Annual Air Emission Monitoring Report 2023

Mt Piper Power Station

PREPARED FOR

EnergyAustralia

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26 February 2024

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VERSION	REVISION	AUTHOR	REVIEWED BY	NAME	DATE	
Draft	D01	E. Edwards M. Paula Perez-Pena	J. Grieve	Paul Fridell	29.01.2024	Draft for client review
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Final	R01	E. Edwards M. Paula Perez-Pena	J. Grieve	Tamie Weaver	26.02.2024	Final

This report was prepared in accordance with the scope of services set out in the contract between Environmental Resources Management Australia Pty Ltd ABN 12 002 773 248 (ERM) and the Client.

To the best of our knowledge, the proposal presented herein accurately reflects the Client's intentions when the report was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document.

In preparing the report, ERM used data, surveys, analyses, designs, plans and other information provided by the individuals and organisations referenced herein. While checks were undertaken to ensure that such materials were the correct and current versions of the materials provided, except as otherwise state, ERM did not independently verify the accuracy or completeness of these information sources.

SIGNATURE PAGE

Annual Air Emission Monitoring Report 2023

Mt Piper Power Station

0716331_R01

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ACRONYMS AND ABBREVIATIONS

Acronyms	Description
AAEMR	Annual Air Emission Monitoring Report
AEMO	Australian Energy Market Operator
APC	Air Pollution Control
AQIA	Air quality impact assessment
AQMS	Air quality monitoring station
AWS	Automatic weather station
BCA	Brine Conditioned Ash
CEMS	Continuous emissions monitoring system
DPHI	Department of Planning, Housing and Infrastructure (DPHI)
EPA	Environment Protection Authority
EPL	Environment protection licence
ERM	Environmental Resources Management Australia Pty Ltd
GWh	gigawatt hour

Acronyms	Description
HDPE	High Density Polyethylene
K	degrees Kelvin
kPa	kilopascals
LBL	(NSW) Load-based Licencing Scheme
LNAR	Lamberts North Ash Repository
mg/Nm³	milligrams per normal cubic metre (i.e. at conditions of 273K and 101.3 kPa)
MPAR	Mt Piper Ash Repository
MPPS	Mount Piper Power Station
MW	megawatt
MWh	megawatt hour
NEPC	National Environment Protection Council
Nm³	Normal cubic metre (i.e. 1 cubic metre at conditions of 273 K and 101.3 kPa)
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
NPI	National Pollutant Inventory
NSW	New South Wales
LOR	Limit of reporting
O_2	Oxygen (molecular)
OEMP	Operational Environment Management Plan
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in aerodynamic diameter
ppb	parts per billion (by volume)
pphm	parts per hundred million (by volume)
QA/QC	Quality Assurance / Quality Control
RL	Reduced Level
SO_2	Sulfur dioxide
SO_3	Sulfur trioxide
SWTP	Springvale Water Treatment Plant
t	tonne
µg/m³	micrograms per cubic metre
WCA	Water Conditioned Ash

1. INTRODUCTION

EnergyAustralia operates the Mount Piper Power Station (MPPS), located at 350 Boulder Road, Portland, New South Wales. The MPPS is approved to operate 700 MW and 730 MW coal-fired steam turbine generators that have the capacity (> 4000 GWh) to meet the energy needs of approximately 1.18 million homes in New South Wales every year. MPPS is fuelled using black coal sourced from coal mines in the local area.

The MPPS operates under various licences and approvals including Environmental Protection Licence (EPL) 13007 issued by the NSW Environmental Protection Authority (EPA). This Annual Air Emissions Monitoring Report (AAEMR) has been prepared to satisfy Condition R1.9 of EPL13007. The AAEMR is required to analyse and summarise air emission and ambient air quality monitoring data collected within the reporting period.

ERM was engaged by EnergyAustralia to prepare the AAEMR for the 2023 calendar year ('the reporting period') and summarise the methodology and findings in a technical report (this report).

1.1 EPL UPDATES

A 5-year licence review was completed in 2023. The licence was revised five times. Three of these variations included conditions relevant to air emissions. These variations are as follows:

Licence Variation: 27 January, 2023

The 27 January 2023 variation to EPL 13007 includes the following updates:

- Condition L3.2 (note) - varied to reflect new Protection of the Environment (Clean Air) Regulation 2022;
- Condition M3.1 (note) - varied to reflect new Protection of the Environment (Clean Air) Regulation 2022;
- Condition O4 (note) - varied to reflect new Protection of the Environment (General) Regulation 2022;
- Remove all conditions related to the emergency discharge to Thompsons Creek Reservoir (TCR) emergency discharge being conditions A2.1, A2.5, P1.3, L3.8, L4.1, M2.6, M8.1 and E8;
- Condition A2.1 location table updated as follows;
    - Removal of Lot 15 DP 804929,
    - Removal of Lot 1 DP 813288,
    - Addition of Lot 3 DP 999329,
    - Addition of Lot 4 DP 1151441,
    - Addition of Lot 101 DP 1240974,
    - Addition of Lot 101 DP 1164619; and
- Condition A2.2 - varied to replace the location data for the Nu-Rock facility, Lot 2 DP 702619 formally Lot 103 DP 1164619.

Licence Variation: 18 October, 2023

The 18 October 2023 variation to EPL 13007 includes the following updates:

- Condition O5.2 - Varied. References to conditions have been varied to reference the correct conditions.
- Condition O5.6 – Varied. The condition that requires the testing of various substances within the coal fuel has been varied to specifically include mercury, as detailed in the Background section of this Notice. The wording has also been varied for consistency with other power station licences.
- Condition O5.7 (new) – Added. A new condition has been added to require the Licensee to provide the fuel testing data to the EPA upon request.
- Condition O5.7 Note – Added. A note has also been included to identify that the EPA intend on reviewing the testing regime after a set date.
- Condition O5.7 – O5.9 – Varied. The numbering of the conditions has been changed due to the addition of a new condition.
- Conditions L3.9 and L3.10 – Varied. References to conditions have been varied to reference the correct conditions.
- Condition M2.2 - Varied. The references to testing methods for cadmium and chlorine have been corrected to align with the 'Approved methods for the sampling and analysis of air pollutants in NSW'.
- Condition M2.4 – Varied. The Licensee now monitors for moisture, oxygen and temperature, as evidenced by monitoring data provided in the latest Annual Return, and as such the requirement for the installation of the equipment for these parameters has been removed.
- Condition M2.4 and Note – Varied. The Licensee condition has been varied to update the due date for continuous monitoring of flow rate, as agreed with the EPA. The Note has also been varied in respect of the above variation.
- Condition E1 (former) – Removed. The Dioxin and Furan Study has been provided to the EPA, as detailed in the Background section of this Notice, and as such the Licence condition has been removed.
- Condition E7 (former) – Removed. The Water Management Review Report has been provided to the EPA, as detailed in the Background section of this Notice, and as such the Licence condition has been removed.
- Conditions E1 to E9 – Varied. The former numbering of conditions has been varied due to the removal of conditions as detailed in the section of the Notice.
- Condition E1 – Varied. The Air Emissions Monitoring Plan has been provided and the condition has been changed to ‘must implement and maintain’, as detailed in the Background section of this Notice. Former condition E2.2 has been removed as the plan has been provided.
- Condition E2 – Varied. The QA/QC Procedure has been provided and the condition has been changed to must implement and maintain, as detailed in the Background section of this Notice. Former condition E3.2 has been removed as the plan has been provided.
- Condition E3 – Varied. The Air Pollution Control Procedure has been provided and the condition has been changed to must implement and maintain, as detailed in the

Background section of this Notice. Former conditions E4.2 and E4.3 have been removed as the plan has been provided.

- Condition E4 – Varied. The Particulate CEMS installation and commissioning has been successfully completed, as detailed in the Background section of this Notice, and as such the licence condition has been removed.
- Condition E4 Note – Added. A Note has been added to clarify that the EPA is currently evaluating an industry-wide consistent approach to the licensing requirements for PM-CEMS. The EPA intends on varying all coal-fired power station licences in due course to include consistent monitoring requirements that become in-force as each station's PM-CEMS are commissioned.
- Condition E6 – Added. A condition that requires appropriate dust management has been added to specifically include a dust management plan and a TARP, as detailed in the Background section of this Notice. The condition does not come into force until four months after the licence variation.

Licence Variation: 19 October, 2023

The 19 October 2023 variation to EPL 13007 includes the following updates:

- Condition M9.1 and Note – Added – A condition has been added to the licence to require the licensee to monitor and record details regarding generation, deposition, storage, transport and reuse of coal ash generated at the premises, for the reasons provided in the Background section of this Notice.
- Conditions R4.4, R4.5 and R4.6 – Added – A condition has been added to the licence to require the licensee to submit to the EPA and publicly publish an Annual Coal Ash Monitoring Report that details information required under condition M9.1 in respect of generation, deposition, storage, transport and reuse of coal ash generated at the premises for the previous reporting period, for the reasons provided in the Background section of this Notice.
- Condition E7.1, 7.2, and Note – Added - Conditions have been added to require quarterly reporting to the EPA of the coal testing results collected in accordance with condition O5.6, as detailed in the Background section of this Notice. The condition allows for a review of the regime after a set length of time.

1.2 EPL REQUIREMENTS

Condition R1.9 – Annual Air Emission Monitoring Report outlines a number of requirements that are to be addressed in preparation of the AAEMR. Table 1-1 lists these requirements with corresponding report sections that address each condition.

The monitoring requirements of *Condition M2.2 – Air Monitoring Requirements*, (as referenced in Condition R1.9) are shown in Table 1.2.

Condition – M9.1 Other Monitoring and Recording Conditions Coal Ash Monitoring outlines a number of reporting requirements relating to the production and storage of ash. These requirements are listed in Table 1-3. In addition to Condition – *R4.4 Other Monitoring Conditions Coal Ash Monitoring Reporting*, shown in Table 1-4, it is noted that this condition is not a specific requirement of the AAEMR, but has nominally been incorporated into the AAEMR to address conditions M9.1 and R4.4.

TABLE 1-1 NSW EPA EPL13007 CONDITION – R1.9 ANNUAL AIR EMISSION MONITORING REPORT

R1.9	Annual Air Emission Monitoring Report	Refer to
	The licensee must submit with the Annual Return an Annual Air Emission Monitoring Report. The Annual Emission Monitoring Report must analyse and summarise emission monitoring data from the reporting period including, but not limited to:	This report.
a)	*a comprehensive summary (tabulated and graphical) of all periodic and continuous monitoring data as required by condition M2.2 of this licence, including a comparison with the concentration limits specified in condition L3.2 and L3.3;*	Section 2 Table 2-1, Table 2-4, Table 2-6 Figure 2-1 to Figure 2.9
b)	*analysis of trends in emission performance for all pollutants monitored as required under condition M2.2. Trend analysis must include comparison of emission performance during the reporting period with emission performance from the previous 4 years;*	Section 3
c)	*details of any exceedances of air emission licence limits and details of plant operating conditions at the times the exceedances occurred;*	Section 2.4.1
d)	*details of plant operating conditions, including Boiler load (MW), during sampling for each Boiler;*	Table 2-1
e)	*demonstrated compliance with the CEMS Quality Assurance and Control Procedures prepared for the premises;*	Section 2.2.2 Table 2-5
f)	*summary of fuel usage, including:* *i. total coal and other permitted fuels consumed in each Boiler (including start-up);* *ii. a statement about the representativeness of fuel quality during periodic air emission sampling compared to non-sampling periods;* *iii. total fuel consumed by each Boiler during times when periodic air emission sampling was undertaken.*	Section 3.1 Table 3-1 Table 2-1
g)	*detailed calculations used to determine the aggregated pollutant emission rates for each boiler.*	Section 4

TABLE 1-2 NSW EPA EPL13007 CONDITION – M2.2 AIR MONITORING REQUIREMENTS

Pollutant	Units of Measure	Frequency	Sampling Method
Point 2,3			
Cadmium	milligrams per cubic metre	Every 6 months	TM-38
Chlorine	milligrams per cubic metre	Every 6 months	TM-38
Fluorine	milligrams per cubic metre	Every 6 months	TM-38
Hydrogen chloride	milligrams per cubic metre	Every 6 months	TM-38
Mercury	milligrams per cubic metre	Every 6 months	TM-38
Nitrogen oxides	milligrams per cubic metre	Continuous	TM-38
Solid particles	milligrams per cubic metre	Quarterly	TM-38

Pollutant	Units of Measure	Frequency	Sampling Method
Sulfur dioxide	milligrams per cubic metre	Continuous	TM-38
Sulfuric acid mist and sulfur trioxide (as SO_3)	milligrams per cubic metre	Every 6 months	TM-38
Type 1 and Type 2 substances in aggregate	milligrams per cubic metre	Every 6 months	TM-38
Volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Every 6 months	TM-38
Point 4,5,6,7			
Cadmium	milligrams per cubic metre	Every 6 months	TM-12
Flow rate	cubic metres per second	Continuous	CEM-6 and US EPA Procedure 1
Mercury	milligrams per cubic metre	Every 6 months	TM-14
Moisture	Percent	Continuous	Special Method 1
Nitrogen oxides	milligrams per cubic metre	Continuous	CEM-2 and US EPA Procedure 1
Oxygen (O_2)	Percent	Continuous	CEM-3 and US EPA Procedure 1
Solid particles	milligrams per cubic metre	Quarterly	TM-15
Sulfur dioxide	milligrams per cubic metre	Continuous	CEM-2 and US EPA Procedure 1
Temperature	degrees Celsius	Continuous	TM-2 and US EPA Procedure 1
Type 1 and Type 2 substance in aggregate	milligrams per cubic metre	Every 6 months	TM-12, TM-13 & TM-14
Point 4,6			
Carbon dioxide	Percent	Every 6 months	TM-24
Chlorine	milligrams per cubic metre	Every 6 months	TM-7
Fluorine	milligrams per cubic metre	Every 6 months	TM-9
Hydrogen chloride	milligrams per cubic metre	Every 6 months	TM-8
Sulfuric acid mist and sulfur trioxide (as SO_3)	milligrams per cubic metre	Every 6 months	TM-3

Pollutant	Units of Measure	Frequency	Sampling Method
Volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Every 6 months	TM-34
Point 8			
Fluoride	micrograms per cubic metre	Continuous	AM-8
Point 8,9			
Nitrogen dioxide	parts per hundred million	Continuous	AM-12
$PM_{2.5}$	micrograms per cubic metre	Continuous	Special Method 2
Sulfur dioxide	parts per hundred million	Continuous	AM-20
Point 10			
Nitrogen dioxide	parts per hundred million	Monthly	Special Method 3
Sulfur dioxide	parts per hundred million	Monthly	Special Method 3

TABLE 1-3 NSW EPA EPL13007 CONDITION – M9.1 OTHER MONITORING AND RECORDING CONDITIONS - COAL ASH MONITORING

M9.1	Other monitoring and recording conditions Coal Ash Monitoring (quantities to be reported in tonnes)	Refer to
	For each licence reporting period, the licensee must monitor and record the following details regarding generation, deposition, storage, transport and reuse of coal ash generated at the premises:	Section 5
a)	*Quantity of coal used for electricity generation at the premises;*	Table 5.1 (1)
b)	*Quantity of bottom ash; and quantity of fly ash, generated at the premises and the grade of fly ash produced (if the grade is known);*	Table 5.1 (2) (4)
c)	*Quantity of bottom ash; and quantity of fly ash, deposited, and/or stored at the premises with a description of how it is stored and the processes for managing the storage;*	Table 5.1 (1)
d)	*Quantity of bottom ash; and quantity of fly ash, transported from the premises together with identification of the destination; and*	Table 5.1 (1)
e)	*Management measures used for coal ash repositories on the premises to maintain the viability of ash reuse, including identification of any other materials being stored concurrently with newly deposited coal ash.*	Section 5
Note: The collection and reporting of information required by the above condition does not come into effect until three months after the issued date of this licence version to allow the licensee to put in place the relevant systems required to meet the condition.		

TABLE 1-4 NSW EPA EPL13007 CONDITION – R4.4 OTHER REPORTING CONDITIONS

R4.4	Coal Ash Monitoring Reporting	Refer to
	The licensee must prepare an Annual Coal Ash Monitoring Report that details information required under condition M9.1 in respect of generation, deposition, storage, transport and reuse of coal ash generated at the premises for each Annual Return reporting period.	Section 5

The stack concentration limits as referenced in Condition R1.9, *Condition L3.2 – Air Concentration Limits*, are shown in Table 1-5. Condition L3.3 states that in addition to the concentration limits specified in condition L3.2, the following 99th percentile concentration limits apply for points 2 and 3 utilising the same units of measure, reference conditions, oxygen correction and averaging period as above for each pollutant listed below:

a) nitrogen oxides: 1,100 mg/Nm^3; and

b) sulfur dioxide: 1,400 mg/Nm^3.

