2015 Annual Performance Report

Aberthaw Ash Disposal Site

Permit Number: DP3432SW

March 2016

RWE

The energy to lead

Summary

This document gives details on the performance of Aberthaw Ash Disposal Site over 2015, as required by condition 4.2.1 of the site's Environmental Permit (EP).

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.

CONTENTS

1. Review of Results for Emission Monitoring

1.1. 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 (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
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*	*16-25*		
E09-01B	*Limestone*	*N*	*22-31*		
E09-02A	*Limestone*	*N*	*19-28*		
E09-02B	*Limestone*	*N*	*25-34*		
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. There was a change to the contractor for the groundwater sampling in July 2011 and a change to the analytical laboratory in February 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	—

Figure 1 shows the recorded groundwater elevations for the previous 9 years which vary between +1 (BH10B/BH7A) to +11m OD (BH5/BH11A). Groundwater elevations in limestone boreholes are characterised by seasonal cyclic water level fluctuations with annual winter influxes of rainfall recharge. 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

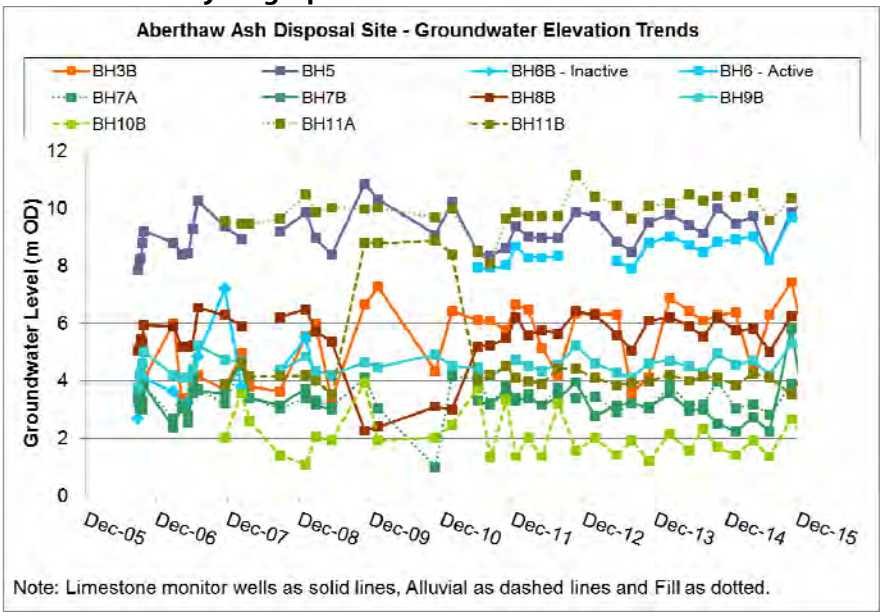


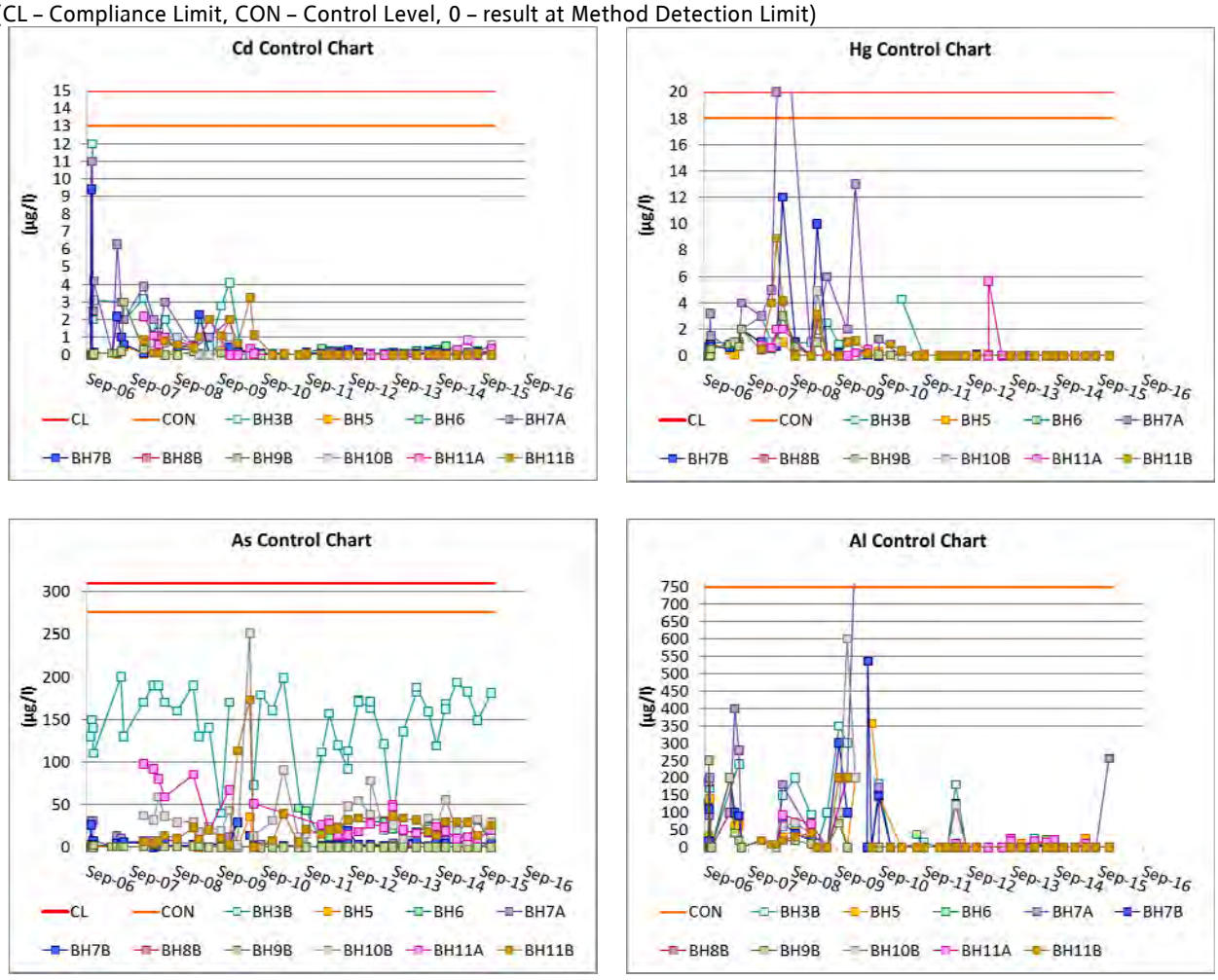
Figure 2 shows the groundwater control charts with concentrations of all boreholes plotted. It should be noted that the compliance limits and control levels (where defined) apply to boreholes BH3B and BH7B. An exceedance is defined as a result above the compliance limit or control level for 3 consecutive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

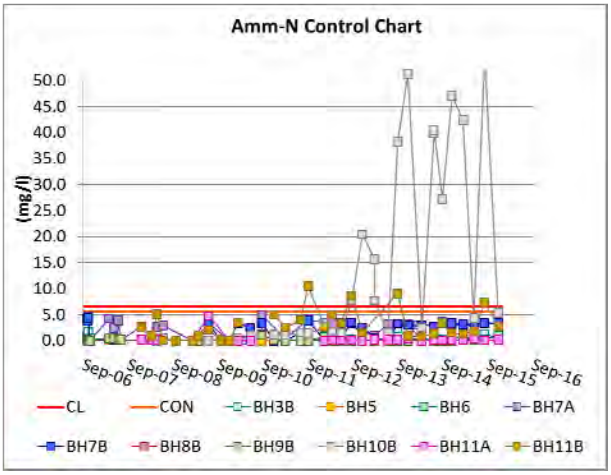
In 2015, there were no exceedances of the compliance limit or control level for any critical parameter. In BH3B there are elevated concentrations of arsenic, boron, molybdenum, sulphate and vanadium. In BH7B there are elevated concentrations of boron, molybdenum and sulphate. In BH7B, the seasonal pattern 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.

