2016 Annual Performance Report

Aberthaw Ash Disposal Site

Permit Number: DP3432SW

March 2017

RWE

The energy to lead

Summary

This document gives details on the performance of Aberthaw Ash Disposal Site over 2016, as required by condition 4.2.1 of the site's Environmental Permit (EP), DP3432SW.

CONTENTS

1. Operational Update

Aberthaw Ash Disposal Site has reached its maximum height and the only area used for landfilling of Pulverised Fuel Ash (PFA) is the temporary storage area on the western side. The site has been restored as per plans approved by the Local Authorities. In 2016 there were no changes to the operational activities and no Environmental Permit variations.

2. Review of Results for Emission Monitoring

2.1. Groundwater Quality Review

Monitoring Objective

To carry out routine monitoring of groundwater to monitor the performance of the ash disposal site by measurement of absolute levels and concentrations and trends relative to relevant criteria including background levels and concentrations, control levels and compliance limits.

Number and Location of Monitoring Points

A summary of the monitoring boreholes is provided in Table 1 below and the locations are shown in Appendix A. In January 2015, borehole improvement works were completed to improve water sampling. BH3B was unblocked, BH7B was re-drilled (new details provided in Table 1) and the top hat cover was replaced on BH6. There are 8 boreholes in natural ground, of which 6 are completed in the Porthkerry Member limestone and 2 in the Alluvium (clay), and 2 shallow boreholes in fill material, BH7A with a response zone partly in clay fill and BH11A with a response zone partly in fill containing coal ash (BH11A).

Groundwater flow beneath the ash disposal site is directed towards the River Thaw to the west and the sea to the south. Due to the ash disposal site's contact with the sea, the southern boundary of the site is a downgradient boundary. There are 4 boreholes on this boundary, BH10B, BH11B, BH7B and BH9B, with an average spacing of approximately 250m. The two shallow boreholes, BH7A and BH11A are situated close to boreholes BH7B and BH11B respectively. There are also 2 boreholes on the western downgradient boundary, BH3B and BH8B, with an average spacing of approximately 800m.

BH6 and BH5 are located on the eastern boundary with an average spacing of approximately 750m and as both response zones are overlain by PFA they cannot be considered truly upgradient. Upgradient monitoring boreholes at the nearby Aberthaw Quarry Ash Disposal Site (Environmental Permit BP3339BH) are used as an indication of upgradient groundwater quality data for the limestone aquifer (Details of these boreholes are in italic in table below).

Table 1: Summary of Monitoring Boreholes

Monitoring Borehole	Formation Sampled	Lithology Type – Natural (N) Imported Fill (F)	Response Zone Depth (m b GL)	Geological Barrier Thickness above Response Zone (m)	Other Lithology above Response Zone
BH3B	Limestone	N	13.5-23.0	6	PFA: 6m
BH5	Limestone	N	2.5-11.5	0	PFA: 1.5m
BH6	Limestone	N	13.0-20.5	0	PFA: 12.2m
BH7A	Clay fill and Gravelly clay	F/N	2.0-9.5	8	PFA: 1.5m
BH7B	Limestone	N	17.0-26.0	3.9	Fill: 7.4m Sand & gravel: 5.7
BH8B	Limestone	N	30.0-38.0	19	PFA: 9m
BH9B	Limestone	N	6.0-13.0	0	PFA: 3m

Monitoring Borehole	Formation Sampled	Lithology Type – Natural (N) Imported Fill (F)	Response Zone Depth (m b GL)	Geological Barrier Thickness above Response Zone (m)	Other Lithology above Response Zone
BH10B	Clay	N	23.0-30.0	6.6	Fill: 2.8m Sand: 13m
BH11A	Fill – ash and clay	F	1.5-5.0	0	N/A
BH11B	Clay	N	9.5–19.0	4.5	Fill: 4.9m
E09-01A	*Limestone*	*N*	*18-24*		
E09-01B	*Limestone*	*N*	*24-30*		
E09-02A	*Limestone*	*N*	*21-27*		
E09-02B	*Limestone*	*N*	*27-33*		

Note: mb GL – metres below ground level

Monitoring Measurements

The groundwater monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis along with the groundwater level and standard field measurements in accordance with the Environmental Permit. An independent external contractor is responsible for the sampling of the groundwater boreholes and an independent external laboratory is responsible for the analysis of the samples. The independent external contractor changed for the groundwater sampling from Q2 2011 and the independent external laboratory changed for the groundwater analysis from Q1 2010. Table 2 summarises the changes to the groundwater sampling method since monitoring began to improve the sample quality.

Table 2: Summary of Groundwater Sampling Methods

Monitoring Borehole	Purge Strategy	Purge Equipment	Date From	Date To
BH3B	1 x Well volume	Bailer	Quarter 3 2006	Quarter 1 2011
	1 x Well volume	Inertial pump	Quarter 2 2011	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
BH7A	1 x Well volume	Bailer	Quarter 3 2006	Quarter 1 2011
	1 x Well volume	Inertial pump	Quarter 2 2011	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—
BH7B, BH8B, BH10B	1 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—
BH5, BH6, BH9B	1 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	3 x Well volume	Inertial pump	Quarter 3 2013	—
BH11A	2 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	3 x Well volume	Bailer	Quarter 3 2013	—
BH11B	3 x Well volume	Bailer	Quarter 3 2006	Quarter 2 2013
	Low flow steady state	Submersible pump	Quarter 3 2013	—

Note: Inertial pump used at BH8B in Q4 2016 as BH damaged by grass cutting machine.