Condition L3.5 states that exceedances due to compliance with an Australian Energy Market Operator (AEMO) direction in accordance with Section 74 of the Protection of the Environment Operations (Clean Air) Regulation 2022 do not count towards the accumulated hours for the purpose of calculating compliance with condition L3.3.

It should be noted that the reference conditions (Dry, 273K, 101.3kPA), oxygen correction (7% O_2) and averaging period (1 hour) are constant for each pollutant and are left out of Table 1-5.

TABLE 1-5 NSW EPA EPL13007 CONDITION – L3.2 AIR CONCENTRATION LIMITS

Pollutant	100th percentile concentration limit
Mercury	0.05 mg/m^3
Chlorine	20 mg/m^3
Type 1 and Type 2 substance in aggregate	0.75 mg/m^3
Volatile organic compounds as n-propane equivalent	10 mg/m^3
Hydrogen chloride	50 mg/m^3
Solid Particles	50 mg/m^3
Sulfuric acid mist and sulfur trioxide (as SO_3)	100 mg/m^3
Nitrogen oxides	1,500 mg/m^3
Fluorine (total fluoride as HF equivalent)	30 mg/m^3
Cadmium	0.2 mg/m^3
Sulfur dioxide	1,700 mg/m^3

Note: During calibration and commissioning testing of the Particulate Continuous Emission Monitors undertaken in accordance with condition E5.2 (SIC), the limit for solid particles does not apply, however the concentration must not exceed the limits listed in the *Protection of the Environment (Clean Air) Regulation 2022*.

1.3 STUDY METHODOLOGY

The following steps were undertaken to complete this air emission monitoring report:

- Summarise data of the 2023 monitoring results required under EPL13007;
- Review historical monitoring data to analyse the trends in emission performance for all pollutants monitored under EPL13007;
- Consolidate and analyse monitoring data to understand if the data available is representative of normal operating conditions at MPPS; and
- Summarise compliance with Condition R1.9 under EPL13007.

2. AIR EMISSION MONITORING SUMMARY

The following sections summarise the air monitoring as relevant to the requirements of the *Condition R1.9 – Annual Air Emissions Monitoring Report*.

2.1 STACK TESTING

The stack test documents reviewed for 2023 monitoring include:

- Ektimo 2023a, Quarterly (Q1) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R014518, 5 April 2023;
- Ektimo 2023b, Quarterly (Q1) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R014323, 26 April 2023;
- Ektimo 2023c, Quarterly (Q3) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R015163, 14 August 2023; and
- Ektimo 2023d, Quarterly (Q4) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R015826, 30 November 2023.
- Ektimo 2024a, Quarterly (Q2) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R014882a, 15 January 2024;

The individual 2023 stack testing results are summarised in Table 2-1. All the concentrations provided are at normal conditions (0 °C, 101.325 kPa), dry basis, and at a reference oxygen content of 7% O_2 (dry basis).

The stack test frequencies met the stack, non-continuous sampling requirements as described in *Condition M2.2 – Air Monitoring Requirements* as outlined in Table 1-2. The results of the stack test indicate that there were no exceedances of the air concentration limits outlined in Table 1-5.

The corresponding stack test reports are included in Appendix A.

TABLE 2-1 SUMMARY OF STACK TESTING RESULTS AND POWER STATION OPERATING CONDITIONS

Sampling Date	Unit & Duct	Process condition	Temperature (°C)	Oxygen (%)	Daily Coal Burn (t)	Fuel Oil Consumed (L)	Daily Generation (MWh)	Mass Rate (g/min)	Measured Concentration (mg/Nm³)
Solid particles									
31/01/2023	1B	Load 350MW	122	10.5	4,367	6,225	7,558	17	2.2
1/02/2023	1A	Load 350MW	115	10.3	4,338	5,529	9,966	80	7.5
2/02/2023	2A	Load 350MW (mill running/adjustment with liquid fuel introduced)	117	9.1	9,870	14,385	10,487	58	3.9
3/02/2023	2B	Load 350MW	113	9.4	8,489	6,464	9,078	36	2.9
9/05/2023	2A	Boiler load stable at 280MW	106	10.6	9,805	4,549	10,505	<20	<2
9/05/2023	2B	Boiler load stable at 450 MW	120	8.1	9,805	4,549	10,505	17	1.2
10/05/2023	1B	Boiler load was stable at 280MW and increased to 350MW around 12:10pm	115	10.6	4,753	4,800	11,631	19	2
11/05/2023	1A	Boiler load stable at 280MW	118	10.2	4,743	6,007	9,869	31	3.3
4/07/2023	1A	Boiler load stable at 550 MW	121	8	5,699	7,981	12,713	<20	<1
5/07/2023	1B	Boiler load stable at 400 MW	122	7.8	5,034	8	11,675	26	1.6
6/07/2023	2A	Boiler load stable at 500-450 MW	113	9.4	10,832	4,192	11,493	<0.3	2.2
7/07/2023	2B	Boiler load stable at 350 MW	107	9.5	9,585	4,857	10,230	13	1.1
24/10/2023	1A	Boiler load stable at 220 MW	112	11	3,043	7,625	7,425	28	3.3
24/10/2023	1B	Boiler load stable at 220 MW	110	11.4	3,043	7,625	7,425	14	1.6
25/10/2023	2A	Boiler load stable at 220 MW	105	11.2	6,618	11,084	7,202	21	2.8
25/10/2023	2B	Boiler load stable at 220 MW	102	10.6	6,618	11,084	7,202	26	2.9
Sulfuric acid mist and sulfur trioxide (as SO_3)									
21/02/2023	1B	Boiler load stable at 220 MW	108	11.9	5,782	15,227	6,408	47	5
23/02/2023	2A	Boiler load stable at 220 MW	104	12.2	5,208	3,292	5,751	72	8.8
25/10/2023	2A	Boiler load stable at 220 MW	105	11.2	6,618	11,084	7,202	7	0.94
24/10/2023	1B	Boiler load stable at 220 MW	110	11.4	3,043	7,625	7,425	23	2.6
Volatile organic compounds (VOCs) as n-propane equivalent									
21/02/2023	1B	Boiler load stable at 220 MW	114	12.1	5,782	15,227	6,408	1.1	0.13
23/02/2023	2A	Boiler load stable at 220 MW	107	12.1	5,208	3,292	5,751	<0.7	<0.08
24/10/2023	1B	Boiler load stable at 220 MW	110	11.4	3,043	7,625	7,425	1.5	0.17
25/10/2023	2A	Boiler load stable at 220 MW	105	11.2	6,618	11,084	7,202	1.5	0.2
Chlorine									
21/02/2023	1B	Boiler load stable at 220 MW	114	12.1	5,782	15,227	6,408	1.3	0.16
23/02/2023	2A	Boiler load stable at 220 MW	107	12.1	5,208	3,292	5,751	0.42	0.051
5/07/2023	1B	Boiler load stable at 400 MW	125	8.5	5,034	8	11,675	<0.3	<0.02
6/07/2023	2A	Boiler load stable at 500-450 MW	113	8.7	10,832	4,192	11,493	<0.3	<0.02
Hydrogen chloride									
21/02/2023	1B	Boiler load stable at 220 MW	114	12.1	5,782	15,227	6,408	33	4.1
23/02/2023	2A	Boiler load stable at 220 MW	107	12.1	5,208	3,292	5,751	15	1.8
5/07/2023	1B	Boiler load stable at 400 MW	125	8.5	5,034	8	11,675	18	1.2
6/07/2023	2A	Boiler load stable at 500-450 MW	113	8.7	10,832	4192	11,493	25	1.7

Sampling Date	Unit & Duct	Process condition	Temperature (°C)	Oxygen (%)	Daily Coal Burn (t)	Fuel Oil Consumed (L)	Daily Generation (MWh)	Mass Rate (g/min)	Measured Concentration (mg/Nm³)
Fluorine									
21/02/2023	1B	Boiler load stable at 220 MW	114	12.1	5,782	15,227	6,408	100	13
23/02/2023	2A	Boiler load stable at 220 MW	107	12.1	5,208	3,292	5,751	57	6.8
5/07/2023	1B	Boiler load stable at 400 MW	125	8.5	5,034	8	11,675	170	12
6/07/2023	2A	Boiler load stable at 500-450 MW	113	8.7	10,832	4,192	11,493	240	16
Cadmium									
31/01/2023	1B	Load 350MW	122	10.5	4,338	5,529	9,966	0.0054	0.00069
1/02/2023	1A	Load 350MW	115	10.3	4,338	5,529	9,966	<0.004	<0.0004
2/02/2023	2A	Load 350MW (mill running/adjustment with liquid fuel introduced)	117	9.1	9,870	14,385	10,487	<0.004	<0.0003
3/02/2023	2B	Load 350MW	113	9.4	8,489	6,464	9,078	0.0044	0.00036
4/07/2023	1A	Boiler load stable at 550 MW	121	8.0	5,699	7,981	12,713	0.013	0.00088
5/07/2023	1B	Boiler load stable at 400 MW	122	7.8	5,034	8	11,675	<0.006	<0.0004
6/07/2023	2A	Boiler load stable at 500-450 MW	109	9.4	10,832	4,192	11,493	<0.003	<0.0002
7/07/2023	2B	Boiler load stable at 350 MW	107	9.5	9,585	4,857	10,230	0.0037	0.0003
Mercury									
1/02/2023	1A	Load 350MW	115	10.3	4,338	5,529	9,966	0.040	0.0037
1/02/2023	1B	Load 350MW	122	10.5	4,338	5,529	9,966	0.022	0.0028
2/02/2023	2A	Load 350MW (mill running/adjustment with liquid fuel introduced)	117	9.1	9,870	14,385	10,487	0.039	0.0027
3/02/2023	2B	Load 350MW	113	9.4	8,489	6,464	9,078	0.052	0.0042
6/07/2023	2A	Boiler load stable at 500-450 MW	109	9.4	10,832	4,192	11,493	0.0051	0.0004
7/07/2023	2B	Boiler load stable at 350 MW	107	9.5	9,585	4,857	10,230	0.0046	0.00038
5/07/2023	1B	Boiler load stable at 400 MW	122	7.8	5,034	8	11,675	0.011	0.00068
4/07/2023	1A	Boiler load stable at 550 MW	121	8.0	5,699	7,981	12,713	0.020	0.0014
Type 1 and Type 2 substances in aggregate									
1/02/2023	1A	Load 350MW	115	10.3	4,338	5,529	9,966	<0.38	<0.036
1/02/2023	1B	Load 350MW	122	10.5	4,338	5,529	9,966	<0.21	<0.027
2/02/2023	2A	Load 350MW (mill running/adjustment with liquid fuel introduced)	117	9.1	9,870	14,385	10,487	<0.42	<0.029
3/02/2023	2B	Load 350MW	113	9.4	8,489	6,464	9,078	<0.34	<0.028
4/07/2023	1A	Boiler load stable at 550 MW	121	8.0	5,699	7,981	12,713	<3.7	<0.25
5/07/2023	1B	Boiler load stable at 400 MW	122	7.8	5,034	8	11,675	<1.4	<0.085
6/07/2023	2A	Boiler load stable at 500-450 MW	109	9.4	10,832	4,192	11,493	<0.61	<0.048
7/07/2023	2B	Boiler load stable at 350 MW	107	9.5	9,585	4,857	10,230	0.53	<0.043

*Reported as dry, 0°C, 101.325 kPa and corrected to 7% O_2.
N/A – Not Applicable: Sampling performed as per required sampling frequencies outlined in Table 1-2.

2.2 CEMS

Condition M2.2 – *Air Monitoring Requirements* requires the continuous monitoring of specific stack parameters. Table 2-2 summarises the Continuous Emissions Monitoring System (CEMS) data as required in Condition M2.2.

The following sections summarise the CEMS data and quality assurance program.

TABLE 2-2 LIST OF REQUIRED CEMS PARAMETERS

Pollutant	Monitoring Points	Unit & Duct
Nitrogen Oxides	Point 2, 3, 4, 5, 6, 7	Unit 1, Unit 2, Unit 1A, Unit 1B, Unit 2A, Unit 2B
Sulfur dioxide		
Flow rate [a]	Point 4, 5, 6, 7	Unit 1A, Unit 1B, Unit 2A, Unit 2B
Moisture		
Oxygen (O_2)		
Temperature		

Moisture, temperature and oxygen are monitored as part of the existing CEMS at MPPS. EnergyAustralia requested an extension for the implementation of flow rate monitoring as provided by EPL13007. Consultation with the EPA is ongoing regarding the flow rate calculation methodology.

2.2.1 CEMS RESULTS SUMMARY

The 2023 CEMS monitoring results are summarised in Table 2-3 and presented in Figure 2-1 to Figure 2-7.

For NO_x and SO_2, compliance was achieved with the limits set for the 100^{th} and 99^{th} percentile concentration at the monitoring points. The NO_x concentrations are distributed broadly between 200 mg/Nm³ and 1,000 mg/Nm³, while the SO_2 concentrations are more concentrated between 1000 mg/Nm³ and 1,400 mg/Nm³ until October 2023, when lower concentrations of ~600 mg/Nm^3 were measured.

The moisture is generally between 4% and 9% for both boilers, with an average moisture of approximately 6.6%. The discharge oxygen percentage was, on average, 9.7%. The discharge temperatures are mostly between 100 °C and 130 °C, with some lower temperatures of ~80 °C. The trends identified are a result of lower load profile during the second half of the year at MPPS, shown in Figure 2-8.

FIGURE 2-1 CEMS RESULTS – NO_X (POINT 2 AND 3)

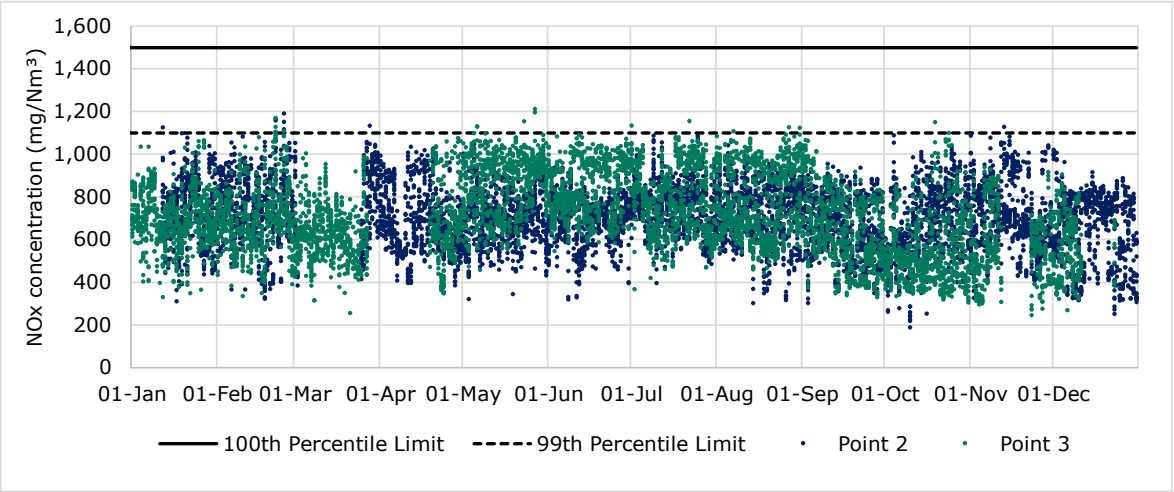


FIGURE 2-2 CEMS RESULTS – NO_X (POINT 4, 5, 6 AND 7)

