pH Trial Report – Improvement Condition IC39

Aberthaw Power Station EP RP3133LD/V012

Reference Number: RP3133LD/V012/IC39

September 2016

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RWE Generation UK plc Aberthaw Power Station
EP RP3133LD/V012

pH Trial Report – Improvement Condition IC39

Prepared for Natural Resources Wales

This report has been produced to fulfil the requirements of Improvement Condition IC39 as part of Environmental Permit RP3133LD/V012:

A written report shall be submitted to Natural Resources Wales for approval. The report shall describe the outcome of the reduced pH discharge trials submitted as further information to the Regulation 60 Notice response dated 02/12/15. The report shall include quantification of the sulphur dioxide emission reductions achieved and relevant performance parameters including but not limited to

- *Energy consumption for SWTP operation*
- *Upper limit of coal sulphur content*
- *Changes in seawater discharge amenity, including foaming and odour*
- *Changes in concrete infrastructure condition*
- *Changes in seawater discharge TOC, dissolved oxygen, sulphide, sulphite and dissolved trace elements levels.*
- *TROLL instrument performance*

The report shall include a justification of the Best Available Techniques Associated Emission Limits (BAT ELV's) for seawater process FGD discharge pH to be adopted upon completion of the trial programme and approval by Natural Resources Wales.

The notification requirements of condition 2.4.2 shall be deemed to have been complied with on submission of the report.

CONTENTS

1. Introduction

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1.1. Background

In 2008, to comply with the Large Combustion Plant Directive, the Aberthaw Power Station installed a Flue Gas Desulphurisation (FGD) process. This utilises the station's sea water cooling water to absorb approximately 95% of the sulphur dioxide gases generated in the coal combustion process. This results in an acidic effluent that is neutralised by the addition of oxygen in the Sea Water Treatment Plant (SWTP), before being released back into the Bristol Channel. The level of acidity is directly related to the sulphur content of the various coals fired by the Power Station.

The original FGD design reflected the quantity and quality of appropriate low volatile Welsh and internationally sourced coal available in the coal market.

In recent years, the volume of available coal has decreased significantly with the decline of the Welsh coal industry and the expansion of the Chinese economy attracting many of the international coals previously readily available to Aberthaw.

Those coals remaining available to the Power Station typically have higher sulphur levels than the original FGD design, however via a series of controlled trials the Station has to date been able to accommodate the increasing coal sulphur levels by optimisation of the original SWTP / FGD operation.

It is now agreed however that the SWTP process is operating at maximum capacity within the discharge limits stipulated in the Station's operating permit.

From 2016 onward, the volume of appropriate low volatile coal is yet further constrained with the indigenous suppliers predicting increased sulphur levels and international supplies becoming limited to only one suitable supplier. Furthermore, during Summer 2017 the Station are planning to convert all three units to be able to burn higher volatile coals than historically have been fired at Aberthaw. These higher volatile coals will be internationally sourced and are typically of sulphur content 0.8 – 1.5% sulphur i.e significantly higher sulphur content than the currently sourced international coals.

In order to address these constraints, RWE proposed a temporary variation to the Station's cooling water discharge pH of 5.6 (instantaneous) and 5.8 – 6.0 (95%ile of instantaneous measurements). To confirm this variation has no adverse impact to the environment, the Station initially proposed a 3 month trial, however this was extended, with permission from NRW to just over 5 months duration operating with the new pH limits alongside specifically designed chemical and environmental monitoring programmes that would identify and prompt immediate cessation of the trial on the detection of any adverse environmental impact.

2. Trial Programme

As mentioned above the trial was initially programmed to run from January 1st to March 31st 2016, however due to delays in the return of Unit 9 from its Low NO_x Technology upgrade installation programme the trial actually started on 27th January and went on until the end of July, although there was very little generation in the month of July.

3. Trial Results

3.1. Sulphur dioxide emissions

The coal that was supplied to the station during this trial period did not had a sulphur content as high as that predicted or contracted. There has been a general increase in sulphur content over the trial period, although this has not been outside of levels previously received at the station (see Figure 1), however, previously, these higher sulphur coals would have been blended with lower sulphur coals. The highest sulphur coal content received during the trial period was just under 2.2% which was a Fos y Fran coal. Figure 2 below shows the Fos y Fran coal sulphur levels during the last couple of years and the general upward trend during the trial can be seen (pre-trial FYF approx. 1-1.5%, during trial approx. 1.1-2.2%).

