. Groundwaters beneath the site would also significantly dilute the emission from the site.
Given the River Dee's SSSI and special area of conservation status, the risk rating has been deemed higher than that of a receptor without such status. Therefore, the receptor risk rating is **medium**.

2.5 Site Hazard Rating

C736 Box 2.1 provides a suggested means of combining the source, pathway and receptor hazard ratings to give the overall site hazard rating, this methodology is summarised below;

POSSIBLE COMBINATION OF RATINGS	SUGGESTED OVERALL SITE HAZARD RATING
HHH or HHM or HMM	HIGH
HHL or MMM or HML	MODERATE
MML or HLL or MLL or LLL	LOW

2.5.1 Site Hazard Rating Calculation

Table 2: Site Hazard Rating

Inventory	Source Risk	Pathway Risk	Receptor Risk	Site Hazard Rating
Nitric Acid	M	M	M	M

Following this guidance results in a **moderate** site hazard rating for the nitric acid storage at the facility.

2.6 Site Risk Rating

The site hazard rating is combined with the likelihood of an event leading to the release of inventory to provide the overall site risk rating. C736 Table 2.3 provides a suggested means of correlating the risk of a loss of containment with the annual probability of loss of containment at sites based on the likely frequency of loss of containment.

2.6.1 Storage Tank Risk

The storage tank is a new build constructed of stainless steel and has undergone suitable design and factory acceptance testing to ensure it is fit for purpose. As such any defect in the structure of the tank leading to loss of containment is considered to be an extremely remote possibility. Complete structural failure (spontaneous collapse) is not considered to be credible scenario as long as manufacturer recommended inspection and maintenance is completed throughout the tanks working life.
A Safety Instrumented System (SIS) will be installed to ensure the safe operation of the nitric acid storage tank when filling from a road tanker and when discharging to the production mixing vessel. A Siemens Safety PLC S7-1500F and two unified HMI panels will be installed to control the storage, vehicle delivery and transfer of nitric acid.
The storage tank will be fitted with a high-level switch, low level switch, radar level transmitter and a temperature sensor.

Nitric acid will only be purchased from approved suppliers, all of whom will have had to demonstrate their compliance with basic minimum legal requirements for the transport of chemicals of this nature and will have also had to demonstrate that they operate their own health, safety and environment risk management procedures. Tankers used to transport bulk chemicals such as nitric acid are therefore of high quality and operated by well trained drivers following predetermined procedures design to limit the risk of spills and other health and safety incidents. However, this is manual operation and therefore accidents are not impossible.
Incidents arising from tank filling, maintenance and inspection however do increase the risk of minor spillages occurring. Therefore, the risk of loss of containment is considered to be **Medium** for the supply and storage of nitric acid.

2.6.2 Site Risk Rating Calculation

The C736 guide at Box 2.2 details that for an overall site risk rating the site hazard rating and the risk of loss of containment is assessed as follows:

POSSIBLE COMBINATION OF RATINGS	SUGGESTED OVERALL SITE HAZARD RATING
HH or HM or MM	HIGH
MM or HL or LH	MODERATE
LL or ML or LM	LOW

Therefore, for the FMC Agro facility, the following site risk rating assessments are made;

Table 3: Site Risk Rating

Inventory	Containment System Element	Risk of Loss of Containment	Site Hazard Rating	Site Risk Rating
Nitric Acid	Storage Tank	Medium	Medium	Moderate

2.7 Containment Classification

Section 2.6 of the CIRIA C736 guidance goes on to state the following;

- **Low** overall site risk containment type class 1, i.e. base level of integrity;
- **Moderate** overall site risk containment type class 2, i.e. intermediate degree of integrity; and
- **High** overall site risk containment type class 3, i.e. highest degree of integrity.

2.7.1 Containment Classicisation Calculation

At the FMC Agro facility, the following containment classifications are calculated:

Table 4: Containment Classicisation Calculation

Inventory	Containment System Element	Site Risk Rating	Containment Classification
Nitric Acid	Nitric Acid	Moderate	Class 2

2.8 Calculation of Containment Volume

The volume of secondary containment to be supplied is calculated with reference to C736 Section 4.3, this should consider:

- Volume of spilled inventory;

- Rainfall; 24 hour 10% Annual Exceedance Probability (AEP)[3] storm preceding the event, during the event and an 8 day period following the event (total 10 day 10% AEP Event); and
- Firefighting Water.

2.8.1 Volume of Spilled Inventory

The volume of spilled inventory based on the credible scenarios discussed above is 26m^3.

2.8.2 Rainfall

Rainfall amounts have been obtained from the Flood Estimation Handbook Web Service[4]. Both the 10% (1 in 10) AEP and the 100% (1 in 1) rainfall depths have been obtained for comparison. A 10-day duration assessment period is often selected to account for rainfall prior to, during and in the aftermath of a loss of containment event.

However, in the situation at the FMC Agro facility there are automated arrangements to maintain the bund free from rainwater and the site benefits from pre-existing arrangements with effluent tankering and disposal companies as part of thier responsibilities as a COMAH site, so removal and disposal of any spilt material could be undertaken quickly should an emergency occur. Because of this a reduced period of 8 days has been selected for the duration of an 'incident', this acknowledges the facilities ability to respond quickly to any rainfall and spill event but also conservatively assumes such an event could take place over a prolonged holiday period such as the Christmas break where tankering may be more difficult to arrange at short notice.

Table 5: FEH Handbook Rainfall Figures for FMC Agro Ltd Facility

Event Duration	Rainfall Depth (mm)	
	100% (1 in 1) AEP	10% (1 in 10) AEP
1 hour	9.71	22.62
1 day	30.12	52.86
2 day	36.00	62.1
3 day	40.91	69.13
4 day	45.44	75.45
5 day	49.82	81.75
6 day	54.11	88
7 day	58.36	94.28
8 day	62.62	100.66
10 day	71.09	113.68

For the FMC Agro facility the following rainfall values have been used:

- 8-day 100% AEP event: 62.62mm; and
- 8-day 10% AEP event: 100.66mm.

The catchment areas over which these rainfall values have been calculated is as follows;

- The total area of the storage tank bund has been calculated at 37.92m^2;

[3] AEP: The chance or probability of a natural hazard event (usually a rainfall or flooding event) occurring annually and is usually expressed as a percentage. Bigger rainfall events occur (are exceeded) less often and will therefore have a lesser annual probability.

[4] https://fehweb.ceh.ac.uk/

2.8.3 Firefighting Water

Fire involving the inventory stored in the tank is not possible, as it is non-flammable. Therefore, no allowance for firewater has been made.

2.8.4 Containment Volume Requirement for the Bund

Presented below in Table 6 are calculations of current and required bund volumes based on the historic 110% capacity 'rule' and also on the CIRIA C736 based calculation of inventory, plus rainfall.

SLR have presented CIRIA C736 compliant calculations for both 100% and 10% AEP rainfall events.

This work indicates the following:

Current Bund Configuration

- The bund is sufficient to provide 110% of the volume of the failed tank; and
- The bund is sufficient to provide secondary containment volumes calculated as required by CIRIA C736 (lost inventory, plus 8-day 10% AEP rainfall event plus 250mm freeboard) for a single failed tank.

Table 6: Bund Volume Requirement Calculation

Item	Volume (m^3)	Gross Bund Volume as % of Tank Volume	Inventory plus Rainfall		Remaining Capacity in Bund (m^3)		Freeboard implied (m)	
			8 Day 100% AEP Event (2.37m^3 rainfall)	8 Day 10% AEP Event (3.82m^3 rainfall)	8 Day 100% AEP Event	8 Day 10% AEP Event	8 Day 100% AEP Event	8 Day 10% AEP Event
Single Tank	26	160%	28.37	29.82	13.33	11.88	0.35	0.31
Gross Bund Volume	41.7	-	-	-	-	-	-	-

Note :
- Complies with relevant guidance
- Does not comply with relevant guidance

3.0 Gap Analysis

As set out in Table 4, Class 2 secondary containment should be provided for the nitric acid storage tank. Class 2 containment should also be provided for the tanker loading area that serves both the tank and any associated pipework.

It is noted that a suitably sized local secondary containment bund, constructed from reinforced concrete design to meet the requirements of EN 1992-3:2006 has been installed (see design details in Appendix A). It is also noted that the bund has recently been tested for watertightness and passed its water tightness test (see Appendix B).

