LAFARGE CEMENT UK

# ABERTHAW CEMENT WORKS
# ABERTHAW, NEAR BARRY

# LANDFILL CLOSURE REPORT

| Report Reference | Date of Issue | Author | Checked | Approved |
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## SECTION 1 INTRODUCTION

1.1 Merebrook Projects Limited (Merebrook) has been commissioned by Lafarge Cement UK (Lafarge) to produce a closure report as part of their formal application to close the licensed landfill facility associated with the Aberthaw Cement Works. The landfill is located at Ordnance Survey grid reference ST 037 669 and has been used only to accept waste arising from cement production at the adjacent works. It is hereafter referred to as 'the site'.

1.2 The objectives of the investigation are to:

*i.* Review previous investigation and survey reports made available by Lafarge;

*ii.* Review documentation and carry out interviews regarding the site's operation and carry out a site walkover to inspect for signs of potential sources of contamination, environmental receptors and pathways; and

*iii.* Propose monitoring locations, frequencies and determinands to be analysed for discussion with the Environment Agency (EA).

1.3 This report summarises the findings of previous environmental investigations and provides an interpretation of the environmental conditions that exist at the site pursuant to Lafarge applying to surrender a Waste Management Licence (WML).

1.4 This report has been prepared for Lafarge for the sole purpose described above and no extended duty of care to any third party is implied or offered. Third parties making reference to the report should consult Lafarge and Merebrook as to the extent to which the findings may be appropriate for their use.

## SECTION 2 PHASE 1 (NON-INTRUSIVE INVESTIGATION)

### 2.1 INTRODUCTION

2.1.1 The non-intrusive investigation has been conducted with reference to the documents and sources detailed in Table 1 below:

Table 1: Published Data and Information Sources

| SOURCE DATA | |
|---|---|
| BGS 1:50,000 Series Geological Sheet 261/262 Bridgend | Environment Agency Website: Data maps and data searches. |
| BGS British Regional Geology: South Wales | Lafarge Cement: Aberthaw Works booklet. |
| NRA Groundwater Vulnerability 1:100,000 Sheet 6 Gwent, South & Mid Glamorgan | |

2.1.2 The following reports have been made available for review:

*i.* *'Aberthaw Works IPPC Permit Application, report no. 29444/OR/1'* by Parkman Ltd. for Blue Circle Industries plc dated July 2001;

*ii.* *'Application for Authorisation to Operate under the Pollution Prevention and Control Regulations (England and Wales) 2000 reference BL3986'* by Blue Circle Cement, Aberthaw Works;

*iii.* *'Aberthaw – 1st Quarterly Monitoring Results, reference 00513614/503'* by Golder Associates (UK) Limited dated May 2001;

*iv.* *'Aberthaw – 2nd Quarterly Monitoring Results, reference 00513614'* by Golder Associates (UK) Limited dated September 2001;

*v.* *Aberthaw – Quarterly Monitoring Results, reference 00513614'* by Golder Associates (UK) Limited dated January 2002;

*vi.* *'Aberthaw – 1st Quarterly Monitoring Results, reference 00513614'* by Golder Associates (UK) Limited dated February 2002;

*vii.* *'Aberthaw - Quarterly Monitoring Results, reference 00513614'* by Golder Associates (UK) Limited dated July 2002;

*viii.* *'Aberthaw – Quarterly Monitoring Results, November 2002, reference 00513614'* by Golder Associates (UK) Limited dated December 2002;

*ix.* 'Aberthaw – *Quarterly Monitoring Results, reference 00513614'* by Golder Associates (UK) Limited dated March 2003;

*x.* 'Aberthaw – *Quarterly Monitoring Results, reference 00513614'* by Golder Associates (UK) Limited dated September 2003; and

*xi.* 'Aberthaw – *Biannual Monitoring Results, February 2004, reference 00513614'* by Golder Associates (UK) Limited dated April 2004.

2.1.3 The above published sources are all authoritative and it is believed that they are reasonably reliable. However, independent verification of the information supplied has not necessarily been carried out and Merebrook cannot be held liable for inaccuracies or deficiencies in the information.