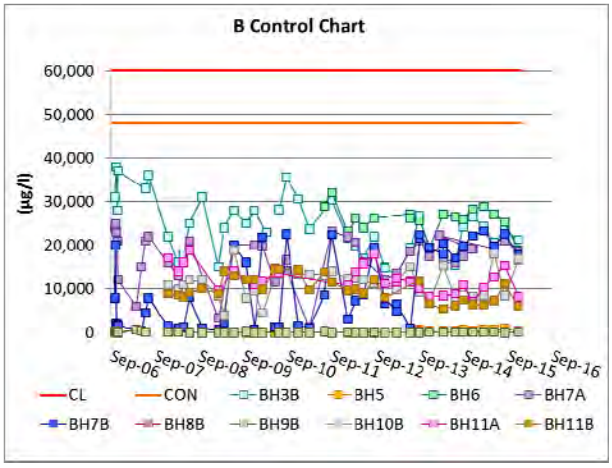
The control charts show that there are no increasing trends in critical parameter concentrations. Other key points to note are:

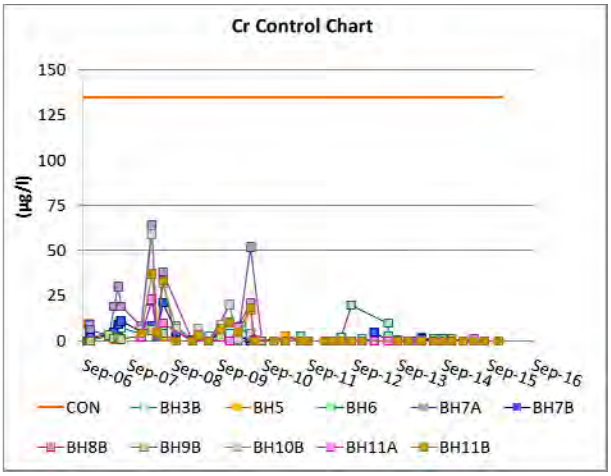
- Decreasing trend in cadmium, mercury, aluminium, chromium and selenium since sampling began;
- Highly variable ammoniacal nitrogen concentrations in BH10B and;
- Elevated sulphate, boron and molybdenum in most boreholes.

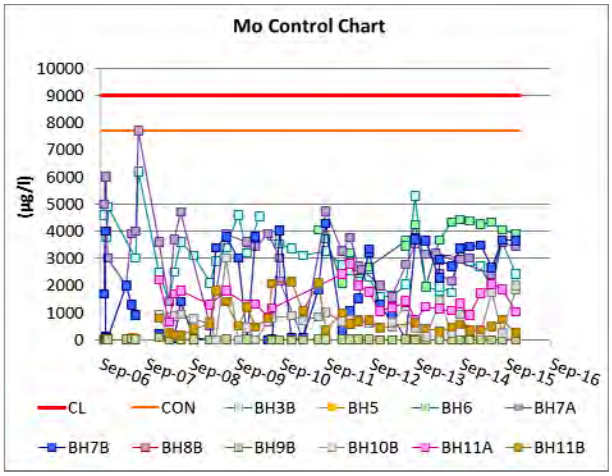
Figure 2: Control charts for groundwater boreholes
(CL – Compliance Limit, CON – Control Level, 0 – result at Method Detection Limit)

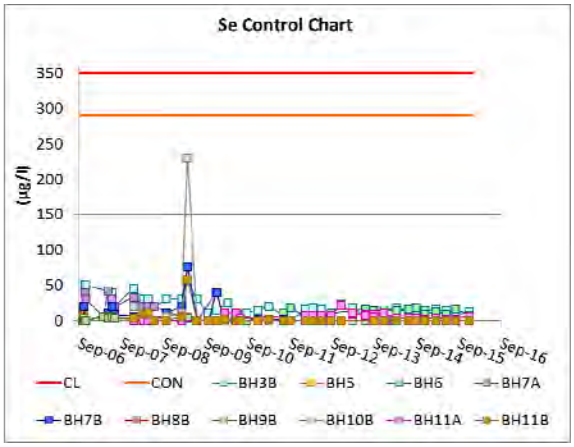


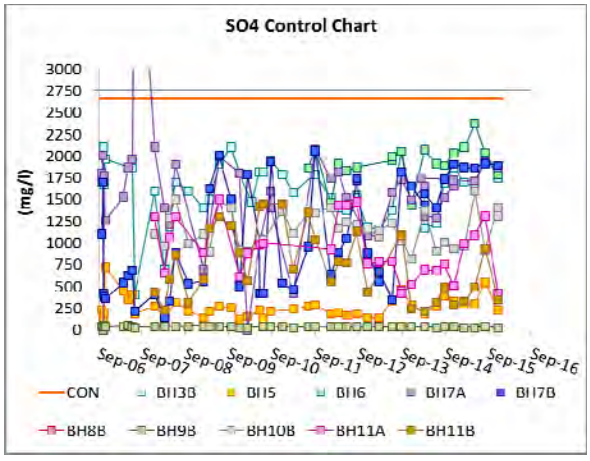

Amm-N Control Chart
(mg/l)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CL CON BH3B BH5 BH6 BH7A
BH7B BH8B BH9B BH10B BH11A BH11B