Figure 1 shows the recorded groundwater elevations for the previous 10 years which vary between +1 (BH10B/BH7A) to +12m OD (BH5). Groundwater elevations in limestone boreholes are characterised by seasonal cyclic water level fluctuations with annual winter influxes of rainfall recharge. This pattern appears to be more pronounced in 2016 particularly in BH5, BH6, BH8B and BH9B. It should be noted that Groundwater elevations up to 5m OD or higher may be affected by saline intrusion both directly from the sea and via the River Thaw.

Figure 1: Groundwater Hydrograph

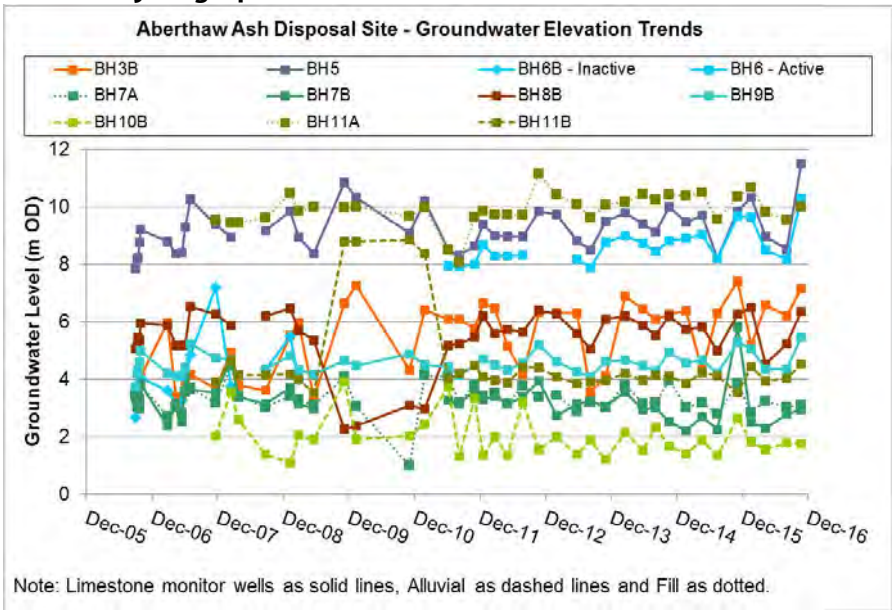


Figure 2 shows the groundwater control charts with concentrations of all boreholes plotted. It should be noted that the compliance limits and control levels (where defined) apply to boreholes BH3B and BH7B. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive sampling events.

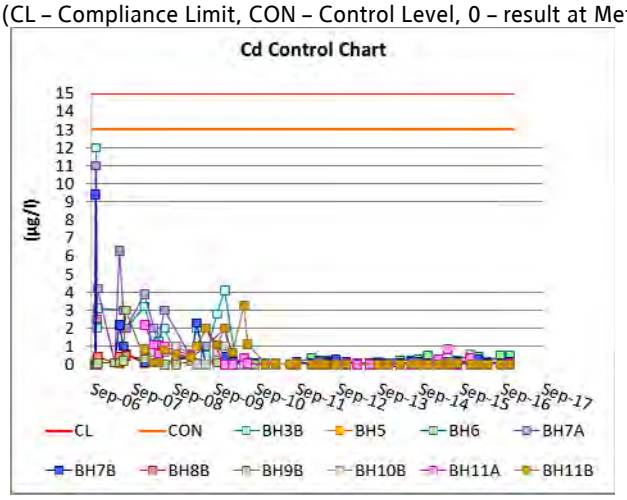
In 2016, there were no exceedances of the compliance limit or control level for any critical parameter. In BH3B there are elevated concentrations of arsenic, boron, molybdenum, sulphate and vanadium. In BH7B there are elevated concentrations of boron, molybdenum, sulphate and ammoniacal-nitrogen. In BH7B, the seasonal pattern previously seen (with highs in the summer and lows in the winter) in concentrations of ammoniacal-nitrogen, boron, molybdenum, and sulphate appears to have reduced since low flow steady state sampling was introduced.

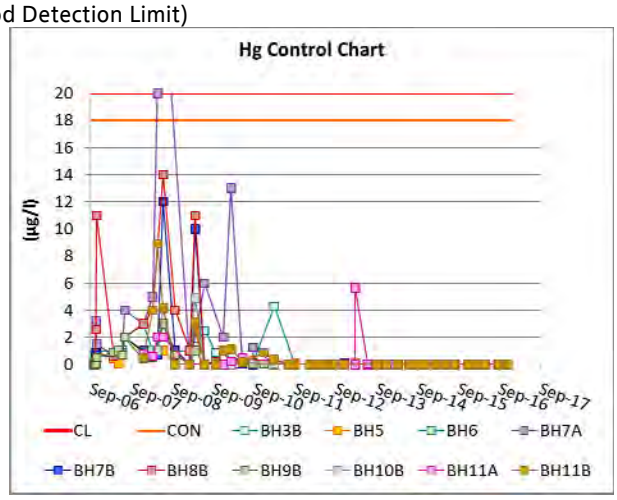
The control charts show that there are no increasing trends in critical parameter concentrations. Other key points to note are:

