

NSW Environment Protection Authority Review of Coal Fired Power Stations Air Emissions and Monitoring

Attachment B:

Environment Protection Licences - Consistency Review

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Purpose

The purpose of this document is to provide supplementary information for *the NSW EPA Review of Coal Fired Power Stations Air Emissions and Monitoring (March 2018)* report. This document contains summary information, data analysis and technical discussions that were used to inform the power station review report.

This appendix comprises of the following:

Part A

- Consistency review of environment protection licence requirements

Part B

- Review of EPL reporting conditions
- Review of EPL opacity monitoring requirements
- Review of EPL monitoring locations

Part A – Consistency review of Environment Protection Licence requirements

1. PROJECT FOCUS

This part of the review was prepared by the EPA's Intelligence and Analysis Unit and reported in DOC17/336309 Intelligence Product Report - IAU-17-27: Coal fired power stations. This product provides a high level consistency review of environment protection licence requirements for operating coal fired power stations in NSW. The scope includes air emissions monitoring and limits; non-standard licence conditions related to air emissions; and self-reported non-compliances.

Currently operating coal fired power stations are listed in **Table 1**.

Table 1 Currently operating coal fired power stations

Lic No.	Licensee Name	Premises name	Scale of activity	LGA
761	Sunset Power International Pty Ltd	Vales Point Power Station And Coal Unloader	> 4000 GWh annual generating capacity	Wyong
779	AGL Macquarie Pty Limited	Bayswater Power Station	> 4000 GWh annual generating capacity	Muswellbrook
1429	Origin Energy Eraring Pty Ltd	Eraring Power Station	> 4000 GWh annual generating capacity	Lake Macquarie
2122	AGL Macquarie Pty Limited	Liddell Power Station	> 4000 GWh annual generating capacity	Singleton
13007	EnergyAustralia NSW Pty Ltd	Mount Piper Power Station	> 4000 GWh annual generating capacity	Lithgow

2. KEY FINDINGS

A review of air monitoring and limit requirements for the five operating coal fired power stations identified a range of variability, including more stringent emission limits at some premises; inconsistent monitoring requirements; limits specified with no corresponding monitoring requirements; inconsistent sampling methods; and inconsistent reference basis specifications. The significance of these was not determined. However, it was observed that the inconsistencies are spread across the different premises and pollutants and that no one premises had significantly different requirements across all pollutants.

A review of non-standard licence conditions identified that there are some variations between licence requirements regarding the regulation of point source air emissions for the five premises. Key areas of inconsistency include requirements related to start up fuel (quality and monitoring), use of alternative fuels and reporting of exceedances.

Of the five premises, only one – Liddell – has self-reported non-compliances with air emissions requirements since 1 January 2014. These related to failure to monitor Volatile Organic Compounds (VOCs) due to oversight, an opacity exceedance due to operational failure, and failure to report an exceedance of sulphur dioxide limits within the statutory timeframe.

3. AIR EMISSIONS MONITORING AND LIMITS

Table A (Page 6) identifies air emission monitoring and limits (including inconsistencies) for the primary air emissions monitoring points at the five premises. Note that Eraring and Liddell have emergency generators with monitoring points, and Liddell has four Continuous Emissions Monitoring System (CEMS) points which are not included in Table A.

Points of inconsistency are summarised in the **Table 2** below. Note that variation in limits may be resultant of the group of the premises (under Part V of the Protection of the Environment (Clear Air) Regulation 2010) or premises-specific limits.

Table 2 Summary of inconsistencies in air emissions monitoring and limit requirements

Pollutant / Topic	Comment
Cadmium	No monitoring or limit is specified for Mount Piper. Limit for Eraring (0.2 mg/m ³) is more stringent than remaining premises (1 mg/m ³).
Carbon dioxide	No monitoring specified for Vales Point.
Carbon monoxide	No monitoring specified for Liddell, Mount Piper or Vales Point. Vales Point states a reference basis of 7% O ₂ for pollutant despite no monitoring requirements on licence.
Dioxins & Furans	Monitoring and limit specified for Mount Piper only.
Dry gas density	No monitoring specified for Vales Point.
Mercury	Limit specified for Liddell without a corresponding monitoring requirement. Limits specified for Eraring and Mount Piper (0.2 mg/m ³) more stringent than remaining premises (1 mg/m ³).
Nitrogen oxides	Limit specified for Eraring (1100 mg/m ³) more stringent than remaining premises (1500 mg/m ³).
Oxygen	No monitoring specified for Eraring or Vales Point.
Sulfuric acid mist and sulfur trioxide (as SO ₃)	Limit specified for Eraring without a corresponding monitoring requirement.
Solid particles / Total solid particles	Limits specified for Eraring and Mount Piper (50 mg/m ³) more stringent than remaining premises (100 mg/m ³). Inconsistent terminology ('solid particles' used for all except Vales Point which uses 'total solid particles').
Type 1 and Type 2 substances in aggregate / Hazardous Substances	Limits specified for Eraring and Mount Piper (1 mg/m ³) more stringent than remaining premises (5 mg/m ³). Inconsistent terminology ('type 1 / type 2' used for Liddell, Mount Piper and Vales Point, 'hazardous substances' used for Bayswater, and Eraring uses both).
Undifferentiated Particulates	No monitoring specified for Mount Piper.
Volatile organic compounds	Monitoring and limit specified for Mount Piper only (no monitoring or limit specified for Bayswater, and monitoring but no limit specified for Eraring, Liddell and Vales Point).
Reference basis	Reference conditions are generally specified as 'Dry, 273 K, 101.3 kPa', either for all pollutants (Bayswater, Eraring and Liddell) or for a selection of pollutants (Mount Piper and Eraring). O ₂ is specified as 7% for all pollutants at Eraring and Liddell. O ₂ is specified as 7% for nitrogen oxides and solid particles at Mount Piper and Vales Point (Vales Point also specifies 7% O ₂ for carbon monoxide despite no monitoring requirements). O ₂ is specified as equivalent to 12% CO ₂ for solid particles at Bayswater (no O ₂ specified for remaining pollutants).