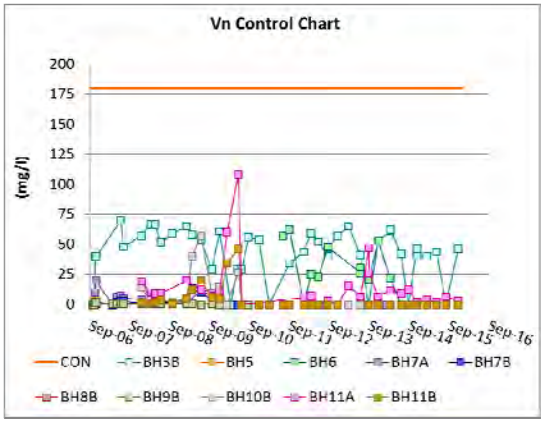

B Control Chart
(µg/l)
60,000
50,000
40,000
30,000
20,000
10,000
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CL CON BH3B BH5 BH6 BH7A
BH7B BH8B BH9B BH10B BH11A BH11B


Cr Control Chart
(µg/l)
150
125
100
75
50
25
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CON BH3B BH5 BH6 BH7A BH7B
BH8B BH9B BH10B BH11A BH11B


Mo Control Chart
(µg/l)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CL CON BH3B BH5 BH6 BH7A
BH7B BH8B BH9B BH10B BH11A BH11B


Se Control Chart
(µg/l)
350
300
250
200
150
100
50
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CL CON BH3B BH5 BH6 BH7A
BH7B BH8B BH9B BH10B BH11A BH11B


SO4 Control Chart
(mg/l)
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CON BH3B BH5 BH6 BH7A BH7B
BH8B BH9B BH10B BH11A BH11B


Vn Control Chart
(mg/l)
200
175
150
125
100
75
50
25
0
Sep-06 Sep-07 Sep-08 Sep-09 Sep-10 Sep-11 Sep-12 Sep-13 Sep-14 Sep-15 Sep-16
CON BH3B BH5 BH6 BH7A BH7B
BH8B BH9B BH10B BH11A BH11B

1.2. 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. Trained in-house operatives are responsible for the sampling of the surface water monitoring points and an independent external laboratory is responsible for the analysis of the samples. There have been no changes to the in-house operatives for the surface water sampling. There was a change to the analytical laboratory in December 2009.

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 compliance limit or control level for 3 consecutive sampling events.