## 2.2 SITE SETTING

2.2.1 Aberthaw Works is located north of the village of East Aberthaw in South Glamorgan and the site lies in the south-western corner of the associated quarry. The site is located at Ordnance Survey Reference ST 037 669 and is indicated on drawing SL/01, presented in Appendix 1. The boundary of the site is delineated by the line labelled 'limit of future tipping'. The site is linked to the main works by an access road.

2.2.2 The site has been licensed as a landfill since 21 April 1978, following its former use as a working quarry and is operating under a current WML, reference number 30016 (25).

## 2.3 GEOLOGY

2.3.1 The geological sheet indicates that Aberthaw Works is underlain by interbedded sandstone and shale of the Porthkerry Formation which belongs to the Jurassic age Lower Lias and is indicated to be greater than 120 m in thickness in places. Drift deposits comprising estuarine alluvium associated with the River Thaw immediately border the main works buildings to the northwest of the quarry and landfill.

## 2.4 HYDROGEOLOGY

2.4.1 The site lies in an area classed by the EA as a Minor Aquifer with soils of high leaching potential (unclassified). However, elsewhere in the region the Lower Lias (marginal facies) is designated as a Major Aquifer.

2.4.2 The site does not lie within an EA designated Groundwater Source Protection Zone (SPZ).

## 2.5 HYDROLOGY

2.5.1 The nearest surface water feature to the site is the River Thaw which lies approximately 750 m to the west.

2.5.2 A tidal floodplain is located approximately 1200 m to the west.

## 2.6 HISTORICAL LAND USE

2.6.1 The site was previously a limestone quarry, which has then been backfilled and before that was poor grade grazing land. Aberthaw Works with which the site is associated was first established in 1912 by the Aberthaw & Bristol Channel Portland Cement Company.

## 2.7 DETAILS OF THE INSTALLATION

2.7.1 The WML which pertains to the site is held by Blue Circle Industries plc (now Lafarge), details of which are presented in Appendix 2. The boundary of the site is delineated by the line labelled 'limit of future tipping' indicated on drawing SL/01, presented in Appendix 1. This closure application relates to the area defined within the WML as the landfill site. The licence was issued on 27 June 1978 to Blue Circle Industries plc for Industrial Waste Landfill under the 1974 Control of Pollution Act as a Waste Disposal Licence before transfer to a WML. The conditions attached to the authorised waste types and quantities according to this licence include;

*i.* Only materials arising from the activities of the company at the Aberthaw Cement Works are to be disposed of in the landfill;

*ii.* The waste is to consist of general industrial waste, including cement works waste; and

*iii.* The rate of input of permitted waste shall be less than 25,000 tonnes per annum.

2.7.2 There are no known recorded land pollution incidents associated with the landfill.

2.7.3 Due to the generally inert nature of the wastes received the landfill is unengineered, with the floor being exposed limestone. The landfill site has been regularly capped with waste from the quarrying process to prevent windblow. In accordance with the WML all waste has been deposited in layers, with the top and faces covered by 0.15 m of inert material as work proceeded. Slope profiles are stable, and each layer of waste and covering material has been laid to a fall to encourage surface water run-off, with waste layers not exceeding 4 m in depth and 25 m in width. A final topographic survey will be carried out in due course.

2.7.4 The landfill generates low levels of leachate (with reference to the Golder Associates (UK) Limited reports and site interviews). Since March 2001 when the four landfill gas monitoring wells were installed (BH1-4) no leachate samples have been recovered as the wells have consistently been found to be dry. The reports are included in Appendix 5. The first monitoring report, dated 3 May 2001, also includes a map (Figure 1) showing the locations of all the monitoring points.

2.7.5 Ground water monitoring has been carried out at six-monthly intervals in accordance with the requirements of the WML, the results of which are included in Appendix 5. Monitoring is carried out on three existing groundwater wells, two of

which are hydraulically downstream of the landfill site (GW1 and GW2), and a third which is hydraulically upstream (GW3). The initial monitoring round was carried out on 5 March 2001, and the latest on 5 February 2004. Chemical analysis results were assessed with reference to screening levels derived from the Maximum Allowable Concentrations (MAC) in the Water Supply (Water Quality) Regulations 2000 where prescribed, or for those determinands not included, the 1989 regulations. A summary of groundwater contaminant concentrations is contained in Table 2.

