Proposal for discontinuing AQMP reporting at Aberthaw Power Station and closure of Font-y-gary air quality monitoring station.

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Proposal for discontinuing AQMP reporting at Aberthaw Power Station and closure of Font-y-gary air quality monitoring station.

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Summary

Aberthaw Power Station has had an Air Quality Management Plan (AQMP) in place since 2001, along with all coal and oil-fired power stations in England and Wales. The aim of the AQMPs is to manage and report compliance with the UK Air Quality Strategy (AQS) objectives, with a particular focus on sulphur dioxide impacts. The AQMPs have involved both assessing past compliance (from both modelling and monitoring), future compliance (from modelling) and, if appropriate, implementing measures to ensure compliance. These obligations are due to lapse at the end of 2015, when power stations will be subject to permit variations so that they meet the requirements of the Industrial Emissions Directive (IED).

Aberthaw has been running Flue Gas Desulphurisation (FGD), with all units operational since the end of January 2009. This has resulted in a substantial reduction in both SO_2 emissions and air quality impacts and hence the aim of this report is to review the appropriate level of air quality management for Aberthaw, including the need for ambient air quality monitoring.

The Environment Agency (EA) and Joint Environment Programme (JEP) have agreed a framework and criteria for assessing whether an FGD station continues to require an AQMP. These criteria are intended as indicators, and the methodology recognizes that each case requires site-specific consideration with the Environment Agency or in the case of Aberthaw Power Station, Natural Resources Wales (NRW). This framework is based on consideration of the risk to AQS objectives and provides a useful way of assessing post-FGD impacts and the implications for the appropriate level of air quality management. This framework has previously been applied to Aberthaw Power Station (Hunter, 2011) and this report updates those findings.

The assessment indicates, as did the previous report, that Aberthaw Power Station meets the indicative criteria for discontinuing its AQMP now and, by implication, closure of the Font-y-Gary air quality monitoring station. In particular, there is a now a greater body of evidence from monitoring and modelling that operation of Aberthaw Power Station does not pose a significiant risk to maintaining compliance with AQS objectives. Hence, taking into account the costs and current contractual arrangements for such reporting, we propose closure of the Font-y-gary air quality monitoring station at the end of May 2015 with no AQMP reporting thereafter.

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1 Introduction

Aberthaw has had an Air Quality Management Plan (AQMP) in place since 2001, along with all coal and oil-fired power stations in England and Wales. The aim of the AQMPs is to manage and report compliance with the UK Air Quality Strategy (AQS) objectives, detailed in Appendix A. The 15-minute SO_2 objective is the most demanding of the targets for coal and oil-fired power stations. Thus, although the AQMPs cover SO_2, NO_x and PM_{10}, the focus has always been primarily on compliance with the UK-only 15-minute standard. The AQMPs involve both assessing past compliance (from both modelling and monitoring), future compliance (from modelling) and if appropriate implementing measures to ensure compliance. With the exception of some very low load stations (e.g. oil stations) all AQMP power stations have at least one monitoring station, situated in the region of highest impacts. These obligations are due to lapse at the end of 2015, when power stations will be subject to permit variations so that they meet the requirements of the Industrial Emissions Directive (IED).

Aberthaw installed Flue Gas Desulphurisation (FGD), with all units operational by the end of January 2009. This has resulted in a substantial reduction in both SO_2 emissions and air quality impacts. Hence, the aim of this note is to review the appropriate level of air quality management for Aberthaw. It builds on a previous similar report (Hunter, 2011), which indicated that Aberthaw Power Station met the indicative criteria for discontinuing its AQMP.

In recognition of the reduced air quality risk from stations fitted with FGD, the Environment Agency (EA) and Joint Environment Programme (JEP) working group on AQS previously agreed a framework and generic criteria which can be used as indicators of whether AQMP closure may be appropriate (JEP (2010)). These are intended as “indicators”, and the methodology recognizes that each case requires site specific consideration with the competent authority, which for Aberthaw is now Natural Resources Wales (NRW). This framework is based on consideration of the risk to AQS objectives and provides a useful way of assessing post-FGD impacts and the implications for the appropriate level of air quality management. Therefore, this framework has been applied to Aberthaw Power Station.