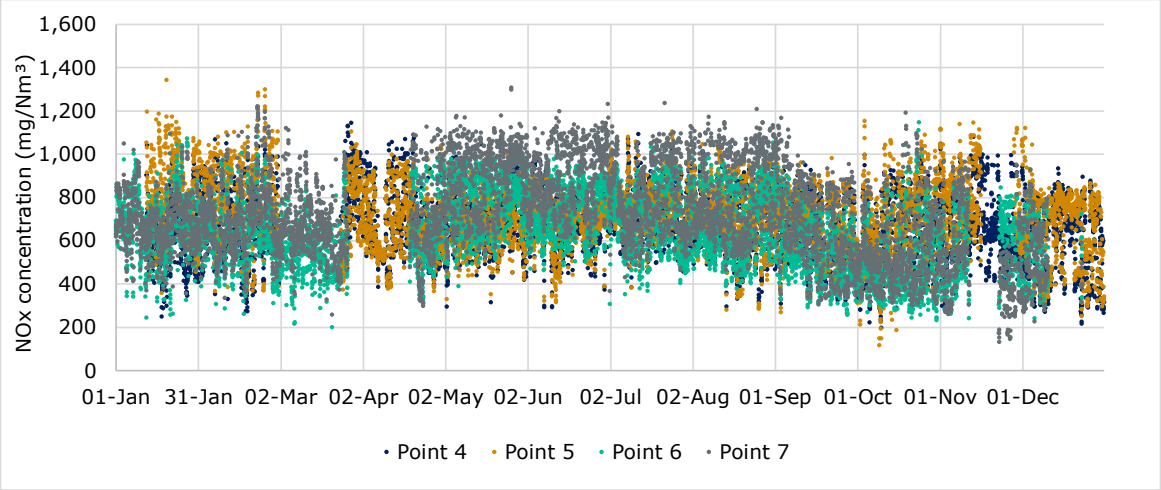


FIGURE 2-3 CEMS RESULTS – SO_2 (POINT 2 AND 3)

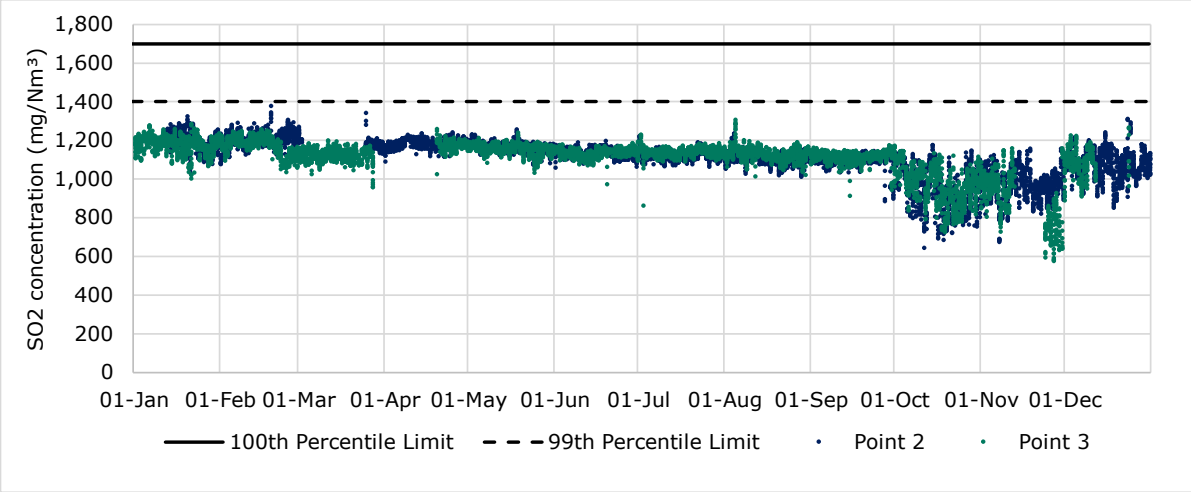


FIGURE 2-4 CEMS RESULTS – SO_2 (POINT 4, 5, 6 AND 7)

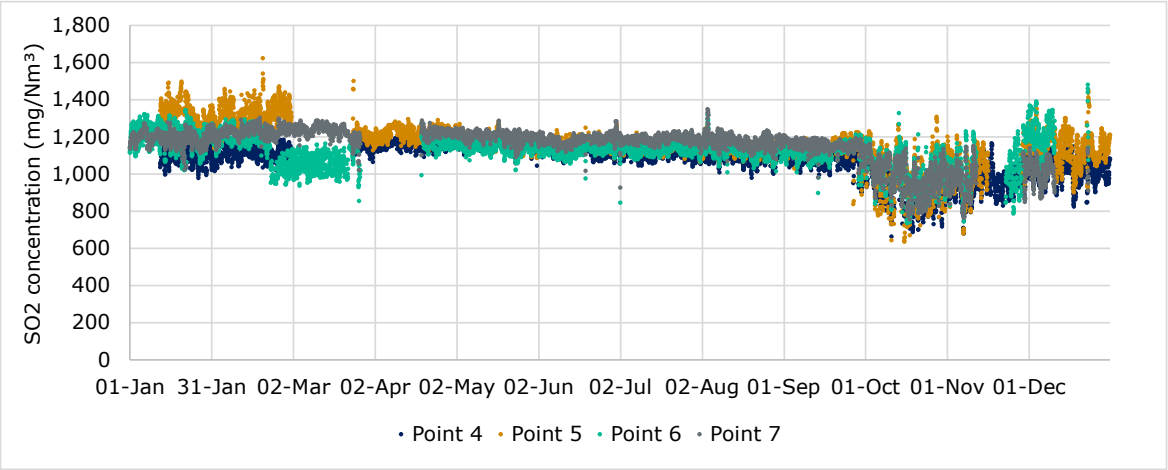


FIGURE 2-5 CEMS RESULTS – MOISTURE (POINT 4, 5, 6 AND 7)

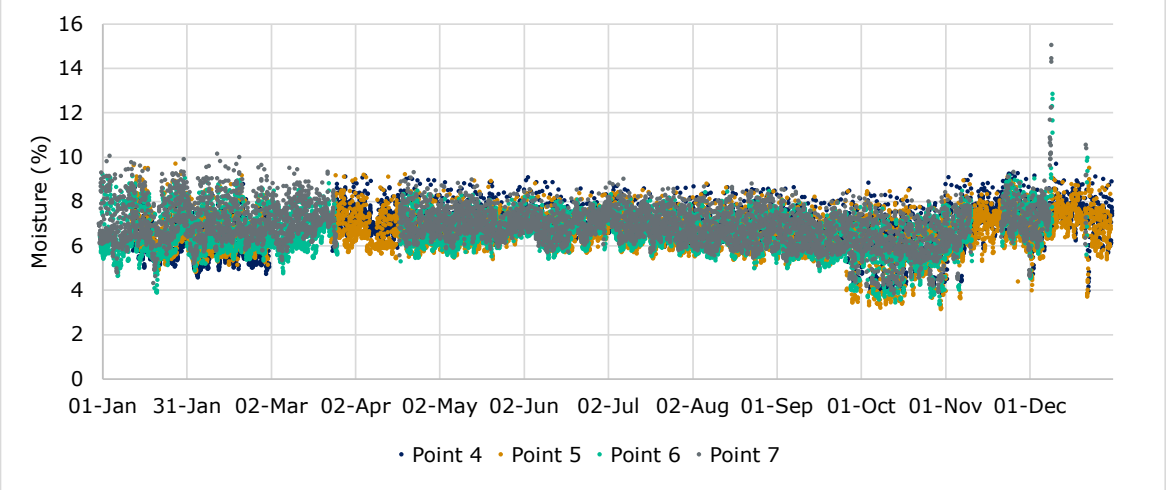


FIGURE 2-6 CEMS RESULTS – OXYGEN (POINT 4, 5, 6 AND 7)

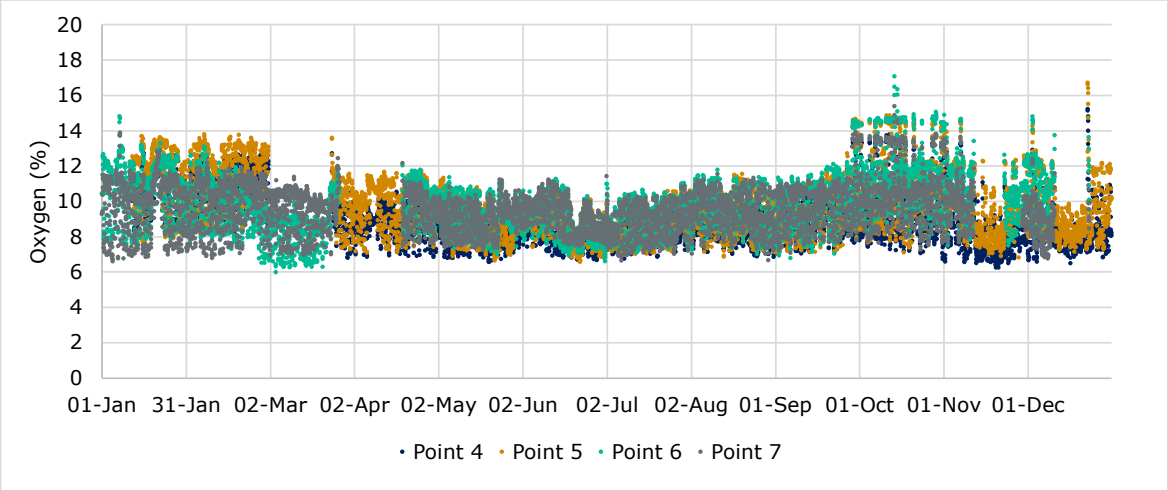


FIGURE 2-7 CEMS RESULTS – TEMPERATURE (POINT 4, 5, 6 AND 7)

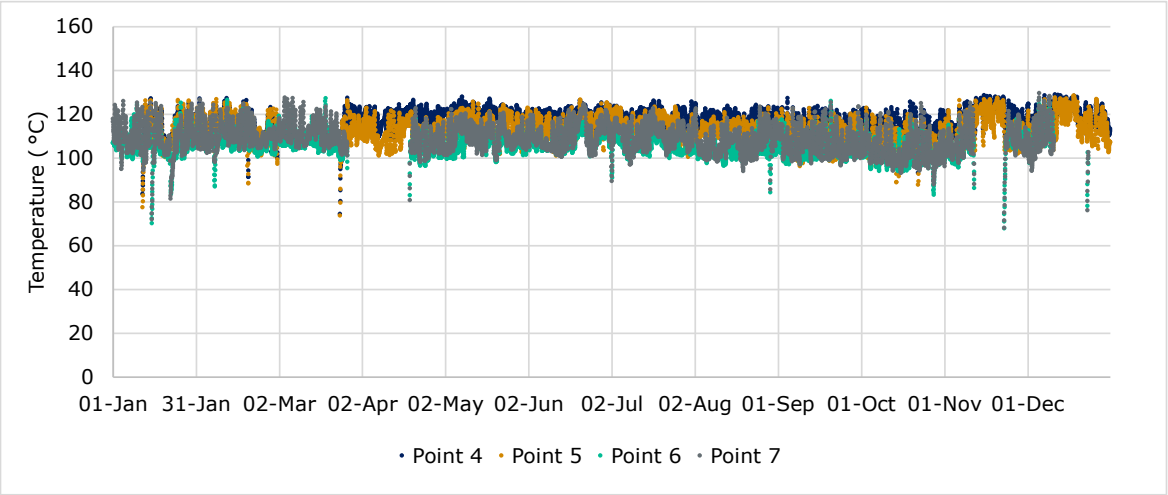


FIGURE 2-8 CEMS RESULTS – LOAD (MW, POINT 2 AND 3)

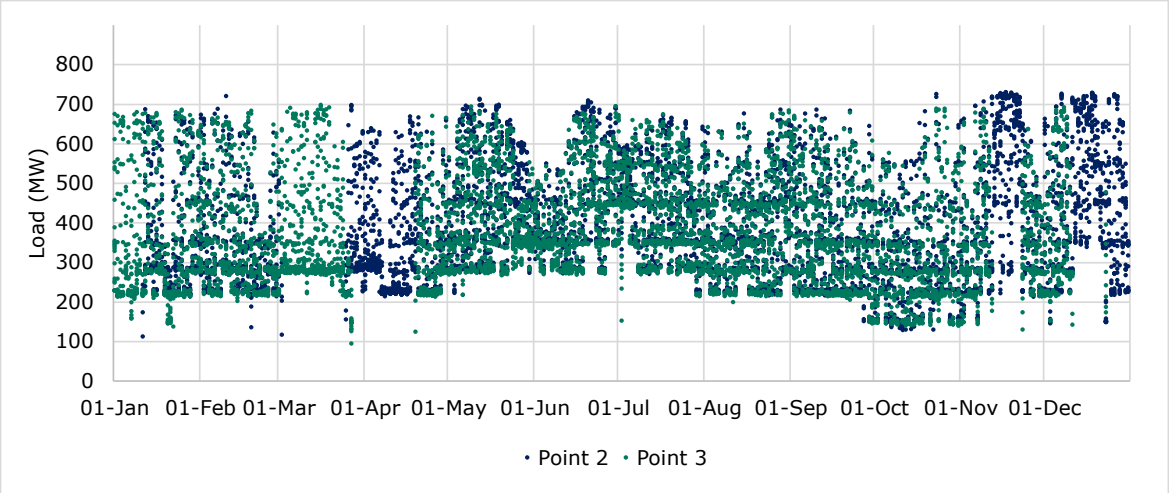


TABLE 2-3 SUMMARY OF 2023 CEMS RESULTS

Monitoring Point	Data Capture[a]	Minimum	Average	Maximum	50th Percentile	70th Percentile	99th Percentile	100th Percentile Concentration Limit compliance	99th percentile Concentration Limit Compliance
NO_x (mg/Nm³) – 1 hour average									
Point 2 (Unit 1)	99%	182	694	1,187	698	777	1,013	✓	✓
Point 3 (Unit 2)	99%	232	694	1,201	683	790	1,049	✓	✓
Point 5 (Unit 1A)	99%	204	671	1,146	672	756	999	N/A	
Point 4 (Unit 1B)	95%	129	719	1,349	725	797	1,085		
Point 6 (Unit 2A)	99%	215	650	1,165	645	747	986		
Point 7 (Unit 2B)	99%	157	737	1,328	723	845	1,137		
SO_2 (mg/Nm³) – 1 hour average									
Point 2 (Unit 1)	99%	644	1,110	1,378	1,129	1,161	1,266	✓	✓
Point 3 (Unit 2)	99%	730	1,118	1,311	1,137	1,159	1,240	✓	✓
Point 5 (Unit 1A)	99%	658	1,076	1,238	1,101	1,127	1,189	N/A	
Point 4 (Unit 1B)	95%	623	1,151	1,613	1,153	1,188	1,412		
Point 6 (Unit 2A)	99%	717	1,104	1,458	1,118	1,144	1,284		

Monitoring Point	Data Capture[a]	Minimum	Average	Maximum	50th Percentile	70th Percentile	99th Percentile	100th Percentile Concentration Limit compliance	99th percentile Concentration Limit Compliance
Point 7 (Unit 2B)	99%	730	1,135	1,328	1,164	1,186	1,248		
Moisture (%)									
Point 5 (Unit 1A)	99%	3.9	6.9	9.8	6.9	7.3	8.7	N/A	
Point 4 (Unit 1B)	99%	3.1	6.6	9.7	6.6	7.1	8.5		
Point 6 (Unit 2A)	99%	3.3	6.5	12.8	6.5	7.0	8.5		
Point 7 (Unit 2B)	99%	3.8	6.7	14.9	6.7	7.1	9.0		
O_2 (%)									
Point 5 (Unit 1A)	99%	6.4	9.1	15.4	8.8	9.5	13.3	N/A	
Point 4 (Unit 1B)	99%	6.8	10.0	17.0	9.7	10.7	14.6		
Point 6 (Unit 2A)	99%	6.2	10.1	17.4	10.0	10.9	14.9		
Point 7 (Unit 2B)	97%	6.9	9.9	15.7	9.9	10.6	13.8		
Temperature (°C)									
Point 5 (Unit 1A)	100%	75	118	130	118	121	128	N/A	
Point 4 (Unit 1B)	100%	75	114	131	114	118	128		

Monitoring Point	Data Capture[a]	Minimum	Average	Maximum	50th Percentile	70th Percentile	99th Percentile	100th Percentile Concentration Limit compliance	99th percentile Concentration Limit Compliance
Point 6 (Unit 2A)	100%	71	109	130	109	111	122		
Point 7 (Unit 2B)	100%	73	113	134	113	116	127		

[a.] Data capture calculation only considers periods when the units are in operation at loads of greater than 150 MW. Periods when the boilers are out of service are excluded.
N/A: Not Applicable

2.2.2 CEMS QUALITY ASSURANCE AND CONTROL PROCEDURES

Condition E2 requires an implemented CEMS Quality Assurance and Quality Control Procedure. The document *Mount Piper Power Station – Site Specific Air Emission Monitoring Plan and CEMS Quality Assurance and Quality Control Procedures* (HRL, 2021) was compared with the requirements of Condition E3.1 in Table 2-4 . The CEMS quality assurance and quality control reporting has been reviewed, and has demonstrated compliance with the procedure.