Pollutant / Topic	Comment
Methods	A range of different methods are specified for the same pollutants.

4. NON-STANDARD LICENCE CONDITIONS

Table B (Page 7) identifies non-standard conditions (including inconsistencies) for the five premises. Comments and points of inconsistency are summarised in the **Table 3** below.

Table 3 Non-standard conditions (comments and points of inconsistency)

Topic	Comment
Reference basis	The reference basis for air pollutants was listed as a separate condition on three of the licences (Vales Point, Eraring and Mount Piper). Refer to Table 2 above for further inconsistencies with reference basis specifications.
POEO (Clean Air) Regulation groups	References to the POEO (Clean Air) Regulation 'groups' for air pollutants was included in a condition on three of the licences (Vales Point, Eraring and Liddell). It should be noted that the Liddell licence references 'Group 5' subject to completion of a PRP at condition U5 – however there is no condition U5 listed on the licence.
Start-up fuel	Four of the five licences have conditions regarding specifications for start-up fuel. Bayswater and Liddell reference an automotive diesel fuel standard (AS3570-1998) while the Vales Point and Eraring licence allow the use of distillate/distillate heating oils provided they comply with licence specifications. Mt Piper does not list any requirements for start-up fuel.
Sulfur content of fuel	The licences for Vales Point and Eraring have conditions limiting the sulphur content of coal fuel to 'not exceed 0.5% by weight.' The licence for Liddell requires that 'the sulfur content of coal as fired in the boilers must not exceed 1% by weight'. The licences for Bayswater and Mt Piper do not list any limits for sulfur in coal. Vales Point and Eraring also list the sulfur content of fuel oil/liquid fuels (must not exceed 0.5% by weight). Eraring also has a detailed set of specifications (including Sulfur) for distillate/heating oils and distillate refined oil blends burnt.
Monitoring of fuels	The licences for Eraring and Liddell require the sampling and analysis of fuel received on the premises. The licence for Liddell refers specifically to blending of coal to minimise any exceedance of SO ₂ trigger value of 600 ppm. The licence for Eraring also specifically prohibits the use of fuel oils containing PCB's. Vales Point, Bayswater and Mt Piper do not have any specific licence requirements for fuel monitoring.
Alternative fuels	Vales Point, Eraring, Liddell and Mt Piper have conditions on the use of alternative fuels. The conditions on Vales Point and Mt Piper licences refer to solids fuels such as wood (and has detailed specifications), while Eraring and Liddell licences refer to alternative liquid fuels and waste mineral oils. Bayswater does not have any specific alternative fuel conditions.
Emergency exemptions from limits	Bayswater and Liddell have a condition allowing exemptions from licence limits in emergency electricity supply circumstances.
Monitoring requirements	The licence for Mt Piper (Condition M2.2) includes a monitoring 'note' outlining that monitoring on points 2 and/or 3 is not required if the boiler is not operating and not discharging. Mt Piper also has a monitoring 'note' (Condition M2.3) as a reminder to include the 'respective boiler MW load at the time of sampling'. At Liddell, there is a requirement to have at least 2 of the CEMS operating during the reporting period.
Exceedance reporting	Vales Point, Eraring and Liddell have requirements for exceedance reporting to EPA. Vales Point and Eraring are required to submit an exceedance report within 7 days if Sulfur (>600ppm) is exceeded. Liddell is required to submit an exceedance report within 30 days if Opacity (>20%), SO ₂ (600ppm) or Nitrogen (700ppm) is exceeded.

Topic	Comment
NOx reduction PRP	Vales Point and Liddell have a NOx reduction PRP to be completed and submitted to EPA in July 2017.

5. SELF-REPORTED LICENCE NON-COMPLIANCES

Table C (Page 12) identifies the three self-reported non-compliances with air emissions requirements for the five premises since 2014.¹ During this period only one premises – Liddell – has reported non-compliances in their Annual Return. The non-compliances reported by Liddell related to:

- Failure to monitor Volatile Organic Compounds (VOCs) due to oversight in monitoring regime
- Opacity exceedance due to operational failure
- Failure to report sulfur dioxide limit exceedance within required timeframe.

6. REFERENCE DATA

System	Description	Scope/size	Date
PALMS	Licence, monitoring points, load limits, concentration limits, concentration monitoring and volume/mass limits data for operating coal fired power stations	Five power stations	21/06/2017
	Annual return self-reported non-compliances for operating coal fired power stations		

7. CAVEAT AND LIMITATIONS

This product has been prepared by the EPA Intelligence and Analysis Unit using public and restricted material, including personal information, for use by the requesting officer. Any further alteration, use or disclosure must have regard to the relevant legislative and organisation-specific requirements including, but not limited to the:

- *Privacy and Personal Information Protection Act 1998*
- EPA [Informant Confidentiality Statement](#)
- EPA Code of Conduct for the Protection of Confidential Vehicle Driver Information
- EPA [Code of Ethics and Conduct](#).