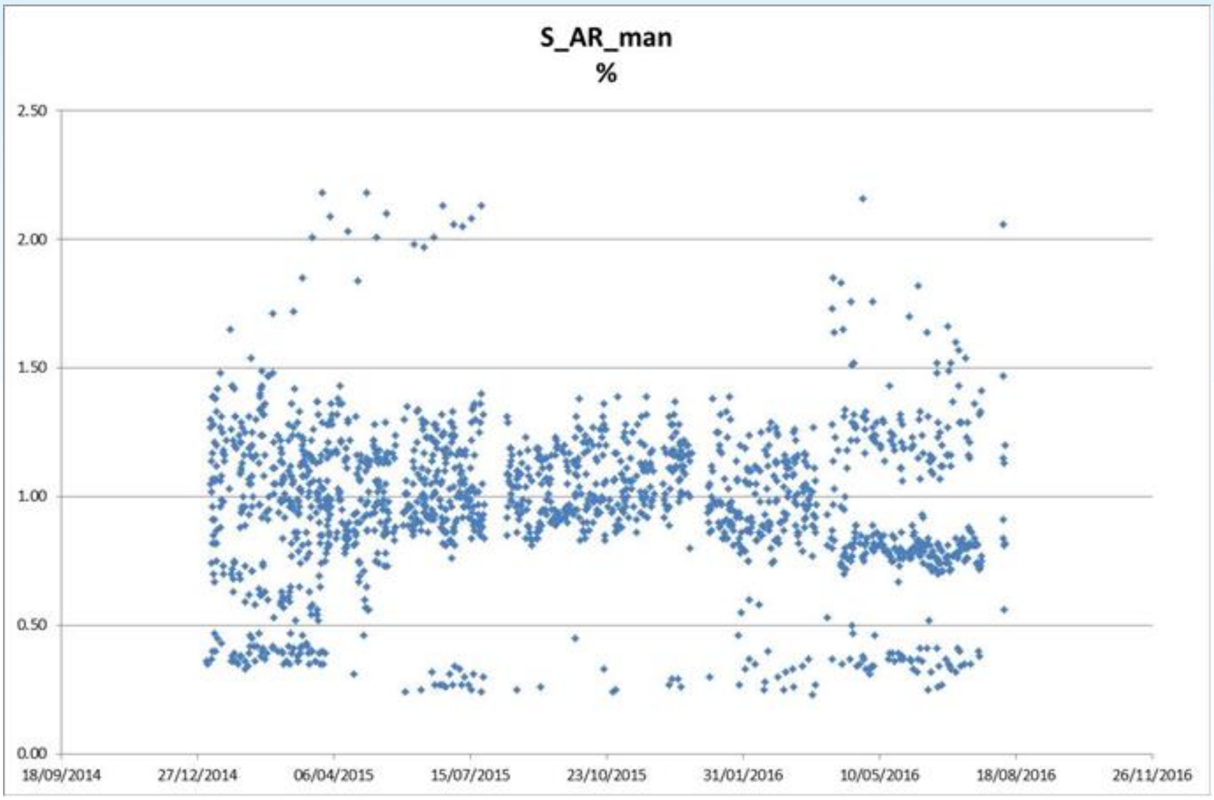

Figure 1 - % Sulphur coal received (all sources)

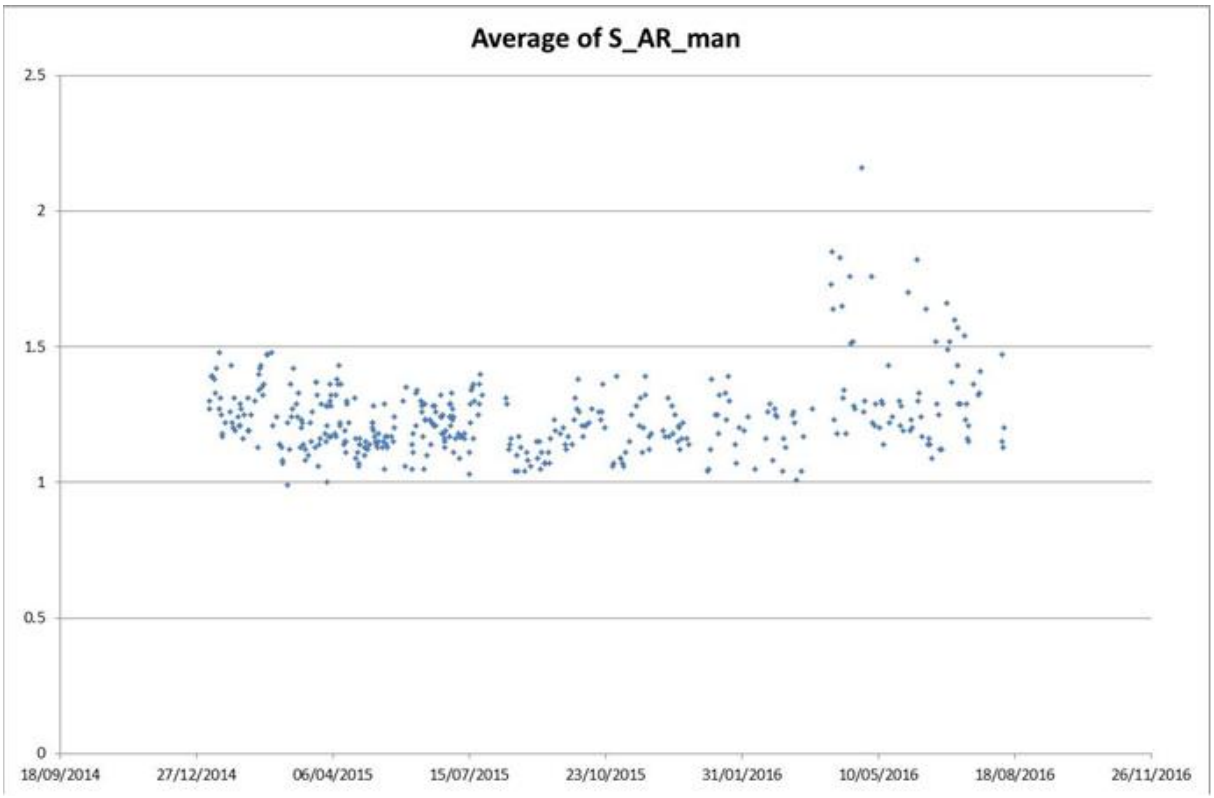

Figure 2 - Fos y Fran % Sulphur coal received

The information submitted with the trial request indicated that it was not expected that SO_2 emissions would significantly change, however the graph below shows the monthly mean SO_2 emissions since the beginning of 2015 and it does show that SO_2 emissions were lower during the trial period than for the same period the previous year. This appears to tie in with the pH readings of the two periods (see Figure 4), in Feb-July 2015 the SO_2 emissions to air are higher and the pH readings are higher, whereas in Feb-July 2016 the SO_2 emissions to air are lower and the pH readings are lower. This change was attributed to the greater flexibility of the SWTP with the lower pH limit and hence greater opportunity to optimise the FGD damper system. Note that whilst not exactly the same for both years the load factors for these periods were similar, it should also be noted that as a result of the Industrial Emissions Directive (IED) the monthly SO_2 emission limit changed at the beginning of 2016 which may also have influenced the SO_2 emissions to air.