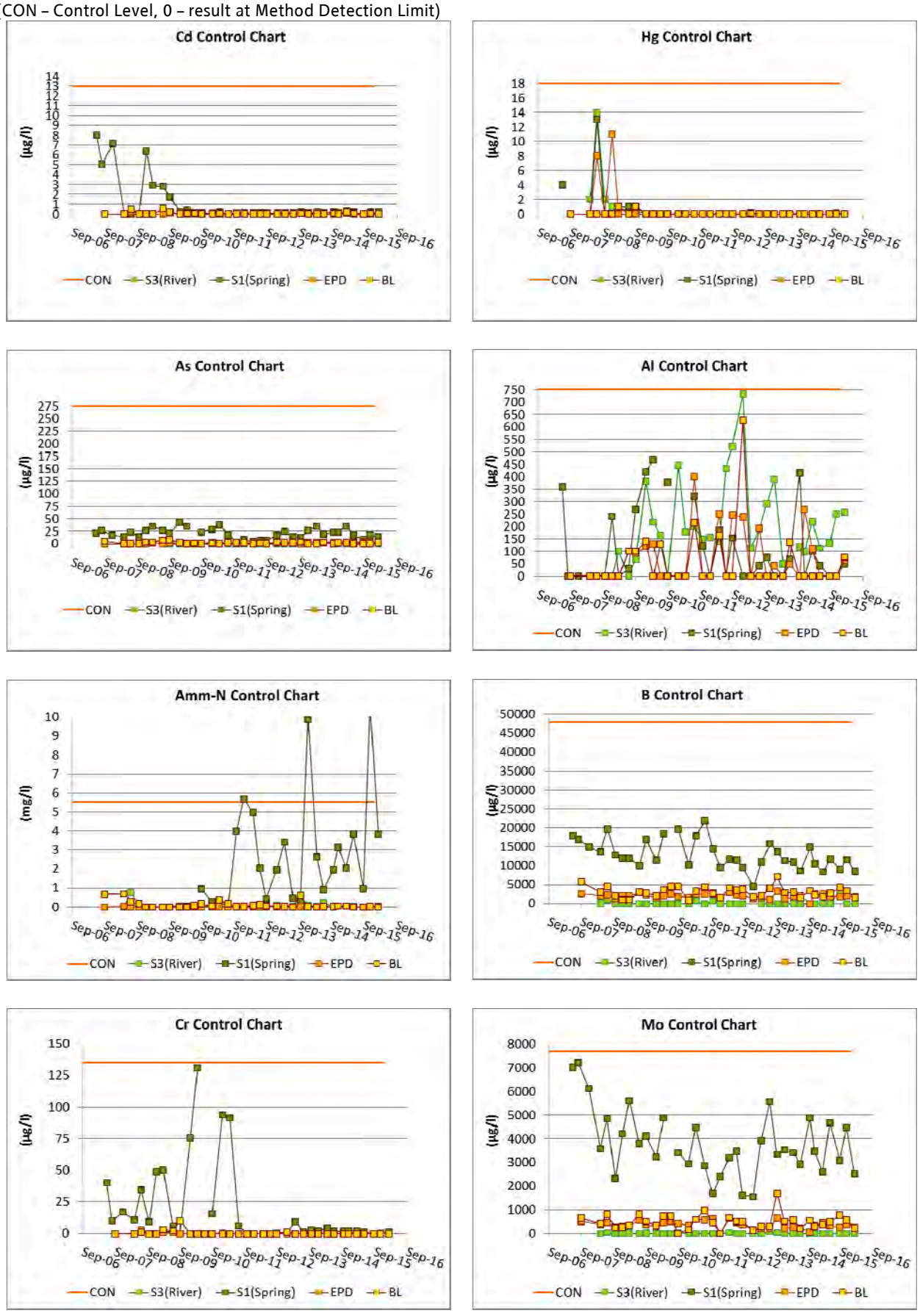
In 2015, there were no exceedances of the control level for any critical parameter. There was 1 elevated ammoniacal-nitrogen result in S1 (Group 5 Spring) in November 2015, which appears to be a spurious result as per November 2013, although it is noted that concentrations appear to increase in the winter and fall again in the summer.

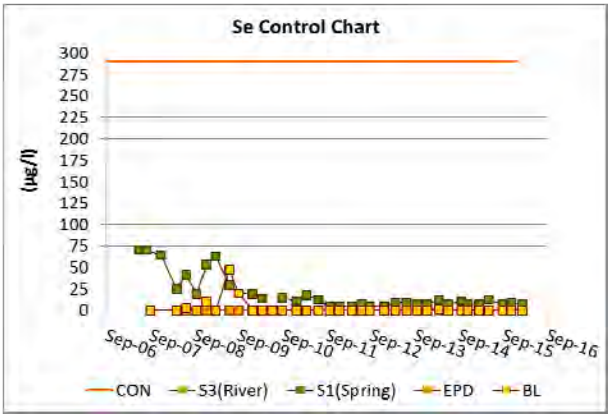
The control charts show that there are no increasing trends in critical parameter concentrations. Group 5 Spring (S1) generally has the highest concentrations of critical parameters, in particular, boron, molybdenum and sulphate, which suggests it is affected by PFA leachate, however, as the water ponds 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:

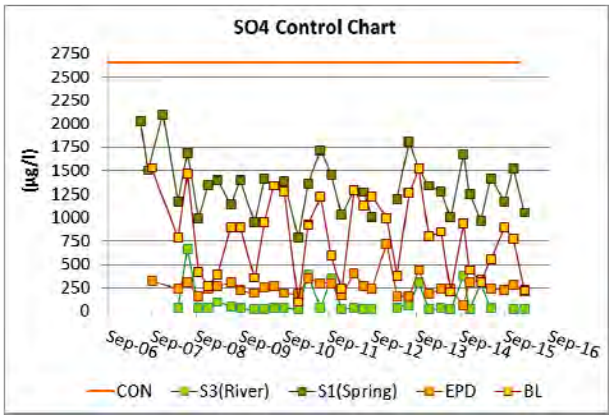
- Decreasing trend in cadmium, mercury, chromium and selenium since sampling began;
- Highly variable aluminium concentrations with highest concentrations in the River Thaw upgradient monitoring point.