Table 2: Summary of Groundwater Chemical Analysis Results

| Determinand | Units | Max recorded | Mean recorded | No. Tests | Screen Level (SL) | No. >=SL* |
|---|---|---|---|---|---|---|
| Cadmium | $mg.l^{-1}$ | <0.05 | 0.025 | 14 | 0.005 | 7** |
| Chromium (total) | $mg.l^{-1}$ | <0.05 | 0.026 | 14 | 0.05 | 7** |
| Lead | $mg.l^{-1}$ | <0.05 | 0.026 | 14 | 0.05 | 7** |
| Boron (water soluble) | $mg.l^{-1}$ | <0.05 | <0.05 | 1 | 0.001 | 1** |
| Copper | $mg.l^{-1}$ | <0.05 | 0.027 | 14 | 2 | 0 |
| Nickel | $mg.l^{-1}$ | <0.05 | 0.026 | 14 | 0.02 | 7** |
| Zinc | $mg.l^{-1}$ | 0.085 | 0.046 | 14 | 5 | 0 |
| Sulphate (water soluble) | $mg.l^{-1}$ | 457 | 117 | 14 | 250 | 1 |
| Ammoniacal - N | $mg.l^{-1}$ | 26 | 2.56 | 14 | 0.5 | 10 |
| Chloride | $mg.l^{-1}$ | 83 | 40 | 14 | 200 | 0 |

Notes: * Number of samples equal to or exceeding screen level
**Laboratory Limit of Detection is equal to or greater than screening level in some or all samples

2.7.6 The parameters analysed have generally been detected at concentrations at or below the Drinking Water Quality Standards. High ammoniacal nitrogen results were initially detected in samples from the three boreholes, however, a supplementary visit found snails in the wells and other detritus which may have contributed to these results. Subsequent analysis confirmed that the ammoniacal nitrogen concentrations decreased after the wells were cleared and purged. In several cases the laboratory limit of detection exceeded the Drinking Water Quality Standard making a statistical assessment difficult. Generally the groundwater chemistry from the upstream well and two downstream wells has been found to be similar and the downstream wells do not show deterioration in groundwater quality as a result of the landfill.

2.7.7 Hazardous gas monitoring has been required by the EA at intervals not greater than six months, as stipulated in paragraph 25.3 of the WML 30016 (25) (a copy of which is presented in Appendix 2). Copies of gas monitoring results from 5 March 2001 until 5 February 2004 are presented in Appendix 5. The latest monitoring visit for which records are included was carried out by Golder Associates (UK) Limited and comprised gas, leachate and groundwater monitoring

of the existing boreholes. No methane or carbon dioxide was recorded within any of the four existing boreholes. Landfill gas concentrations have been monitored at the site since March 2001. No methane has been detected at any of the four boreholes during the monitoring rounds. Carbon dioxide was detected at 0.1 % on one occasion in BH2 and BH3. Oxygen has been detected at depleted concentrations, to a minimum of 10.9 % in BH3 in November 2001.

## 2.8 SOURCES OF WASTE GENERATION

2.8.1 The landfill is understood to have been solely used for the disposal of inert or non-putrescible material arising from the operation of the cement production plant. Procedures are also set out in the Aberthaw Work's Environmental Management System to ensure that the site is operated in accordance with the WML, the working plan and associated planning permission. The Quarry Manager ensures that any waste not produced by Aberthaw Cement Works, or waste that was been placed in skips for offsite disposal is not deposited in the Work's Landfill (IPPC application, Parkman Ltd).

2.8.2 The Environment, Health and Safety Co-ordinator also ensures that only certain types of waste, as set out in the WML, are deposited in the Work's Landfill (see Appendix 4 for examples of Tip Inspection logs produced weekly). The Environment, Health and Safety Co-ordinator also ensures that all waste not eligible for such transfer is deposited in the skips provided for transfer to a suitably licensed waste disposal/management facility. The Environment, Health and Safety Co-ordinator ensures that an internal transfer note is completed for the transfer of wastes to Work's Landfill.