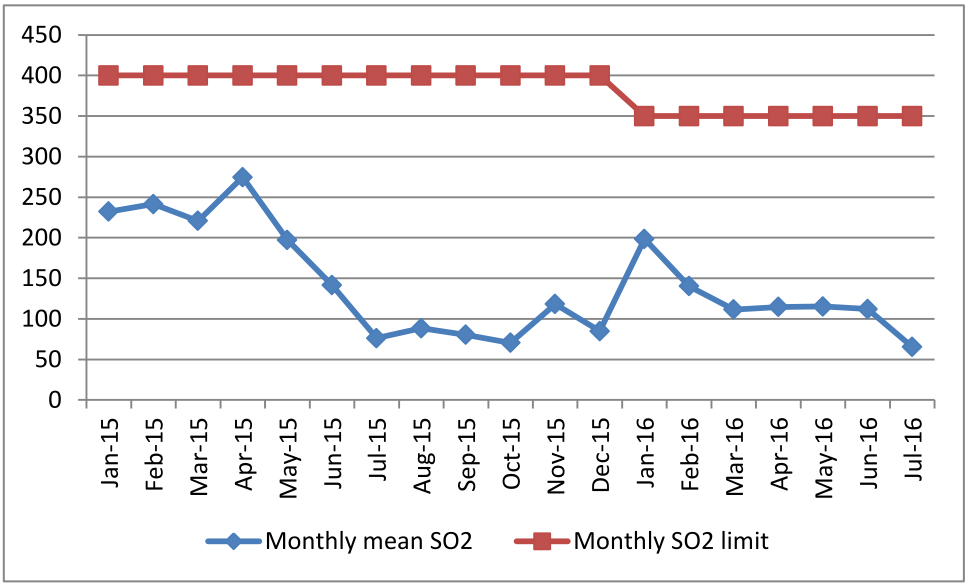

Figure 3 - Monthly SO_2 emissions

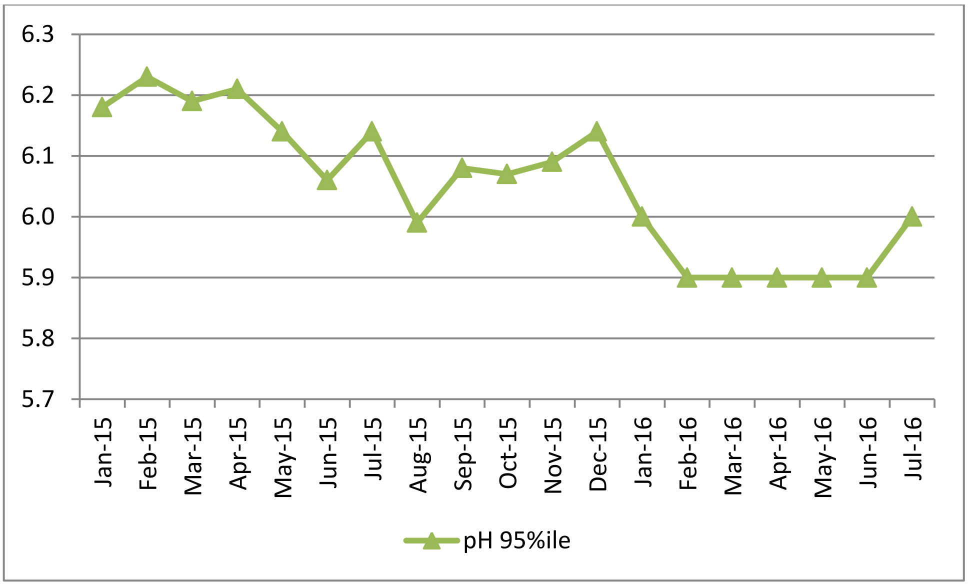

Figure 4 - Monthly minimum pH 95%ile

3.2. Seawater Treatment Plant (SWTP) energy consumption

Making a direct comparison of works power pre and post-trial and therefore any change in seawater treatment plant energy consumption is difficult. There are many variables that impact on how the SWTP system operates, and therefore how much works power is used, these include tide levels & cooling water flow, sea temperatures, number of cooling water pumps in service, coal sulphur content, coal Net Calorific Value, number of units on load and generated load per unit.

What has been demonstrated is the impact individual aeration blowers have on pH and therefore a works power to pH relationship has been created. On average 1 blower is 0.07pH units, so for a given set of conditions a discharge pH that is 0.2 pH units lower is approximately equal to 3 less blowers in operation which at 0.5MW each which would be a 1.5MW reduction in energy consumption. However a higher sulphur loading would mean that these blowers would need to remain in service to meet the required pH limit and the energy consumption would remain the same.

The graph below shows the percentage of works power used by the SWTP compared to the station generation for the last few years, it shows that the trial period was within the range for the past few years, with the exception of July where the station was not operating but had a number of warming contracts from National Grid.