Reliance is also placed on the tertiary containment and surface water (and/or spills) management procedures at the site to provide tertiary containment for tankering operations, pipelines and any other potential losses from the local secondary containment systems (for example jetting). From the information presented below it is clear that even were a full loss of primary containment (from either a tanker or the nitric acid storage tank) to take place (a highly unlikely event) the tertiary containment system has more than sufficient volume to contain the spill and allow an 8-day 10% AEP rainfall event prior to any clean up activities taking place with containment still being maintained.

- Maximum inventory volume = 26m^3 (see Table 6);
- Area of hardstanding = 11,400m^3 (see Figure 2);
- 8-day 10% AEP Event Rainfall Volume (using 100.66mm, see Table 5) = 1,147.5m^3
- Total storage volume required = 1,173.5m^3
- Total storage volume available = 1,400m^3 (see Section 1.1)
- Tertiary storage volume in excess of requirement = 226m^3

The following Section presents a gap analysis against C736 for the proposed secondary containment measures provided within the Facility based on the information presented in the foregoing report and its appendices.

Compliance against the guidance for Class 2 containment is reported for the assessment against the key design requirements as follows:

Category	Compliance Assessment
R	Non-compliant
A	Partial compliance, requires further assessment or recommended action to maintain compliance8
G	Compliant
	Not applicable
Note:	Any recommend action is highlighted in **bold**.

Table 7: Gap Analyss of Secondary and Tertiary Containment for Nitirc Acid Facilites Against CIRIA C736 Design Elements

Design Issue	Comments	Observations / Comments	RAG
C736 Chapter 4 Containment system capacity			
Fire duration	All classes	Not applicable as inventory is non-flammable material.	G
Local secondary containment	All classes	Local secondary containment of a suitable quality for class 2 bunding is provided for the storage tank itself. Suitable tertiary containment is provided for tanker loading and pipework associated with main nitric acid tank. Both secondary and tertiary containment are assessed to provide adequate storage volumes, including a reasonable allowance for rainfall generation.	G
Site-wide capacity	All classes	Should inventory escape the tank and bund, sufficient tertiary containment capacity is provided of a suitable standard, assuming any joints, cracks or other defects in the surfacing are repaired and maintained on a routine basis. **Recommend that routine yard hardstanding surface inspection and maintenance is continued.**	A
C736 Chapter 6 Introduction to bunds			
Height of wall	All classes	Bund wall height is sufficient to deliver required containment volume and is below 1.5m height and therefore do not create a confined space.	G
Freeboard	All classes	Sufficient freeboard is provided in the local secondary containment bund, this varying between 0.31m and 0.35m depending on rainfall scenario considered, this is versus the minimum requirement of 0.25m to account for wave action, surge, uncertainty etc.	G
Proximity to bund wall	Only a consideration for class 2 and class 3	The bund wall is within the toppling distance of the tank. However, the tank is constructed from suitably robust materials and designed to appropriate standards, including an assessment of stability for the base engineering. Therefore, toppling or spontaneous total collapse is not deemed to be a credible failure scenario, as long as the tank is maintained and inspected as per manufacturer recommendation. **Recommend that a suitable tank inspection and maintenance regime is implemented after installation, with reference to manufacturers recommendations**.	A
Jetting	Only a consideration for class 2 and class 3	The nitric acid tank height is 3.7m with a bund wall height of 1.1m, this means the bund wall should be at least 2.6m from the tank. At its closest the bund wall is 1.2m from the tank, so it is possible for the tank to jet over the bund wall. Whilst this is a highly unlikely event given the quality of the primary storage vessel itself, and any jet would be quickly noted due to the tank level instrumentation and visual	G

Design Issue	Comments	Observations / Comments	RAG
		checks, and actioned by site staff, the bund is located in a significant area of tertiary containment. Therefore, any jet over the bund wall will be adequately contained within tertiary containment.	
Leakage detection from primary containment vessel	Only a consideration for class 3 where primary containment vessel rests on bund floor	Not applicable to class 2 containment. However, in any case, leaks are detectable (visual inspection) from the primary tank as it is raised off the bund floor on footings.	G
Drainage from bunds	No provision for gravity drainage should be made for class 2 and class 3	Pumped removal of bund content only, no gravity drainage installed.	G
Pipework	No penetration of the bund wall should be permitted for class 2 and class 3	All pipework enters and leaves the bund ‘up and over’ bund walls, no penetrations are included in the design.	G
Impermeability testing	Leak testing of all joints and penetrations upon completion of construction works a requirement of class 2 and class 3	The bund has passed a hydrostatic water test (see Appendix B).	G
Structural independence	All classes although integrally bunded tanks may be suitable for class 1	The tank is structurally independent of the containment bund.	G
C736 Chapter 7 In situ reinforced concrete and masonry bunds			
Competence	Design and construction should be completed by competent personnel	Reinforced concrete designs have been completed by a suitably competent design company.	G
In situ reinforced concrete bunds	Design EN 1992-3:2006 as liquid containing and retaining structure	The concrete bund is designed to EN 1992-3:2006.	G

Design Issue	Comments	Observations / Comments	RAG
Joints	Waterbars to be installed in expansions and contraction joints and be resistant to attack by inventory and fire resistant where flammable inventory is stored	Waterbars installed as per the requirement of EN 1992-3:2006. The inner faces of the bund have been provided with a Vinylester VE55 coating, designed to provide chemical resistance to acids and to be able to be applied and adhere to concrete surfaces (see for example ACCS Ltd - Novolac/Epoxy/Vinylester Materials).	G
Kicker joints	Waterbars installed in kicker joints for class 2 and class 3	Waterbars installed to kicker joints as per the requirement of EN 1992-3:2006.	G
Reinforced masonry bunds	Only suitable for class 1 and where inventory is not flammable	Bund is of reinforced concrete, not masonry	G
C736 Chapter 8 Earth banked containment basins (lagoons), earth bunds and earth floors			
Competence	Design and construction should be completed by competent personnel	N/A	
Site investigation	Detailed site investigation required for all classes to BS EN 1997-2:2007	N/A	
Design	Design to be in accordance with BS EN 1997-1:2004	N/A	
Maximum permeability of soils used for earth embankment construction	1 x 10^{-9} ms^{-1}	N/A	

Design Issue	Comments	Observations / Comments	RAG
Earth floors to bunds and lagoons	Equivalent of 1 m depth of soil with a maximum permeability of 1 x 10^{-9} ms^{-1}	N/A	
Liner	Required for class 2 and class 3 unless a significant depth of *in situ* low permeability soil is present in which case this may be relaxed in consultation with the regulator	N/A	
Leak detection	Required for class 3 unless a significant depth of *in situ* low permeability soil is present in which case this may be relaxed in consultation with the regulator	N/A	
C736 Chapter 9 Containment tanks (see also Tables 9.1 and 9.2)			
Leak detection	For class 3 leakage detection where tank rests directly on the ground	N/A	
C736 Chapter 10 Transfer systems (see also Table 10.1)			
Catchment surfacing	Resistant to inventory and fire plus additional redundancy for higher classes	The yard area could be considered to be a transfer system. Floor slabs are concrete to a suitable standard and are resistant to inventory for short to medium term contact (days rather than years) as would be anticipated. Not designed to full water retaining standards but adequate for Class 2 'emergency' use. No requirement for fire assessment as no flammable inventory.	**G**
Catchment construction	Number of options available including soils, paving, concrete slabs and asphalt and	The yard area could be considered to be a transfer system. Reinforced concrete is a suitable material of construction.	**G**

Design Issue	Comments	Observations / Comments	RAG
	dense bitumen macadam		
Transfer system capacity	Designed to cater for flows arising from a credible scenario	The yard area could be considered to be a transfer system. The yards (and associated sump area0 capacity to hold the maximum spilled inventory volume plus rainfall generated over an 8 day 10% AEP storm event is demonstrated in Section 3.0 above).	G

4.0 Conclusions and Recommendations

The nitric acid storage facility has been designed and constructed to appropriate and currently applicable standards and guidance. The volume of secondary and tertiary containment provided is adequate for the storage of spilt inventory along with a suitable allowance for rainfall.

4.1 Conclusions

The nitric acid storage facilities provided at the FMC site at Pentre is assessed as representing Best Practice for the storage and transfer of nitric acid as it has been designed in compliance with the CIRIA C736 guidance.

4.2 Recommendations

A number of minor recommendations are made to ensure that the facility remains in a condition that allows on-going compliance with the CIRIA C736 guidance.