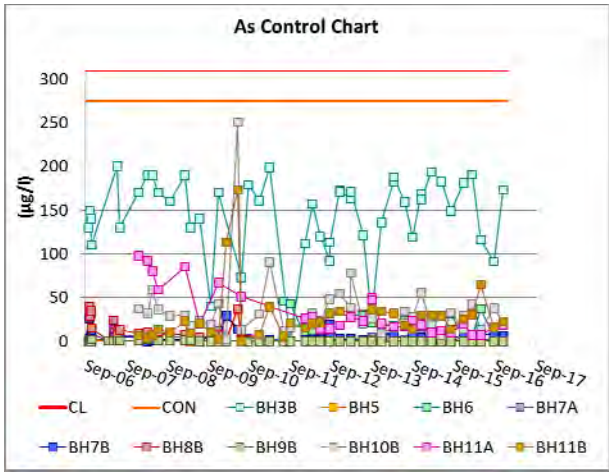
- Decreasing trend in cadmium, mercury, aluminium, chromium and selenium since sampling began;
- Highly variable ammoniacal nitrogen concentrations in BH10B and;
- Elevated sulphate, boron and molybdenum in most boreholes.

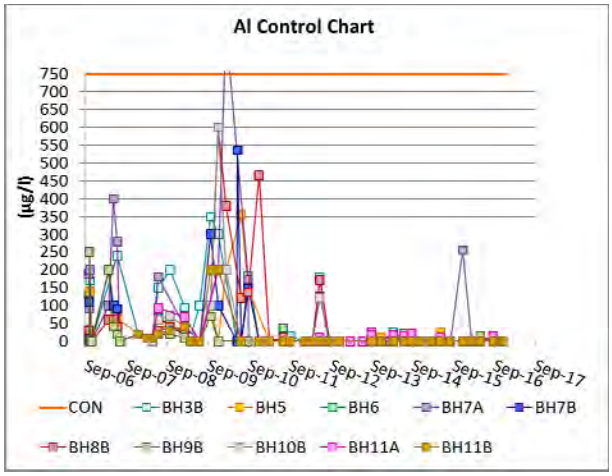
Figure 2: Control charts for groundwater boreholes

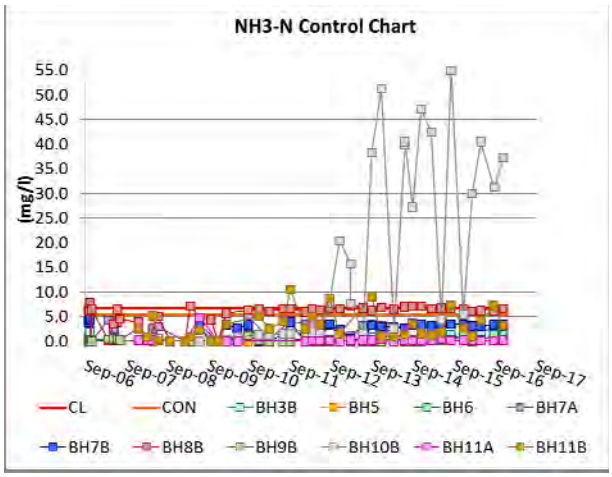
(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit)