Analyst comments have been made based on query results and rely on the accuracy of the underlying data at the time of the query. Any information used by the requesting officer should be verified as necessary.

¹ Since 1 January 2014 the five premises have submitted 19 annual returns. Owing to licence transfers, Bayswater and Liddell submitted two annual returns in 2014 and Vales Point submitted two in 2015. Only Bayswater has submitted an annual return in 2017.

Table A: EPA Intelligence Report: EPL conditions for NSW coal fired power stations

				Bayswater Power Station	Eraring Power Station	Liddell Power Station	Mount Piper Power Station	Vales Point Power Station
Cell code	Interpretation	Group under Part V of POEO (Clean Air) Reg 2010:		3	3 (EPL subject to more stringent limits)	5 (NOx subject to PRP)	4	5 (NOx = Group 2)
M	Monitoring only	Air emission monitoring point number(s):		10	11, 12, 13	11, 12, 13, 14	1, 2, 3, 4	11, 12
1	Monitoring and limit	Air emission monitoring point(s) description:		10: Boiler 1	11: Boiler 2 12: Boiler 3 13: Boiler 4	11: Boiler 1 12: Boiler 2 13: Boiler 3 14: Boiler 4	1: Unit 1 / Boiler 1-2 2: Unit 2 / Boiler 1-2 3: Unit 3 / Boiler 3-4 4: Unit 4 / Boiler 3-4	2: Boiler 1 3: Boiler 2 11: Boiler 5 12: Boiler 6
1	Limit more stringent than other plants	Reference basis:		Dry, 273 K, 101.3 kPa*	Dry, 273 K, 101.3 kPa*	Dry, 273 K, 101.3 kPa, 7% O2	Dry, 273 K, 101.3 kPa, 7% O2	Dry, 273 K, 101.3 kPa**
1	Limit only	Pollutant	Method	Frequency	Unit Of Measure			
	Point of inconsistency	Cadmium	TM-12	Yearly	mg/m3	1	1	1
	Not applicable		TM-14	Yearly	mg/m3		0.2	1
		Carbon dioxide	TM-24	Yearly	%	M	M	M
					mg/m3		M	
		Carbon monoxide	OM-1	Yearly	ppm		M	
			TM-32	Yearly	ppm	M	M	
		Chlorine	TM-7 & TM-8	Yearly	mg/m3	200	200	200
		Copper	TM-12, TM-13 & TM-14	Yearly	mg/m3	M	M	M
		Dioxins & Furans	TM-18	Yearly	ng/m3			0.1
		Dry gas density	TM-23	Yearly	kg/m3	M	M	M
		Hydrogen chloride	TM-7 & TM-8	Yearly	mg/m3	100	100	100
			TM-8	Yearly	mg/m3		100	
		Mercury	TM-12	Yearly	mg/m3	1	1	1
			TM-12, TM-13 & TM-14	Yearly	mg/m3			0.2
			TM-14	Yearly	mg/m3		0.2	1
		Nitrogen Oxides	CEM-2	Continuous	g/m3	M		
					mg/m3	1500		
			In line instrumentation	Continuous	mg/m3			
			Special Method 2	Quarterly	g/m3			1.5
			TM-11	Yearly	g/m3	M		
					mg/m3	1500	1500	
		Oxygen (O2)	CEM-3	Yearly	%			M
			TM-25	Yearly	%	M	M	
		Sulfuric acid mist and sulfur trioxide (as SO3)	TM-3	Yearly	mg/m3	100	100	100
		Sulphur dioxide	CFM-2	Continuous	mg/m3	M	M	
			In line instrumentation	Continuous	ppm			
			TM-4	Quarterly	mg/m3			M
				Yearly	mg/m3	M	M	
		Total Fluoride	TM-9	Yearly	mg/m3	50	50	50
		Solid Particles	TM-15	Yearly	mg/m3	100	100	50
		Total Solid Particles	TM-15	Yearly	mg/m3			100
		Type 1 and Type 2 substances in aggregate	TM-12 & TM-13	Yearly	mg/m3		1	5
			TM-12, TM-13 & TM-14	Yearly	mg/m3		5	1
		Hazardous substances	TM-12, TM-13 & TM-14	Yearly	mg/m3	5	5	M
		Undifferentiated Particulates	CEM-1	Continuous	%Opacity	M	M	M
					mg/m3			
			In line instrumentation	Continuous	mg/m3			M
		Volatile organic compounds	OM-2	Yearly	ppm			
			TM-19	Yearly	mg/m3			40
			TM-34	Yearly	mg/m3		M	
					ppm	M		

Table B: EPA Intelligence Report: Comparison of non-standard licence conditions for NSW coal fired power stations