Table 8: Recommended Actions

Item	Description
1	Routine yard hardstanding surface inspection and maintenance is continued
2	A suitable tank inspection and maintenance regime is implemented after installation, with reference to manufacturers recommendations.
3	A CIRIA C736 compliant containment inspection regime is introduced at the site.

5.0 Closure

Regards,

SLR Consulting Limited

Danny Jones, MSc, BSc, MCIWM
Technical Director, Process Engineering

Richard Coldicott, BSc, CWRM
Associate Process Engineer

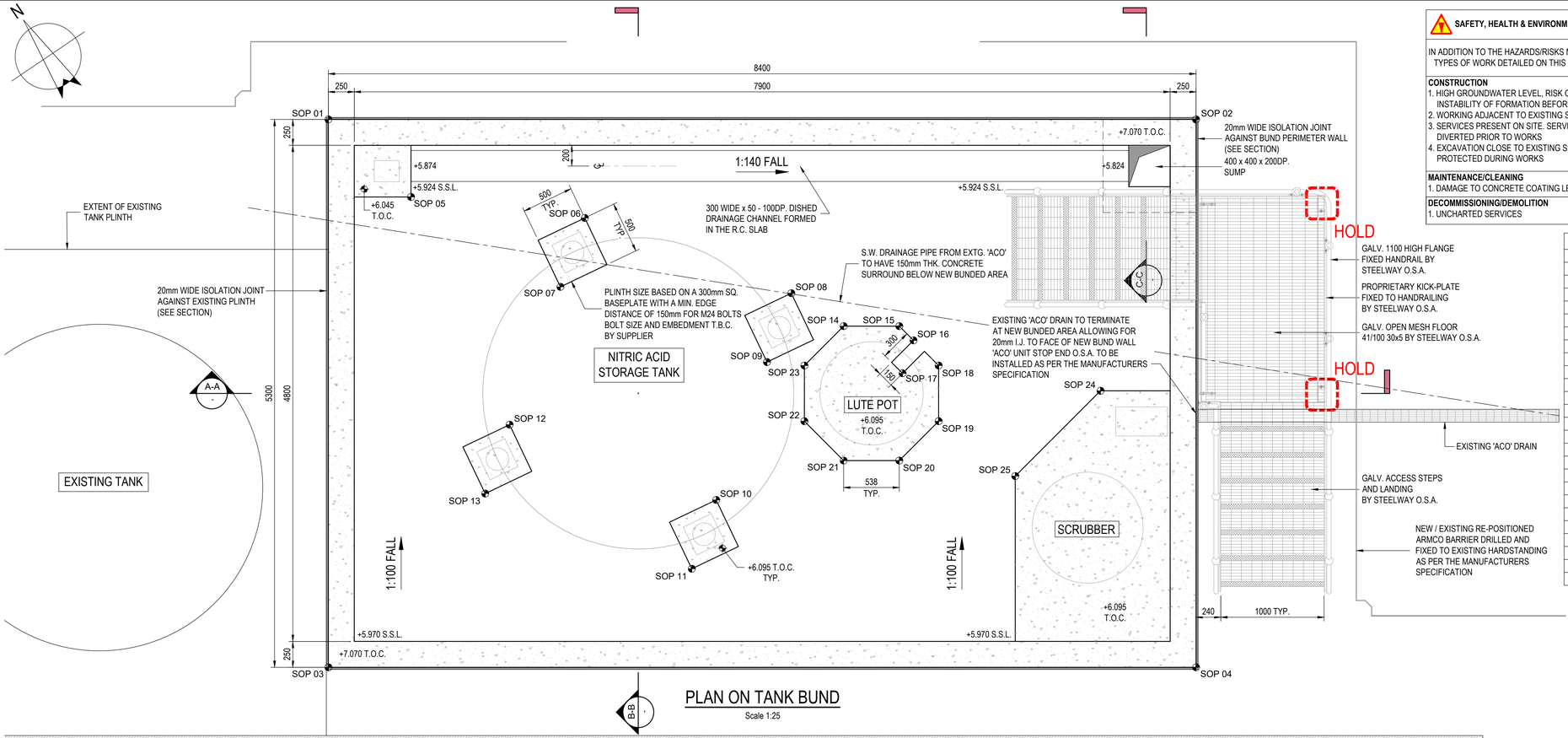
Appendix A Bund Design Details

CIRIA 736 Risk Assessment

FMC Agro Ltd

SLR Project No.: 410.065838.00001

31 May 2024



PLAN ON TANK BUND
Scale 1:25

SAFETY, HEALTH & ENVIRONMENTAL (SHE) INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLOWING:

CONSTRUCTION
1. HIGH GROUNDWATER LEVEL, RISK OF GROUNDWATER INGRESS AND INSTABILITY OF FORMATION BEFORE BASE IS CAST
2. WORKING ADJACENT TO EXISTING STRUCTURES
3. SERVICES PRESENT ON SITE. SERVICES TO BE LOCATED AND DIVERTED PRIOR TO WORKS
4. EXCAVATION CLOSE TO EXISTING SERVICES TO BE MADE SAFE AND PROTECTED DURING WORKS

MAINTENANCE/CLEANING
1. DAMAGE TO CONCRETE COATING LEADING TO CONCRETE DAMAGE

DECOMMISSIONING/DEMOLITION
1. UNCHARTED SERVICES

SETTING-OUT POINTS (m)

SOP	Easting (m)	Northing (m)
SOP 01	332966.221	367536.376
SOP 02	332973.183	367531.676
SOP 03	332963.255	367531.984
SOP 04	332970.217	367527.283
SOP 05	332966.464	367535.307
SOP 06	332967.745	367534.198
SOP 07	332967.176	367533.777
SOP 08	332968.995	367532.476
SOP 09	332968.427	367532.055
SOP 10	332967.273	367531.225
SOP 11	332966.704	367530.805
SOP 12	332966.023	367532.948
SOP 13	332965.454	367532.527
SOP 14	332969.237	367531.927
SOP 15	332969.683	367531.626
SOP 16	332969.720	367531.435
SOP 17	332969.454	367531.231
SOP 18	332969.785	367531.097
SOP 19	332969.484	367530.651
SOP 20	332968.955	367530.548
SOP 21	332968.509	367530.850
SOP 22	332968.407	367531.378
SOP 23	332968.708	367531.825
SOP 24	332970.947	367530.018
SOP 25	332969.802	367529.796

NOTES:

GENERAL:

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL DIMENSIONS ARE IN MILLIMETRES (mm) & ALL LEVELS ARE IN METRES (m) AOD, UNLESS STATED OTHERWISE.
3. ALL DIMENSIONS & LEVELS TO BE CHECKED ON SITE AND ANY DISCREPANCIES SHOULD BE REPORTED TO GHD.
4. THIS DOCUMENT IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT PROJECT STANDARDS AND SPECIFICATIONS.

CONCRETE:

1. CONCRETE PROVIDED IN ACCORDANCE WITH THE REQUIREMENTS OF BS EN 206:2013
2. CONCRETE GRADES PROVIDED IN ACCORDANCE WITH THE RECOMMENDATIONS OF BS8500-1:2015 :-

STRUCTURAL CONCRETE
a.COMPRESSIVE STRENGTH CLASS - C35/45
b.DESIGN CHEMICAL CLASS (DC-CLASS) - DC-2
c.MAXIMUM WATER CEMENT RATIO - 0.5
d.MINIMUM CEMENT CONTENT - 340 kg/m3
e. ALLOWABLE CEMENT COMBINATION TYPES - CEM1
f. AGG. CO-EFFICIENT OF THERMAL EXPANSION - 12
g. MAX AGGREGATE SIZE - 20mm

BENCHING/BLINDING
CONCRETE DESIGNATION - GEN3

CONCRETE ROADS/PATHS
CONCRETE DESIGNATION - PAV2

THE CONTRACTOR SHOULD PROPOSE CONCRETE CONSISTENCE CLASS FOR REVIEW BY GHD.

CONCRETE MIX DESIGNS SHOULD BE PROVIDED BY THE SUPPLIER FOR REVIEW BY GHD.

3. ALL EXPOSED VERTICAL AND HORIZONTAL ARRISES FINISHED WITH A 25 x 25mm CHAMFER, EXTENDING TO 150mm BELOW FINISHED GROUND LEVEL, EXCEPT FOR:
- WEIR TOPS
- STAIR NOSINGS
- HORIZONTAL ARISE ABUTTING FLOORING, COVERS OR STAIR HEADS
- WHERE THE CONCRETE FORMS A STEP ON AN ACCESS ROUTE.