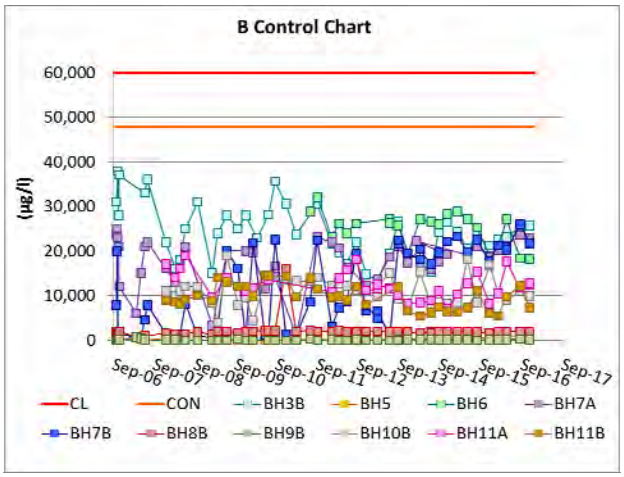


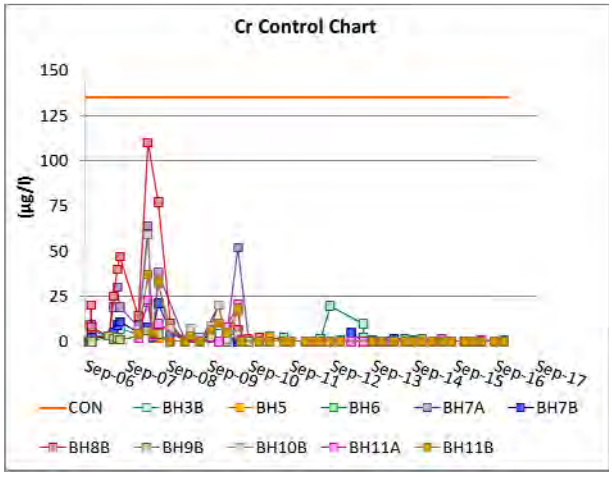


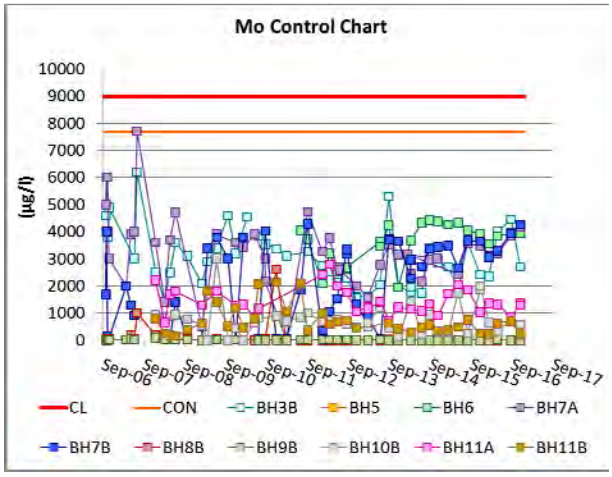


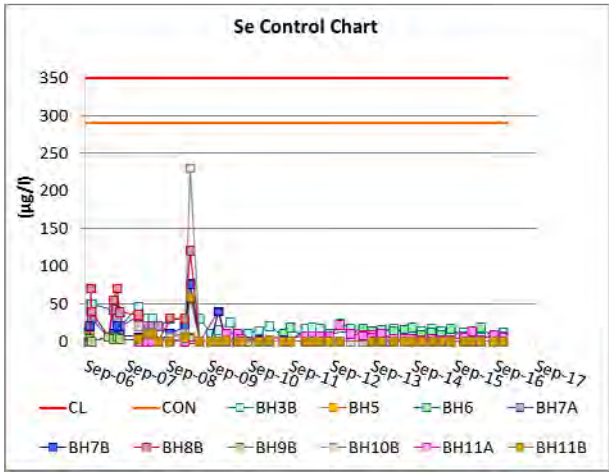


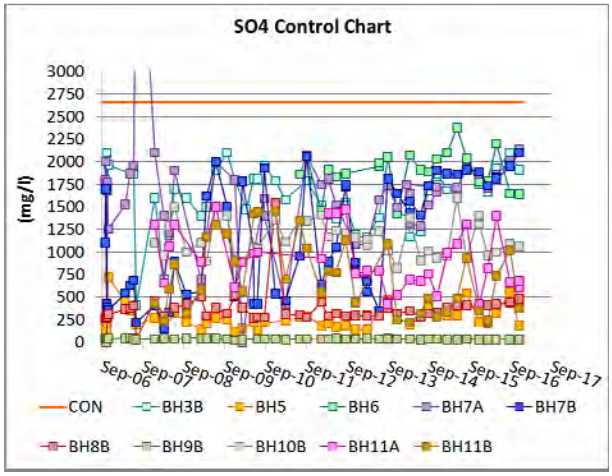


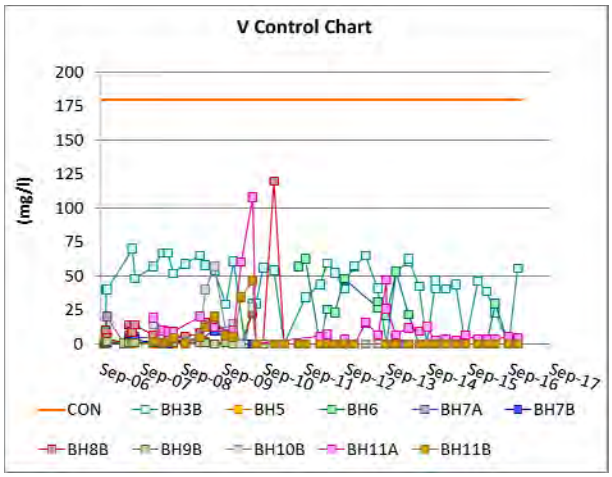












2.2. Surface Water Quality Review

Monitoring Objective

To carry out routine monitoring of surface water to;

- monitor the performance of the ash disposal site by measurement of absolute levels and concentrations and trends relative to relevant criteria including background concentrations and control levels; and;
- identify and quantify effects on surface water receptors.

Number and Location of Monitoring Points

A summary of the surface water monitoring points is provided in Table 3 below and the locations are shown in Appendix A.

Table 3: Summary of Surface water monitoring points

Monitoring Point	Description	Direction from site	Remarks
Eastern Perimeter Drain (EPD)	Western bank of drainage ditch	East	
Brackish Lagoon (BL)	Saline lagoon	South-east	Surface water Receptor
River Thaw (S3)	Eastern bank, tidal mudflats below rail bridge	North upgradient	Surface water Receptor
Group 5 Spring (S1)	Wetland area adjacent to spring within ash disposal site	West	

Monitoring Measurements

The surface water monitoring analytical suite contains a range of parameters which are monitored on a quarterly basis in accordance with the Environmental Permit. An independent external contractor was responsible for the sampling of the surface water monitoring points until Q1 2011 with trained in-house operatives becoming responsible for the sampling of the surface water monitoring points from Q2 2011. An independent external laboratory is responsible for the analysis of the samples. The independent external laboratory changed for the groundwater analysis from Q1 2010.

Figure 3 shows the surface water control charts for the surface water monitoring points. It should be noted that the control levels apply to all surface water monitoring points and are identical to the respective groundwater control levels. An exceedance is defined as a result above the control level for 3 consecutive sampling events.