2 EA/JEP agreed methodology for assessing AQMP closure

The framework and criteria for assessing AQMP closure are detailed in JEP (2010). The underlying principle in assessing the need for a formal AQMP is consideration of the risk of non-compliance with the AQS objectives. The framework uses two aspects to assess the risk; the potential of the plant to pose a risk to air quality (from modelling) and the actual measured air quality over recent years. The flow chart in Figure 1 illustrates the principles behind the AQMP closure methodology.

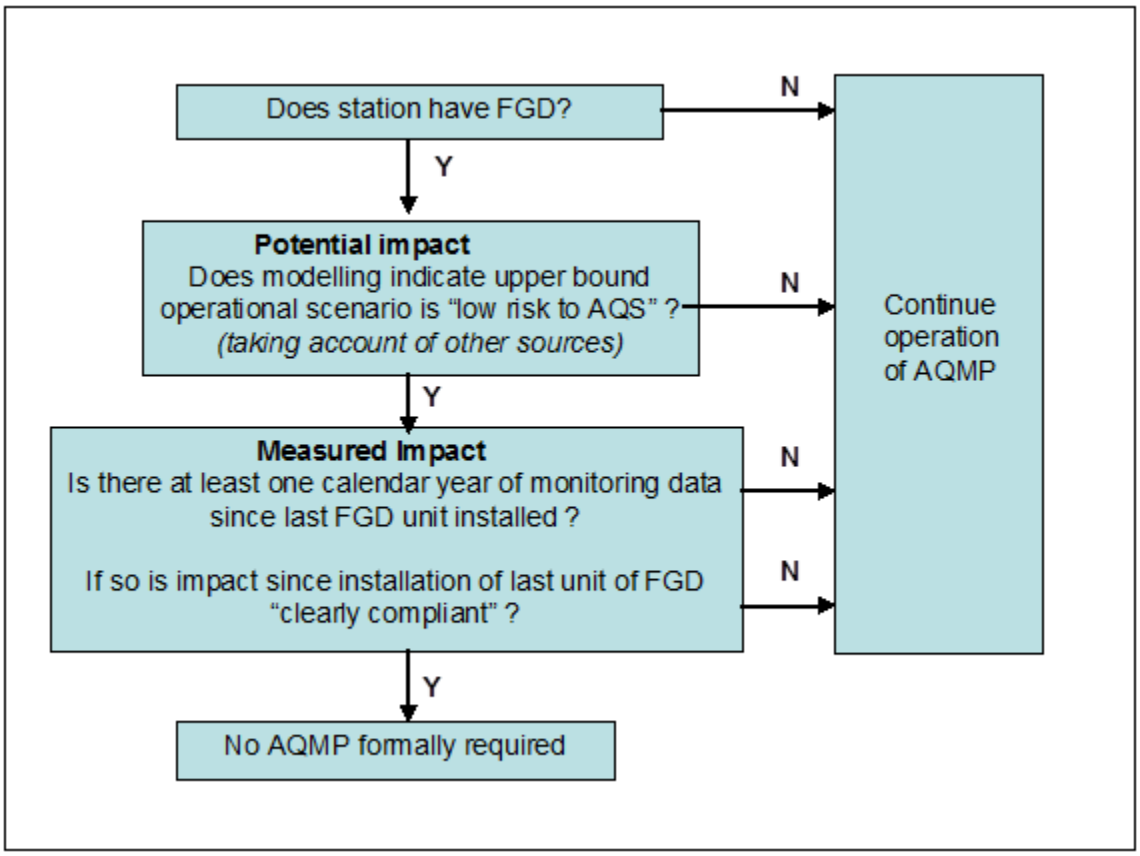

Figure 1. Flow chart illustrating AQMP closure principles

The methodology sets out the following criteria

- **Potential Impact:** Dispersion modelling for a realistic upper bound operational scenario can be used to quantify air quality impacts. Impacts which are less than 60% of the AQS objective (expressed as a 99.9th percentile of 15-minute means) at all spatial locations can be considered "low risk", based on analysis of model performance.
- **Actual Impact:** The measured impact over at least one calendar year since abatement retrofit needs to demonstrate "clear compliance". This threshold needs to be robust against possible future variations in operations, emissions and meteorology. Analysis of the variation in impacts across 26 JEP monitoring sites over four years indicated that a threshold of half the AQS objective (expressed as a 99.9th percentile of 15-minute means) is protective.