4. SURFACES EXPOSED IN THE COMPLETED WORKS SHALL RECEIVE A FAIR WORKED FINISH. ALL OTHER STRUCTURAL CONCRETE SURFACES SHALL RECEIVE A FAIR FINISH.
5. UNLESS SHOWN OTHERWISE ON THE DRAWINGS, NOMINAL COVER SHALL BE:
a. 50mm SLAB AND WALLS.
6. ALL REINFORCEMENT HAS A MINIMUM LAP OF 53 x DIA OF SMALLER BAR IN LAP.
7. REMOVAL OF FORMWORK:

MINIMUM CONCRETE STRENGTH GAIN OF 10N/mm² TO BE ACHIEVED PRIOR TO STRIKING FORMWORK. TEST CUBE RESULTS REQUIRED TO DEMONSTRATE STRENGTH GAIN HAS BEEN ACHIEVED.

8. CONCRETE CONSTRUCTION SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE RECOMMENDATIONS OF BS EN 13670:2009 EXECUTION OF CONCRETE STRUCTURES.

FOUNDATIONS:

1. FOUNDATIONS BLINDED IMMEDIATELY FOLLOWING APPROVAL OF FORMATION TO PREVENT SOFENING OF SUBGRADE.
2. ANY SOFT SOPTS, HARD SPOTS OR DELITERIOUS MATERIAL MUST BE REMOVED AND REPLACED WITH COMPACTED CLASS 6N or 7A SELECTED FILL.
3. FOUNDATIONS ASSUMED TO BE FOUMED ON FINE AND MEDIUM SAND. FORMATION TO BE INSPECTED BY A SUITABLE QUALIFIED ENGINEER. IF BEARING STRATA NOT EXPOSED AT FORMATION LEVEL STATED CONTACT GHD.
4. MASS CONCRETE FOUNDATIONS TO BE CAST MONOLITHICALLY.
5. PLATE BEARING TEST TO BE UNDERTAKEN AT FORMATION LEVEL TO CONFIRM SUITABLE GROUND BEARING CAPACITY A MINIMUM OF 6 No. TESTS ARE TO BE UNDERTAKEN, EAUALLY SPACED VOER THE FULL BUILDING FOOTPRINT. SHOULD SIGNIFICANT DECREPANCIES ARISE BETWEEN THE FIRST TESTES, ADDITIONAL TESTING MAY BE REQUIRED. ALL TEST RESULTS & LOCATIONS OF TESTS TO BE PRESENTED TO GHD FOR REVIEW.
6. HAND SHEAR VANE TESTS TO BE UNDERTAKEN AT FORMATION LEVEL TO CONFIRM UNDRAINED SHEAR STRENGTH. TESTING LOCATIONS ARE TO BE UNDERTAKEN ON A MIXIMUM 10 x 10m GRID OVER THE FULL BUILDING FOOTPRINT. PRIOR TO TESTING, FORMATION TO BE INSPECTED BY SUITABLY QUALIFIED ENGINEER AND GRID SIZE ADJUSTED IF REQUIRED. A MINIMUM OF 3 No. TESTS SHOULD BE UNDERTAKEN AT EACH LOCATION. ALL TEST RESULTS & LOCATIONS OF TESTS TO BE PRESENTED TO GHD FOR REVIEW.

FINISHES:

1. PRIMER - 1 x 1mm AC95 COATING.
2. SCREED - 10 - 25mm EPITEK SCREED (WITH A COARSE SCATTER APPLIED WHILST WET FOR KEY TO NEXT LAYER).
3. TOP COATING - 2 x 1mm VE55 WITH A GLASS MATT OR VEIL INTERMEDIATE LAYER, FOLLOWED BY A COARSE SCATTER WHILST WET FOR A NON-SLIP SURFACE.

PIPEWORK CONCRETE SURROUND

1. WHERE PIPES WITH FLEXIBLE JOINTS ARE USED THE CONCRETE PROTECTION INTERRUPTED OVER ITS FULL CROSS SECTION AT EACHJOINT BY A SHAPED COMPRESSIBLE FILLER.
2. COMPRESSIBLE FILLER IN ACCORDANCE WITH STW ENGINEERING SPECIFICATION v5.3 CLAUSE 2.19.
3. ALL CONCRETE PROTECTION TO PIPEWORK CONSTRUCTED IN ACCORDANCE WITH STW ENGINEERING SPECIFICATION v5.3 CLAUSE 5.3.
4. THE TOP FACE OF PRECAST CONCRETE SETTING BLOCKS COVERED WITH TWO LAYERS OF COMPRESSIBLE PACKING IN ACCORDANCE WITH THE STW ENGINEERING SPECIFICATION v5.3 CLAUSE 2.19.

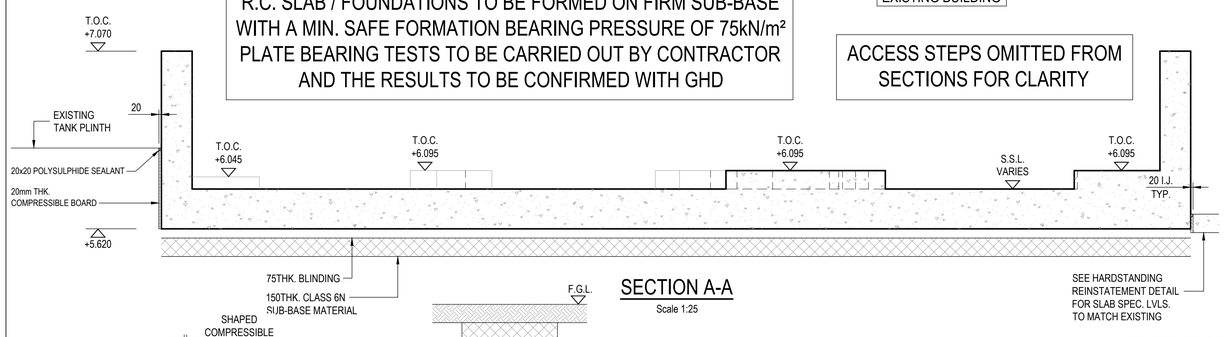
HOLDS: 1. LANDING SUPPORT POST FOUNDATIONS.

R.C. SLAB / FOUNDATIONS TO BE FORMED ON FIRM SUB-BASE WITH A MIN. SAFE FORMATION BEARING PRESSURE OF 75kN/m² PLATE BEARING TESTS TO BE CARRIED OUT BY CONTRACTOR AND THE RESULTS TO BE CONFIRMED WITH GHD

EXISTING BUILDING

ACCESS STEPS OMITTED FROM SECTIONS FOR CLARITY

PROCESS AND MECHANICAL H.D. BOLT FIXING DETAILS SUPPLIED BY OTHERS
TANK SUPPORT LEG H.D. BOLTS TO BE MIN. 24Ø WITH 150mm MIN. CONCRETE EDGE DISTANCE



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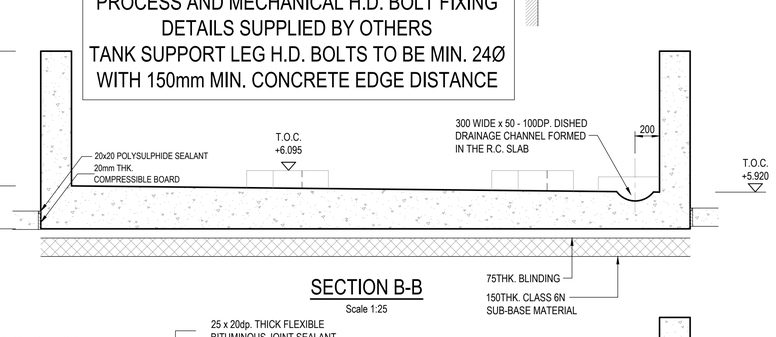

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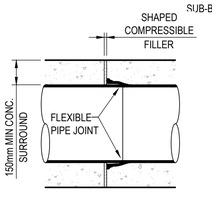
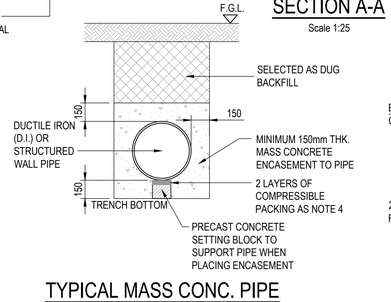
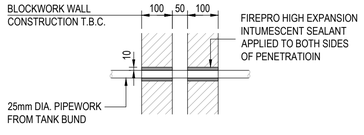