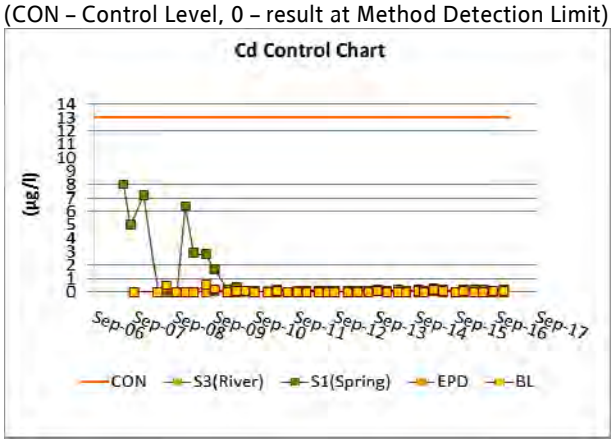
In 2016, there were no exceedances of the control level for any critical parameter. Ammoniacal-nitrogen levels have decreased in Group 5 Spring (S1) indicating that the elevated November 2015 result was most likely an anomaly. The trend that concentrations appear to fall in summer and increase in the winter is not as apparent in 2016 as in previous years.

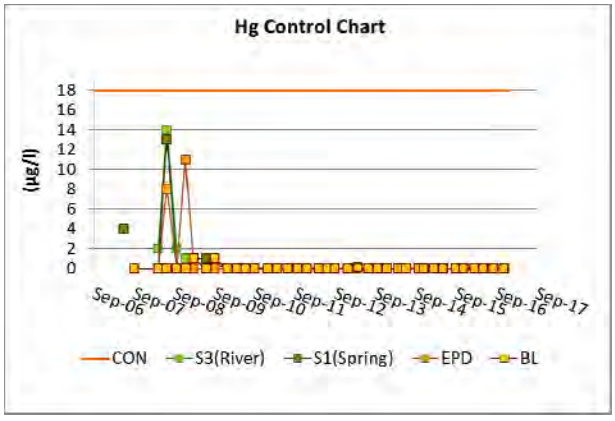
The control charts show that there are no increasing trends in critical parameter concentrations. Group 5 Spring (S1) generally has the highest concentrations of critical parameters, in particular, boron, molybdenum and sulphate, which suggests it is affected by PFA leachate, however, as the water ponds in a wetland area where it is lost by either evapotranspiration or seepage, it is not considered a discharge from the ash disposal site. Other key points to note are:

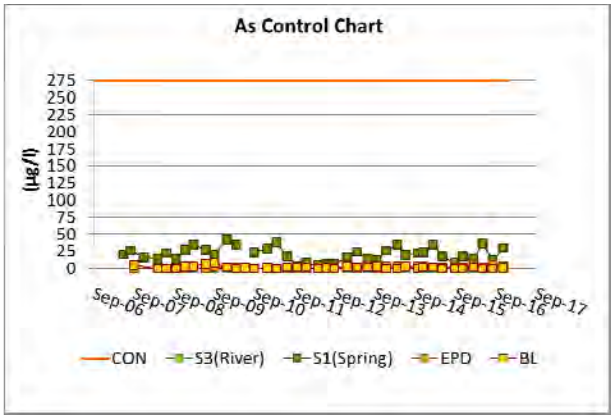
- Decreasing trend in cadmium, mercury, chromium and selenium since sampling began;
- Highly variable aluminium concentrations with highest concentrations in the River Thaw upgradient monitoring point.

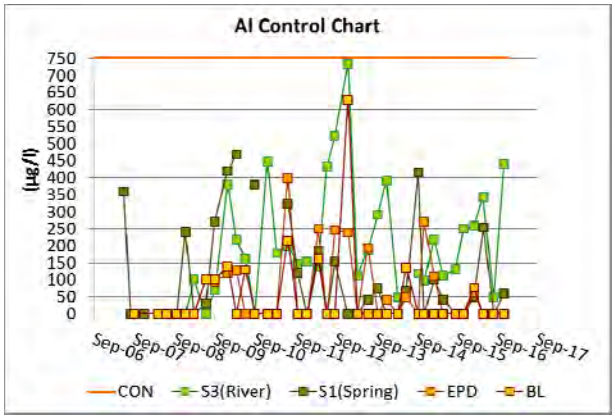
Figure 3: Control charts for surface water monitoring points

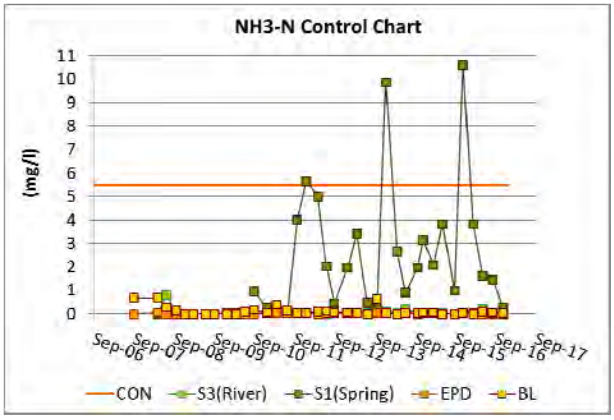
(CON – Control Level, 0 – result at Method Detection Limit)