TABLE 2-4 NSW EPA EPL13007 CONDITION – E2 CONTINUOUS EMISSIONS MONITORING SYSTEMS QUALITY ASSURANCE AND CONTROL PROCEDURES

E2	Continuous Emissions Monitoring Systems Quality Assurance and Control Procedures	Review
E2.1	*The licensee must implement and maintain a CEMS quality assurance (QA) and quality control (QC) procedure which enables the evaluation of the quality of data produced by any CEMS monitoring required by conditions of this licence. As a minimum, the CEMS QA/QC procedure must describe in detail the following:*	EnergyAustralia has provided the Procedure for ERM to review.
	a) calibration and adjustment measures;	Detailed in section 8 of the Procedure.
	b) preventive maintenance measures (including spare parts inventory);	Detailed in section 9 of the Procedure.
	c) data handling, recording and calculation procedures;	Detailed in section 10.3 of the Procedure.
	d) processes for evaluating, verifying and reporting monitoring data;	Detailed in section 11.2 of the Procedure.
	e) accuracy audit measures including sampling and analysis methods;	Detailed in section 11.3 of the Procedure.
	f) fault identification and corrective action measures; and	Detailed in section 11.4 of the Procedure.
	g) process for ongoing review and evaluation of the effectiveness of the CEMS QA/QC procedures	Detailed in section 12 of the Procedure.

2.3 AMBIENT AIR MONITORING

As shown in Table 1-2, ambient air monitoring is required at three locations:

- Point 8 (Blackmans Flat);
- Point 9 (Wallerawang); and
- Point 10 (Newnes Plateau).

The ambient air monitoring results for 2023 are summarised in Table 2-6 and presented in Figure 2.9 to Figure 2.11.

FIGURE 2.9 AMBIENT MONITORING RESULTS – NO_2

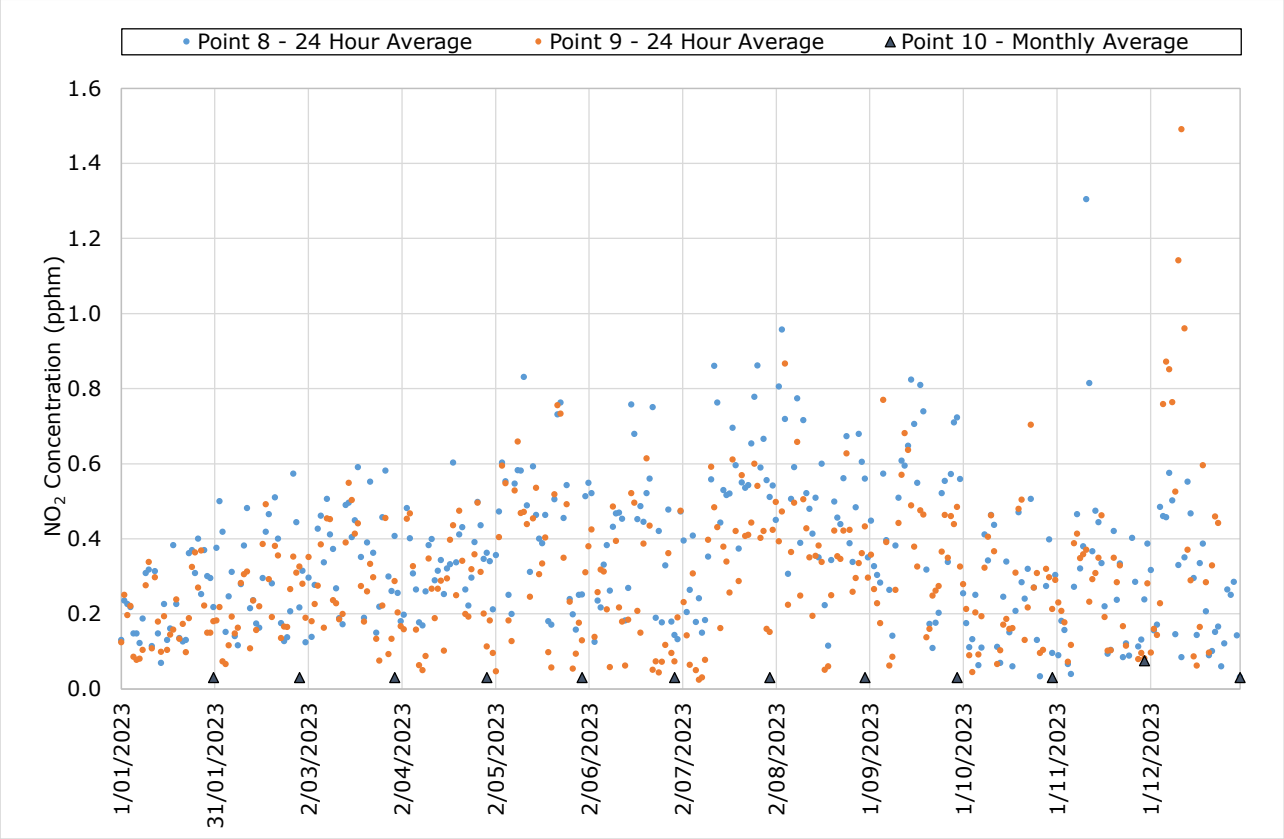


FIGURE 2.10 AMBIENT MONITORING RESULTS – SO_2

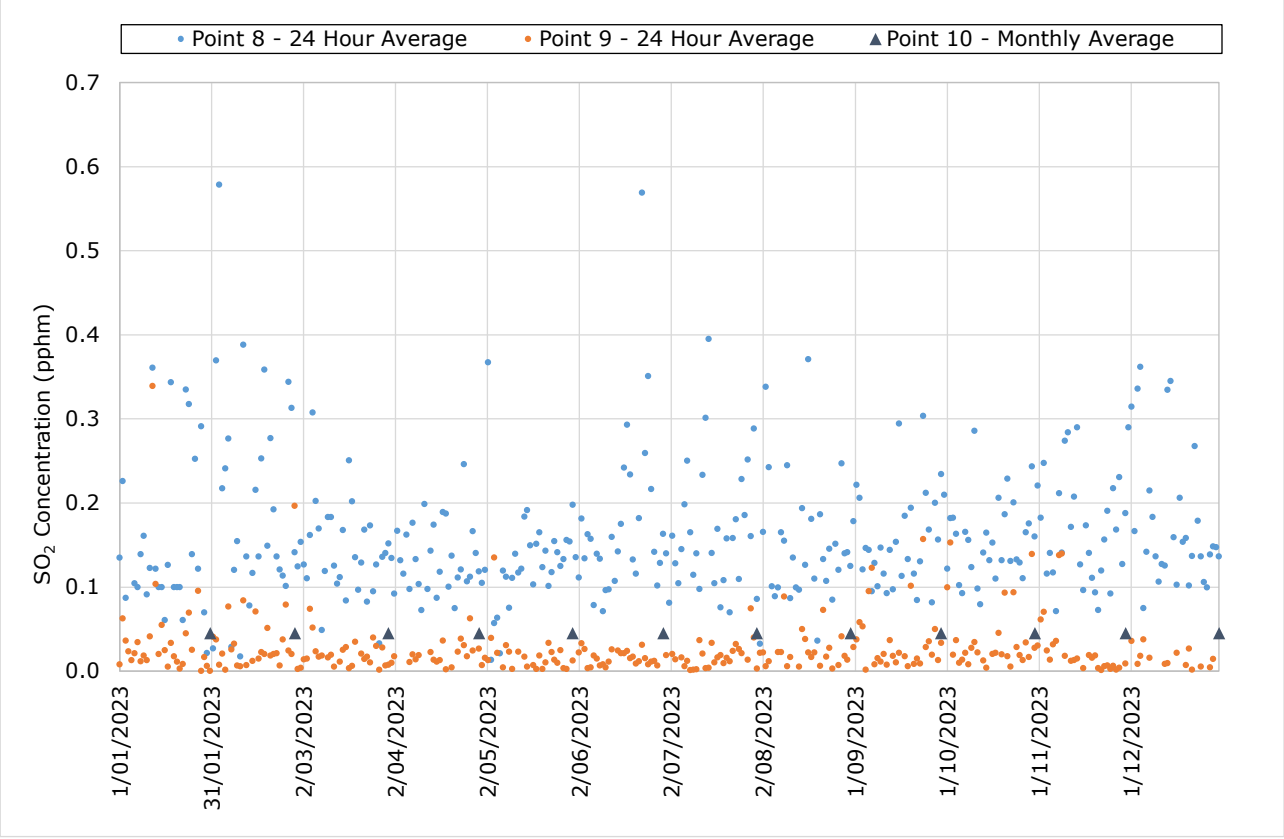


FIGURE 2.11 AMBIENT MONITORING RESULTS – $PM_{2.5}$ DAILY AVERAGE

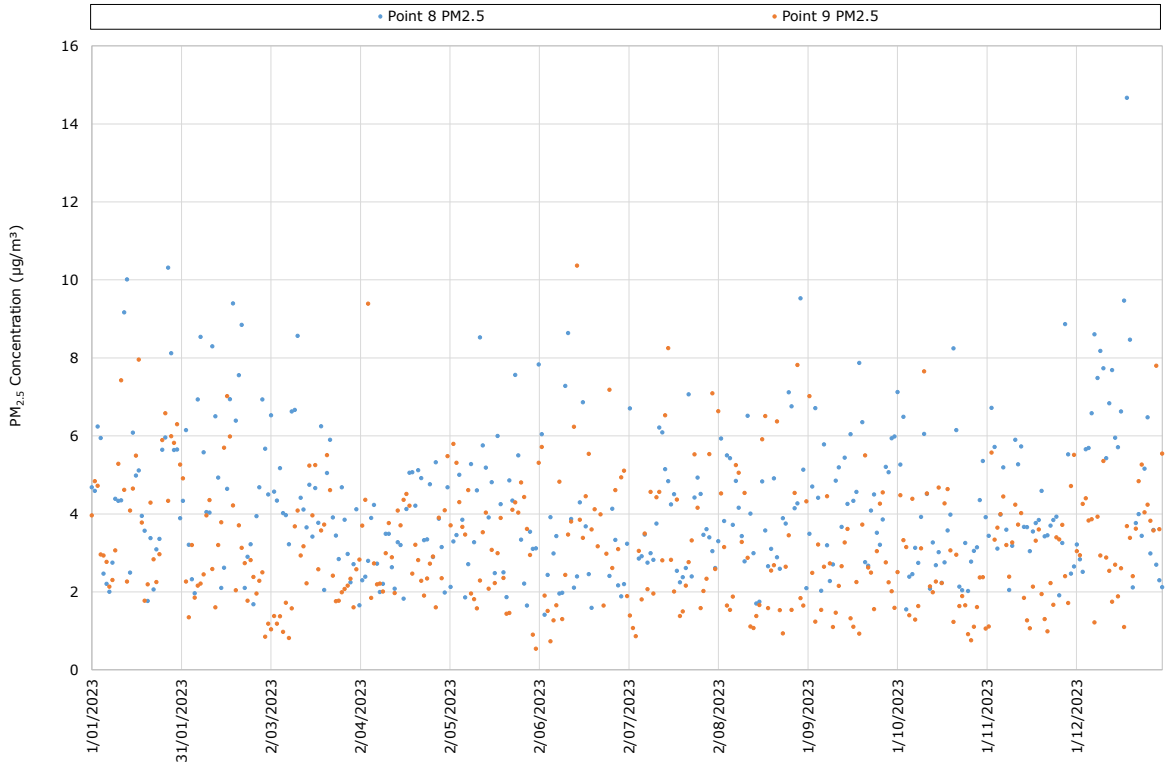


TABLE 2-5 SUMMARY OF 2023 AMBIENT MONITORING RESULTS

Pollutant	Average Period	Unit of Concentration	Data Capture	Concentration Statistic					
				Minimum	Average	Maximum	50th percentile	70th percentile	99th percentile
Point 8 (Blackmans Flat)									
Nitrogen dioxide	1 hour	pphm	95%	-0.045	0.359	2.452	0.245	0.420	1.482
	24 hours		100%	-0.005	0.359	1.304	0.338	0.457	0.841
Sulfur dioxide	1 hour		95%	-0.100	0.158	3.500	0.127	0.150	1.073
	24 hours		100%	-0.022	0.157	0.579	0.140	0.171	0.377
$PM_{2.5}$	24 hours	µg/m³	98%	1.413	4.279	14.666	3.889	4.972	9.491
Fluoride	7 days		96%	0.002	0.012	0.050	0.010	0.014	0.040
	30 days		100%	0.004	0.012	0.026	0.012	0.013	0.025
	90 days		100%	0.004	0.006	0.008	0.006	0.007	0.008
Point 9 (Wallerawang)									
Nitrogen dioxide	1 hour	pphm	92%	-0.136	0.297	2.662	0.161	0.339	1.441
	24 hours		97%	0.025	0.299	1.491	0.280	0.371	0.869
Sulfur dioxide	1 hour		92%	-0.059	0.021	2.047	0.013	0.020	0.301
	24 hours		100%	-0.054	0.021	0.339	0.015	0.022	0.144
$PM_{2.5}$	24 hours	µg/m³	100%	0.5	3.2	10.4	2.9	4.0	7.9
Point 10 (Newnes Plateau)									
Nitrogen dioxide	1 month	pphm	100%	<0.06	0.034*	0.075	0.030*	0.030*	0.070
Sulfur dioxide	1 month		100%	<0.09	0.045*	<0.09	0.045*	0.045*	0.045*

Note: "<" – Less than limit of reporting. * average and percentile values incorporate values less than the LOR at half of the LOR. Statistics prepared from hourly average data.

2.4 COMPLIANCE REVIEW

Compliance against monitoring requirements (EPL Condition M2.2) and air concentration limits (EPL Condition L3.2 and L3.3) has been reviewed and is summarised in Table 2-6.

TABLE 2-6 SUMMARY OF MONITORING REQUIREMENTS AND LIMIT COMPLIANCE REVIEW

Pollutant	Compliance			Comments
	Monitoring Frequency	Monitoring Method	Concentration Limit	
Point 2,3				
Cadmium	✓	✓	✓	-
Chlorine	✓	✓	✓	
Fluorine	✓	✓	✓	
Hydrogen chloride	✓	✓	✓	
Mercury	✓	✓	✓	
Nitrogen oxides	✓	✓	✓	
Solid particles	✓	✓	✓	
Sulfur dioxide	✓	✓	✓	
Sulfuric acid mist and sulfur trioxide (as SO_3)	✓	✓	✓	
Type 1 and Type 2 substances in aggregate	✓	✓	✓	
Volatile organic compounds as n-propane equivalent	✓	✓	✓	
Point 4,5,6,7				
Cadmium	✓	✓	N/A	
Flow rate	N/A	N/A	N/A	
Mercury	✓	✓	N/A	
Moisture	✓	✓	N/A	
Nitrogen oxides	✓	✓	N/A	
Oxygen (O_2)	✓	✓	N/A	
Solid particles	✓	✓	N/A	
Sulfur dioxide	✓	✓	N/A	
Temperature	✓	✓	N/A	
Type 1 and Type 2 substance in aggregate	✓	✓	N/A	

Pollutant	Compliance			Comments
	Monitoring Frequency	Monitoring Method	Concentration Limit	
Point 4,6				
Carbon dioxide	✓	✓	N/A	
Chlorine	✓	✓	N/A	
Fluorine	✓	✓	N/A	
Hydrogen chloride	✓	✓	N/A	
Sulfuric acid mist and sulfur trioxide (as SO_3)	✓	✓	N/A	
Volatile organic compounds as n-propane equivalent	✓	✓	N/A	
Point 8				
Fluoride	✓	✓	N/A	-
Point 8,9				
Nitrogen dioxide	✓	✓	N/A	-
$PM_{2.5}$	✓	✓	N/A	
Sulfur dioxide	✓	✓	N/A	
Point 10				
Nitrogen dioxide	✓	✓	N/A	-
Sulfur dioxide	✓	✓	N/A	

2.4.1 EXCEEDANCES OF AIR EMISSION LIMITS AND PLANT OPERATING CONDITIONS AT THE TIME

No exceedances of air emission limits were reported during the reporting period.

3. HISTORICAL AIR EMISSION MONITORING REVIEW

Condition R1.9(b) requires an analysis of the boilers' emissions performance for the past five years. The historical analysis was completed for the pollutants listed in Condition M2.2. The data used for the historical analysis were sourced from annual returns, stack testing, CEMS data and ambient air monitoring and have been reported at dry, 0°C, 101.325 kPa conditions, corrected to 7% O_2.

3.1 HISTORICAL FUEL USAGE

MPPS has combusted black coal as the primary fuel with supplementary firing using fuel oil during start-up operations for at least the past ten years.