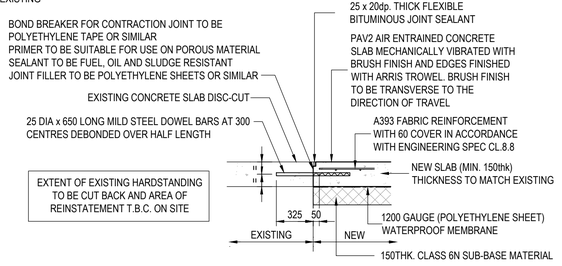
TYPICAL DUCTILE IRON & STRUCTURED WALL PIPEWORK MASS CONC. SURROUND JOINT DETAIL



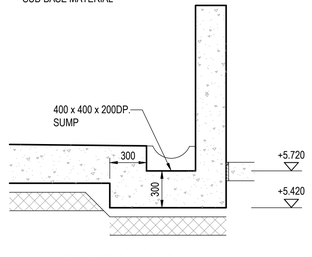
TYPICAL MASS CONC. PIPE SURROUND DETAIL
(REFER TO JOINT DETAIL WHERE APPLICABLE)



PIPE PENETRATION DETAIL THRU' EXISTING WALL
Scale 1:10



TYPICAL HARDSTANDING REINSTATEMENT DETAIL
Scale 1:25



SECTION C-C
Scale 1:25

Rev	Description	Checked	Approved	Date
C01	ISSUED FOR CONSTRUCTION	JL	MS	10.11.23
P01	PRELIMINARY ISSUE	JL	MS	01.09.23

Author RP **Drafting Check** AR / JL
Designer AR **Design Check** JL

0 10 20 30 40 50mm
SCALE 1:1 AT ORIGINAL SIZE

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Project No. 12610567

Client FMC AGRO
Project FMC TANK FARM UPGRADE
Status CONSTRUCTION
Status Code

Drawing Title NITRIC STORAGE TANK BUND GENERAL ARRANGEMENT
Size A1
Drawing No. 12610567-GHD-DRG-CI-00001
Rev C01

Plot Date: 10 November 2023 - 12:40 PM Plotted by: Rob Parker
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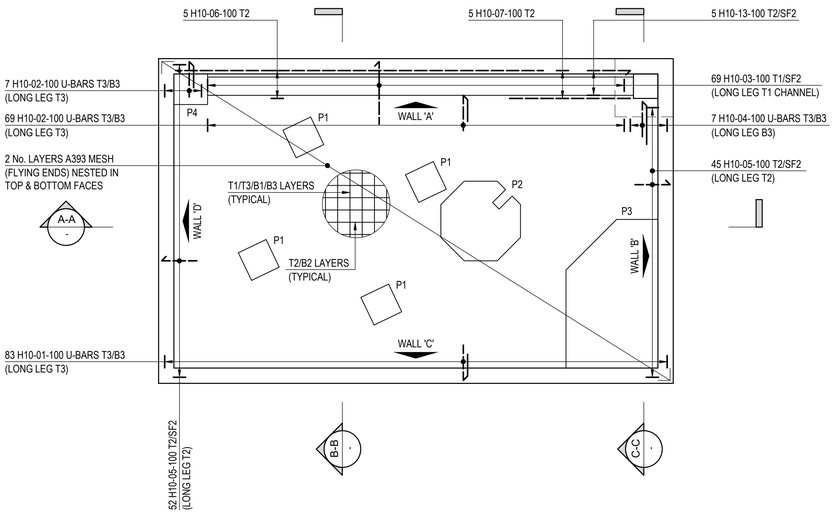

PLAN ON TANK BUND BASE SLAB REINFORCEMENT

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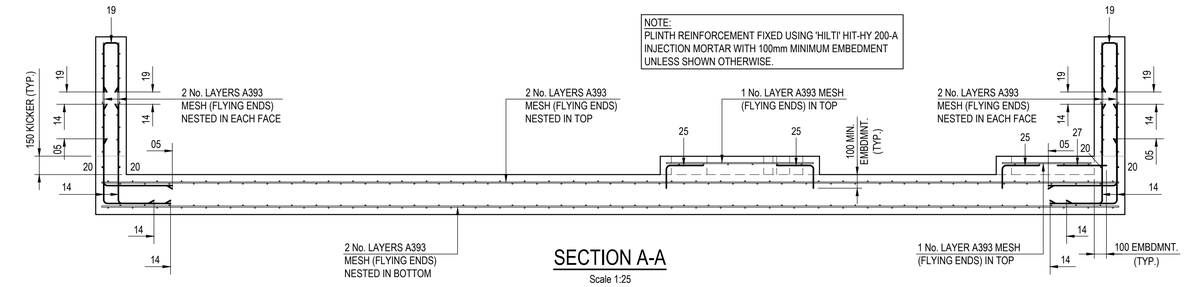

SECTION A-A

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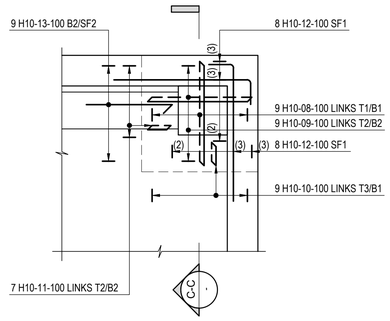
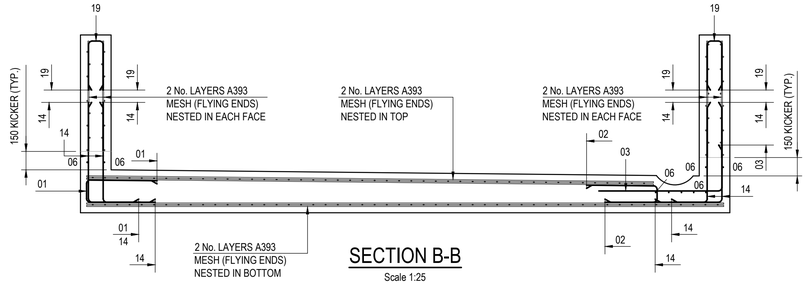


PLAN ON TANK BUND BASE SLAB SUMP REINFORCEMENT

Scale 1:25



SECTION B-B

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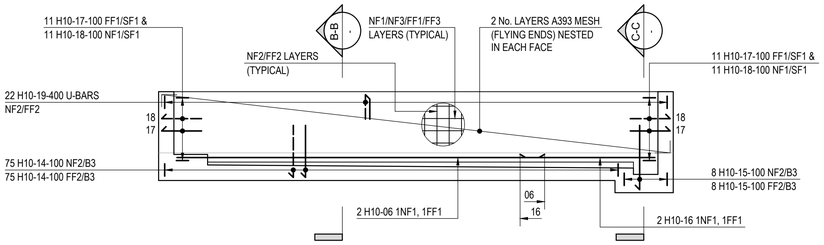
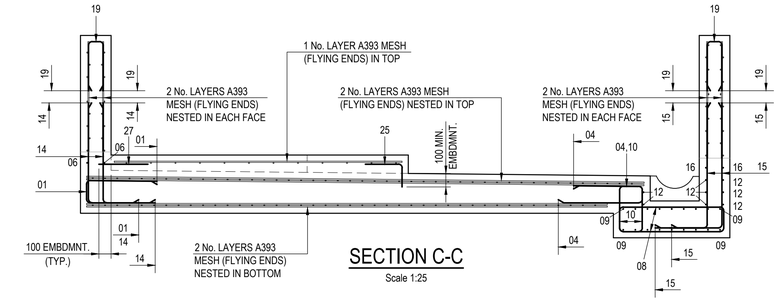


ELEVATION ON WALL 'A' REINFORCEMENT

Scale 1:50



SECTION C-C

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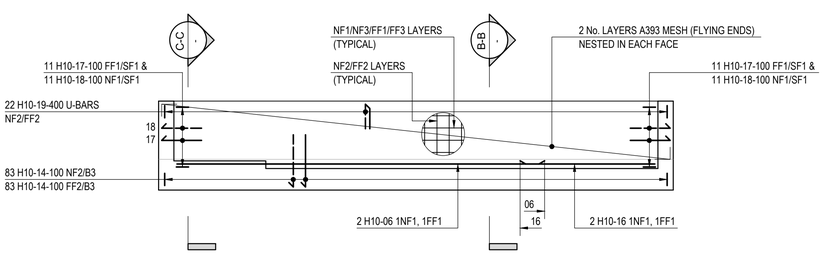