	Bayswater Power Station	Eraring Power Station	Liddell Power Station	Mount Piper Power Station	Vales Point Power Station
Topic	EPL 779	EPL 1429	EPL 2122	EPL 13007	EPL 761
Load limits	No load limits listed	No load limits listed	No load limits listed	No load limits listed	No load limits listed
Load Reduction Agreement					Load Reduction Agreement in place
Reference basis		L3.7: The reference basis for all the air pollutants specified in condition L3.5 for points 11, 12, 13 and 14 are: dry, 273 K, 101.3 kPa and 7% O ₂ .		L3.5: Monitoring at points 2 and 3 must be undertaken under the following reference basis for the pollutants specified in condition L3.4: a) For sulfuric acid mist and/or sulfur trioxide, Chlorine, Hydrogen chloride, Total Fluoride, Hazardous substances, Cadmium, and Mercury: dry, 273 K, 101.3 kPa. b) For Nitrogen oxides and Solid particles: dry, 273 K, 101.3 kPa, 7% O ₂ .	L3.5: The reference basis for the air pollutants in condition L3.4 are as follows: For Nitrogen oxides (NO ₂ and/or NO), solid particles and Carbon monoxide (CO): dry, 273 K, 101.3kPa, 7% O ₂ . For Sulfuric acid mist (H ₂ SO ₄) and/or sulfur trioxide (SO ₃), chlorine (Cl ₂), Hydrogen chloride (HCl), Total Fluoride, Hazardous substances, Cadmium (Cd) and Mercury (Hg): dry, 273K, 101.3 kPa.
Clean Air Reg Groups		L3.4 In accordance with section 33(3) of the POEO (Clean Air) Reg 2010 the emission units corresponding to Points 11, 12, 13 and 14 are taken to belong to Group 3 . However under section 37(3) of the Protection of the Environment (Clean Air) Regulation 2010 the EPA has under section 37(3) of the POEO (Clean Air) Reg 2010 the EPA has imposed more stringent emission standards at Points 11, 12, 13 and 14 for pollutants detailed in limit condition L3.5 of this licence.	Note: Subject to the completion of a Pollution Reduction Program on or before 3 July 2017 (licence condition U5), the emissions from Unit 1 to 4 boiler stacks are not required to meet the Group 5 emission standard for nitrogen oxides.		For the purposes of NO ₂ or NO or both, as NO ₂ equivalent, at Points 11 and 12 and in accordance with the Protection of the Environment Operations (Clean Air) Regulation 2010, the activity or plant defined by the licence at these locations is taken to belong to Group 2 until 1 January 2022 or unless otherwise the licence at these locations is taken to belong to Group 2 until 1 January 2022 or unless otherwise approved in writing by the EPA.
Start up fuel conditions	L3.5: Start-up fuel specifications: All start-up fuel used at the premises must conform with the Australian Standard for Automotive Diesel Fuel (AS 3570 - 1998) and as updated from time to time.	The following fuels may be used in the power station for station start-up and combustion support provided that they comply with the specification set out in this licence: a) Distillate / heating oils b) Distillate / heating oils blended with refined oil additives	L6.1: Start-up fuel specifications All start-up fuel used at the premises must conform with the Australian Standard for Automotive Diesel Fuel (AS 3570 - 1998) and as updated from time to time.		E3: Fuels used in the power station outlines that Distillate / heating oils and Distillate / heating oils blended with refined oil additives fuels may be used for station startup and combustion support provided that they comply with the specification set out in this licence. E3.2 to E3.4 provides sampling requirements, fuel specifications and alternative fuel burning trial information.

	Bayswater Power Station	Eraring Power Station	Liddell Power Station	Mount Piper Power Station	Vales Point Power Station
Sulfur content of coal		COAL - Impurity Units of measure 100% Concentration Limit (Monthly Av. 8% H2O) Sulfur % by weight 0.5. O8.15: Coal fuels must not be burnt in the electricity generating works unless they contain concentrations of Sulfur that do not exceed the 100 percentile Concentration Limit of 0.5 (% by weight) as a monthly average (8% H2O).	O5.1: The sulfur content of coal as fired in the boilers must not exceed 1.0% by weight on a monthly average basis.		O8.1: The sulfur content of coal used in the boilers must not exceed 0.5% by weight on a monthly average basis.
Sulfur content of fuel oil		LIQUID FUELS -Impurity Units of measure 100% Concentration Limit (Monthly Average) Sulfur % by weight 0.5			O8.2: The sulfur content of any fuel oil used in the boilers must not exceed 0.5% by weight on a monthly average basis.
Monitoring of Fuels		O8.13: The licensee must sample and analyse sufficient samples of fuel received on the premise to assess whether the fuel complies with the specifications in this licence.	O3.1 Prior to burning coal fuel supplies, the licensee must: a) assess the sulfur content of each coal fuel supply; b) operate a coal delivery system that can manage the coal delivery and stockpile management process in a manner that would minimise any exceedence of the sulfur dioxide gas emission trigger value of 600ppm and described in condition R4.1. Note: This condition requires the licensee to ensure that all coal fuel for combustion is blended and managed to reduce the concentration of sulfur dioxide emissions during combustion.	The concentration of an impurity contained in the solid alternative fuel must not exceed the concentration specified for that impurity in the table. Impurity Units of measure 100% concentration limit - Type 1 and Type 2 substances in aggregate milligrams per kilogram - 350	
PCB's in Fuel Oil		O8.14: Fuel oils containing Polychlorinated biphenyls (PCB's) are not permitted to be used in the power station.			
Distillate/Fuel oil specifications		Distillate / heating oils and distillate refined oil blends burnt in the power station must comply with the specifications in Table 1. See condition O8.18 for Table 1 detail on page 17 of licence.			