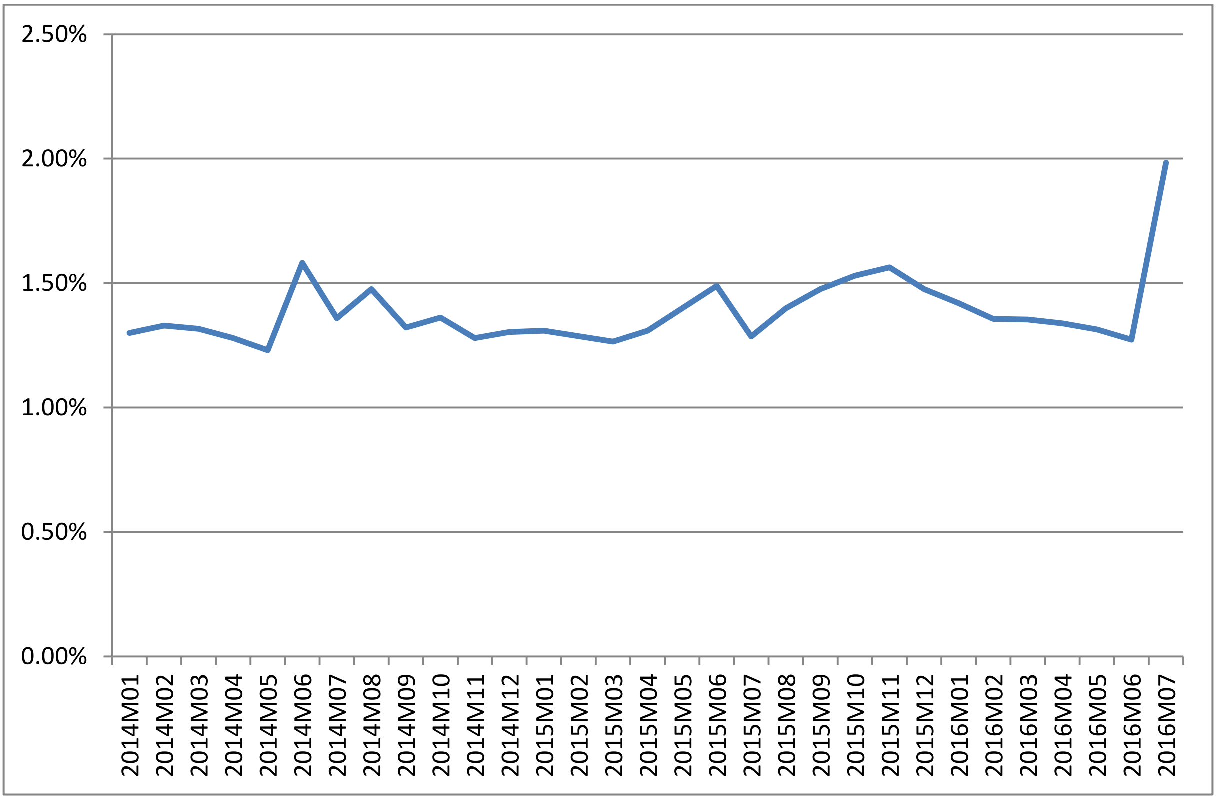

Figure 5 – FGD Works Power as a proportion of Total Generation

3.3. Seawater Treatment Plant (SWTP) concrete infrastructure condition

In order to check the condition of the concrete infrastructure of the SWTP regular inspections are required. This involves a station outage and partial drainage of the system. At a scheduled inspection in 2009 some deterioration was noted, this was repaired in 2011. Another inspection took place in 2013 to confirm condition, only very minor localised issues were noted and therefore it was decided that there was no need for another inspection until 2017. This means that there has been no inspection pre and post the pH trial, however it was considered that the lowering in pH of 0.2 was not likely to have any impact on the condition of the SWTP infrastructure or equipment. See Appendix A for further information on justification for the delay until 2017. In addition there has been no change in the groundwater quality which is monitored in 2 locations to the west of the SWTP which would detect any significant degradation of the SWTP infrastructure.

3.4. Seawater discharge amenity

To check if the trial had any potential negative impacts in terms of amenity, daily (weekday) checks were made on both levels of foam and odour at the SWTP. There were 2 isolated days when an odour was noticeable (03/02 and 10/02), on these days higher amounts of foam were also seen, however, the discharge pH was not particularly low. There were also higher levels of foam seen for a whole week period (06/06-10/06), however again this was not a period when the discharge pH was low. From this information the trial does not appear to have had any impact on either foaming or odour, to back this up there were no complaints during the trial period

3.5. Seawater discharge quality

Below is a summary of the seawater discharge quality monitoring that was carried out during the trial.

pH

The table below shows the pH data reported to NRW during the reduced pH trial as required by the Environmental Permit. The data shows that the station operated within the constraints of the pH ELVs granted for the duration of the trial.

Table 1: CW Outlet pH

	Min	Maximum 95%ile	Minimum 95%ile	Average
ELV	**5.6**	**8.5**	**5.8**	**NA**
Jan	5.7	7.9	6.0	6.5
Feb	5.6	7.8	5.9	6.3
Mar	5.8	7.8	5.9	6.2
Apr	5.9	7.8	5.9	6.3
May	5.8	8.1	5.9	7.2
Jun	5.8	8.3	5.9	6.6
Jul	5.9	8.3	6.0	7.7

Notes:

Data is from the continuous monitoring probe in the CW Outlet seal pit. The May minimum pH data excludes the low reading on the 21st May reported separately to NRW as this was not

related to the trial.

Dissolved Oxygen

The table below shows the Dissolved Oxygen (DO) data reported to NRW during the reduced pH trial as required by the Environmental Permit. The data shows that the DO concentrations are within the range seen in 2015 and consequently there have been no changes in the DO concentrations for the seawater discharge during the reduced pH trial. The Jacobs environmental surveys took spot DO measurements directly by the eastern outfall (although as percentages as opposed to mg/l), these appeared relatively stable across the trial period at between 98.38% and 98.73%.

Table 2: CW Outlet DO (mg/l)

	Min	Max	Average
2015	*2.6*	*13.0*	*9.3*
Jan	6.6	13.0	10.5
Feb	7.2	13.0	10.2
Mar	7.4	13.0	10.1
Apr	6.4	13.0	9.7
May	4.2	13.0	10.2
Jun	3.5	13.0	8.6
Jul	4.2	12.8	10.1

Notes:

Data is from the continuous monitoring probe in the CW Outlet seal pit.

Total Organic Carbon

The Environmental Permit does not require routine monitoring of Total Organic Carbon, however, it is monitored on a six monthly basis as part of the general cooling water survey. In order to assess any changes in total organic carbon concentrations during the reduced pH trial, the monitoring parameter was added to the routine monthly analysis suite for CW Inlet and CW Outlet samples. The data in the table below shows that the total organic carbon concentrations are within the range seen between 2011 and 2015 and consequently there has been no changes in the total organic carbon concentrations for the seawater discharge during the reduced pH trial.

Table 3: Total Organic Carbon Concentrations for cooling water (mg/l)

	CW Inlet	CW Outlet	CW Inlet 2011-15	CW Outlet 2011-15
Jan	1.4	1.9		
Feb	1.8	1.6		
Mar	2	1.65		
Apr	1	1.55	1 – 16.8	0.9-6.2
May	<0.7	<0.7		
Jun	1.35	1.45		
Jul	1.5	1.45		

Notes:

Monthly concentrations are the average of duplicate samples from a monthly composite sample.