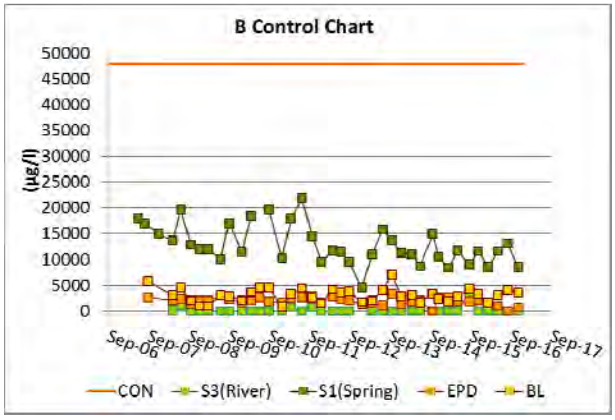


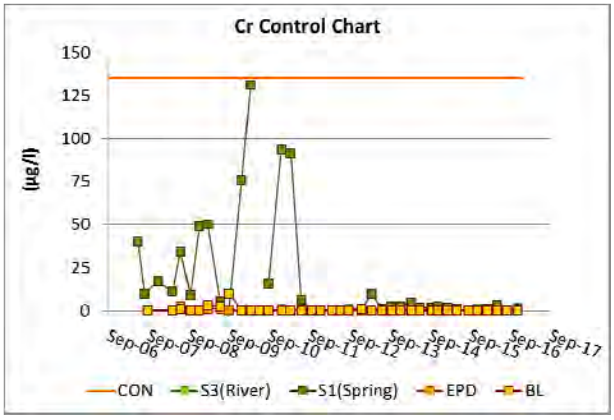


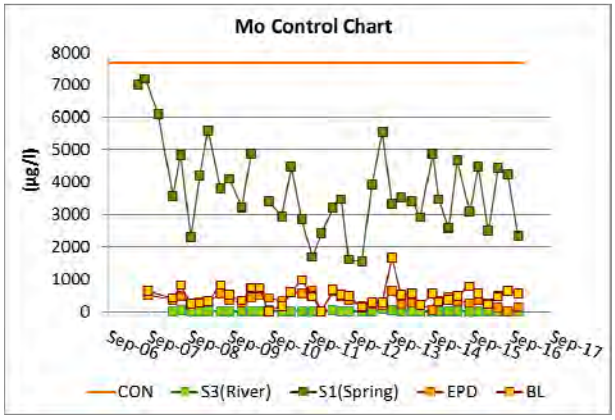


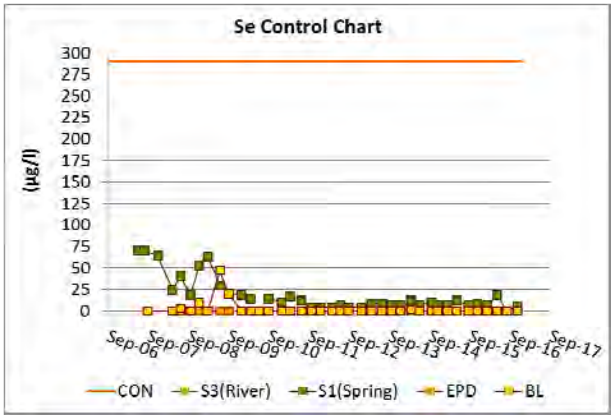


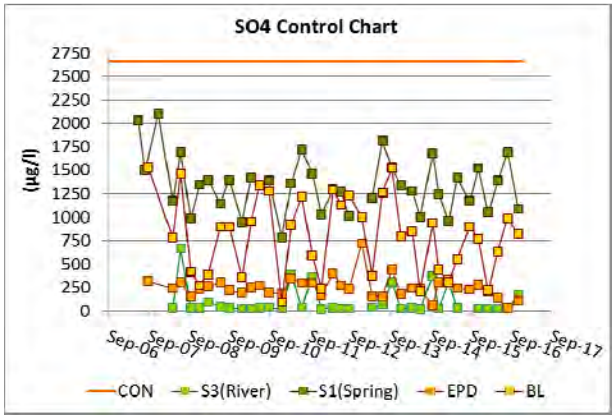


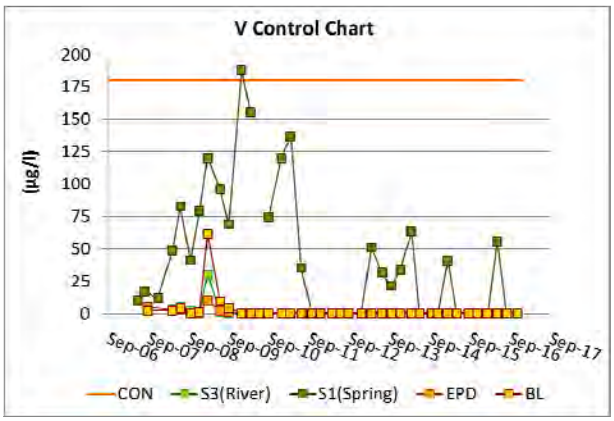












3. Annual Improvement Targets Summary

Aberthaw Power Station continues to maintain its ISO 14001 Certification for the "Generation of electricity, by the combustion of fossil fuel and biomasses, together with the associated sale or disposal of ash". The station had 2 surveillance visits by Lloyds Register Quality Assurance during 2016 and no non-conformities were identified. Table 4 provides details of the improvement targets for 2016 and the performance against those targets.