ELEVATION ON WALL 'C' REINFORCEMENT

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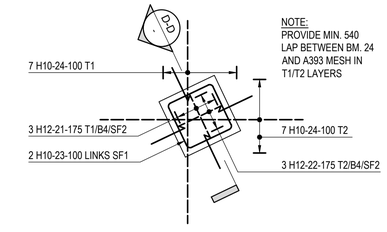
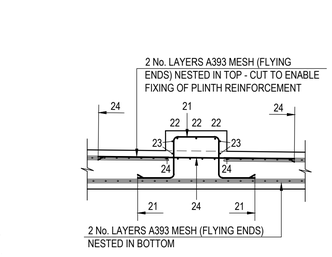


PLAN ON PLINTH TYPE P1 REINFORCEMENT (4 No. THUS)

Scale 1:25



SECTION D-D

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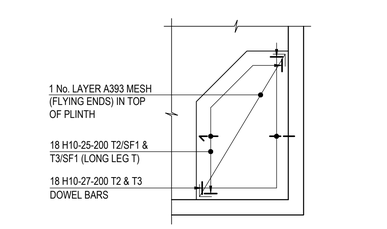

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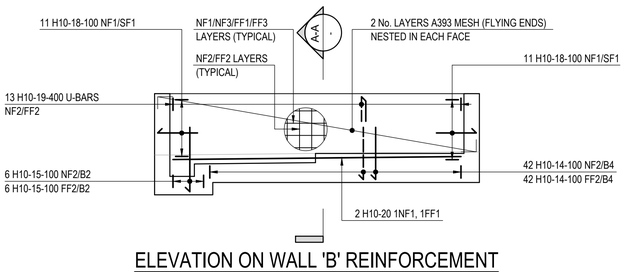
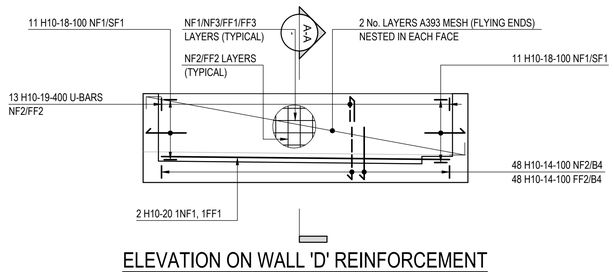


ELEVATION ON WALL 'B' REINFORCEMENT

Scale 1:50



ELEVATION ON WALL 'D' REINFORCEMENT

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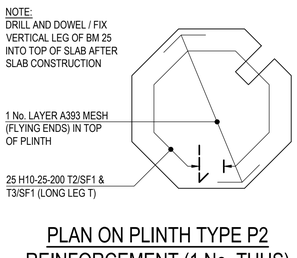

PLAN ON PLINTH TYPE P2 REINFORCEMENT (1 No. THUS)

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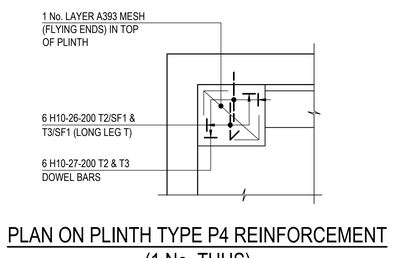

PLAN ON PLINTH TYPE P4 REINFORCEMENT (1 No. THUS)

Scale 1:25

NOTES:

1. FOR GENERAL ARRANGEMENT AND NOTES SEE DRAWING No. 12610567-GHD-DRG-CI-00001.
2. BAR REINFORCEMENT GRADE 500 TYPE H TO BS 4449: 2001 CUT AND BENT TO BS 8666: 2020 UNLESS NOTED OTHERWISE.
3. COVER TO REINFORCEMENT 50mm ALL FACES U.N.O.
4. FOR REINFORCEMENT LAPS AND ANCHORAGES SEE TABLE BELOW.
5. ALL REINFORCEMENT SHOWN ON THIS DRAWING IS LISTED ON BAR BENDING SCHEDULE No. 12610567-GHD-SCH-CI-00002.
6. CONTRACTOR TO PROVIDE ADEQUATE SPACERS TO SUPPORT THE REINFORCEMENT DURING CONSTRUCTION AND TO CONTROL COVER.
7. CONCRETE GRADE: C35/45.

ABBREVIATIONS

B1 - BOTTOM OUTER LAYER
B2 - BOTTOM SECOND LAYER
B3 - BOTTOM THIRD LAYER
B4 - BOTTOM FOURTH LAYER
T1 - TOP OUTER LAYER
T2 - TOP SECOND LAYER
T3 - TOP THIRD LAYER
T4 - TOP FOURTH LAYER
NF1 - NEAR FACE OUTER LAYER
NF2 - NEAR FACE SECOND LAYER
NF3 - NEAR FACE THIRD LAYER
FF1 - FAR FACE OUTER LAYER
FF2 - FAR FACE SECOND LAYER
FF3 - FAR FACE THIRD LAYER
SF - SIDE FACE

REINFORCEMENT LAP LENGTHS		
BAR DIA. (mm)	GOOD BOND (mm)	POOR BOND (mm)
10	380	540
12	490	700

REINFORCEMENT ANCHORAGE LENGTHS		
BAR DIA. (mm)	GOOD BOND (mm)	POOR BOND (mm)
10	330	470
12	390	560

SAFETY, HEALTH & ENVIRONMENTAL (SHE) INFORMATION

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

CONSTRUCTION

1. CARE TO BE TAKEN ON SITE WHEN HANDLING LONG REINFORCEMENT BARS.
2. ANY PROTRUDING BARS TO HAVE SAFETY CAPS FITTED TO ENDS PRIOR TO NEXT LIFT/POUR/CONNECTION.
3. FORMWORK TO BE STABILIZED PRIOR TO POURING OF CONCRETE.
4. CONTRACTOR TO PROVIDE ADEQUATE SPACERS TO SUPPORT REINFORCEMENT DURING CONSTRUCTION AND TO CONTROL COVER.
5. WORKING ADJACENT TO EXISTING STRUCTURES.

Rev	Description	Checked	Approved	Date
C01	ISSUED FOR CONSTRUCTION	RP	MS	15.11.23

Author AH Drafting Check RP
Designer AR Design Check JL

0 500 1000 1500 2000 2500mm
SCALE 1:50 AT ORIGINAL SIZE

0 250 500 750 1000 1250mm
SCALE 1:25 AT ORIGINAL SIZE

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Project No. 12610567

Client FMC AGRO
Project FMC NITRIC TANK FARM UPGRADE
Status CONSTRUCTION Status Code

Drawing Title NITRIC ACID STORAGE TANK BUND R.C. DETAILS

Size A1

Drawing No. 12610567-GHD-DRG-CI-00002

Rev C01

Plot Date: 15 November 2023 - 2:10 PM Plotted by: Andrew Holmes

File Name: C:\Users\aholmes2\DC\ACCDocs\GHD Services Pty Ltd\12610567 - FMC Nitric Tank Farm\Project Data & Docs\WIP\Civil\Models\AutoCAD\12610567-GHD-DRG-CI-00002.dwg

BAR BENDING SCHEDULE TO BS 8666: 2020

Bending Schedule No : 12610567-GHD-SCH-CI-00002

Drawing No.: 12610567-GHD-DRG-CI-00002

Project : FMC NITRIC TANK FARM UPGRADE | Sheet No.: 1 OF 3 | Revision. : C01

Job No: 12610567 | Date prepared : 15.11.23 | Date revised. :

Structure : NITRIC ACID STORAGE TANK BUND | Prepared by : AH | Revised by. :

Position : R.C. DETAILS | Checked by. : RP | Checked by. :