The implications of FGD breakdown do not need to be considered in the assessment of potential impact, as the Permit makes provision for this eventuality, based on JEP (2006).

3 Aberthaw's SO_2 emissions and air quality impacts

3.1 Abatement measures and emissions history

The FGD abatement was installed on the three units at Aberthaw between March 2008 and the end of January 2009. Figure 2 shows total SO_2 emissions from the station since 2000.

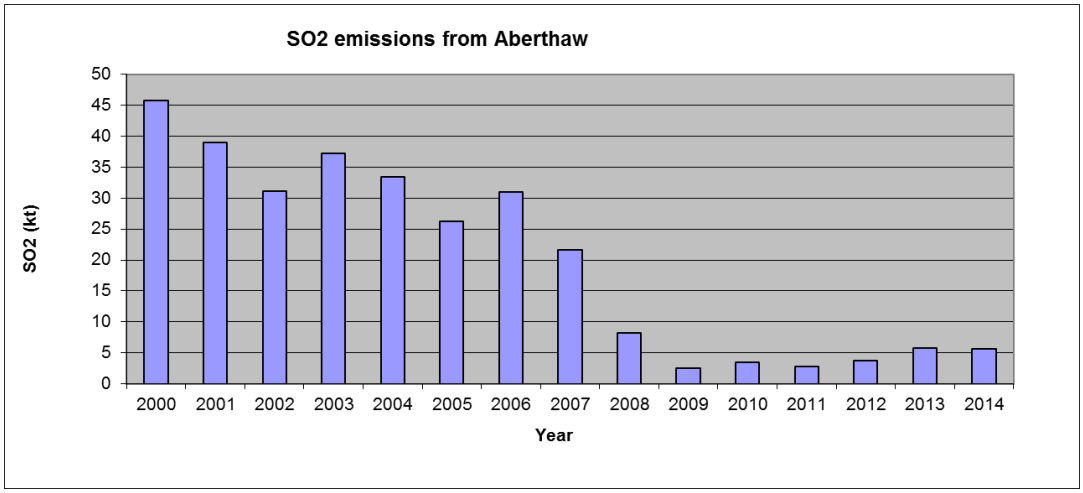

Figure 2. Annual SO_2 emissions from Aberthaw

Figure 2 clearly illustrates the effect of FGD. In 2014, SO_2 emissions were around 20% of those in 2005, the year in which the AQS 15-minute objective came into force.

3.2 Potential air quality impacts – Modelling of upper bound scenarios

The aim of this assessment is to assess the magnitude of impacts from upper bound scenarios from the plant. An extreme worst-case operational scenario for assessing short-term impacts is to assume that the SO_2 emission concentrations are at the LCPD limit of 400 µg m-3 and that the plant operates continuously at full load. This scenario accounts for the possibility of periods of full load operation coinciding with adverse meteorology for dispersion. This is the scenario examined for the 2006 PPC application (PPC, 2006). The AQMP 2011 review (AQMP, 2012) used a 2013 scenario of 71% load factor, representing the expected approximate generation, and emissions at the LCPD limit. The results of both these modelling assessments are shown in Table 1.

Table 1. Potential air quality impacts post-FGD

Scenario	Predicted range of impacts from 5 met. years, no allowance for background		[3]Risk rating
	No. of exceedances of 15-min threshold	99.9th %ile of 15-min means (µg m^{-3})	
[1]Continuous full load operation, SO_2 emission conc of 400 µg m^{-3}	0	146 – 164	Top of range marginally above top of Low risk band (160 µg m^{-3})
[2]Load factor of 71%, SO_2 emission conc. 400 µg m^{-3}	0	129 – 148	LOW

[1] PPC assessment in 2006 (PPC (2006))
[2] Assumed scenario for 2013 used in AQMP 2011 report, submitted in April 2012 (AQMP (2012)).
[3] Based on criteria in JEP (2010)

3.3 Actual air quality impacts

3.3.1 Measured air quality concentrations

Aberthaw currently has one air quality monitoring station at Font-y-gary. This was chosen to

be at a location East of the station where Aberthaw is expected to have its highest impacts. In the past a supplementary site West of the station provided an indication of background air quality around the Aberthaw. This site was located at Boverton Mill Farm from March 2003 until May 2005, and at Seaview Farm from 1st September 2009 until 15th September 2011.