Monthly amounts of coal burnt and average coal analysis for the reporting year 2023 are shown in Table 3-1. The stack tests for the reporting period of 2023 were performed in January, February, May, July and October, as shown bold font in Table 3-1. While there is variability in the coal quality, the quality of coal burnt during the stack testing did not favour any specific conditions and is considered to be representative of typical coal properties for coal used at MPPS.

The long-term trends of the coal consumption and coal quality are presented in Figure 3.1 to Figure 3.3. The data show the monthly coal consumption variations over the past five years. Coal consumption typically peaks in the winter months (June, July and August). The coal quality has been generally stable over the past five years, especially for carbon, ash, sulfur, nitrogen and hydrogen percentages. The moisture and oxygen contents show more variation. Low moisture content in 2019 and increased oxygen percentage in 2023 are the only noted variation from typical values.

Based on the review of the coal composition during 2023 and the long-term trends of coal quality, the coal quality during stack testing is considered to be representative of typical conditions.

TABLE 3-1 MONTHLY COAL CONSUMED AND COAL ANALYSIS – 2023

Month	Coal Burnt	Average Coal Analysis							
		Moisture	Ash	S	F	C	H	N	O
		%	%	%	ppm	%	%	%	%
Jan	189,284	7.82	26.1	0.73	170	83.6	5.23	2.02	8.40
Feb	199,346	7.24	26.7	0.76	160	84.5	5.30	1.91	7.50
Mar	131,176	6.78	27.6	0.74	170	83.8	5.21	1.97	8.30
Apr	151,513	8.79	27.5	0.77	170	84.1	5.26	1.90	8.00
May	282,953	8.52	27.9	0.76	180	84.0	5.51	1.96	7.80
Jun	262,309	8.95	26.6	0.73	150	83.0	5.69	1.87	8.70
Jul	277,793	8.94	26.2	0.77	140	84.4	5.15	1.94	7.70
Aug	247,203	8.27	28.3	0.75	175	82.4	5.45	1.94	9.50
Sep	221,108	8.16	28.6	0.71	140	82.4	5.26	1.88	9.70

Month	Coal Burnt	Average Coal Analysis							
		Moisture	Ash	S	F	C	H	N	O
		%	%	%	ppm	%	%	%	%
Oct	186,155	7.74	25.4	0.71	140	82.4	5.26	1.88	9.70
Nov	202,042	8.44	27.1	0.67	170	82.0	5.20	1.78	10.4
Dec	185,673	7.18	25.2	0.67	155	82.2	5.38	1.84	9.90
Average	-	8.07	26.9	0.73	160	83.2	5.33	1.91	8.80
Total	*2,536,555*	-							

FIGURE 3.1 HISTORICAL MONTHLY COAL BURNT (TONNES)

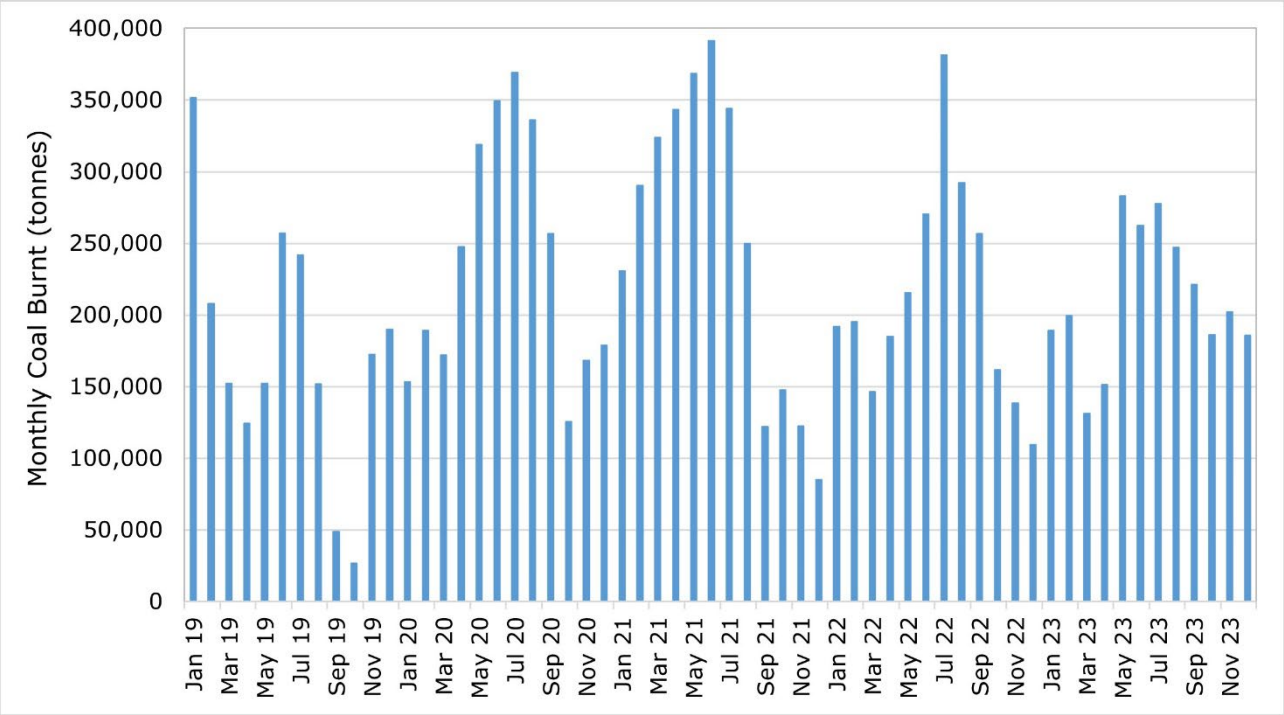


FIGURE 3.2 HISTORICAL COAL ANALYSIS – CARBON AND ASH (%)

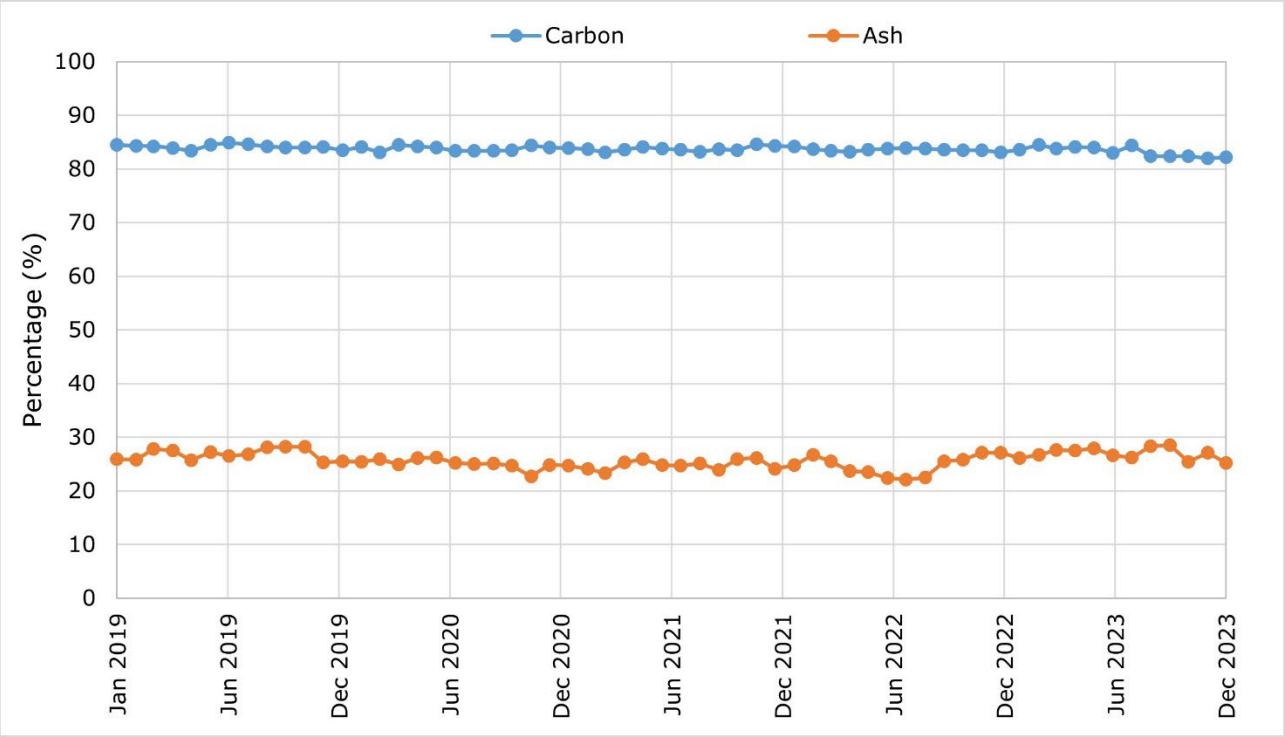
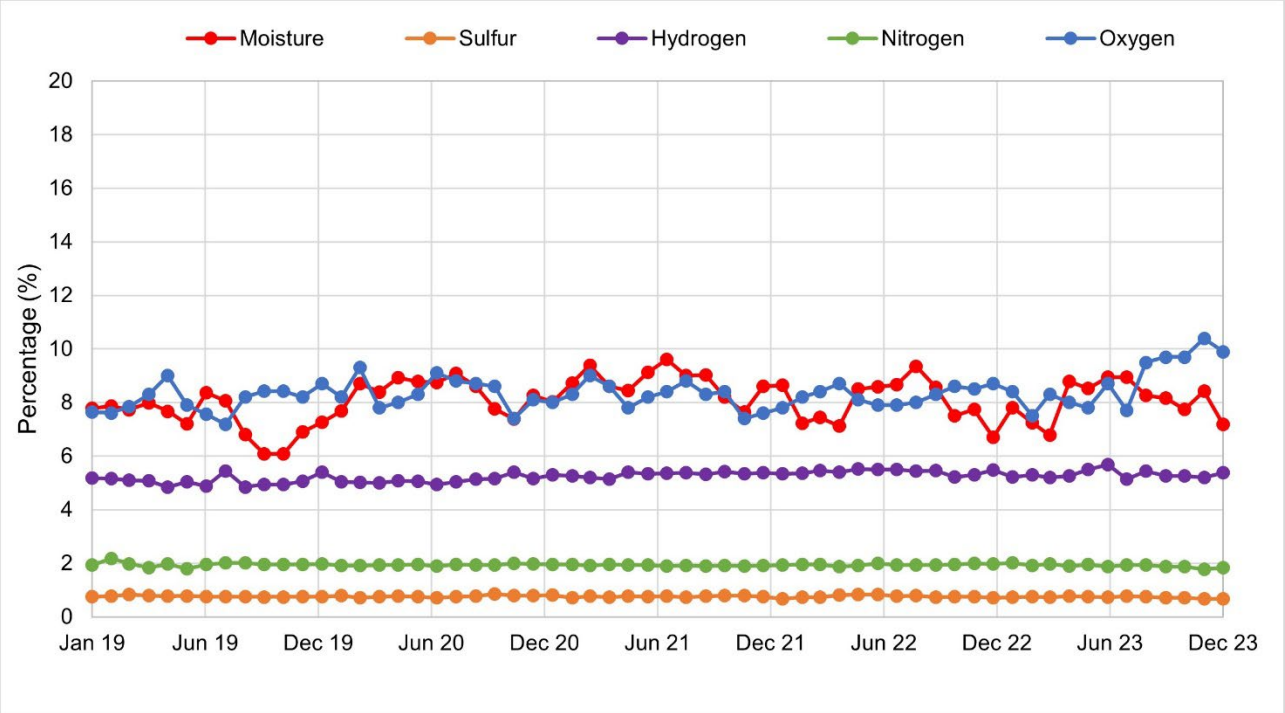


FIGURE 3.3 HISTORICAL COAL ANALYSIS – MOISTURE, SULFUR, HYDROGEN, NITROGEN AND OXYGEN (%)



3.2 COMPARISON WITH HISTORICAL STACK EMISSION MONITORING

The analysis of the historical stack emissions includes review of the fuel usages, stack concentrations (at dry, 0 °C, 101.325 kPa conditions, corrected to 7% O_2), calculated emission factors (kg/tonne coal and kg/PJ), as well as the analysis of correlations with default emission factors and potential coal quality influences. Samples below the limit of reporting (LOR) have been shown at half of the LOR.

As CEMS monitoring has relatively recently been implemented at MPPS, the historical emission analysis has depended on the stack test reports. Historically, EnergyAustralia undertakes annual stack testing on both boilers. The stack testing was typically performed between March and June of the annual period. During the stack testing, notes are provided on boiler operations, which are included in the final reports.

The historical stack test documents reviewed include:

- Ektimo 2019, Annual Emission Testing Report – Energy Australia – Mt Piper Power Station, report no. R007170, 13 November 2019;
- Ektimo 2019, Annual Emission Testing Report – Energy Australia – Mt Piper Power Station, report no. R007171, 13 November 2019;
- Ektimo 2020, Annual Emission Testing Report – Energy Australia – Mt Piper Power Station, report no. R009203, 2 September 2020;
- Ektimo 2020, Annual Emission Testing Report – Energy Australia – Mt Piper Power Station, report no. R009204, 2 September 2020;
- Ektimo 2020, Emission Testing Report – Energy Australia – Mt Piper Power Station, report no. R009599, 13 October 2020;
- Ektimo 2021, Emission Testing Report – Energy Australia – Mt Piper Power Station, report no. R009826, 11 January 2021;
- Ektimo 2021, Quarterly (Q1) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R010363, 12 May 2021;
- Ektimo 2021, Quarterly (Q2) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R010887, 25 June 2021;
- Ektimo 2021, Quarterly (Q3) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R011365, 13 October 2021; and
- Ektimo 2021, Quarterly (Q4) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R011676, 5 January 2022.
- Ektimo 2022, Quarterly (Q1) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R012309, 30 March 2022;
- Ektimo 2022, Quarterly (Q2) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R012769ar, 12 July 2022;
- Ektimo 2022, Quarterly (Q3) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R013250, 29 July 2022;
- Ektimo 2022, Quarterly (Q4) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R013593, 25 October 2022.
- Ektimo 2022, Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R013819, 9 November 2022;

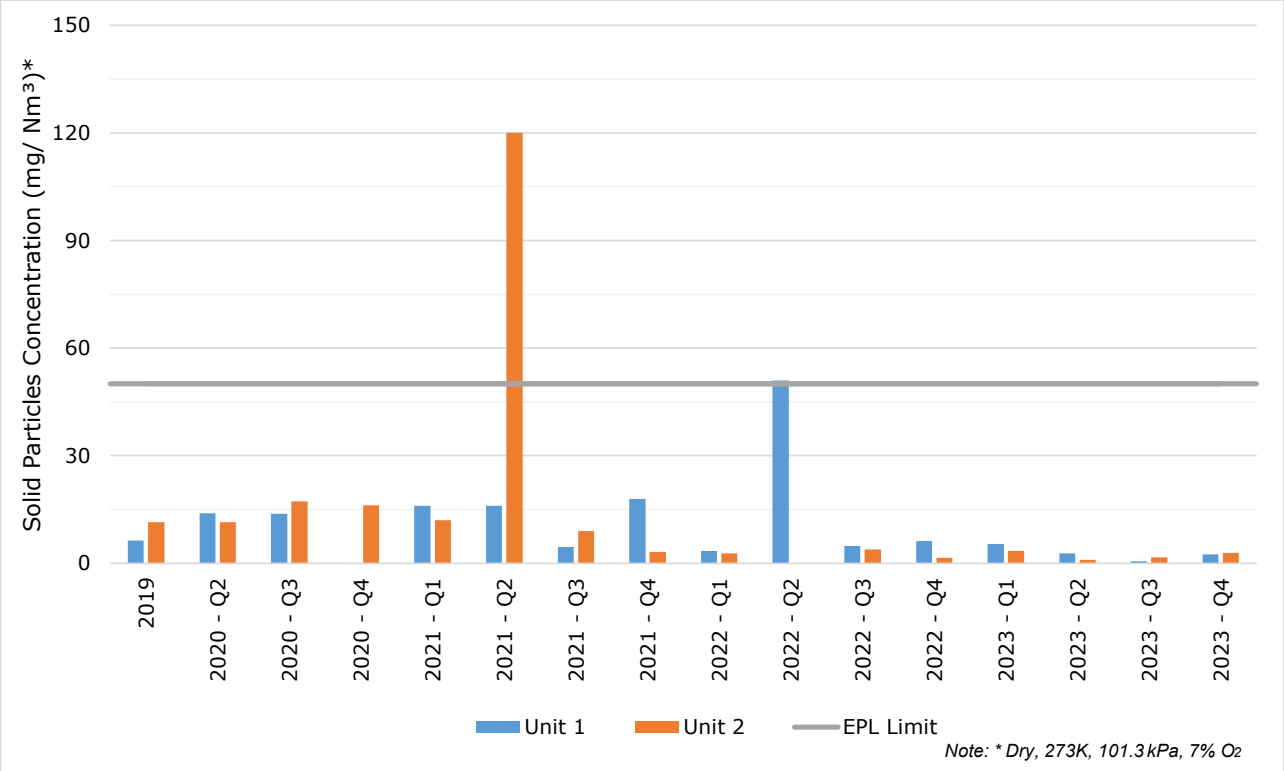
- Ektimo 2022, Quarterly (Q4) Emission Testing Report – Energy Australia NSW Pty Ltd – Mt Piper Power Station. Report number R013949, 16 December 2022.