	Bayswater Power Station	Eraring Power Station	Liddell Power Station	Mount Piper Power Station	Vales Point Power Station
Alternative fuels		O8.15: Alternative liquid fuels must not be burnt in the electricity generating works unless they comply with the specifications below: b) Alternative liquid fuels must not be burnt in the electricity generating works unless they contain concentrations of Sulfur that do not exceed the 100 percentile Concentration Limit of 0.5 (% by weight) as a monthly average.	Use of waste mineral oils as an alternate fuelE1.1 Waste mineral oils generated on the premises can be used as fuel under the following restrictions:a) must only be fed to the boiler unit(s) during coal firing and at a maximum feed rate of less than or equal to 4% of the coal feed rate;b) must not exceed the 100 percentile concentration limit of 0.5% of sulfur by weight.	E1: Solid Alternative Fuel - Detailed PRP on use of alternative solid fuel in E1.1. For the purpose of this licence, Solid Alternative Fuel means timber products.	E4: Solid alternative fuel - Detailed PRP on use of alternative solid fuel in E4. For the purpose of this licence, Solid Alternative Fuel means timber products.
Alternative fuels		Alternative Fuel Burning Trial – Source Emission Testing Any distillate / heating oil or distillate refined oil blend that complies with the specifications in Table 2 may be burnt for the purpose of undertaking emission monitoring trials in accordance with monitoring specified in this licence. See table 2 in condition O8.19 on page 18 of the licence for detail.		The licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1 contained in any solid alternative fuel, and the Calorific Value (MJ/kg) of the fuel. The table in M9.1 on page 15 of the licence lists the pollutants, units of measure and frequencies.	
Emergency exemptions from limits	O2.2 If due to emergency circumstances there is a possibility of interruption to electricity supply, limits prescribed by this licence may be temporarily exceeded provided: a) the licensee notifies the Environment Protection Authority of the situation at the earliest opportunity, and b) the Environment Protection Authority concurs with such emergency operation.		O5.2: If, due to emergency circumstances, there is a possibility of interruption to electricity supply, limits prescribed by this licence may be temporarily exceeded provided (i) the Environment Protection Authority is notified, by the licensee, of the situation at the earliest opportunity, and (ii) the Environment Protection Authority concurs with such emergency operation.		
Number of CEMS operating			M2.4: In relation to the table for monitoring points 7,8,9,10, the licensee must ensure that at least two(2) continuous monitors are operating and accurately measuring nitrogen oxides, opacity and sulfur dioxide in flue gases during the reporting period.		

	Bayswater Power Station	Eraring Power Station	Liddell Power Station	Mount Piper Power Station	Vales Point Power Station
note regarding monitoring				<p>M2.2: Note: For condition M2.2, the frequency of monitoring "quarterly or yearly during discharge" means that when quarterly monitoring is scheduled for Point 2 (Boiler 1) and/or Point 3 (Boiler 2), monitoring of either Point 2 or 3 is not required if the generating unit/ boiler associated with that Point is not operating and not discharging at that time. However, it needs to be demonstratable by the licensee that where a generating unit/ boiler is not operating at time of scheduled monitoring, that the generating unit/ boiler was not operating due to reduced station output resulting from reduced market demand and/or coal availability.</p>	
note regarding monitoring				<p>M2.3: For the purpose of the table above, Special Method 2 means sampling in accordance with TM-11 and include recording of the respective boiler MW Load at time of sampling, to enable reporting under condition R1.9.</p>	
Air Emissions Exceedance Report		<p>For any specified pollutant required to be continuously monitored for points 11, 12, 13 and 14 the licensee must produce an air emission exceedance report if the concentration of that pollutant any anytime exceeds the following level. Sulfur dioxide at any time exceeds 600 ppm. Within seven (7) days of the licensee becoming aware of the exceedance of the limits specified in this condition, a written report must be sent to the EPA's Regional Manager Hunter and must include the following: a) details of the date and time of the exceedance; b) the duration of the exceedance; and c) the reason(s) for the exceedance.</p>	<p>For each of the pollutants required to be continuously monitored at Points 7,8,9 and 10 the licensee must provide a report to the EPA if the concentration values of any of the following pollutants are exceeded: a) Opacity - 20% opacity; b) Sulfur Dioxide - 600ppm; c) Nitrogen oxides - 700ppm. The report must be provided to the EPA within thirty (30) days of the concentration value(s) being exceeded and include the following information: a) Details of the date and times of the exceedance; b) The duration of the exceedance; c) The reason(s) for the exceedance; and d) Actions to be taken to address any future exceedance(s).</p>		<p>The licensee must produce an air emission exceedance report if the concentration of sulfur dioxide at any time exceeds 600ppm. Within seven (7) days of the licensee becoming aware of the exceedance of the limits specified in this condition, a written report must be sent to the EPA and must include the following: a) details of the date and time of the exceedance; b) the duration of the exceedance; and c) the reason(s) for the exceedance.</p>

	Bayswater Power Station	Eraring Power Station	Liddell Power Station	Mount Piper Power Station	Vales Point Power Sation
Annual report/Annual performance report	The Annual Return must include the following information: Air emission reporting limit - The licensee must produce an air emission exceedence report if the concentration of Sulfur Dioxide at any time exceeds 600 ppm (vol). The air emission exceedence report must include the following: a) details of the date and time of the exceedence; b) the duration of the exceedence; and c) the reason(s) for the exceedence.		Annual Performance Report and Mass Emissions and Production Report. The licensee must submit an Annual Performance Report, and a Mass Emissions and Production Report with each Annual Return.	The Annual Return must also include the following information: 1. a report that plots the quarterly Nitrogen oxide concentration sampling results against the historical Nitrogen oxide CEMS data curve for boiler units 1 and 2, and 2. The licensee must report any exceedance of any discharge limit, standard, or concentration set by a condition of this licence.	
NOX Emission reduction PRP			U1: PRP - NOx emission reduction The Licensee must undertake a review of international best practice measures available to minimise the generation and emission of NOx from coal fired electricity generation. This PRP contains 3 parts and is due for completion on 3 July 2017 (it can be found on page 26 of the licence).		U1 Investigation of further controls to reduce Nitrogen Oxide Emissions The aim of this pollution reduction study is to assess the feasibility of achieving reductions in the emissions of nitrogen oxides at the premises and trhis is due to EPA on 1 July 2017. this PRP contains condition U1.1 to U1.5