Figures 3 and 4 show measured impacts against the 15-minute SO_2 objective, in terms of the 99.9th percentile of 15-minute means and number of exceedences of the 15-minute threshold, respectively.

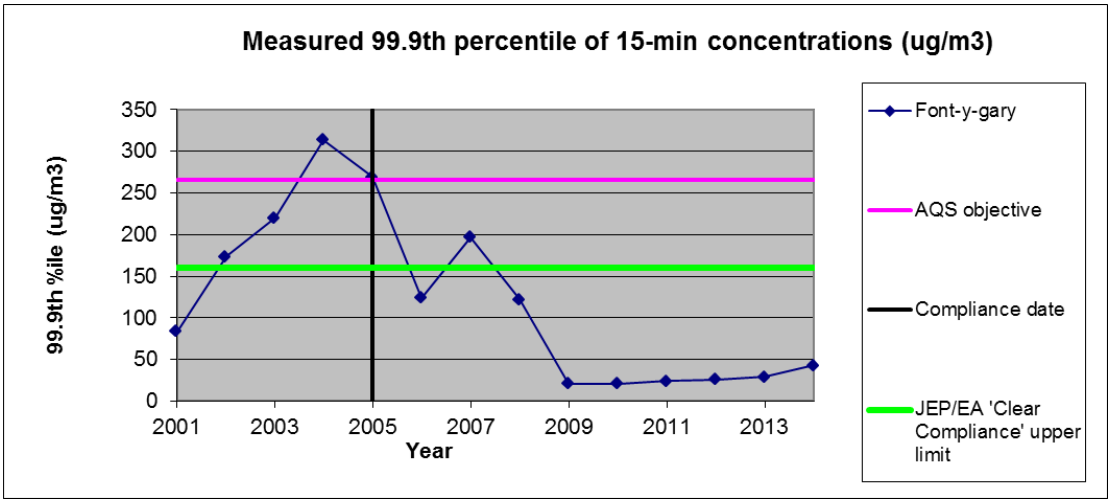

Figure 3. Measured 99.9th percentile of 15-minute mean concentrations relative to the AQS objective

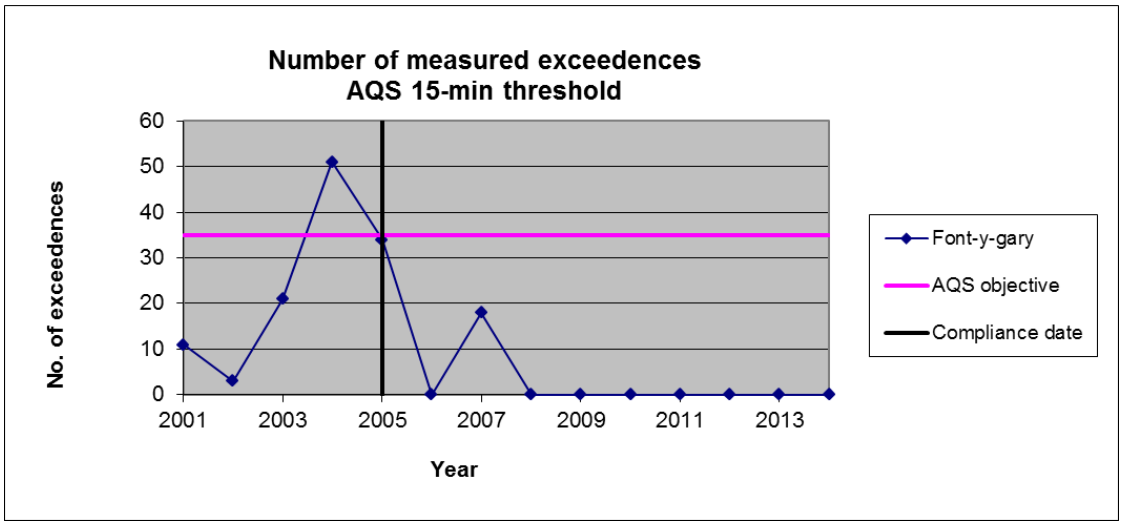

Figure 4. Measured number of exceedences of the 15-minute concentration threshold relative to the AQS objective

The measurements indicate a downward trend in impacts. From 2008 onwards, the impacts meet the criteria of "clear compliance" as defined in JEP (2010).