2.8.3 Sources of waste material include:

*i.* Cement Production; and,

*ii.* Maintenance and Housekeeping operations.

## 2.9 WASTE TYPES (AS DEFINED IN *'IPPC APPLICATION FOR AUTHORISATION FOR ABERTHAW CEMENT WORKS'*)

*i.* *Raw Materials Handling, Storage and Preparation*: Used filter cloths were disposed of in the on-site landfill.

*ii.* *Fuel Storage and Preparation:* Used bag filters from the coal mill were disposed of in the on-site landfill.

*iii.* *Pyroprocessing Kiln, (Clinker Burning) Raw Milling*: The only releases to land from this section of the process occurred during kiln maintenance periods when kiln rubble was sent to the on-site landfill. This material is a mixture of inert calcined dust from the kiln and kiln bricks. Occasional used cloth bags from bag filters were also disposed in the landfill.

*iv.* *Cement Grinding And Storage, Clinker Transport To Cement Mills, Cement Milling And Cement Transport To Silos:* Waste generated by these processes included waste bag filters - any miscellaneous non-recycled spillages were deposited in the on-site landfill.

*v.* *Cement Loading, Packing And Dispatch:* Waste generated by these processes included waste bag filters, and any miscellaneous non-recycled spillages which were deposited in the on-site landfill.

## 2.10 ENVIRONMENTAL OPERATING PROCEDURE

2.10.1 As part of the Environmental Operating Procedure at the site the EA carry out regular monitoring visits to ensure that no problems are arising. Merebrook have been supplied with site inspection logs from the EA. The earliest of these is dated 18 June 2003 (examples of logs are provided in Appendix 4).

2.10.2 The EA logs indicate that the landfill has been consistently compliant, with all criteria applicable to the site being recorded as satisfactory/clean and tidy.

2.10.3 A weekly inspection is also carried out by a Waste Management Industry Training and Advisory Board (WAMITAB) certified member of site personnel to ensure that the wastes deposited are in accordance with the conditions stipulated in the WML. Rare contraventions of the WML have been recorded; however, these were immediately reported to the Quarry Manager and quickly rectified.

2.10.4 In accordance with the WML the site is inspected daily for odours and visual monitoring of aerial emissions is also carried out. The site is also inspected on a monthly basis to monitor pest infestations. All remedial actions and inspection reports are kept in a site diary. The Quarry Manager checks the site at least weekly to ensure that no problems are arising, such as fly tipping or wind blown waste, and in addition the site is inspected prior to the compaction of new waste to ensure that all material deposited is in compliance with the WML. The Quarry Manager will continue to inspect the site on a weekly basis following closure of the landfill to ensure that no problems arise, as before.

2.10.5 In keeping with the Secretary of State for the Environment and the National Assembly for Wales issued guidance, which requires that the EA inspections of waste be guided by a system of risk assessments, in February 2001 the EA conducted an Operator Performance Risk Assessment (OPRA) of the Aberthaw landfill site. The site was given an environmental score of 55 out of a maximum of 150 on the basis of the six main assessment criteria listed below, indicating that the risk posed by the site is generally low: A copy of the Operator and Risk Assessment Score is presented in Appendix 2.

*i.* Facility Type;

*ii.* Waste Input (Annual Tonnage);

*iii.* Control and Containment;

*iv.* Human Dwellings, population density and environmental targets;

*v.* Groundwater; and

*vi.* Surface Water.

2.10.6 Guidance issued by the EA on their website indicates that an OPRA score usually remains the same unless there is significant modification to the facility or its immediate environment.

## 2.11 WASTE RETURN

2.11.1 Table 3 below shows the amount of waste (in tonnes) sent to the works tip from 2000 until 2003. These figures are taken from the electronically held Key Performance Indicator (KPI) spreadsheets which are produced by the Environmental, Health and Safety Coordinator. These are compiled from the internal waste transfer logs. Further details of waste returns are included in Appendix 3.