Member	Bar Mark	Type & size	No. of Mbrs	No. in Each	Total No.	Length	Shape Code	A	B	C	D	E/R	F	Rev.
BASE	01	H 10	1	83	83	1175	21	425	205	575				
SLAB	02	H 10	1	76	76	1125	21	425	155	575				
REINF.	03	H 10	1	69	69	1400	11	375	1025					
	04	H 10	1	7	7	1400	21	575	155	700				
	05	H 10	1	97	97	950	11	375	575					
	06	H 10	1	5	5	6000	00	6000						
	07	H 10	1	5	5	2000	00	2000						
	13	H 10	1	5	5	925	11	200	725					
		213.7 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												
BASE	08	H 10	1	9	9	2250	51	840	195	130	130			
SLAB	09	H 10	1	9	9	2200	51	840	175	130	130			
SUMP	10	H 10	1	9	9	1300	51	375	185	130	130			
REINF.	11	H 10	1	7	7	1100	51	275	185	130	130			
	12	H 10	1	16	16	1325	11	200	1125					
	13	H 10	1	9	9	925	11	200	725					
WALL A	06	H 10	1	2	2	6000	00	6000						
REINF.	14	H 10	1	150	150	1275	11	425	850					
	15	H 10	1	16	16	1475	11	425	1050					
	16	H 10	1	2	2	2250	00	2250						
	17	H 10	1	22	22	1300	11	650	650					
	18	H 10	1	22	22	900	11	250	650					
	19	H 10	1	22	22	900	21	400	125	400				
		40.3 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												

Total Weight: 502 kg

BAR BENDING SCHEDULE TO BS 8666: 2020

Bending Schedule No : 12610567-GHD-SCH-CI-00002

Drawing No.: 12610567-GHD-DRG-CI-00002

Project : FMC NITRIC TANK FARM UPGRADE Sheet No.: 2 OF 3 Revision. : C01

Job No: 12610567 Date prepared : 15.11.23 Date revised. :

Structure : NITRIC ACID STORAGE TANK BUND Prepared by : AH Revised by. :

Position : R.C. DETAILS Checked by. : RP Checked by. :

Member	Bar Mark	Type & size	No. of Mbrs	No. in Each	Total No.	Length	Shape Code	A	B	C	D	E/R	F	Rev.
WALL B	14	H 10	1	84	84	1275	11	425	850					
REINF.	15	H 10	1	12	12	1475	11	425	1050					
	18	H 10	1	22	22	900	11	250	650					
	19	H 10	1	13	13	900	21	400	125	400				
	20	H 10	1	2	2	4725	00	4725						
		24.8 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												
WALL C	06	H 10	1	2	2	6000	00	6000						
REINF.	14	H 10	1	166	166	1275	11	425	850					
	16	H 10	1	2	2	2250	00	2250						
	17	H 10	1	22	22	1300	11	650	650					
	18	H 10	1	22	22	900	11	250	650					
	19	H 10	1	22	22	900	21	400	125	400				
		38.3 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												
WALL D	14	H 10	1	96	96	1275	11	425	850					
REINF.	18	H 10	1	22	22	900	11	250	650					
	19	H 10	1	13	13	900	21	400	125	400				
	20	H 10	1	2	2	4725	00	4725						
		24.8 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												

Total Weight: 385 kg

BAR BENDING SCHEDULE TO BS 8666: 2020

Bending Schedule No : 12610567-GHD-SCH-CI-00002

Drawing No.: 12610567-GHD-DRG-CI-00002

Project : FMC NITRIC TANK FARM UPGRADE | Sheet No.: 3 OF 3 | Revision. : C01

Job No: 12610567 | Date prepared : 15.11.23 | Date revised. :

Structure : NITRIC ACID STORAGE TANK BUND | Prepared by : AH | Revised by. :

Position : R.C. DETAILS | Checked by. : RP | Checked by. :

Member	Bar Mark	Type & size	No. of Mbrs	No. in Each	Total No.	Length	Shape Code	A	B	C	D	E/R	F	Rev.
PLINTH	21	H 12	4	3	12	1575	44	300	340	375	340	300		
TYPE P1	22	H 12	4	3	12	1550	44	300	325	375	325	300		
REINF	23	H 10	4	2	8	1750	51	395	395	130	130			
	24	H 10	4	14	56	1700	00	1700						
PLINTH	25	H 10	1	25	25	500	11	200	300					
TYPE P2														
REINF.		1.6 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												
PLINTH	25	H 10	1	18	18	500	11	200	300					
TYPE P3	27	H 10	1	18	18	400	00	400						
REINF.														
		4.0 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												
PLINTH	26	H 10	1	6	6	475	11	175	300					
TYPE P4	27	H 10	1	6	6	400	00	400						
REINF.														
		0.4 SQUARE METERES A393 MESH (FLYING ENDS) INCLUDING 20% FOR LAPS												

Total Weight: 121 kg

Appendix B Bund Water Tightness Test Record

CIRIA 736 Risk Assessment

FMC Agro Ltd

SLR Project No.: 410.065838.00001

31 May 2024

Nitric Acid Tank: Bund Leak Test Summary

PROJECT	Nitric Acid Tank Replacement
PLANT	Flintshire
EQUIPMENT	BUND
FLINTSHIRE PROJECT NO.	014080
No of days -Bund leak test	5 days
FMC ATTENDEES	Jaishankar Venkatachalam, Sam Worrall, Anton Williams, Steve Guest

Introduction

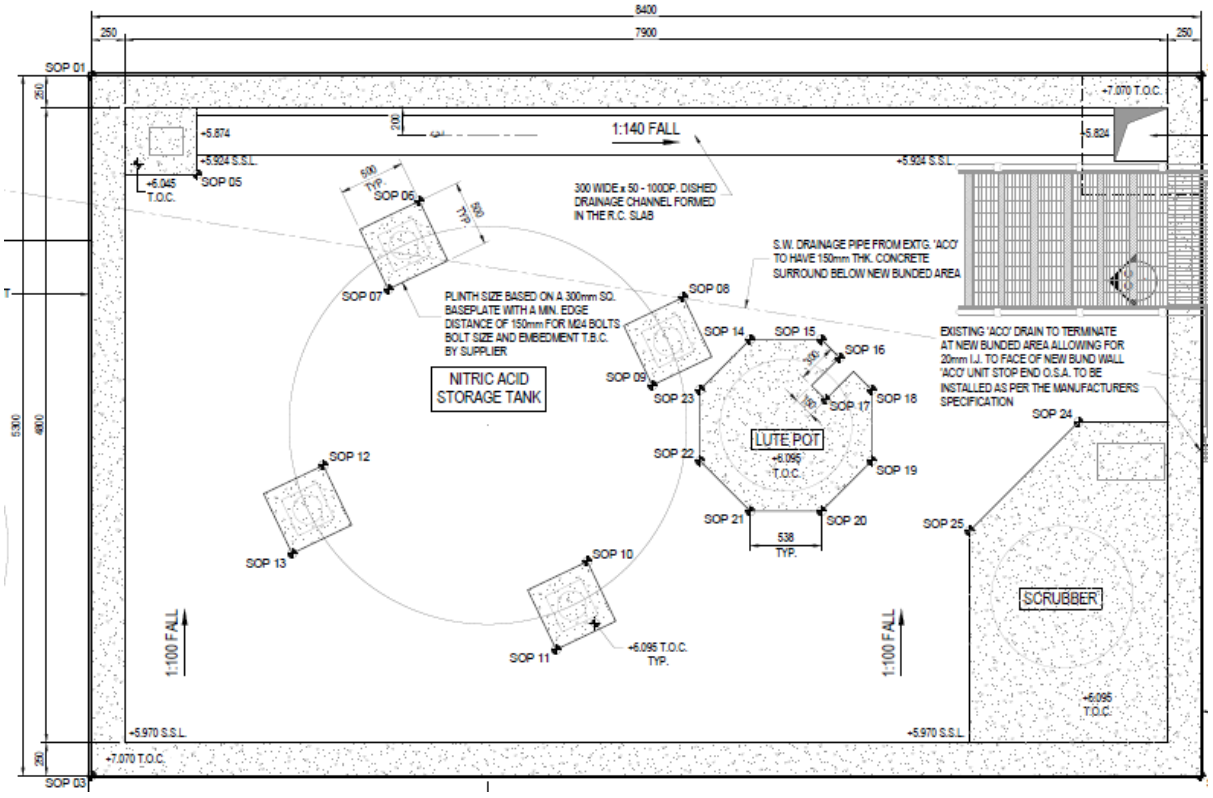
The bund leak test was conducted to Visual inspections and Hydrostatic testing on the new nitric acid bund coated with Vinylester VE55.

Scope of Testing

- Visual inspections — physically inspecting the bund for any visible defects or damage.
- Hydrostatic testing — filling the bund with water to check for leaks.