Sulphide

Sulphide has not historically been measured in the seawater discharge and this is a new monitoring requirement, therefore, it is difficult to assess any changes during the reduced pH trial. The Environmental Permit confirmed that monitoring arrangements need to be agreed with NRW and discussions have taken place. The monitoring parameter was added to the routine monthly analysis suite for CW Outlet samples from June 2016 with results for June and July 2016 at <0.01mg/l which are below the proposed BAT AEL of 0.1-0.2mg/l.

Sulphite

Sulphite has not historically been measured in the seawater discharge and this is a new monitoring requirement, therefore, it is difficult to assess any changes during the reduced pH trial. The Environmental Permit confirmed that monitoring arrangements need to be agreed with NRW and discussions have taken place. As sulphite rapidly oxidises to sulphate, samples have to be analysed immediately after collection, therefore, spot samples were taken from the CW Outlet throughout the trial and immediately analysed on site for sulphite. The table below summarises the results and indicates the number of Units running. The data shows the sulphite concentrations are between 0.64 and 1.28mg/l which are below and within the proposed BAT AEL of 1-20mg/l.

Table 4: CW Outlet Sulphite (mg/l)

Date	Time	No. Units Operational	Sulphite (mg/l)
24/02/2016	14:30	3	1.28
03/05/2016	15:00	2	1.28
19/05/2016	15:00	1	1.28
20/05/2016	14:30	1	1.28
23/05/2016	13:10	1	1.28
31/05/2016	15:30	1	0.64
08/06/2016	14:30	3	0.64
13/06/2016	10:40	1	0.64
20/06/2016	14:00	2	0.64
27/06/2016	12:10	1	1.28
05/07/2016	13:40	1	1.28
12/07/2016	15:00	0	0.64
15/07/2016	11:05	1	1.28
21/07/2016	09:30	1	0.64
22/07/2016	13:45	1	0.64
04/08/2016	14:10	1	0.64

Trace Elements

The Environmental Permit requires the routine analysis of trace elements in the CW Inlet, CW Outlet and each Unit FGD Absorber Outlet when the Unit is operational. The tables below summarises this data along with the historic range of concentrations between January 2013 and December 2015. The data shows that there has not been an increase in concentrations of trace elements in the seawater discharge during the reduced pH trial except for selenium, although this increase is not reflected in the samples from the Unit FGD Absorber Outlets. Arsenic concentrations are slightly elevated in the Unit 7 FGD Absorber Outlet and Unit 9 FGD Absorber Outlet, however, if you consider the maximum concentration seen across the FGD Absorber Outlets, there are only 2 results above this in January and April for Unit 7. Zinc concentrations are moderately elevated in the Unit 9 FGD Absorber Outlet, however they are within the maximum concentration seen across the FGD Absorber Outlets.

Table 5: CW Inlet Trace Element Concentrations (µg/l)

	As	Se	Cd	Pb	Zn	Hg
Historic range	*1.6-3.0*	*<1*	*0.034-0.069*	*0.50-7.43*	*6.64-97.20*	*0.01-0.03*
Jan	**3.4**	<1	0.042	4.72	15.75	0.03
Feb	**3.3**	<1	<0.06	5.64	21.15	0.02
Mar	**3.4**	<1	0.044	4.77	17.20	0.01
Apr	2.8	<1	0.044	1.98	9.32	<0.01
May	2.0	<1	**0.080**	1.41	13.85	0.01
Jun	1.3	<1	0.054	0.32	5.44	<0.01
Jul	1.4	<1	0.056	0.52	8.30	0.01

Notes:

Monthly concentrations are the average of duplicate samples from a monthly composite sample. The historic range for As is the average of monthly duplicate samples collected between September 2009 and March 2011. The historic range for the other parameters is for the monthly average of duplicate samples collected between January 2013 and December 2015. Concentrations above the historic range are in bold orange.

Table 6: CW Outlet Trace Element Concentrations (µg/l)

	As	Se	Cd	Pb	Zn	Hg
Historic range	*1.51-4.44*	*1-1.27*	*0.034-0.067*	*0.78-7.2*	*5.88-21.40*	*0.014-0.279*
Jan	4.17	**2.28**	0.033	6.50	18.55	0.100
Feb	3.62	**1.28**	0.033	4.73	18.75	0.100
Mar	4.01	**1.32**	0.042	5.53	17.5	0.089
Apr	4.21	1.04	0.039	4.58	15.5	0.098
May	2.47	<1	0.053	2.15	12.15	0.036
Jun	2.34	**2.68**	0.050	2.35	10.26	0.022
Jul	1.63	<1	0.047	1.21	6.46	0.012

Notes:

Monthly concentrations are the average of duplicate samples from a monthly composite sample. The historic range is for the monthly average of duplicate samples collected between January 2013 and December 2015. Concentrations above the historic range are in bold orange.

Table 7: U7 FGD Absorber Outlet Trace Element Concentrations (µg/l)

	As	Se	Cd	Pb	Zn	Hg
Historic range	*2.32-5.58*	*1.69-7.67*	*0.033-0.066*	*1.26-7.32*	*3.25-58.6*	*0.149-2.09*
Jan	**7.39**	6.31	<0.06	**8.24**	26.2	0.65
Feb	**6.28**	5.0	<0.06	6.57	28.55	0.24
Mar	4.89	2.71	<0.06	6.24	21.7	0.42
Apr	**6.94**	3.45	<0.06	7.31	29.3	0.59

May	Unit Shutdown					
Jun	3.61	2.94	0.044	2.81	11.75	0.71
Jul	Unit Shutdown					

Notes:
Monthly concentrations are the average of duplicate samples from a monthly composite sample. The historic range is for the monthly average of duplicate samples collected between January 2013 and December 2015. Concentrations above the historic range are in bold orange.

Table 8: U8 FGD Absorber Outlet Trace Element Concentrations (µg/l)

	As	**Se**	**Cd**	**Pb**	**Zn**	**Hg**
Historic range	*2.46-6.66*	*1.01-5.48*	*0.031-0.124*	*1.29-7.67*	*6.83-38.90*	*0.09-2.23*
Jan	5.87	2.83	<0.06	6.59	29.20	0.38
Feb	5.51	2.28	<0.06	6.38	28.55	0.31
Mar	4.06	2.25	<0.06	3.84	14.80	0.49
Apr	5.09	2.13	<0.06	4.16	22.55	0.35
May	Unit Shutdown					
Jun	2.02	2.24	0.078	1.04	12.80	0.20
Jul	2.29	1.10	0.059	0.59	6.42	0.14

Notes:
Monthly concentrations are the average of duplicate samples from a monthly composite sample. The historic range is for the monthly average of duplicate samples collected between January 2013 and December 2015. Concentrations above the historic range are in bold orange.