Table 3: Waste returns 1999-2003

| | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|
| January | 679 | 70 | 27 | 1660 |
| February | 78 | 50 | 21 | 26 |
| March | 66 | 45 | 1677 | 34 |
| April | 58 | 39 | 35 | 19 |
| May | 64 | 70 | 38 | 14 |
| June | 55 | 58 | 29 | 9 |
| July | 44 | 59 | 17 | 24 |
| August | 53 | 34 | 62 | 14 |
| September | 37 | 38 | 28 | 5 |
| October | 63 | 25 | 25 | 9 |
| November | 54 | 32 | 30 | 1503 |
| December | 30 | 29 | 11 | 22 |
| Total | 1280 | 549 | 1998 | 3338 |

2.11.2 Following a programme of waste minimisation, Lafarge have communicated verbally that they intend to close the landfill in the first quarter of 2005 and they no longer wish to use the site for waste disposal.

## 2.12 POTENTIAL CONTAMINANTS

2.12.1 The Department for Environment, Food and Rural Affairs (DEFRA) and the EA have published a document (CLR8) detailing the potential contaminants associated with cement manufacturing works. These include heavy metals, asbestos, fuels, polyaromatic hydrocarbons, sulphates and polychlorinated biphenyls (transformers and electrical equipment). However, the WML and waste records obtained from Lafarge both confirm that only inert wastes were received at the landfill during its operation (see Appendices 2 and 3 for copies of the licence and waste returns respectively).

## 2.13 PREVIOUS INVESTIGATION

2.13.1 A site investigation was undertaken by Structural Soils Limited under the supervision of Parkman Ltd between 10 May 2001 and 31 May 2001 in order to establish a 'baseline' for the site ground conditions when submitting an application for an authorisation under the 1996 European Union Integrated Pollution Prevention and Control (IPPC) Directive 96/61.

2.13.2 A total of 36 trial pits were excavated by means of a JCB 3CX, four hand dug pits were excavated where access prevented the use of the JCB, and a further eight window sample locations were drilled using a trailer mounted dynamic probe. In addition 29 boreholes were advanced using a combination of window sampling, rotary open hole and rotary coring. Eleven of these boreholes were installed with groundwater monitoring wells, with one of these also used for gas monitoring. Of these, three boreholes were within the landfill itself – BH112, BH113 and BH114 (referred to in the report as the active works landfill in quarry). Exploratory hole logs for the three boreholes within the landfill are included in Appendix 8, together with a map indicating their locations.

2.13.3 Materials encountered within the landfill consisted of cement mixed with concrete, limestone, shale, brick fragments, rubber and coal dust. Some sandy clay was noted at depths. Hard limestone with occasional shale beds was proved to at least 2 m below the base of the landfill.

2.13.4 Samples of material taken from various depths (0–4.0 m) within the three borehole exploratory holes in the landfill were analysed for a range of determinands including arsenic, cadmium, chromium, lead, mercury, nickel and zinc. A summary of results is presented in Table 4 below. Of the parameters analysed for which Soil Guideline Values (SGVs) derived from the Contaminated Land Exposure Assessment (CLEA) model exist, the concentrations were all below the screening levels for an open space end use. Chemical analysis results are contained in Appendix 6.

Table 4: Summary of Soils Chemical Analysis Results

| Determinand | Units | Max recorded | Mean recorded | No. Tests | Screen Level (SL) | No. >= SL* |
|---|---|---|---|---|---|---|
| pH | pH units | 12 | 11.5 | 10 | 5 (min) | 0 |
| Arsenic | $mg.kg^{-1}$ | 6.5 | 3.39 | 10 | 20 | 0 |
| Boron | $mg.kg^{-1}$ | 0.94 | 0.46 | 10 | 3 | 0 |
| Cadmium | $mg.kg^{-1}$ | 0.5 | 0.5 | 10 | 30 | 0 |
| Chromium | $mg.kg^{-1}$ | 21 | 14.4 | 10 | 200 | 0 |
| Copper | $mg.kg^{-1}$ | 15 | 4.27 | 10 | 200 | 0 |
| Lead | $mg.kg^{-1}$ | 52 | 11.99 | 10 | 450 | 0 |
| Mercury | $mg.kg^{-1}$ | 0.1 | 0.1 | 10 | 15 | 0 |
| Selenium | $mg.kg^{-1}$ | 0.81 | 0.46 | 10 | 260 | 0 |
| Nickel | $mg.kg^{-1}$ | 12 | 9.54 | 10 | 75 | 0 |
| Asbestos | % | Not Detected | Not Detected | 9 | Detected | 0 |

Notes: * Number of samples equal to or exceeding screen level

2.13.5 Leachate samples were prepared from the same soil samples analysed above. The leachate from each sample was analysed for a range of determinands including arsenic, boron, cadmium, nickel and zinc. A summary of contaminant concentrations is contained in Table 5. Chemical analysis results are contained in Appendix 6.