The 2023 stack test reports are included in Appendix A and all other reports can be made available upon request.

3.2.1 SOLID PARTICLES

Figure 3.4 shows the solid particles concentrations measured between 2019 and 2023. The solid particles limit is 50 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to quarterly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.4 with the exception of Unit 2 in Quarter 2 of 2021 and Unit 1 in Quarter 2 of 2022.

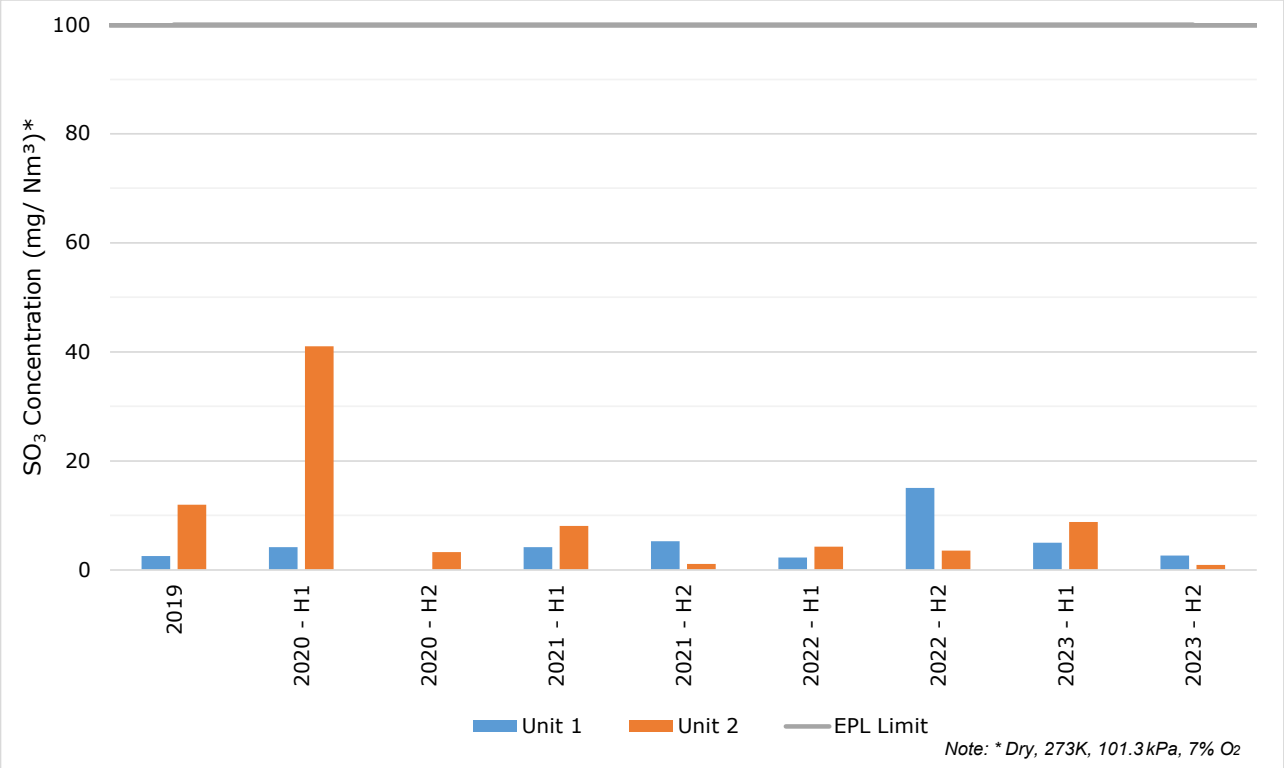
FIGURE 3.4 2019 – 2023 STACK TESTING RESULTS – SOLID PARTICLES



3.2.2 SULFUR TRIOXIDE/SULFURIC ACID (AS SO_3)

Figure 3.5 shows the sulfur trioxide/sulfuric acid (as SO_3) concentrations measured between 2019 and 2023. The sulfur trioxide/sulfuric acid (as SO_3) limit is 100 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.5.

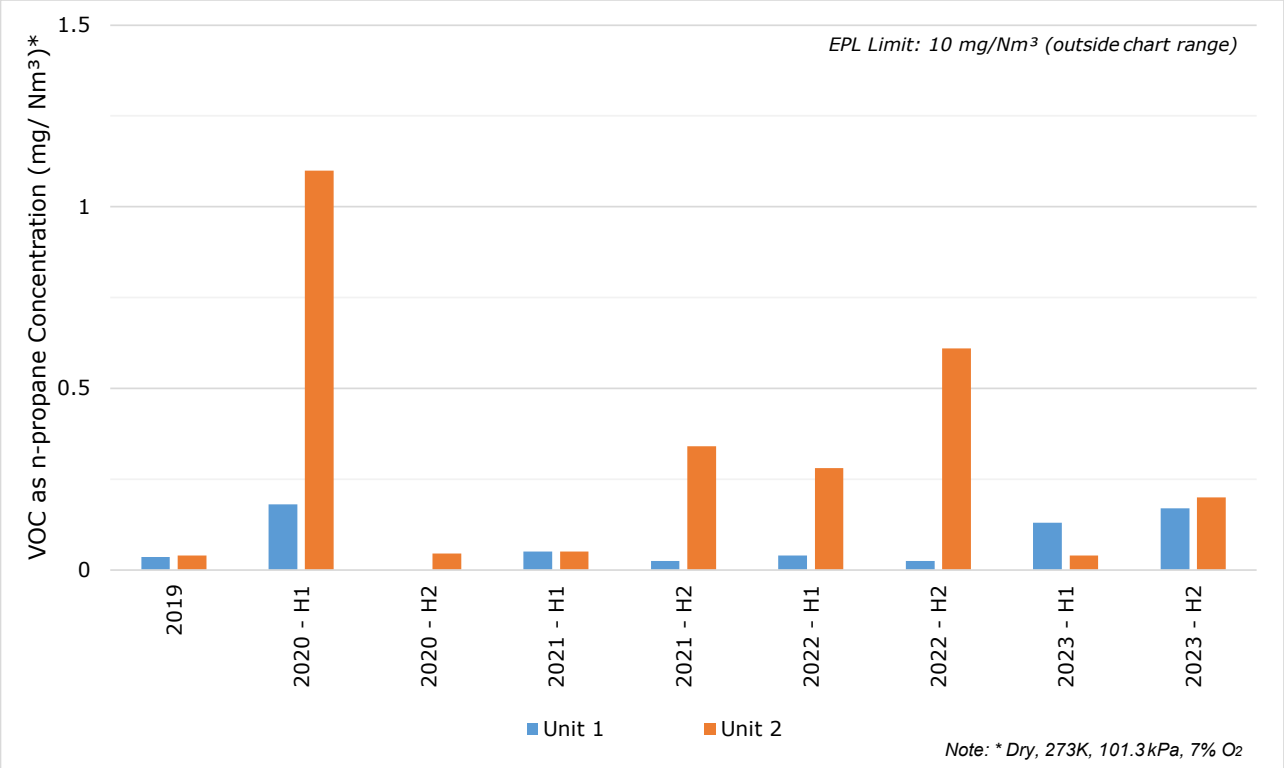
FIGURE 3.5 2019 – 2023 STACK TESTING RESULTS – SULFUR TRIOXIDE AND/OR SULFURIC ACID (AS SO_3)



3.2.3 VOC (AS N-PROPANE)

Figure 3.6 shows VOC concentrations measured between 2019 and 2023. The VOC limit is 10 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.6. Reported concentrations are commonly below the LOR, which varies based on sampling and analysis conditions, and was commonly in the range of 0.05 – 0.10 mg/Nm³.

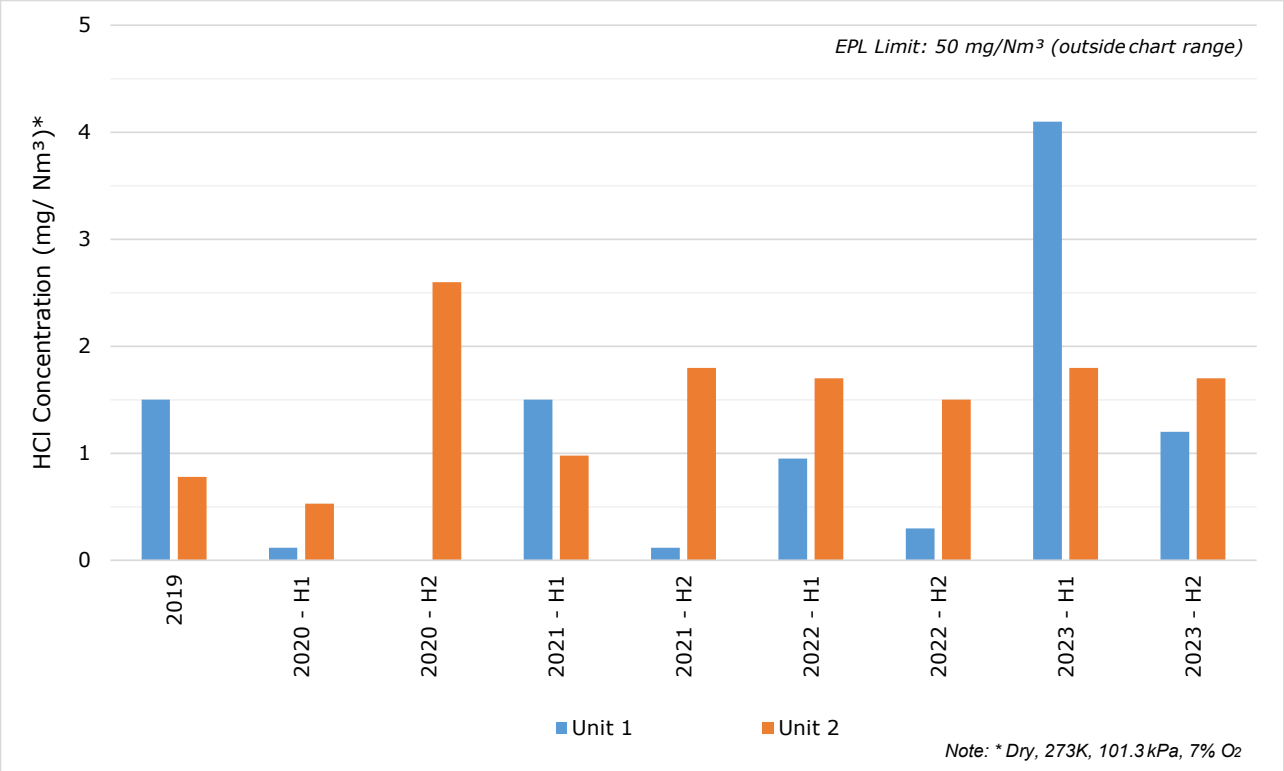
FIGURE 3.6 2019 – 2023 STACK TESTING RESULTS – VOC (AS N-PROPANE)



3.2.4 HYDROGEN CHLORIDE

Figure 3.7 shows hydrogen chloride concentrations measured between 2019 and 2023. The hydrogen chloride limit is 50 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.7.

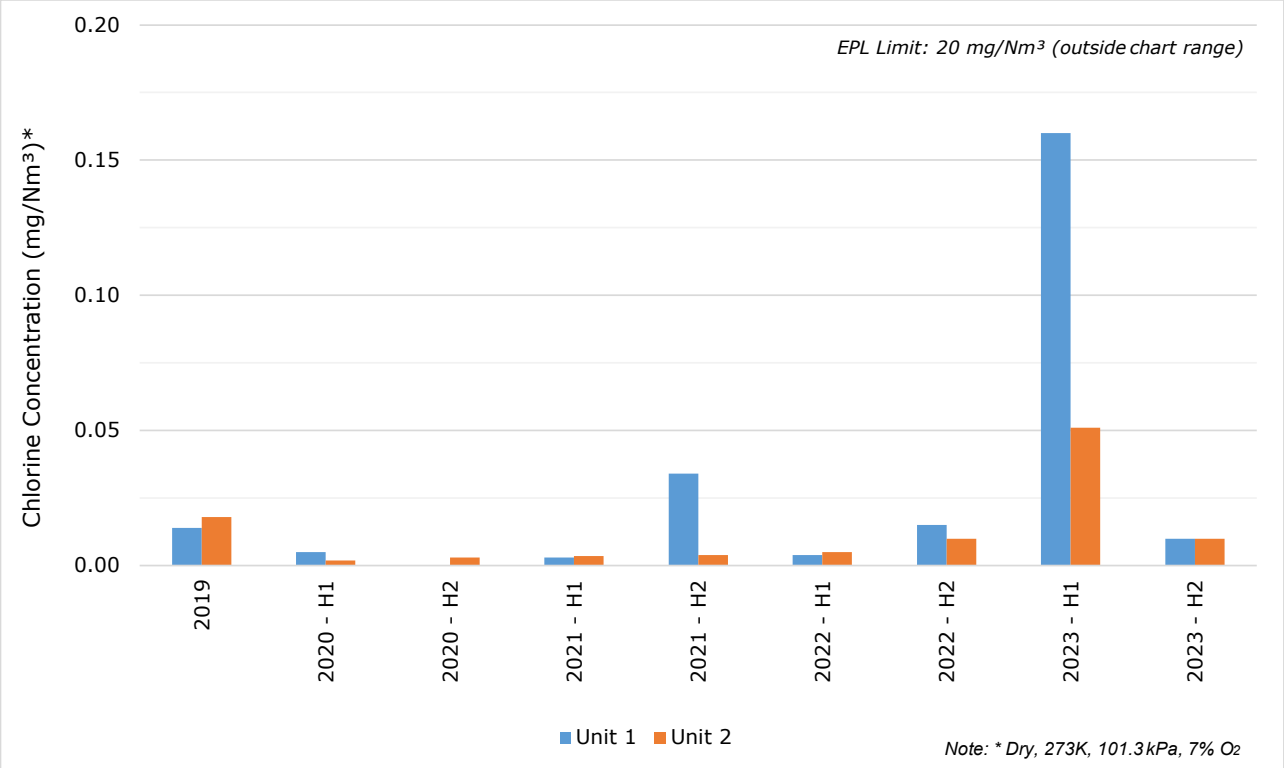
FIGURE 3.7 2019 – 2023 STACK TESTING RESULTS – HYDROGEN CHLORIDE



3.2.5 CHLORINE

Figure 3.8 shows chlorine concentrations measured between 2019 and 2023. The chlorine limit is 20 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were well below the EPL limit as shown in Figure 3.8. Reported concentrations were commonly below the LOR, which varied based on sampling and analysis conditions, and was commonly less than 0.01 mg/Nm³.