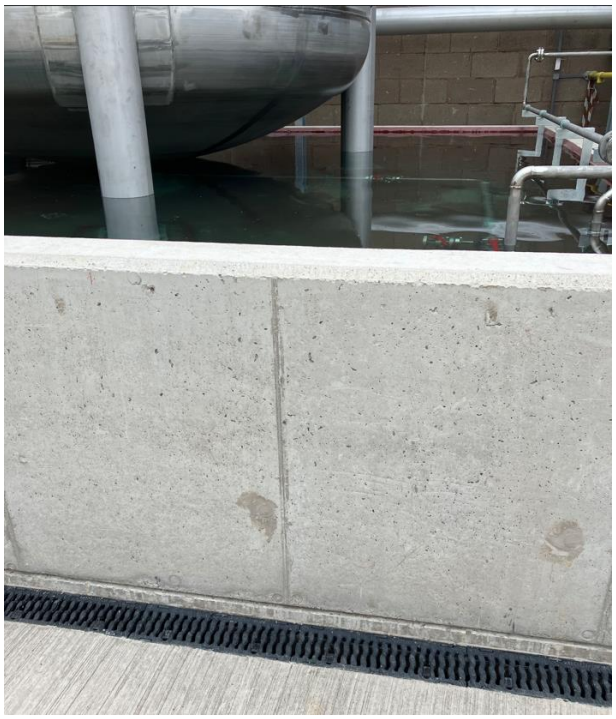
Testing Results

Drawings – Nitric Acid Bund



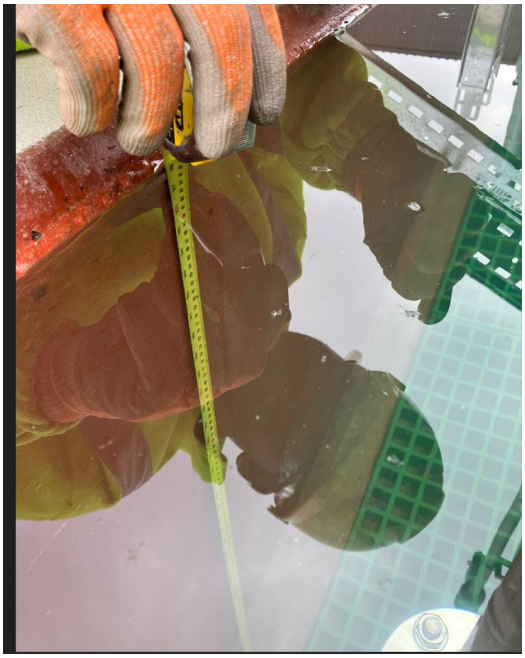
Bund filled with water- First day.

Water level



No leak

Bund with water- After final day



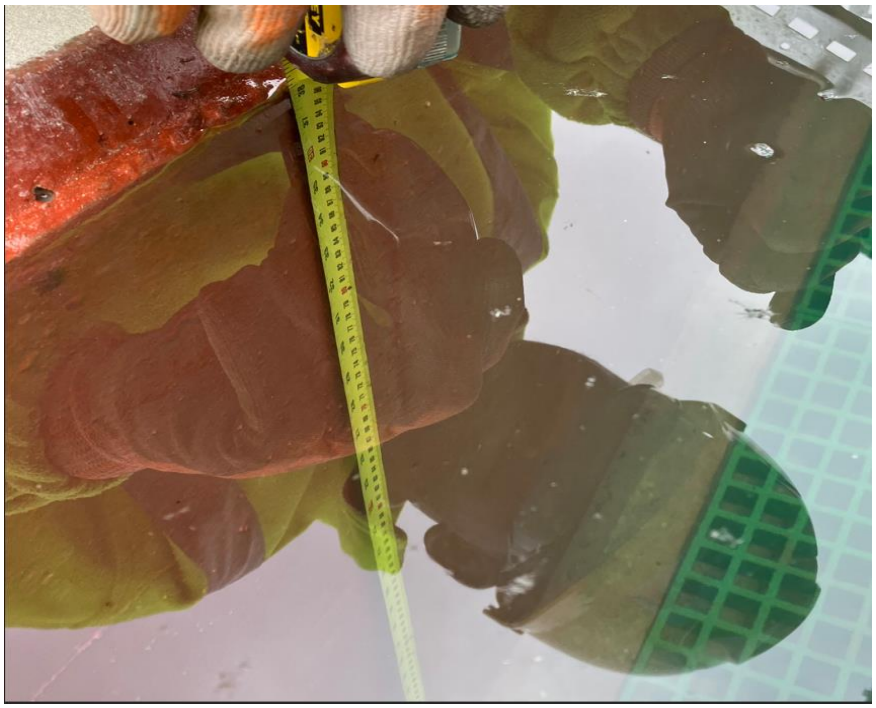
Water Level

No leak

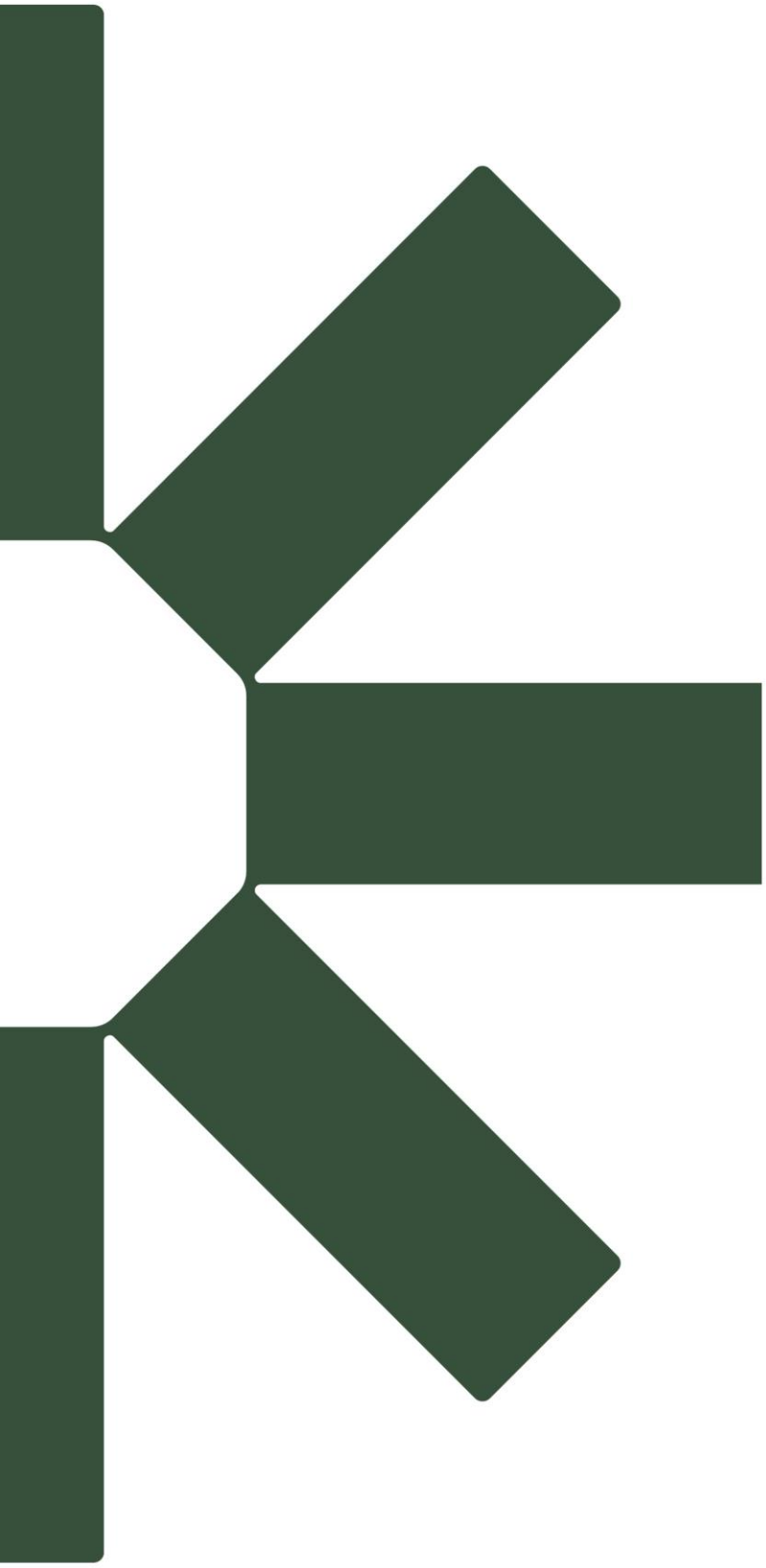
Conclusion

First day water level- 38inch

After few days water level – 38inch



No leak around the bund



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