Table 5: Summary of Leachate Chemical Analysis Results

| Determinand | Units | Max recorded | Mean recorded | No. Tests | Screen Level (SL) | No. >= SL* |
|---|---|---|---|---|---|---|
| Arsenic | $mg.l^{-1}$ | 0.01 | 0.01 | 10 | 0.01 | 10** |
| Cadmium | $mg.l^{-1}$ | 0.0005 | 0.0005 | 10 | 0.005 | 0 |
| Chromium (total) | $mg.l^{-1}$ | 0.034 | 0.015 | 10 | 0.05 | 0 |
| Lead | $mg.l^{-1}$ | 0.01 | 0.01 | 10 | 0.05 | 0 |
| Boron (water soluble) | $mg.l^{-1}$ | 0.05 | 0.05 | 10 | 0.001 | 10** |
| Copper | $mg.l^{-1}$ | 0.01 | 0.01 | 10 | 2 | 0 |
| Nickel | $mg.l^{-1}$ | 0.01 | 0.01 | 10 | 0.02 | 0 |
| Zinc | $mg.l^{-1}$ | 0.016 | 0.011 | 10 | 5 | 0 |
| Ammoniacal - N | $mg.l^{-1}$ | 0.5 | 0.5 | 10 | 0.5 | 10** |
| Chloride | $mg.l^{-1}$ | 59 | 41.2 | 10 | 200 | 0 |

Notes: * Number of samples equal to or exceeding screen level
**Limit of detection unknown but likely to be equal to screening level

2.13.6 When these leachate results are assessed with reference to screening levels derived from the Maximum Allowable Concentrations (MAC) in the Water Supply (Water Quality) Regulations 2000 where prescribed, or for those determinands not included, the 1989 regulations, it can be seen that arsenic, boron and ammoniacal nitrogen were all detected in the samples at concentrations equal to or exceeding their respective screening levels, however, it is possible that the laboratory limit of detection is equal to or greater than the screening level. The concentrations would therefore not be considered elevated.

2.13.7 A surface water sample (W109) was collected from the quarry pond in the vicinity of the landfill. The parameters analysed were generally detected at concentrations below the Drinking Water Quality Standard, although total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) were both detected at elevated concentrations. However, as the comparable results for samples taken from the Rivers Thaw and Kenson upstream indicated higher TPH results and similar PAH concentrations these elevated concentrations are not considered an indicator of significant pollution. Chemical analysis results are contained in Appendix 6.

2.13.8 Gas monitoring was also undertaken in the 'active landfill', and no landfill gas (methane or carbon dioxide) was detected.

## SECTION 3 SITE RECONNAISSANCE

### 3.1 INTRODUCTION

3.1.1 A site walkover was carried out by Merebrook on the 9 September 2004. No significant sensitive environmental receptors were identified other than those mentioned elsewhere in the report.

### 3.2 SURFACE GROUND CONDITIONS

3.2.1 The site was found to be well compacted and was colonised by occasional shrubs (mainly buddleia).

## SECTION 4 RISK ASSESSMENT

4.1 The potential sources of contamination at the site and the implications with respect to development have been interpreted in accordance with the current government guidance on source-pathway-receptor risk assessment.

4.2 The following potential receptors have been identified:

*i.* Groundwater;

*ii.* Surface Water;

*iii.* Human Health (site staff); and

*iv.* Human Health (local residents).

4.3 Groundwater

4.3.1 Contaminant migration via groundwater is not considered to be a major pathway as the metal contaminants detected in the previous site investigation were not present in a mobile form and groundwater quality has been found to be good over the course of the monitoring period. Leaching has also not been indicated to be a significant pathway since the monitoring wells have been consistently found to be dry. Therefore the risk is categorised as low.