Table 9: U9 FGD Absorber Outlet Trace Element Concentrations (µg/l)

	As	**Se**	**Cd**	**Pb**	**Zn**	**Hg**
Historic range	*1.99-4.42*	*0.05-4.70*	*0.032-0.063*	*0.87-7.88*	*6.4-21.0*	*0.18-0.56*
Jan	Unit Shutdown					
Feb	**4.73**	**4.74**	0.050	6.48	**31.2**	0.30
Mar	**4.93**	3.50	0.033	5.55	**22.3**	**0.78**
Apr	**4.43**	3.18	<0.03	4.59	**22.0**	0.53
May	3.06	2.68	0.047	2.53	13.0	0.34
Jun	2.33	3.45	0.049	2.16	11.8	0.32
Jul	Unit Shutdown					

Notes:
Monthly concentrations are the average of duplicate samples from a monthly composite sample. The historic range is for the monthly average of duplicate samples collected between January 2013 and December 2015. Concentrations above the historic range are in bold orange.

Seal Pit Monitoring

It is intended to upgrade the existing main effluent outlet pH monitoring system at the seal pit from the current 2 x pH probes (direct immersion) each with an independent output signal to a 3 x pH (direct immersion) probe system which would produce a single signal output which will be an averaged reading of 2 out of the 3 signals. The reason for this is to increase instrument redundancy as well as improving clarity for the operators by having a single reading for compliance. In order to achieve the new system significant effort has been made in testing the new generation of pH monitors which are replacing the current units used at Aberthaw. There have been several teething problems which have delayed progress however an order has now been placed to purchase the new units and the system will be upgraded in the near future.

Outfall Monitoring

As part of the trial a pH probe was installed at the outfall to further increase knowledge of pH as the cooling water system moves through to discharge. There were some initial power issues with the probe so data is limited to between 23rd March and the end July. The graph below shows that the pH readings in the seal pit (Troll instrument) and at the outfall (Sonde) show similar patterns over time and the outfall readings are on average 0.22 pH units above the seal pit readings. Note that readings are 15 minute averages rather than instantaneous and also show periods when the station was on outage or had limited generation .

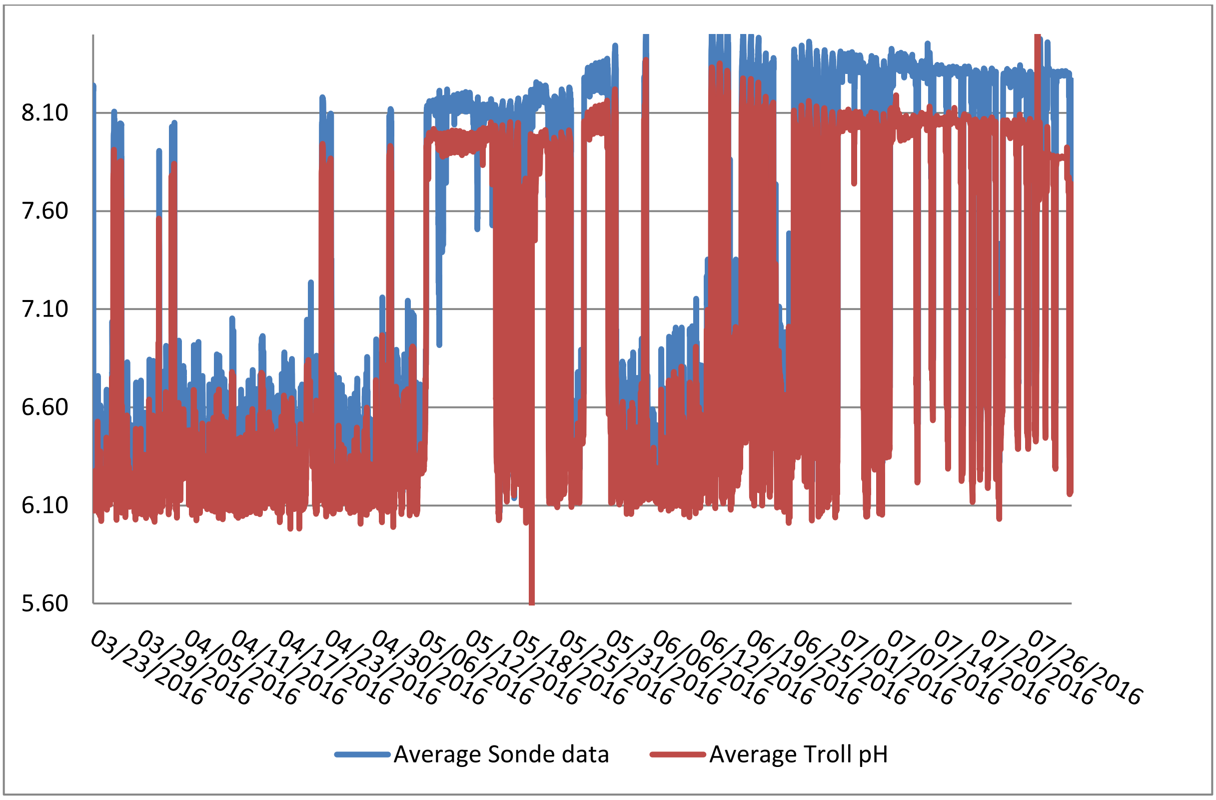

Figure 6 pH data from Outfall (Sonde) and seal pit (Troll)

3.6. Environmental monitoring

Environmental monitoring including mapping of the Sabelleria reefs and biota monitoring was undertaken before, during and at the end of the trial. The full report has been submitted as a response to Improvement Condition 38. The concluding paragraph of the Executive Summary says:-

Overall, it is considered that the reduction in pH of the discharge from 5.8 to 5.6 during the trial had limited effects on the biota and habitats in the vicinity of the outfalls. The dispersive nature of the discharge plume into the wave swept exposed shores of Limpert Bay and the large dilution capacity provides an almost instant buffering and mixing of the discharge with the seawater. During periods of reduced tidal exchange/mixing, any zone of influence from the low pH conditions is likely to small and limited to an area immediately east of the outfall. The study has shown that the benthic communities in the study appear to be unaffected by the short term reduction of the pH of the discharge during the trial.