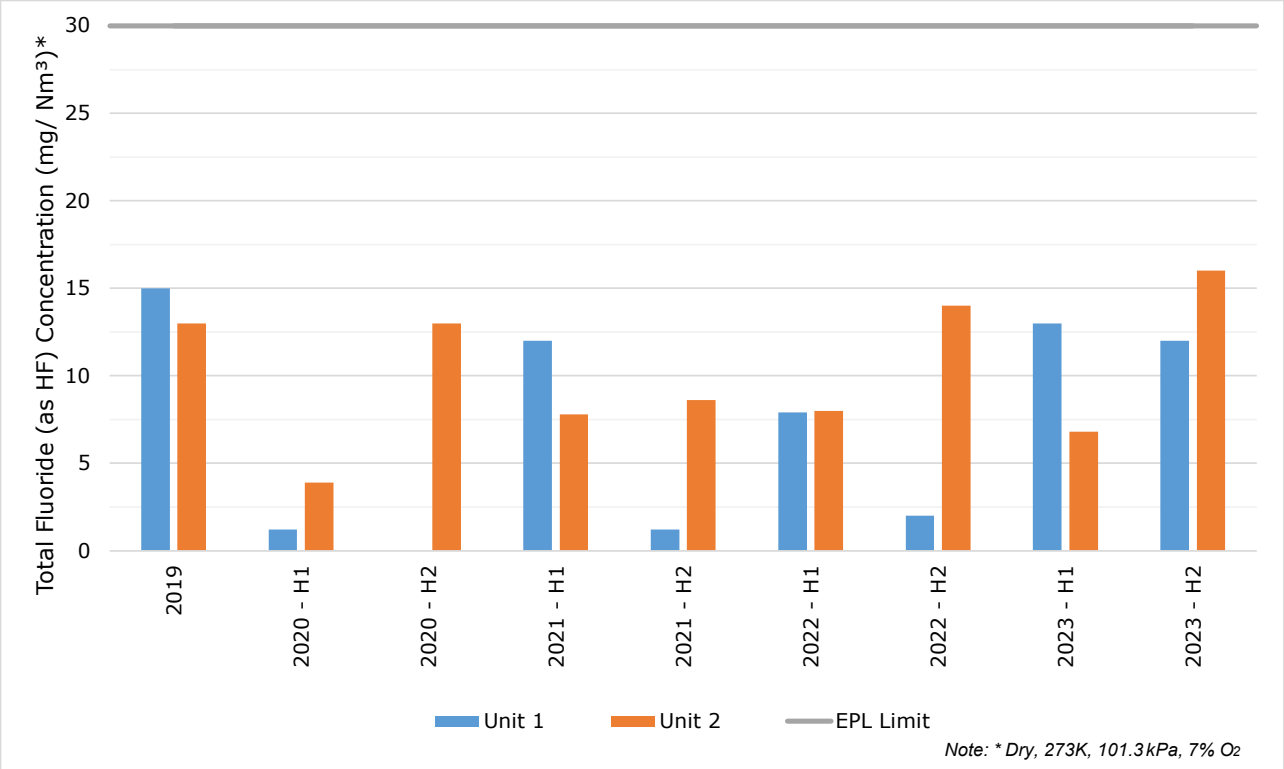
FIGURE 3.8 2019 – 2023 STACK TESTING RESULTS – CHLORINE



3.2.6 TOTAL FLUORIDE

Figure 3.9 shows total fluoride concentrations measured between 2019 and 2023. The total fluoride limit is 30 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.9.

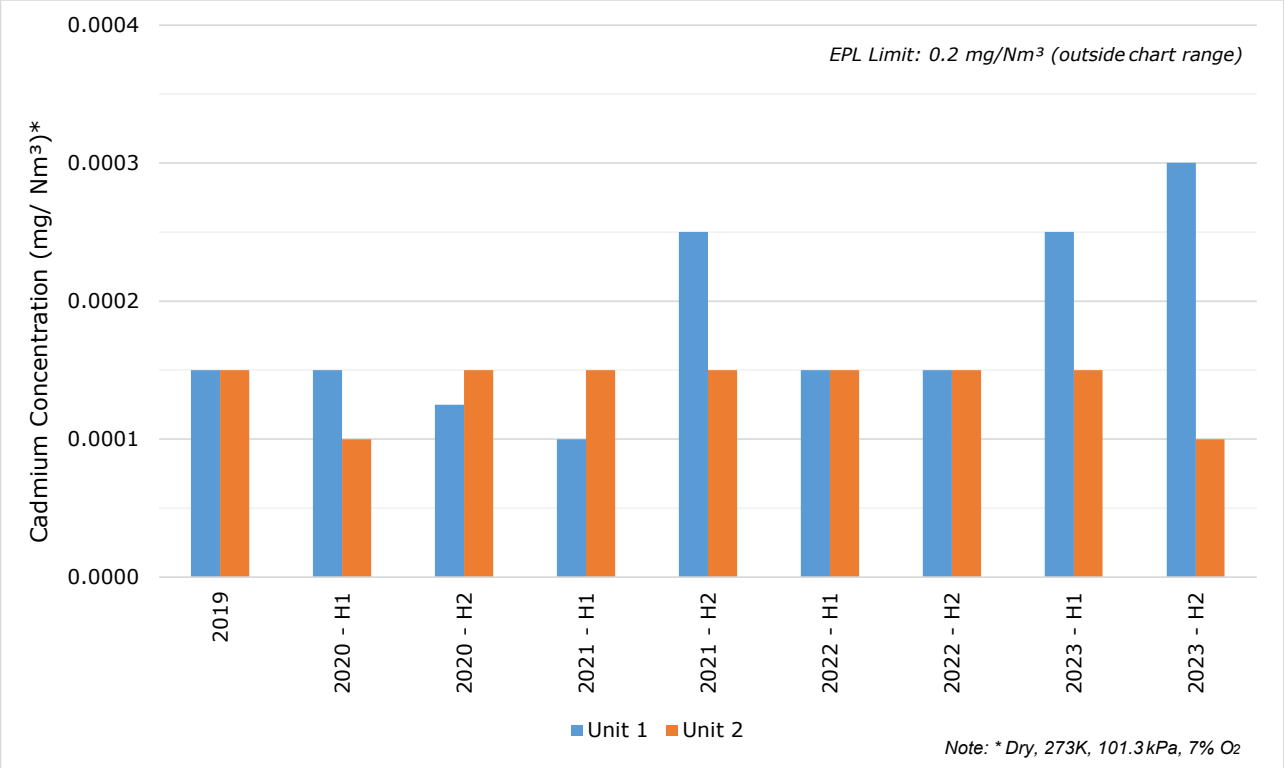
FIGURE 3.9 2019 – 2023 STACK TESTING RESULTS – TOTAL FLUORIDE



3.2.7 CADMIUM

Figure 3.10 shows cadmium concentrations measured between 2019 and 2023. The cadmium limit is 0.2 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.10. Reported concentrations were commonly below the LOR, which varied based on sampling and analysis conditions, and is commonly less than 0.0005 mg/Nm³.

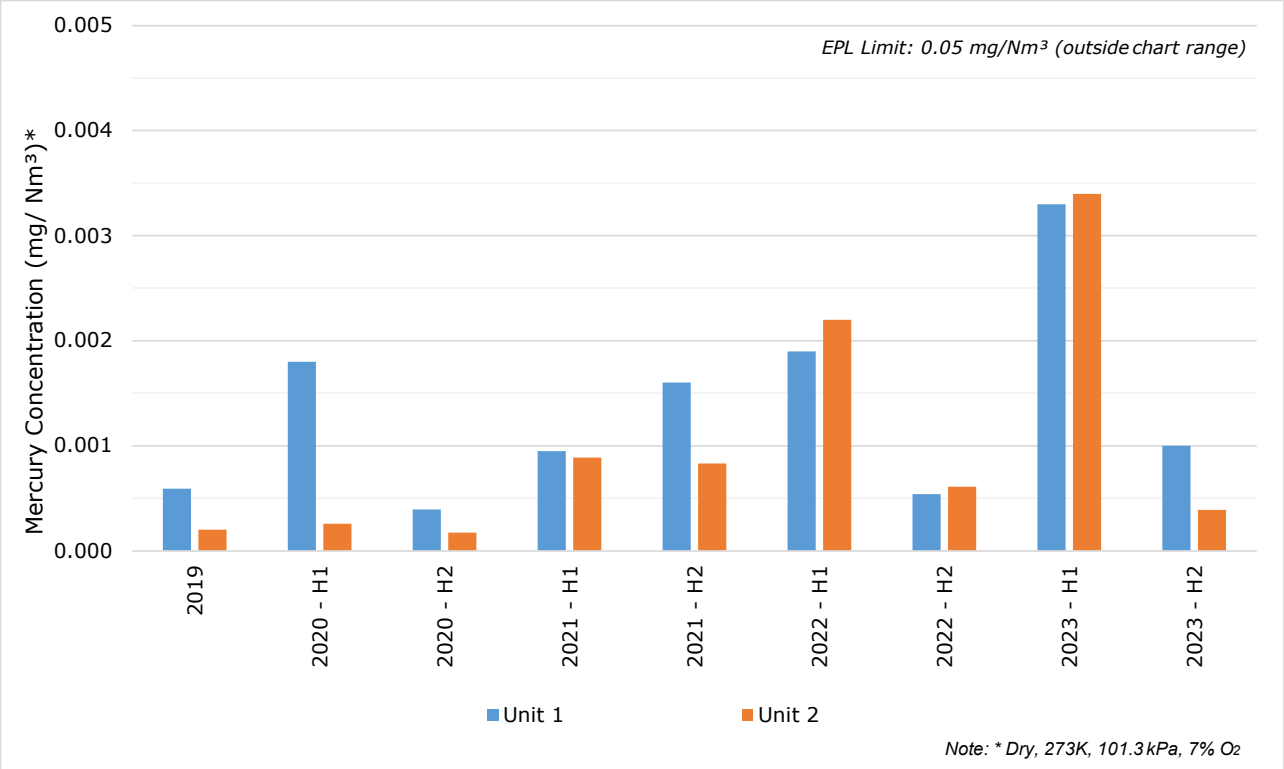
FIGURE 3.10 2019 – 2023 STACK TESTING RESULTS – CADMIUM



3.2.8 MERCURY

Figure 3.11 shows mercury concentrations measured between 2019 and 2023. The mercury limit is 0.05 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.11.

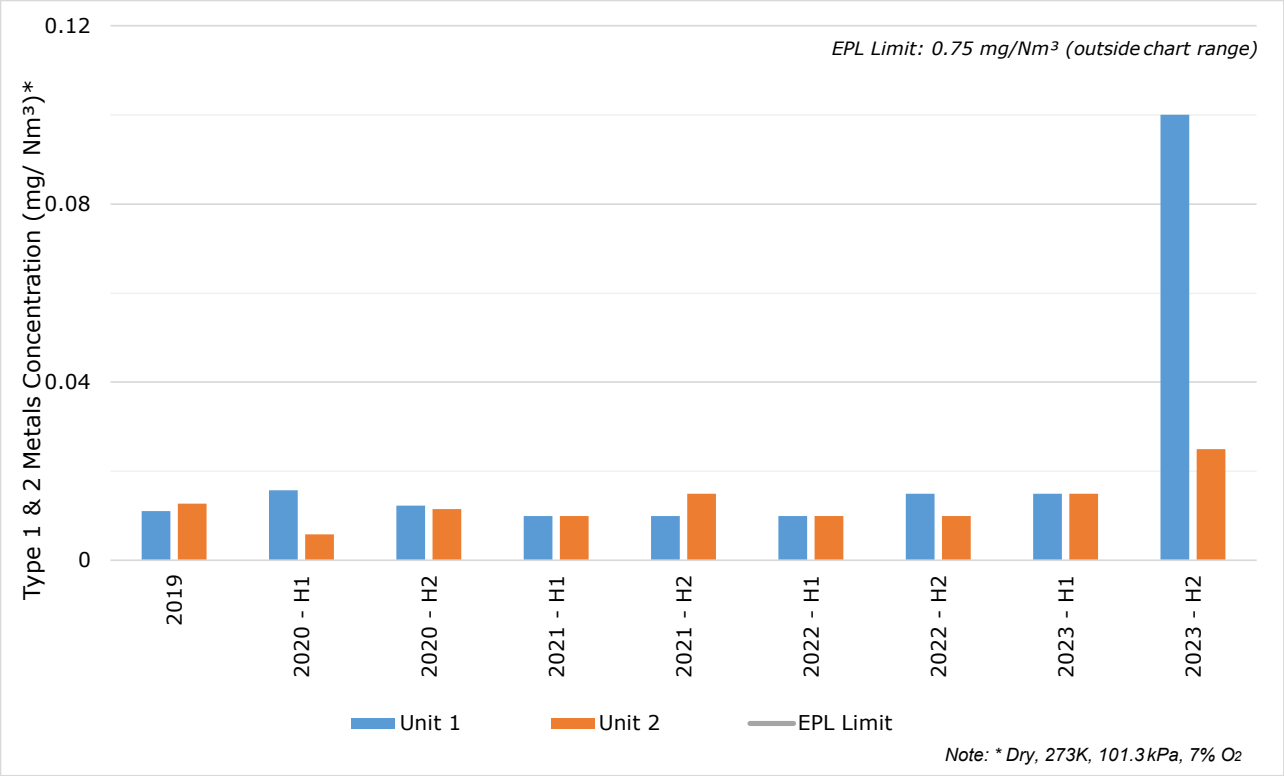
FIGURE 3.11 2019 – 2023 STACK TESTING RESULTS – MERCURY



3.2.9 TYPE 1 & 2 METALS

Figure 3.12 shows type 1 & 2 metals concentrations measured between 2019 and 2023. The type 1 & 2 metals limit is 0.75 mg/Nm³ in both the current and previous EPL, with the monitoring frequency changed from annual to six-monthly in 2020. All reported concentrations were below the EPL limit as shown in Figure 3.12.

FIGURE 3.12 2019 – 2023 STACK TESTING RESULTS – TYPE 1 & 2 METALS



3.2.9.1 NON-REPRESENTATIVE DATA

Stack emission testing of metals (Type 1 and 2 substances as well as copper and zinc) was conducted between the 4 and 7 July 2023. Elevated concentrations of lead, copper, nickel and zinc were reported for the test on 4 July 2023. These concentrations are uncharacteristically high when compared against historic measurements. MPPS has sought independent expert advice from consultants ERM and HRL to assess the representativeness of these results. A copy of the HRL assessment is included in full in Appendix B.

It was generally concluded that the test results for Unit 1 were anomalous and should not be considered representative of MPPS emissions. Consultants HRL and ERM both concluded that the anomalous test results should not be included in the dataset when reporting emissions from MPPS. The anomalous results for the four elevated metals from the July 2023 test have not been included in the data set for the purpose of LBL reporting.

3.2.10 NO_X AND SO_2 MONITORING REVIEW

NO_x and SO_2 (including SO_2 and sulfuric acid/sulfuric trioxide) are the assessable pollutants emitted in greatest quantity by the MPPS facility via the two boiler stacks. The licence has required SO_2 and NO_x to be monitored using CEMS since 2019.

Table 3-2 summarises the statistics of the CEMS monitoring results for the period of 2019 – 2023 (inclusive). Figure 3.13 and Figure 3.14 provide hourly monitoring data plots for this period for NO_x and SO_2, respectively. In addition to Figure 3.15 and Figure 3.16, which present the quarterly average CEMS NO_x and SO_2 concentration to visually assess long term trends.

TABLE 3-2 STATISTICS OF 2019 TO 2023 CEMS MONITORING RESULTS

Unit	Year	Data Capture	Concentration (mg/Nm³)*		
			Minimum	Average	Maximum
NO_x (as NO_2)					
Unit 1 (Point 2)	2019	100%	2.7*	577	1,239*
	2020	100%	185	728	1,121
	2021	98%	230	627	1,072
	2022	99%	202	694	1,193
	2023	95%	182	695	1,187
Unit 2 (Point 3)	2019	100%	10.2*	394	1,172*
	2020	100%	131	686	1,265
	2021	100%	178	619	1,133
	2022	99%	224	624	1,260
	2023	99%	247	697	1,201
SO_2					
Unit 1 (Point 2)	2019	100%	160*	871	2,266*
	2020	100%	506	1,177	1,436
	2021	98%	1,006	1,185	1,381
	2022	99%	885	1,238	1,402
	2023	95%	644	1,115	1,378
Unit 2 (Point 3)	2019	100%	27*	783	2,719*
	2020	100%	678	1,189	1,597
	2021	100%	906	1,203	1,417
	2022	99%	1,002	1,229	1,399
	2023	97%	730	1,121	1,311

Note: * 2019 maximum and minimum include start up and shut down periods where the unit is operating below 150 MW.