3.3.2 Retrospective modelling of actual operations

As well as using monitoring data to demonstrate the power station has not caused an adverse effect on local air quality, the AQMP process requires that the power station

operator carries out dispersion modelling of retrospective operation of the power station at the end of each year, based on actual hourly-varying generation levels and emissions. Figure 5 below illustrates the modelling results at the location with the highest impact. This indicates that since 2008 onwards the impacts are well within the low risk category.

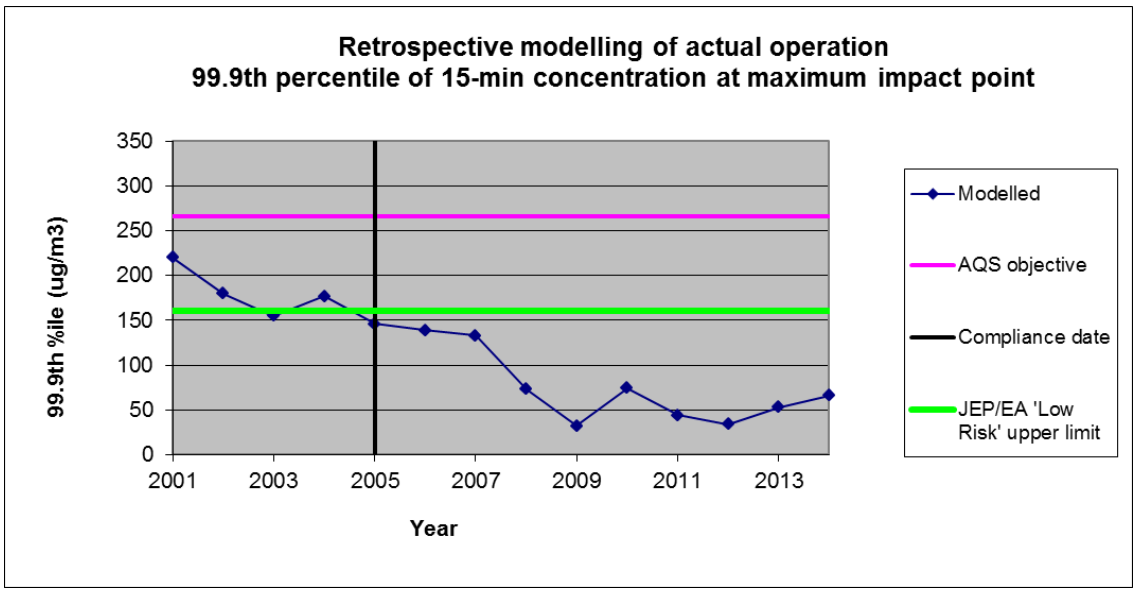

Figure 5. Maximum impact on receptor grid from retrospective modelling

3.4 Consideration of NO_2 impacts

Figures 6 and 7 below show measured NO_2 concentrations, which include contributions from all sources.