3.7. Modelling comparison

This note is concerned with a comparison of the pH measured by Jacobs on behalf of RWE Generation UK with modelled values in Limpert bay. Jacobs measured pH during surveys carried out in March, April & May 2016. The main focus of the survey was monitoring the condition of ecology around the outfall and at a control site (Nash Point) but water quality parameters were also recorded by the ecologists during their walkover of the site. The water quality measurements were made using hand held instruments of the water's edge and pools in the intertidal zone.

3.7.1. Predicted pH change at proposed limit

The survey data is plotted in Figure 1 in Appendix B with predicted pH assuming a discharge at the proposed limit. The pH of the discharge at the time of the survey varied but was typically around 6. Model output was selected for low water on a spring tide as the surveys were generally undertaken at low water to allow the ecologist access to the foreshore. The model did not include the influence of wind on the plume.

Measurements of pH 700m to the north west of the outfall show (with one exception) values of around 8, this is in line with the prediction of 7.96 (from a background of 8) or very little to no change in pH at this distance. Approximately 800m to the south east of the outfall the observed pH is similar to the predicted worst case (7.9), the observations are in line with the predictions of a slightly greater change in pH to the south east compared to a similar distance the north west. Approximately 380m south east of the outfall the predicted pH is 7.9-8.0 while observations range between 7.44 and 7.84. Model predictions at this location are higher than observed, however the location is relatively close to the outfall (within 2-3 cells) Very close to the outfall the predicted mixing will be influenced by the grid size and how the discharge is introduced into the model. For instance it will be noted that the model is predicting low pH values in the cells to the north east of the outfall. In practise at low water the discharge from the outfall flows southwards to the sea in a shallow channel. The lowest observed pH values (6.56 to 7.02) occur adjacent to the outfall these values imply some dilution is occurring however the lowest predicted pH is 5.8 which implies no mixing of the discharge is occurring at that cell at low water on a spring tide.
Overall the observations are in line with the predicted change in pH resulting from the discharge being limited in extent. It is probably unrealistic to expect the model to be able to predict the pH very close to the outfall because of the practical limitations on grid sizes and the need to make an assumption about how the discharge is distributed within the cell.

3.7.2. Modelling Conclusions

The ecological and water quality monitoring undertaken as part of the trial reduction in pH discharge limit has provided an opportunity to compare predicted and actual changes in water quality in Limpert Bay. The water quality measurements were undertaken at the same time as the ecology walkover and are therefore for a time window around low water. Samples were taken from water that could be accessed from the intertidal zone.

The modelling predicted a change in pH that was limited to a few hundred metres of the outfall. This was confirmed by the measurements. Differences do occur between the survey measurements and predicted changes but can be explained by the assumptions implicit in the modelling.

4. Conclusions

The information from both the onsite monitoring and the environmental monitoring show that the trial that was carried out did not have any measurable adverse impact on the environment. It has been shown that the pH generally increases by on average 0.22 units between the monitoring point onsite in the seal pit and the final outfall.

5. Recommendations

It is proposed that due to the ongoing coal supply issues at Aberthaw the amended pH limits will be required in the future. The trial has shown that the lower pH figures are needed as even though coals were burned with a lower sulphur content than expected both the instantaneous and the 95 percentile values fell below the previous limit. These lower pH operations have not been shown to have any adverse impact on the environment. As stated in section 1.1 above it is now agreed that the SWTP process is operating at maximum capacity within the discharge limits stipulated in the Station's operating permit. The possible alternatives to continuing with a permanent reduction in the pH limits are to not accept these higher sulphur coals which would have an impact on the volume of coal available for the power station to meet its predicted generation profiles. The alternative is to look at the feasibility to upgrade the SWTP to better manage a higher sulphur loading. Given the current situation of the power station and the potential future life it is not considered that the cost of an upgrade to the SWTP would be justifiable considering that no adverse impacts have been observed as a result of the trial. It is therefore recommended that the pH limits as detailed in Table 10 below are BAT for Aberthaw and should now become the standard limits noting that the recent outfall monitoring shows an increase in pH level before the final discharge to the Bristol Channel.

Improvement Condition 38 of the environmental permit requires an annual report if the reduced limits are continued and RWE recommends that additional monitoring is added to the current annual environmental monitoring, with the exact scope to be agreed with NRW.

Table 10: Recommended pH limits to be continued following trial

Limit Type	Limit
Instantaneous	5.6 (min)
95%ile of instantaneous measurements	5.8-8.5

Appendix A – Justification for delay of SWTP inspection

AOS Report

Subject / Title: **Document ref:** **Issue date:**	Justification for 12 months delay in the SWTP Inspection at Aberthaw Power Station – Rev 1 June 2016
Client: **Client contact:** **Client contract ref:**	Aberthaw Power Station Amy Lavisher, Alex D'Souza, Zoe Harrison
Technology Services Group/Team	Boilers Aux. & Structures Asset Operations Support Civil Engineering Group
Prepared by	Fernando Ferrero
Reviewed by	Zoe Harrison
Authorised by	

Justification

The last inspection of the Sea Water Treatment Pond was undertaken in 2013 primarily to verify that the rapid corrosion and section loss on reinforcing bars, as detected in 2009 and repaired in 2011, had been arrested and that no further ongoing corrosion was occurring.

The results from the investigation in 2013 were generally conclusive in identifying that only localised rust spots, delamination and loss of protection (Cemprotec or MC RIM) had occurred during the two years of operation since the repairs. No concrete damage was observed, apart from few random cracks, rust staining and repair mortar defects.