Table C: EPA Intelligence Report: NSW power stations 2014-2016, Self reported Non-Compliances

Location	Annual Return	End Date	Number Of Times	Condition Number	Summary	Cause	Action	Follow up Action
Liddell Power Station	86566	30/06/2014	2	M2.2	Monitoring of VOC concentrations on points 2 & 4 were not carried out after change in requirements due to an oversight. Minor opacity trigger exceedence due to mechanical fault in pulse cycling for bag cleaning.	Monitoring of VOC concentrations on points 2 & 4 were not carried out after change in requirements due to an oversight. Opacity exceedence on Unit 1 due to operational failure with automated cleaning cycles in baghouse.	VOC - New requirement. OPACITY - have applied for a licence variation that will allow for better on site ambient monitoring equipment that can capture downwind effects of operations.	The 20%ile opacity is a trigger value that is set below approximate particulate limits in this licence. It prompts the licensee to check for filter bag failures.
Liddell Power Station	86998	1/09/2014	1	M2.2	No VOC monitoring was completed during the reporting period due to an oversight in the monitoring regime. The next monitoring event is scheduled for October 2014 and is to incorporate VOC monitoring.	An oversight in the monitoring regime.	VOC monitoring is scheduled to be undertaken prior to the end of the next monitoring period to satisfy the EPL requirement for annual monitoring of this pollutant.	Interim Annual Return as licence transferred from Macquarie Generation
Liddell Power Station	90707	30/06/2016	1	R4.1	Concentration limit exceedance of sulfur dioxide was not reported within 30 days as required.	Under the existing monitoring system, only raw SO2 values are seen by operating staff not values corrected for 12% CO2. On the day of this incident the operators observed values between 458ppm and 480ppm which without CO2 correction would be perceived as well below limit. As such no corrective actions to stop an exceedance was initiated by operating staff.	Nil.	

Part B – Discussion of specific monitoring and reporting requirements

1) Review of EPL Reporting Conditions

As identified in Part A of this document, reporting conditions vary somewhat between each of the power stations. This section provides additional discussion of the reporting condition requirements of each EPL, including: Reporting limits; Notification periods; EPL terminology.

A selection of applicable reporting conditions for each power station are reproduced from each EPL below.

Eraring

EPL Section 6: Reporting Condition R1.12 - For any specified pollutant required to be continuously monitored for points 11, 12, 13 and 14 the licensee must produce an air emission exceedance report if the concentration of that pollutant any anytime exceeds the following level. Sulfur dioxide at any time exceeds 600 ppm.

Within seven (7) days of the licensee becoming aware of the exceedance of the limits specified in this condition, a written report must be sent to the EPA's Regional Manager Hunter and must include the following:

- a) details of the date and time of the exceedance
- b) the duration of the exceedance
- c) the reason(s) for the exceedance

Bayswater

EPL Section 6: Reporting Condition R1.9 - The Annual Return must include the following information: Air emission reporting limit - The licensee must produce an air emission exceedance report if the concentration of sulfur dioxide at any time exceeds 600 ppm (vol). The air emission exceedance report must include the following:

- a) details of the date and time of the exceedance
- b) the duration of the exceedance
- c) the reason(s) for the exceedance

Vales Point

EPL Section 6: Other reporting condition R5.1 - The licensee must produce an air emission exceedance report if the concentration of sulfur dioxide at any time exceeds 600ppm.

Within seven (7) days of the licensee becoming aware of the exceedance of the limits specified in this condition, a written report must be sent to the EPA's Regional Manager - Hunter at PO Box 488G, Newcastle, NSW, 2300, or emailed to hunter.region@epa.nsw.gov.au and must include the following:

- a) details of the date and time of the exceedance
- b) the duration of the exceedance
- c) the reason(s) for the exceedance

Mount Piper

Mount Piper does not have a requirement to continuously monitor discharges to air. There are no specific reporting limits prescribed in the reporting conditions of the EPL, except for the following.

Section R1.9 of the EPL states:

The Annual Return must also include the following information:

2. The licensee must report any exceedance of any discharge limit, standard, or concentration set by a

condition of this licence. The report must include the sample results or the exceedance and indicate the name of the testing laboratory, parameter(s) monitored, the limit, standard, or concentration exceeded, the date of the exceedance and the results of any analysis.

Liddell

Other reporting conditions: R4.1 - Air emission trigger value exceedances at Points 7,8,9 and 10 - For each of the pollutants required to be continuously monitored at Points 7,8,9 and 10 the licensee must provide a report to the EPA if the concentration values of any of the following pollutants are exceeded:

- a) opacity - 20% opacity
- b) sulfur dioxide - 600ppm
- c) nitrogen oxides - 700ppm

The report must be provided to the EPA's Regional Manager, Hunter within thirty (30) days of the concentration value(s) being exceeded and include the following information:

- a) details of the date and times of the exceedence
- b) the duration of the exceedence
- c) the reason(s) for the exceedence
- d) actions to be taken to address any future exceedence(s)

EPL Conditions - Reporting Limits

Reporting limits included in the power stations EPLs require the licensee to inform the EPA any time an exceedance, of specific pollutants, occurs.