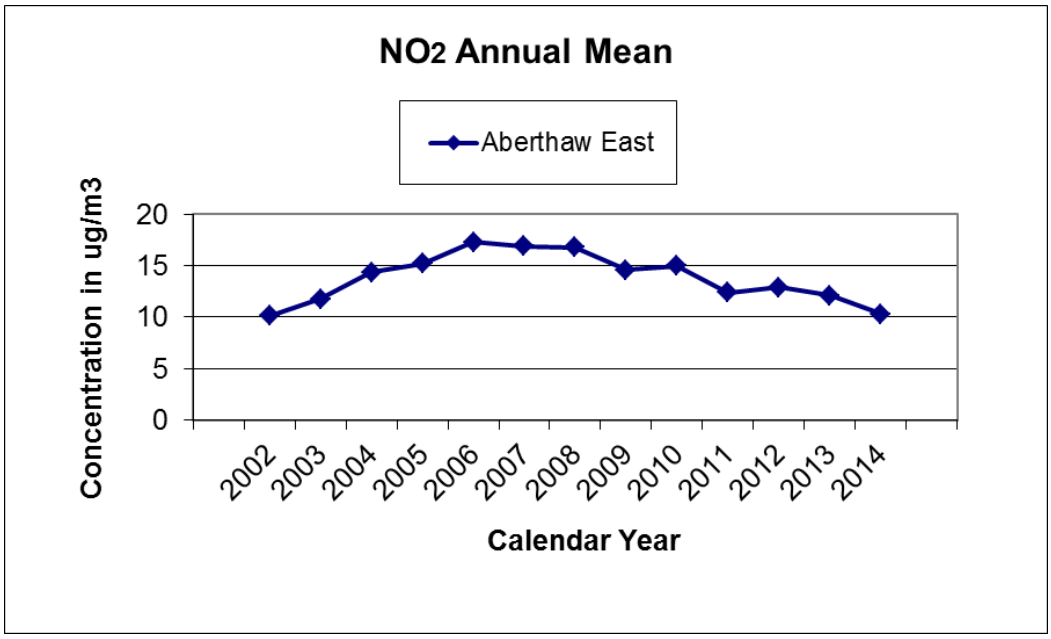

Figure 6. Measured annual mean NO_2 concentrations.

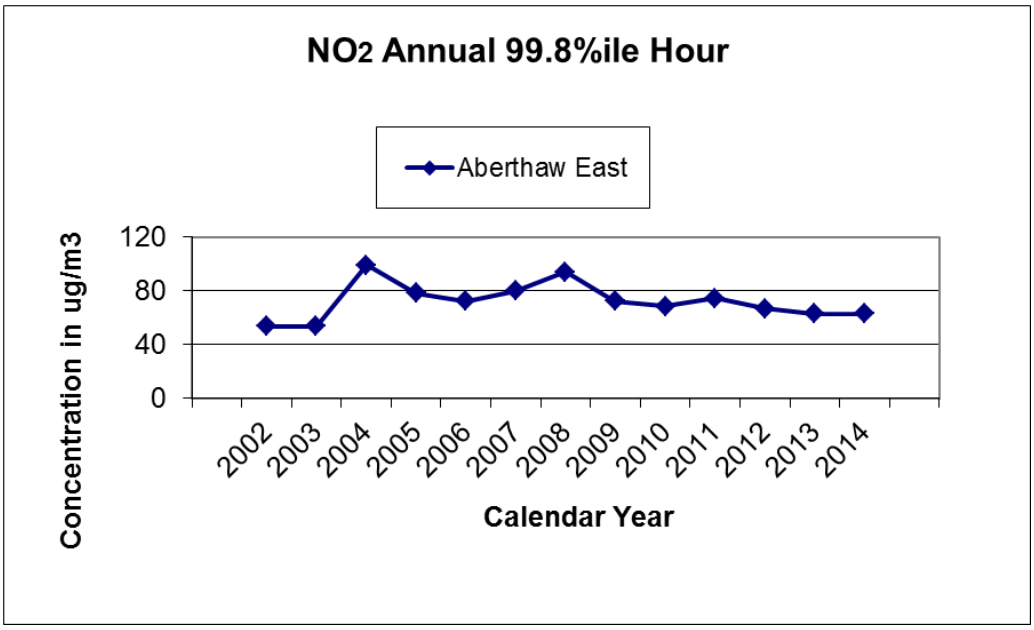

Figure 7. Measured short-term NO_2 concentrations

Figures 6 and 7 do not indicate any noticeable trend following the FGD retrofit at Aberthaw, which has resulted in a reduction on plume buoyancy. This is consistent with expectations, given the substantial role played by other diffuse sources such as traffic and by the fact that NO_2 is primarily a secondary pollutant whose formation is dependent on the availability of ambient ozone. The measured concentrations are well below the AQS objectives for NO_2.

4 Conclusions and proposal

The EA/JEP agreed framework for assessing whether an FGD station requires an AQMP has been used as a basis for reviewing air quality impacts from Aberthaw and the future need for an Air Quality Management Plan.