Delamination (hammer tap) survey was undertaken on the walls of the basin and the side faces of the slotted walls mainly on the repaired areas. No areas of delamination were identified. A small spall (50mm x 20mm x 20mm deep) was identified on the northern face of the weir side slotted wall.

The lower and upper decks, the ramp and the ramp kicker were also inspected and no signs of concrete damage were found, only de-bonding of the MC RIM lining.

The interpretation of Analysis results by ECHA Microbiology Limited indicates:

Light contamination with Sulphide Generating Bacteria (SGB) / Sulphate Reducing Bacteria (SRB) was detected in the Mixing Area sample.

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No SGB / SRB were detected in the samples from the Aeration pipe, Inlet Area, and Inlet Absorber Pump.

The numbers of SRB detected are low at present and, in all probability, not actively engaged in corrosion.

These findings are positive for the future of the SWTP and indicate the mechanisms causing deterioration had been correctly identified at the time, and were chiefly related to direct seawater or effluent water contact with reinforcing bars down construction joints, cracks or otherwise porous concrete.

No damage to concrete was reported in 2013 and it is expected to obtain similar results in the next inspection. Based on the findings from 2013, it could be seen that the rate of concrete deterioration was significantly diminished by the repair works carried out in 2011. Due to the 2013 findings a decision was made to have the next inspection after a 4 year period i.e. 2017 rather than 2016.

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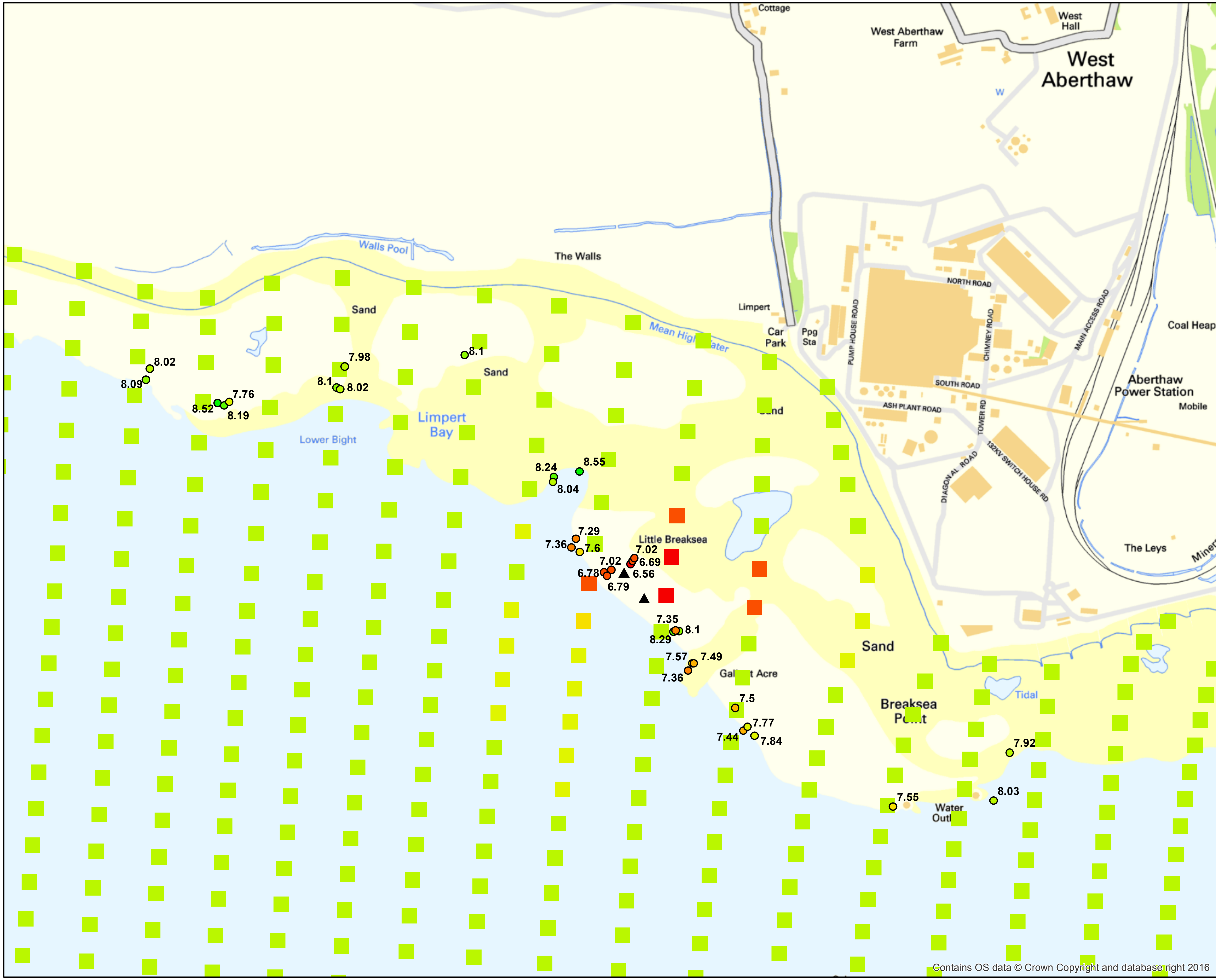
Appendix B - Observed and predicted pH figure



N

0 25 50 100 150 200 Metres

KEY:

▲ Outfall

pH - measured	pH - predictions
6.56 - 6.56	5.6 - 6.56
6.56 - 7.23	6.56 - 7.23
7.23 - 7.36	7.23 - 7.36
7.36 - 7.5	7.36 - 7.5
7.5 - 7.6	7.5 - 7.6
7.6 - 7.84	7.6 - 7.84
7.84 - 8.04	7.84 - 8.04
8.04 - 8.1	8.04 - 8.1
8.1 - 8.29	8.1 - 8.29
8.29 - 8.55	8.29 - 8.55

Drawn	Checked	Date	Approved	Rev
SJP	***	29/09/2016	ZH	A

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Size of original: A3

Scale of original: 1:7,000

Site: ABERTHAW

Title: MARCH - MAY RESULTS AGAINST PREDICTIONS

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