4.4 Surface Water

4.4.1 The nearest surface water feature to the site is the River Thaw which lies approximately 750 m to the west. Given the distance from the site and that both surface water samples taken during the previous investigation, and regular groundwater monitoring samples have not shown elevated levels of contamination, a significant risk to surface water has therefore not been demonstrated.

4.5 Human Health – Site Workers

4.5.1 The waste which has been tipped at the site is classed as chemically non-hazardous and inert. In addition, handling within the licensed area is minimal. The site is regularly capped and compacted with a layer of quarrying process waste, thereby removing the likelihood of human contact with any contaminated materials. Therefore no significant risk of harm to the health of site workers is present.

4.6 Human Health – the General Public

4.6.1 The site is within the boundary of Aberthaw Cement Works, access to which is restricted, and the site itself is wholly secured by virtue of a stock-proof fence together with a lockable gate at the quarry entrance. Site security will continue to be maintained and inspected in accordance with conditions set out in the WML following closure of the landfill site. However, the risk to the health of persons gaining access to the site is not considered significant given the levels of contamination detected previously, and the capping of the site with quarrying process waste. Hazardous gas monitoring has regularly been carried out and levels of carbon dioxide and methane have always been detected well below the trigger concentrations (< 1.5 % $CO_2$ and < 1 % $CH_4$) given in Table C1 of Waste Management Paper 27: Landfill Gas. A significant risk of migration to adjacent properties has not been identified.

## SECTION 5 POST CLOSURE PROPOSED MONITORING STRATEGY

5.1 It is proposed that water and gas monitoring would continue to be carried out from existing boreholes on a six monthly basis for one year following closure of the site. Monitoring installations shall be inspected for defects and damage during each routine monitoring exercise, and maintained in accordance with conditions within the WML.

5.2 Landfill gas monitoring within the existing boreholes is to comprise measurement of peak and steady state methane, carbon dioxide and oxygen concentrations, and barometric pressure.

5.3 Water samples would be collected and sent to a UKAS accredited laboratory for determination of a standard set of parameters to include metals, chloride, sulphate, dissolved oxygen, total organic carbon and pH. The results would then be compared to the drinking water standards as a preliminary screening tool, and cases where these are exceeded would be investigated by a more detailed quantitative risk assessment.

5.4 A record of the landfill gas and groundwater monitoring and sampling results shall be submitted to the Agency within one month of the samples being taken, with exceedences of trigger levels highlighted. Records will also be held by the Health, Safety and Environment Co-ordinator.

## SECTION 6 CONCLUSIONS

6.1 Generally the site is considered to be of low risk with regards to potential contamination, and is considered to have had little environmental impact during its operation, particularly in the context of surrounding quarrying and cement production activities. The waste returns show that the site has only accepted non-putrescible wastes, as listed in the Waste Management Licence, and these were all generated from the operation of the cement production plant. Site inspection logs by the EA consistently demonstrate that the site operated in a clean and tidy manner, and in accordance with the conditions of the waste management licence.

6.2 From the results of the previous site investigation surface water quality does not appear to have been affected by the landfill and associated operations, and is unlikely to be affected in the future.

6.3 In addition there are not believed to be any significant pollution linkages associated with the site.

**APPENDIX 1**

- Drawings:
- SL/01
- Copy of site plan provided by Lafarge Cement UK indicating landfill boundary

**APPENDIX 2** ▪ Copy of Waste Management Licences and OPRA Score

**APPENDIX 3** ▪ Waste returns

**APPENDIX 4** ▪ Site Inspection Logs

**APPENDIX 5** ▪ Gas Monitoring Records

**APPENDIX 6**

- Soil, Leachate, Groundwater and Surface Water Results (reproduced from Volume 2 of '*IPPC Permit Application Site Report*'' by Parkman for Blue Circle Industries plc dated July 2001. Reference 29444/OR/1)

**APPENDIX 7** ▪ Documents Reviewed

**APPENDIX 8**

- Exploratory hole logs and locations (reproduced from Volume 2 of '*IPPC Permit Application Site Report*'' by Parkman for Blue Circle Industries plc dated July 2001. Reference 29444/OR/1)