The assessment indicates that

- The retro-fit of FGD has led to a substantial reduction in SO_2 emissions, and a very clear reduction in measured SO_2 concentrations locally.
- Assessing the impact of Aberthaw against the framework for assessing whether an FGD station requires an AQMP indicates

    - Modelling of the potential impact of the plant for an extreme worst case scenario (full load and SO_2 emission concentration at LCPD limit of 400µgm^{-3}) indicates that at the point of maximum impact the predicted concentrations are only marginally above the top of the low risk zone.
    - Modelling of a realistic load factor and worst case SO_2 emission concentration (400µgm^{-3}) indicates impacts well within the low risk zone. Thus, taking into account the fact that the plant generally abates to a significantly higher level than LCPD, this indicates a classification of "low risk".
    - Since 2008 measured SO_2 concentrations have been within the criteria of "clear compliance". This has been maintained for seven years, with no exceedences of the 15-min SO_2 AQS objective concentration.

As demonstrated in the previous report (Hunter, 2011), Aberthaw power station meets the indicative criteria for complete closure of its AQMP, against the agreed JEP/EA framework.

Hence, noting that the AQMP reporting commitments will in any case lapse at the end of 2015 and taking into account the costs and current contractual arrangements for such reporting we propose that:

- The downwind monitoring site at Font-y-gary is closed at the end of May 2015.
- All Aberthaw AQMP reporting is discontinued following submission of the 2014 AQMP annual review.

5 References

AQMP (2012). Annual Review of Air Quality Strategy Management Plan for Aberthaw Power Station 2011.

JEP (2006). Protocol for the ESI in dealing with the malfunction or breakdown of abatement equipment at qualifying LCP.

JEP (2010). AQMP Closure – Framework and Criteria for JEP power stations. JEP report ENV/360/2010.

Hunter, G. (2011). Post-FGD Air Quality Management at Aberthaw Power Station – Proposal for Simplification. RWE npower Report No. ENV/467/2011.

PPC (2006). PPC : Air Quality Impact Assessment for Aberthaw Power Station. ENV/075/2006

Appendix A. Air quality standards for the protection of human health for species relevant to power plant emissions.

Substance	Standard		Date to be achieved by and maintained thereafter
	Concentration	Measured as	
Sulphur dioxide (SO_2)	266µg/m^3 (100ppb) not to be exceeded more than 35 times a year (99.9th percentile)	15 minute mean	31st December 2005[a]
	350µg/m^3 (132ppb) not to be exceeded more than 24 times a year (99.73rd percentile)	1 hour mean	31st December 2004[a]
			1st January 2005[b]
	125µg/m^3 (47ppb) not to be exceeded more than 3 times a year (99.18th percentile)	24 hour mean	31st December 2004[a]
			1st January 2005[b]
Nitrogen dioxide (NO_2)	200µg/m^3 (105ppb) not to be exceeded more than 18 times a year (99.8th percentile)	1 hour mean	31st December 2005[a]
			1st January 2010[b]
	40µg/m^3 (21ppb)	Annual mean	31st December 2005[a]
			1st January 2010[b]
Particulate matter (PM_{10})	50µg/m^3 not to be exceeded more then 35 times a year (90.4th percentile)	24 hour mean	31st December 2004[a]
			1st January 2005[b]
	40µg/m^3	Annual mean	31st December 2004[a]
			1 January 2005[b]
Particulate matter ($PM_{2.5}$)	25µg/m^3	Annual mean	1st January 2015[b]
	10% or 15% reduction from 2010	AEI[c]	2020
	20µg/m^3	AEI[c]	2015
Carbon monoxide (CO)	10mg/m^3 (8.6ppm)	Maximum daily running 8 hour mean	31st December 2003[a]
			1st January 2005[b]

[a]NAQO

[b]EU limit value

[c]AEI is the average exposure indicator determined as the average annual concentration from three sequential years of measurements at all designated urban background monitoring locations. The 2010 AEI is based on measurements for the years 2009, 2010 and 2011. The 2015 AEI is the average of measurements from 2013, 2014 and 2015 and the 2020 AEI is the average of measurements from 2018, 2019 and 2020.

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