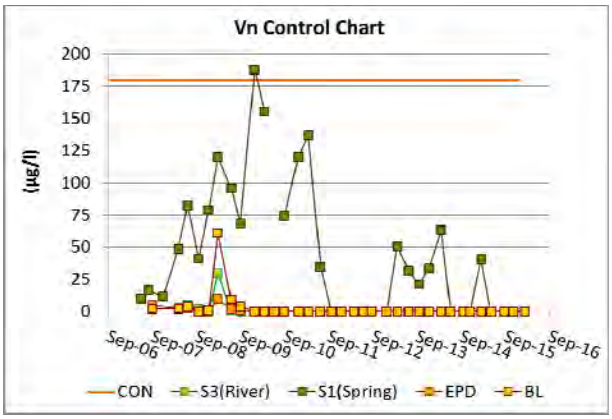
Figure 3: Control charts for surface water monitoring points

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









2. 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 2015 and no non-conformities were identified. Table 4 provides details of the improvement targets for 2015 and the performance against those targets.

Table 4: Environmental Performance 2015

Objective	Target	Target Date	Responsible Person	Final Status
Maintain a High Level of Environmental Compliance	No more then 2 environmental incidents resulting in justified complaints.	End 2015	All employees	0
	No more then zero exceedences of permit conditions which result or have potential to cause significant environmental harm. (Natural Resources Wales CCS Category 1 and 2).	End 2015	All employees	0
	Minimise exceedences of permit conditions which result or have potential to cause minor environmental harm. (Natural Resources Wales CCS Category 3). Fully investigate all exceedences of this type and implement improvements to minimise the likelihood of environmental harm.	End 2015	All employees	2 - CW low pH Discharge & Noise from de-glazing
	No more than zero non-compliance with emissions limits or conditions as set out in EPR permits (Natural Resources Wales CCS Category 4). Submit all NRW reporting on time.	End 2015	Environmental Compliance Engineer	0
	Provide environmental support for the Low NOx Boiler Project including environmental permitting, impact assessment and analysis.	Ongoing	Environmental Compliance Engineer	Permit Variation received 28/08/15.

Objective	Target	Target Date	Responsible Person	Final Status
	Complete response to Improvement Condition 35 – Cost benefit appraisal of best available technique for safe passage of eel.	30/06/2015	Environmental Compliance Engineer	Response submitted 24/06/15.
	Complete responses to Improvement Condition 7: (1) 2015 soil sampling/vegetation analysis report. (2) 2014 Third year monitoring report	31/08/2015 13/11/2015	Environmental Compliance Engineer	(1) Report submitted 20/08/15. (2) Report submitted 13/11/15.
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 2015	All employees	6
	Monitor and regularly report waste disposal and recycling statistics to identify minimisation opportunities.	Ongoing	Environmental Compliance Engineer	Completed
	Water 5% reduction on 2013 target < 110 m3/GWh process water (Ely Wells and St Lythans supplement).	End 2015	All employees	Dec - 229m3/GWhr YTD - 173m3/GWhr
	Monitor and regularly report process and potable water use to identify minimisation opportunities.	Ongoing	Section Head Performance & Commercial Section Head Regulation	Completed
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	Compliant
Be Accountable by Publicly Reporting our Environmental Performance	Hold a Local Liaison Committee.	Nov-15	Station Manager Section Head Regulation	Held 28/10/15 - no issues.
Reduce the Carbon Intensity of Electricity Generated	To meet the business plan targets for biomass burn and thermal efficiency.	End 2015	Section Head Materials Handling Section Head Performance & Commercial	Biomass -39% TEMP -0.45%
Drive Continuous Improvements in Standards of Environmental Management	Ensure the Environmental Management System (EMS) is maintained to ISO 14001 and plan for updating the EMS to the revised 2015 Standard.	Ongoing	Section Head Regulation Environmental Compliance Engineer	BIP created. Two successful surveillance visits. Training attended.
	Ensure all staff and residential contractors (managers and first line supervisors) new to site in 2015 have completed the environmental training program.	End 2015	Section Heads Technical Officers	Staff - 71% Contractors - 100%
	Progress development of a new environmental training program.	Q4 2015	Environmental Compliance Engineer	Contract in place and work in progress.
	Update the Biodiversity Management Plan.	Q3 2015	Environmental Compliance Engineer	Draft received.