Compliance with reporting conditions requires the licensee to continuously monitor for the pollutants specified in their EPL. Variation in the reporting conditions, between power stations, results in varying monitoring requirements. It is noted that requirements to continuously monitor air emissions, results in increased capital expenditure, operating costs and time.

Table 1 summarises the reporting limits and monitoring requirements for each of the power stations.

Table 1: Summary of EPL monitoring conditions and reporting limits.

Environment Protection Licence - Reporting Limit Requirements			
	SO ₂ ¹	NO _x ²	Opacity
Bayswater (Boiler 1 Only)	1760 mg/m ³	-	-
Liddell	1760 mg/m ³	1438 mg/m ³	20% Opacity
Eraring	1760 mg/m ³	-	-
Mount Piper	-	-	-
Vales Point	1760 mg/m ³	-	-

¹ - SO₂ concentration converted based on 1 ppm (SO₂) = 2.86 mg/m³

² - NO_x concentration converted based on 1 ppm (NO₂ equivalent) = 2.05 mg/m³

Notification Periods

The notification period for exceedances vary from 7 days to 'include in annual return'. Exceedances of any reporting limits should be treated with equal importance for all licenses. Inconsistent reporting requirements, as currently exist on power station EPLs, could be viewed as having unequal importance by licensees and other stakeholders.

EPL Terminology

The terminology used to describe what the reporting requirements vary between each licence. i.e: Liddell's EPL refers to 'Air Emission Trigger Values', Bayswater calls it an 'Air emission reporting limit'. Eraring and Vales point do not have a specific name.

2) Review of EPL Opacity Monitoring Requirements

Each of the NSW coal fired power station EPL's, except for Mount Piper, include a requirement to monitor undifferentiated particulates/opacity. Table 2 provides a summary of the EPL requirements for measuring undifferentiated particles for each power station.

Table 2: NSW coal fired power stations - undifferentiated particulates monitoring requirements

Station	Pollutant	Unit of measure	Sampling Frequency	Sampling Method
Bayswater	Undifferentiated Particulates	percent Opacity	Continuous	CEM-1
Liddell	Undifferentiated Particulates	percent Opacity	Continuous	CEM-1
Mount Piper	No Requirement			
Eraring	Undifferentiated Particulates	mg/m ³	Continuous	CEM-1
Vales Point	Undifferentiated Particulates	mg/m ³	Continuous	In line instrumentation

Sampling Method

'In-line' instrumentation is not a NSW Approved test method for sampling and analysis of air pollutants. 'In-line instrumentation' is not defined in the Vales Point Power Station EPL.

As per the Approved Methods for Sampling and Analysis of Air Pollutants in NSW (Jan 2007), continuous opacity monitoring is required to be performed in accordance with CEM-1 if determining whether a specified standard of concentration of opacity has been exceeded.

The reference method for CEM-1 is USEPA Performance Specification 1 (PS-1) - *Specifications and test procedures for continuous opacity monitoring systems in stationary sources*. PS-1 covers the instrumental measurement of opacity caused by attenuation of projected light due to absorption and scatter of the light through the effluent gas stream.

Undifferentiated Particulates

The term undifferentiated particles is not defined in NSW regulatory instruments, including EPL's. The NSW EPA does not have published guidance on how to determine undifferentiated particles or mass emissions from continuous opacity monitoring using CEM-1. Therefore, each of the NSW power stations have adopted their own approach to meet the licence requirements.

Reporting Units

As can be seen in Table 2, above, EPLs exhibit some inconsistent unit of measure requirements for reporting between stations. Further, some units of measure are inconsistent with the measurement technique prescribed by the licence i.e. the reported unit of measure from an opacity monitor should be percent opacity.

3) Review of EPL Monitoring Locations

Each boiler exhaust stack is identified, as an EPA emission monitoring point, in each of the power stations' EPLs.

The configuration of the exhaust system of each power station boiler is different, but often comprises multiple ducts (passes). Each duct directs boiler flue exhaust gases through parallel pollution control systems. The ducts either recombine before entering the boiler exhaust stack or enter directly into the stack. The number of ducts, associated with each boiler, is not included in the EPLs.

The location of monitoring/discharge point descriptions listed in the power station EPLs do not specify the number of ducts associated with a single emission point, nor do they clearly identify sampling locations for each EPA Identification number. Due to the complexity of the flue gas exhaust systems (multiple and merged ducts) non-prescriptive EPL location descriptions may cause some unnecessary ambiguity.

Table 3 below, lists the number of ducts associated with each boiler and the EPL descriptions used to identify sampling locations.

Table 3: NSW coal fired power station EPL location descriptions and exhaust duct configurations.

Station	EPA ID no.	EPL Location Description	Number of ducts (Information not included in EPL)
Bayswater	10	Boiler 1 stack	2 (1A, 1B)
	11	Boiler 2 stack	2 (2A, 2B)
	12	Boiler 3 stack	2 (3A, 3B)
	13	Boiler 4 stack	2 (4A, 4B)
Liddell	1 and 7	Unit 1 Boiler	2 (1A, 1B)
	2 and 8	Unit 2 Boiler	2 (2A, 2B)
	3 and 9	Unit 3 Boiler	2 (3A, 3B)
	4 and 10	Unit 4 Boiler	2 (4A, 4B)
Mount Piper	2	Boiler 1	2 (1A, 1B)
	3	Boiler 2	2 (2A, 2B)
Eraring	11	Boiler No. 1	2 (1A, 1B)
	12	Boiler No. 2	2 (2A, 2B)
	13	Boiler No. 3	2 (3A, 3B)
	14	Boiler No. 4	2 (4A, 4B)
Vales Point	11	Boiler Unit No. 5	4 (5A,5B,5C,5D)
	12	Boiler Unit No. 6	4 (6A,6B,6C,6D)

Note: Most EPLs location descriptions also include a reference to a corresponding engineering/ plant drawing.