Table 4: Environmental Improvement Plan

Objective	Target	Target Date	Responsible Person	Final Status
Maintain a High Level of Environmental Compliance	No more than 2 environmental incidents resulting in justified complaints.	End 2016	All employees	Target not met. 4 Justified Complaints (not related to Aberthaw Ash Disposal Site Operations)
	No more than zero exceedances of permit conditions which result or have potential to cause significant environmental harm. (Natural Resources Wales CCS Category 1 and 2).	End 2016	All employees	Target met - 0
	Minimise exceedances of permit conditions which result or have potential to cause minor environmental harm. (Natural Resources Wales CCS Category 3). Fully investigate all exceedances of this type and implement improvements to minimise the likelihood of environmental harm.	End 2016	All employees	Target not met. 4 CCS Cat 3 (not related to Aberthaw Ash Disposal Site Operations)
	No more than zero non-compliance with emissions limits or conditions as set out in Environmental Permits (Natural Resources Wales CCS Category 4). Submit all NRW reporting on time.	End 2016	Environmental Compliance Engineer	Target not met. 3 CCS Cat 4 (not related to Aberthaw Ash Disposal Site Operations)
	Complete response to Environmental Permit Pre-Operational Condition 14 - Unit 9 Low NOx Boiler Commissioning Plan.	12/02/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 6 – Third update to Plan of how Aberthaw will contribute to minimising total SO2 emissions from existing coal fired stations in England and Wales and not exceeding 70kt/yr by 2020.	01/04/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 36 - Review of Accident Management Plan for Unit 9 Low NOx Boiler Modifications.	25/04/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 40 - Normal Volatile Coal Trial Report.	31/08/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 37 - Unit 9 Low NOx Boiler Post-Commissioning Report.	25/07/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 21 - Impact of Flue Gas Desulphurisation on Marine Environment Report.	01/08/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 38 - Impact of pH Trial on Marine Environment Report.	30/09/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 39 - pH Trial Report.	30/09/2016	Environmental Compliance Engineer	Target met.
	Complete response to Environmental Permit Improvement Condition 7 - 2015 Annual monitoring report on acidifying and eutrophying deposition and ecological paramters at protected nature sites.	31/12/2016	Environmental Compliance Engineer	Target met.

Ensure Efficient Uses of Resources	Waste < 15 segregation non-compliances. Non-compliance definition: - >10% wrong material in the skip. - Waste causing a safety or environmental hazard.	End 2016	All employees	Target met - 2
	Monitor and regularly report waste disposal and recycling statistics to identify minimisation opportunities.	Ongoing	Environmental Compliance Engineer	Target met.
	Water 5% reduction on 2013 target <110 m3/GWh process water (Ely Wells and St Lythans supplement).	End 2016	All employees	Target not met - 208m3/hr
	Monitor and regularly report process and potable water use to identify minimisation opportunities.	Ongoing	Section Head Performance & Commercial Section Head Regulation	Target met.
Be Responsive to Concerns and Complaints regarding our Operations	Provide response to public enquiries and complaints within 48hrs of normal office hours.	Ongoing	Section Head Regulation Environmental Compliance Engineer	Target met.
Be Accountable by Publicly Reporting our Environmental Performance	Hold a Local Liaison Committee.	Jul-16	Station Manager Section Head Regulation	Target met.
Reduce the Carbon Intensity of Electricity Generated	To meet the business plan targets for biomass burn and thermal efficiency.	End 2016	Section Head Materials Handling Section Head Performance & Commercial	Target not met.
Drive Continuous Improvements in Standards of Environmental Management	Ensure the Environmental Management System (EMS) is maintained to ISO 14001, plan and implement the transition process for updating the EMS to the revised 2015 Standard.	End 2016	Section Head Regulation Environmental Compliance Engineer	Target met.
	Ensure all staff and residential contractors (managers and first line supervisors) new to site in 2016 have completed the environmental training program.	End 2016	Section Heads & Line Managers Technical Officers	Target partially met.
	Finalise and roll-out the new environmental training program.	Q2 2016	Environmental Compliance Engineer	Target met.
	Finalise the Biodiversity Management Plan for 2016-2020.	Q1 2016	Environmental Compliance Engineer	Target met.
	Improve the bund planting around the northern laydown area and review landscaping opportunities for biodiversity/visual improvement.	Q4 2016	Environmental Compliance Engineer	Target not met.
	Complete installation of water meters on the process water system.	Q2 2016	Station Chemist	Target partially met.
	Install oil in water monitor in the site drainage system at P2.	Q2 2016	Station Chemist	Target partially met.
	Install a weather station at Aberthaw Centre for Energy and the Environment.	Q2 2016	Environmental Compliance Engineer	Target partially met.

4. Annual Production/Treatment Data 2016

Table 5: Annual Production/Treatment Data(Table S5.2 EP)

Parameter	Value	Unit
Surface water disposed off site	0	m^3/yr
Groundwater disposed off site	0	m^3/yr

5. Contamination/Decontamination of Site

There have been no incidents or emissions which may have caused any site contamination during 2016, and, therefore, no requirement to decontaminate the site during 2016.

6. Topographical Surveys

The last topographical survey to ordnance datum was carried out in May 2009 which was effectively after the ash disposal site had been closed with exception of the temporary storage area on the western side.

7. Landfill Capacity

Aberthaw Ash Disposal Site has reached its maximum height and the only area used for landfilling of Pulverised Fuel Ash (PFA) is the temporary storage area on the western side. Hence, there was no PFA permanently deposited at the ash disposal site in 2016 as recorded Table 6 below and reported to Natural Resources Wales via the Waste Return Form. It is estimated that around 133,588m^3 of void capacity remains within the temporary storage area on the western side of the ash mound.

Table 6: PFA Deposited

Reporting Period	PFA Deposited (tonnes)
1st January – 31st December 2016	0

8. Waste Acceptance Compliance Testing

Aberthaw Ash Disposal Site is a mono-landfill site which is under the direct operational control of Aberthaw Power Station. All the ash is transported directly from the Power Station which is adjacent to Aberthaw Ash Disposal Site.