Objective	Target	Target Date	Responsible Person	Final Status
	Upgrade the emissions to air monitoring and reporting systems to meet the requirements of the Industrial Emissions Directive.	Dec-15	Environmental Compliance Engineer	MERS, G2 & PIPB Updated.
	Plan for demolition of the 3MW carbon capture pilot plant.	Q2 2015	Section Head Regulation	Planning Permission Condition for demolition removed.
	Complete installation of water meters on the process water system.	Q4 2015	Station Chemist	2 Magflow Meters waiting for installation on HP and LP (AR 15/500976 & 15/500977).
	Install oil in water monitor in the site drainage system at P2.	Q4 2015	Station Chemist	Installation planned.
	Install a weather station at Aberthaw Centre for Energy and the Environment.	Q4 2015	Section Head Regulation	Weather station installed awaiting connection to PIPB.

3. Performance Parameters

The table below details the site performance parameters for 2015:

Performance Parameter	Quantity	Unit
Surface water disposed off site	0	m^3/yr
Groundwater disposed off site	0	m^3/yr
Energy used (including for leachate treatment)	0	MWh of electricity

4. Contamination/Decontamination of Site

There have been no incidents or emissions which may have caused any site contamination during 2015, and, therefore, no requirement to decontaminate the site during 2015.

5. 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.

6. Landfill Capacity

During 2015 the ash disposal site was closed for any landfilling activities except for in the temporary storage area on the western side. Hence, there was no PFA permanently deposited at the ash disposal site in 2015 as recorded in the table below and reported to Natural Resources Wales via the Waste Return Form. It is estimated that around 194,140 tonnes of void capacity remains within the temporary storage area on the western side of the ash mound.

Reporting Period	PFA Deposited (tonnes)
January 15 – December 15	0

7. 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.

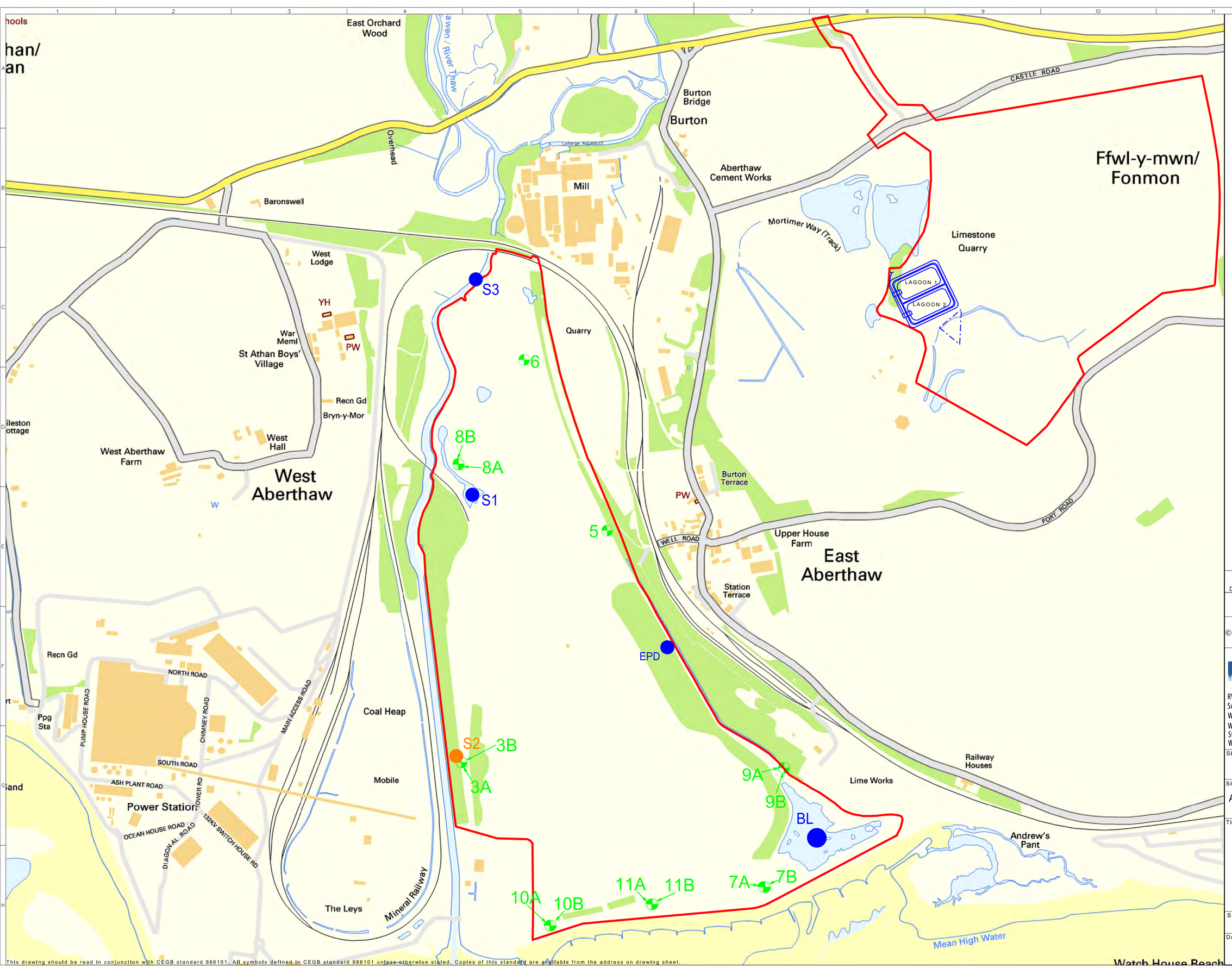
The exact composition of PFA is dependent upon the composition of the fuel utilised by Aberthaw Power Station. RWE has well established procedures which control the quality of fuel supplied to its stations. The coal purchased by RWEST for Aberthaw is only from an approved 'matrix' for the site (i.e. 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 5 summarises the analytical data obtained for leachate tests performed on composite samples of conditioned PFA from Aberthaw Power Station between 2012 and 2015. 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 5: Summary of 10:1 Leachate Calculated Results (mg/kg)