The ambiguity of EPL listed monitoring locations and sampling requirements has resulted in differing approaches applied to the collection and reporting of emissions, eg. the approach used at each power station to collect solid particle samples differ. Bayswater EPA ID No.10 (Boiler 1 stack) is comprised of two ducts, A and B. Periodic solid particle sampling is conducted from either Duct A or B, of each boiler per year. Vales Point EPA ID No.11 (Boiler Unit No. 5) is comprised of four ducts. Periodic solid particle sampling is conducted on all four ducts. The four sample results are combined to give an average total concentration for the boiler.

Liddell Power Station EPL Monitoring Points

Liddell power station has 4 boiler units, each with a dedicated flue gas exhaust system. Each exhaust splits into two ducts (Duct A and Duct B) as it passes through the dust filtration system, resulting in a total of 8 ducts, from 4 boilers.

The EPL for Liddell identifies 8 separate monitoring points from the boilers, as shown in Figure 1 below. EPA identification points 1-4 have the same location descriptions as points 7-10. The only applicable limits for points 7-10 are NO_x, SO₂ and Opacity. No other limits apply.

As can be seen, in Figure 2, undifferentiated particles are to be monitored at EPL points 1,2,3 and 4 and Opacity is to be measured at points 7,8,9 and 10 -with the exception that points 7 to 10 identify continuous monitoring equipment. Based on the EPL, it is not clear if these are the same points, if they refer to combined ducts or separate ducts (Duct A or B).

Figure 1: Liddell power station EPL excerpt -Location of monitoring points.

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air			
EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	In the flue gases of unit 1 boiler labelled as "Unit 1 Boiler 1-2 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.
2	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	In the flue gases of unit 2 boiler labelled as "Unit 2 Boiler 1-2 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.
3	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	In the flue gases of unit 3 boiler labelled as "Unit 3 Boiler 3-4 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.
4	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	In the flue gases of unit 4 boiler labelled as "Unit 4 Boiler 3-4 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.
6	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	Diesel generator exhaust labelled as "diesel generator" on plan no. LD800474 amended 05 and dated 24/01/2007.
7	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	Continuous monitoring equipment in flue gases of unit 1 boiler labelled as "Unit 1 Boiler 1-2 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.
8	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	Continuous monitoring equipment in flue gases of unit 2 boiler labelled as "Unit 2 Boiler 1-2 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.

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9	Discharge to air Air emissions monitoring	Discharge to air Air emissions monitoring	Continuous monitoring equipment in flue gases in flue gases of unit 3 boiler labelled as "Unit 1 Boiler 3-4 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.
10	Discharges to air Air emissions monitoring	Discharges to air Air emissions monitoring	Continuous monitoring equipment in flue gases of unit 4 boiler labelled as "Unit 4 Boiler 3-4 Chimney Stack" on plan No. LD800474 amended 05 and dated 24/01/2007.

Figure 2: Liddell power station EPL excerpt - monitoring requirements.

M2.3 Air Monitoring Requirements

POINT 1,2,3,4

Pollutant	Units of measure	Frequency	Sampling Method
Cadmium	milligrams per cubic metre	Yearly	TM-12
Carbon dioxide	milligrams per cubic metre	Yearly	TM-24
Chlorine	milligrams per cubic metre	Yearly	TM-7 & TM-8
Copper	milligrams per cubic metre	Yearly	TM-12, TM-13 & TM-14
Dry gas density	kilograms per cubic metre	Yearly	TM-23

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Hydrogen chloride	milligrams per cubic metre	Yearly	TM-7 & TM-8
Moisture content	percent	Yearly	TM-22
Molecular weight of stack gases	grams per gram mole	Yearly	TM-23
Nitrogen Oxides	milligrams per cubic metre	Yearly	TM-11
Oxygen (O ₂)	percent	Yearly	TM-25
Solid Particles	milligrams per cubic metre	Yearly	TM-15
Sulfuric acid mist and sulfur trioxide (as SO ₃)	milligrams per cubic metre	Yearly	TM-3
Sulphur dioxide	milligrams per cubic metre	Yearly	TM-4
Temperature	degrees Celsius	Yearly	TM-2
Total Fluoride	milligrams per cubic metre	Yearly	TM-6
Type 1 and Type 2 substances in aggregate	milligrams per cubic metre	Yearly	TM-12, TM-13 & TM-14
Undifferentiated Particulates	percent Opacity	Continuous	CEM-1
Velocity	metres per second	Yearly	TM-2
Volatile organic compounds	milligrams per cubic metre	Yearly	TM-34
Volumetric flowrate	cubic metres per second	Yearly	TM-2

POINT 7,8,9,10

Pollutant	Units of measure	Frequency	Sampling Method
Nitrogen Oxides	parts per million	Continuous	CEM-2
Opacity	percent	Continuous	CEM-1
Sulphur dioxide	parts per million	Continuous	CEM-2