The exact composition of PFA is dependent upon the composition of the fuel utilised by Aberthaw Power Station. RWE has well established procedures which control the quality of fuel supplied to its stations. The coal purchased by RWEST for Aberthaw is only from an approved 'matrix' for the site (i.e. a list of named coals specifically approved for use at Aberthaw). Any new fuels undergo a rigorous fuel assessment process before trial/use on site to ensure they meet the mandatory fuel specifications and safety requirements of the station.

Table 7 summarises the analytical data obtained for leachate tests performed on composite samples of conditioned PFA from Aberthaw Power Station between 2012 and 2016. The CEN two-stage method for leachate analysis was used (BS EN 12457-3:2002 Characterisation of waste – Leaching – Compliance test for leaching of granular waste materials and sludges of which Part 3).

Table 7: Summary of 10:1 Leachate Calculated Results (mg/kg)

Period	Jan-17	Apr-12 to Jan-17			
Analyte:	Latest Result	Minimum	Mean	Maximum	Number of results
Aluminium as Al (Dissolved)	8.1	2.4	21.9	75.4	15
Ammoniacal Nitrogen as N	156.6	4.2	83.5	158.1	15
Antimony as Sb (Dissolved)	0.192	0.020	0.163	0.256	15
Arsenic as As (Dissolved)	2.449	0.077	1.907	3.313	15
Barium as Ba (Dissolved)	1.4	0.1	2.5	5.9	15
Boron as B (Dissolved)	12.1	0.7	12.8	17.7	15
Bromide as Br	36.3	0.6	71.5	293.5	15
Cadmium as Cd (Dissolved)	0.0010	0.0004	0.002	0.0056	15
Chromium as Cr (Dissolved)	0.19	0.01	0.3	1.03	15
Copper as Cu (Dissolved)	0.010	0.004	0.015	0.028	15
Cyanide (Total) as CN	0.5	0.2	0.3	0.5	15
Dissolved Organic Carbon	25.5	2.2	22.6	43.3	15
Fluoride as F	21.7	2.3	23.5	45.1	15
Iron as Fe (Dissolved)	1.16	0.52	1.03	1.52	15
Lead as Pb (Dissolved)	0.043	0.013	0.034	0.083	15
Manganese as Mn (Dissolved)	0.025	0.006	0.066	0.174	15
Mercury as Hg (Dissolved)	0.0019	0.0004	0.0057	0.0132	15
Molybdenum as Mo (Dissolved)	8.1	0.7	9.4	17.8	15
Nickel as Ni (Dissolved)	0.040	0.003	0.028	0.062	15
Nitrate as N	4.6	2.3	3.1	4.6	15
Selenium as Se (Dissolved)	2.8	0.2	2.1	3.5	15
Sodium as Na (Dissolved)	327	9	821	2696	15
Total Dissolved Solids	6787	350	8888	21800	15
Total Nitrogen as N	162.7	5.0	92.1	166.0	15
Total Sulphur as SO4 (Dissolved)	3745	170	3422	4271	15
Vanadium as V (Dissolved)	3.59	0.40	2.39	3.59	15
Zinc as Zn (Dissolved)	0.17	0.01	0.14	0.57	15

Appendix A. Groundwater and Surface Water Monitoring Locations

East Orchard Wood
Burton Bridge
Burton
Aberthaw Cement Works
Ffwl-y-mwn/ Fonmon
CASTLE ROAD
Overhead
Loforge Aqueduct
Mill
Baronswell
West Lodge
Mortimer Way (Track)
Limestone Quarry
War Meml
St Athan Boys' Village
PW
Quarry
S3
6
Recn Gd
Bryn-y-Mor
West Hall
West Aberthaw Farm
8B
8A
S1
West Aberthaw
Burton Terrace
PW
Quarry
PORT ROAD
5
WELL ROAD
Upper House Farm
East Aberthaw
Station Terrace
EPD
NORTH ROAD
PUMP HOUSE ROAD
CHIMNEY ROAD
MAIN ACCESS ROAD
Coal Heap
Ppg Sta
S2
3B
3A
SOUTH ROAD
ASH PLANT ROAD
TOWER RD
Aberthaw Power Station
Mobile
OCEAN HOUSE ROAD
DIAGONAL ROAD
132KV SWITCH HOUSE RD
9A
9B
Railway Houses
Lime Works
BL
Sand
Andrew's Pant
7B
7A
11A
11B
10A
10B
The Leys
Mineral Railway
Mean High Water
Watch House Beach

N

ENVIRONMENTAL PERMIT BOUNDARY
INACTIVE POINT
ACTIVE BOREHOLES
ACTIVE POINT
INACTIVE BOREHOLES

EPD - EASTERN PERIMETER DITCH
BL - BRACKISH LAGOON

GROUNDWATER QUALITY & LEVELS WILL BE MONITORED WITHIN ACTIVE BOREHOLES & SURFACE WATER QUALITY WILL BE MONITORED AT ACTIVE POINTS

0 50 100 150 200 250
METRES

SJP	**	09.05.16	AL	C
Drawn	Checked	Date	Approved	Rev.

THE PERSON NAMED IN THE "APPROVED BY" BOX HOLDS RESPONSIBILITY FOR THE TECHNICAL CONTENT OF THIS DRAWING AND SHOULD BE CONSULTED PRIOR TO REQUESTING MODIFICATION.

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Size of original	Scale of original
A2	1:5250

Site
ABERTHAW ASH DISPOSAL SITE

Title
GROUNDWATER & SURFACE WATER MONITORING LOCATIONS

Status
APPROVED

Drawing number
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