	Jul-15	Apr-12	to	Jul-15	
Analyte:	Latest Result	Minimum	Mean	Maximum	Number of results
Aluminium as Al (Dissolved)	2.4	2.4	24.8	75.4	12
Ammoniacal Nitrogen as N	4.2	4.2	74.7	158.1	12
Antimony as Sb (Dissolved)	0.020	0.020	0.2	0.256	12
Arsenic as As (Dissolved)	0.461	0.077	1.7	3.274	12
Barium as Ba (Dissolved)	0.1	0.1	2.7	5.9	12
Boron as B (Dissolved)	0.7	0.7	12.7	17.7	12
Bromide as Br	0.6	0.6	86.1	293.5	12
Cadmium as Cd (Dissolved)	0.0004	0.0004	0.0023	0.0056	12
Chromium as Cr (Dissolved)	0.01	0.01	0.33	1.03	12
Copper as Cu (Dissolved)	0.004	0.004	0.017	0.028	12
Cyanide (Total) as CN	<0.02	bld*	bld*	bld*	12
Dissolved Organic Carbon	2.2	2.2	19.8	34.4	12
Fluoride as F	2.3	2.3	25.6	45.1	12
Iron as Fe (Dissolved)	0.52	0.52	0.89	1.17	12
Lead as Pb (Dissolved)	0.013	0.013	0.036	0.083	12
Manganese as Mn (Dissolved)	0.006	0.006	0.081	0.174	12
Mercury as Hg (Dissolved)	0.0004	0.0004	0.0063	0.0132	12
Molybdenum as Mo (Dissolved)	0.7	0.7	8.8	16.2	12
Nickel as Ni (Dissolved)	0.003	0.003	0.012	0.019	12
Nitrate as N	<0.01	2.6	2.7	2.7	12
Selenium as Se (Dissolved)	0.3	0.2	2.1	3.5	12
Sodium as Na (Dissolved)	9	9	974	2696	12
Total Dissolved Solids	350	350	8125	16169	12
Total Nitrogen as N	5.0	5.0	83.5	166.0	12
Total Sulphur as SO4 (Dissolved)	170	170	3338	4271	12
Vanadium as V (Dissolved)	0.40	0.40	2.28	3.43	12
Zinc as Zn (Dissolved)	0.01	0.01	0.15	0.57	12
*bld = below limit of detection					

Appendix A. Groundwater and Surface Water Monitoring Locations



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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
ISSUED

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UKP/ATB/1379/A

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