FIGURE 3.13 2019 TO 2023 CEMS RESULTS – NO_X

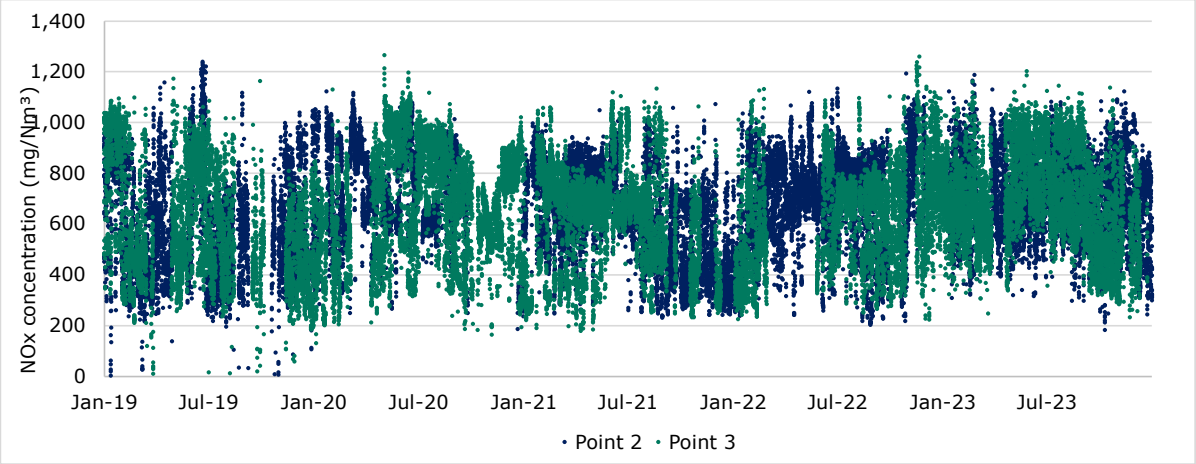


FIGURE 3.14 2019 TO 2023 CEMS RESULTS – SO_2

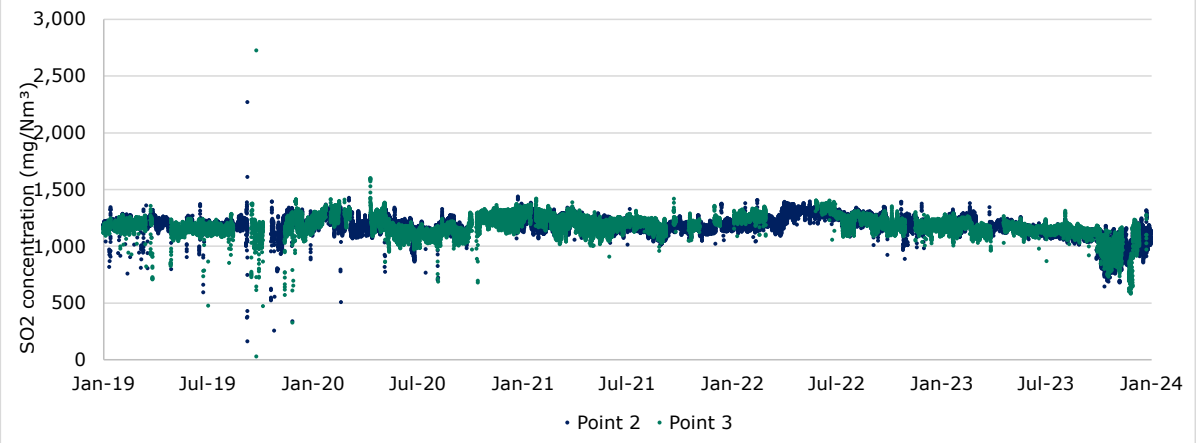


FIGURE 3.15 QUARTERLY AVERAGE CEMS MONITORING RESULTS – NO_X

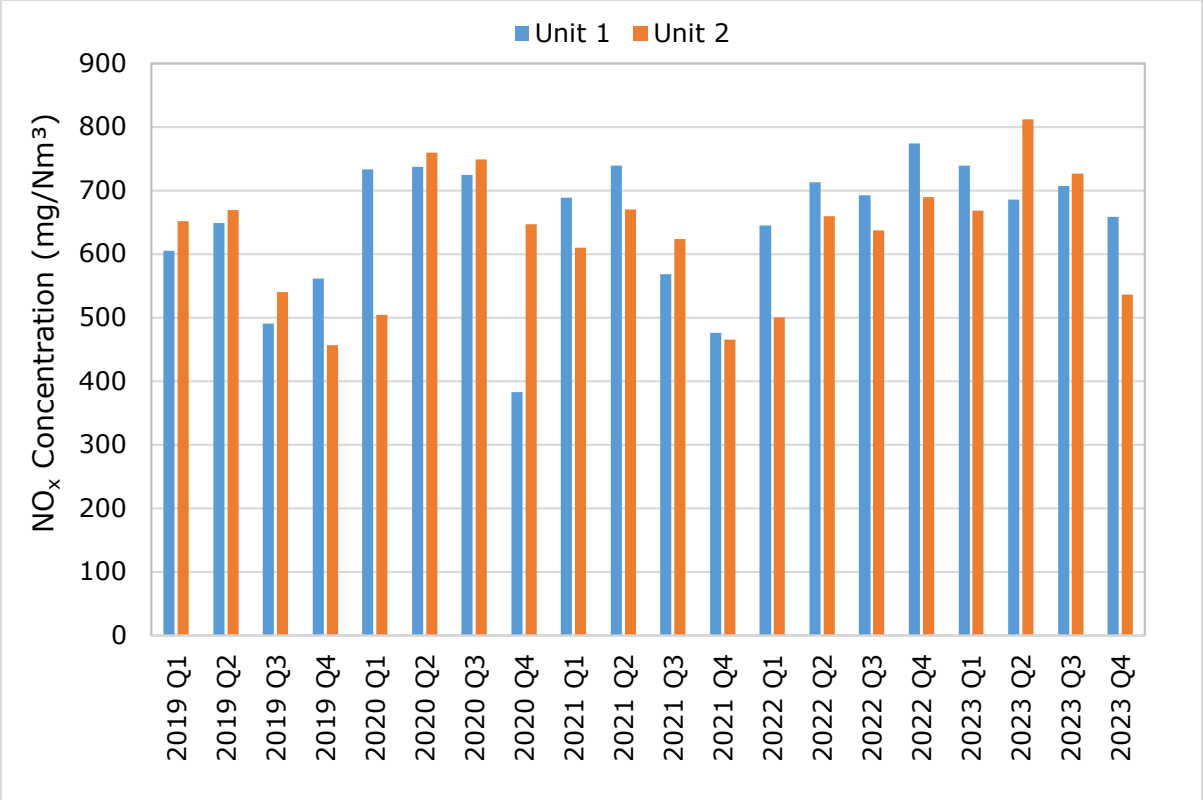
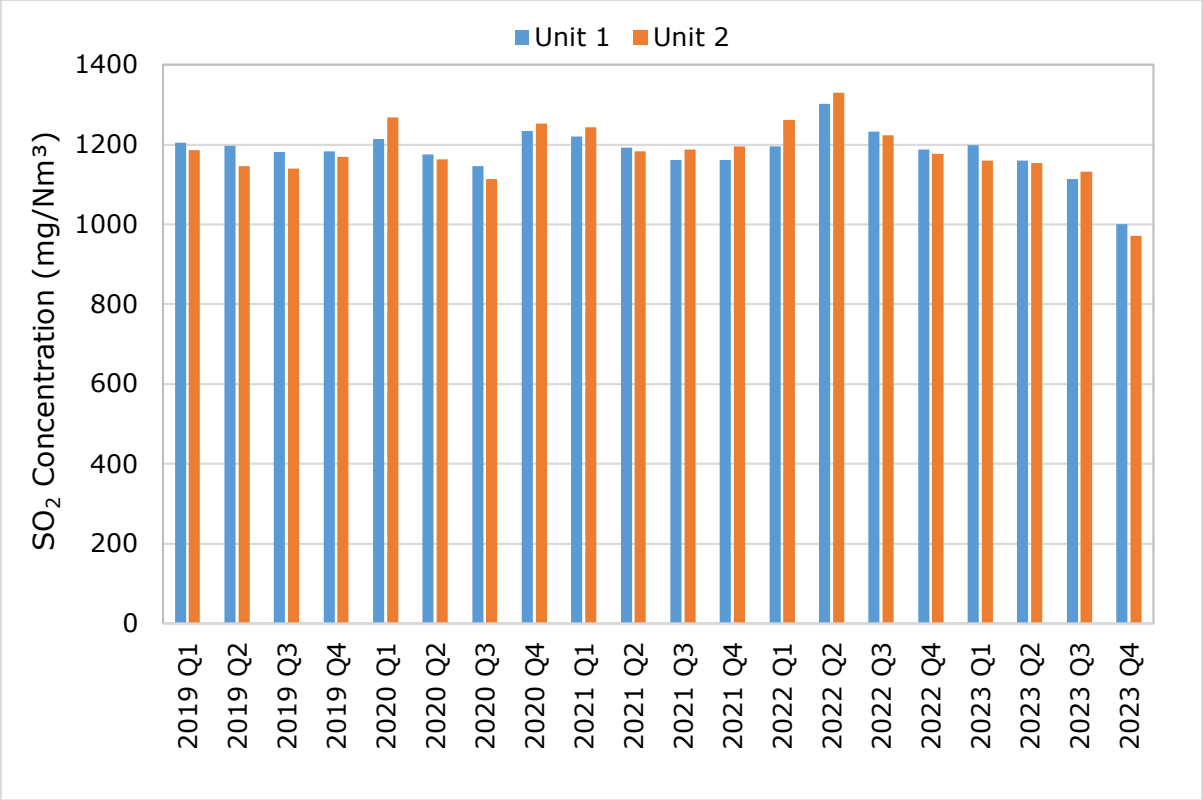


FIGURE 3.16 QUARTERLY AVERAGE CEMS MONITORING RESULTS – SO_2



3.3 AMBIENT AIR MONITORING REVIEW

EnergyAustralia monitors ambient air quality at three locations, Blackmans Flat (continuously), Wallerawang (continuously) and Newnes Plateau (monthly), (monitoring Points 8, 9 and 10 in the EPL). To analyse the long-term trends of the ambient air monitoring, the available monitoring results for the current year (2023) and previous four years are reviewed and analysed in this section.

The statistics of the hourly ambient air monitoring results for Points 8 & 9 and monthly ambient air monitoring results for Point 10 are summarised in Table 3.3. The annual average concentrations are shown in Figure 3.17 and Figure 3.18 for NO_2 and SO_2, respectively. Blackmans Flat (Point 8) and Wallerawang (Point 9) have similar NO_2 concentrations from 2019 through to 2023, with both locations recording the highest reading in 2019, which subsequently decreased from 2020 onwards, with a slight increase in 2023.

Blackmans Flat (Point 8) and Wallerawang (Point 9) had similar SO_2 concentrations in 2019 and 2020. However, Blackmans Flat then recorded the higher SO_2 concentrations for the next three years being over double the measurement of Wallerawang and Newnes Plateau, which is possibly due to a change in the instrumentation noise floor, as indicated in Figure 3.19.

When reviewing annual average trends and patterns in data at Point 10, it should be noted that samples that registered results below the LOR have been reported at half of the LOR (e.g. Figure 3.21).

The daily average concentrations for Point 8 and Point 9 are plotted in Figure 3.19 and Figure 3.20, respectively. The monthly concentrations for Point 10 are provided in Figure 3.21.

TABLE 3-3 SUMMARY OF AMBIENT AIR MONITORING RESULTS BETWEEN 2019 AND 2023

Pollutant	Year	Data Capture	Concentration (pphm)					
			Min	Average	Max	50th percentile	70th percentile	99th percentile
Point 8 (Blackmans Flat) – 1-hour average								
NO_2	2019	94%	0.000	0.442	11.3	0.300	0.483	2.22
	2020	95%	0.000	0.319	3.03	0.200	0.367	1.33
	2021	96%	0.000	0.256	2.42	0.150	0.283	1.15
	2022	94%	0.000	0.242	2.45	0.150	0.250	1.13
	2023	95%	-0.045	0.359	2.45	0.245	0.420	1.48
SO_2	2019	91%	0.000	0.204	20.9	0.021	0.095	1.07
	2020	93%	0.000	0.062	0.794	0.024	0.075	0.412
	2021	95%	0.000	0.183	0.634	0.184	0.202	0.500
	2022	95%	0.034	0.191	0.732	0.178	0.200	0.588
	2023	95%	-0.100	0.158	3.50	0.127	0.150	1.073
Point 9 (Wallerawang) – 1-hour average								
NO_2	2019	98%	0.053	0.441	1.91	0.406	0.534	1.46
	2020	97%	0.024	0.409	1.27	0.377	0.511	0.991
	2021	90%	0.000	0.292	0.952	0.272	0.369	0.819
	2022	87%	0.000	0.202	0.888	0.165	0.250	0.778

Pollutant	Year	Data Capture	Concentration (pphm)					
			Min	Average	Max	50th percentile	70th percentile	99th percentile
	2023	92%	-0.136	0.297	2.662	0.161	0.339	1.441
SO_2	2019	97%	0.000	0.105	1.68	0.024	0.060	0.935
	2020	91%	0.000	0.040	0.429	0.011	0.036	0.289
	2021	90%	0.000	0.071	0.463	0.030	0.081	0.393
	2022	99%	0.000	0.076	0.478	0.002	0.051	0.397
	2023	92%	-0.059	0.021	2.05	0.013	0.020	0.301
Point 10 (Newnes Plateau) – Monthly averaged								
NO_2	2019	100%	0.030	0.080	0.540	0.030	0.030	0.494
	2020	100%	0.030	0.038	0.080	0.030	0.030	0.079
	2021	100%	0.030	0.030	0.030	0.030	0.030	0.030
	2022	100%	0.030	0.055	0.330	0.030	0.030	0.297
	2023	100%	0.030	0.034	0.075	0.030	0.030	0.070
SO_2	2019	100%	0.045	0.045	0.045	0.045	0.045	0.045
	2020	100%	0.045	0.051	0.120	0.045	0.045	0.112
	2021	100%	0.045	0.091	0.435	0.045	0.045	0.411
	2022	100%	0.045	0.065	0.185	0.045	0.045	0.181
	2023	100%	0.045	0.045	0.045	0.045	0.045	0.045

FIGURE 3.17 AMBIENT AIR MONITORING RESULTS – ANNUAL AVERAGE NO_2

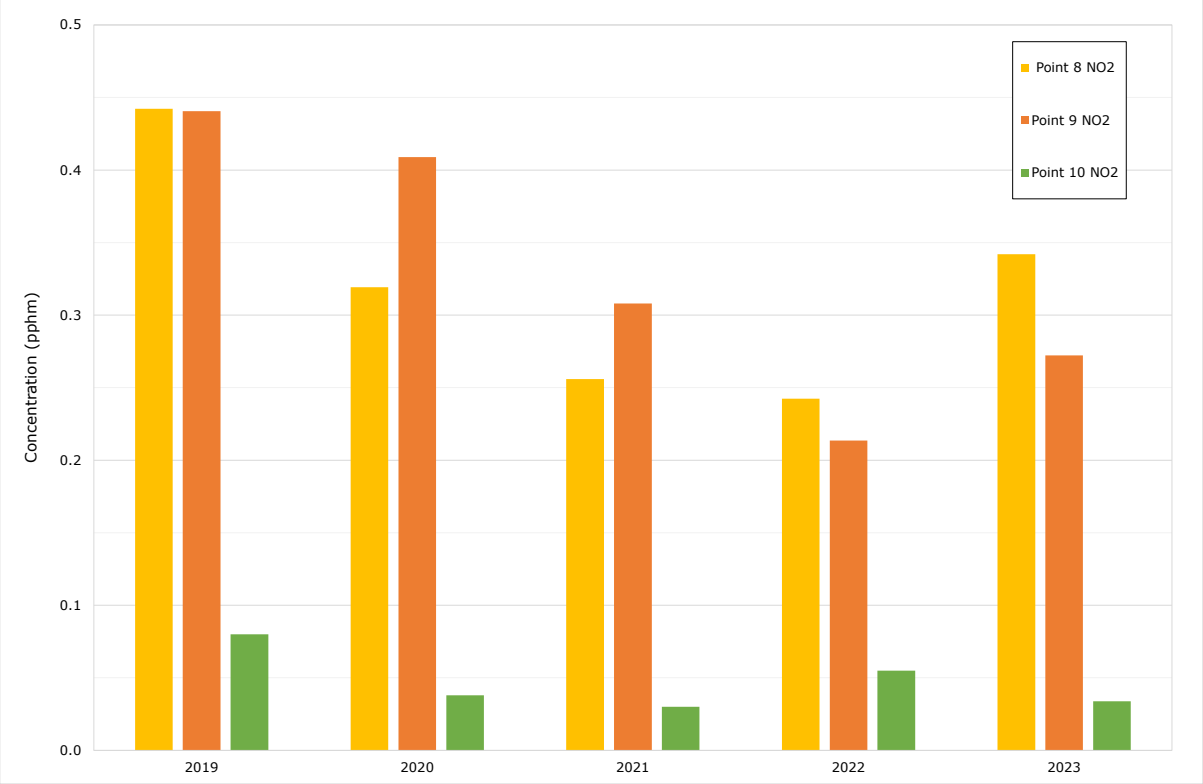


FIGURE 3.18 AMBIENT AIR MONITORING RESULTS – ANNUAL AVERAGE SO_2

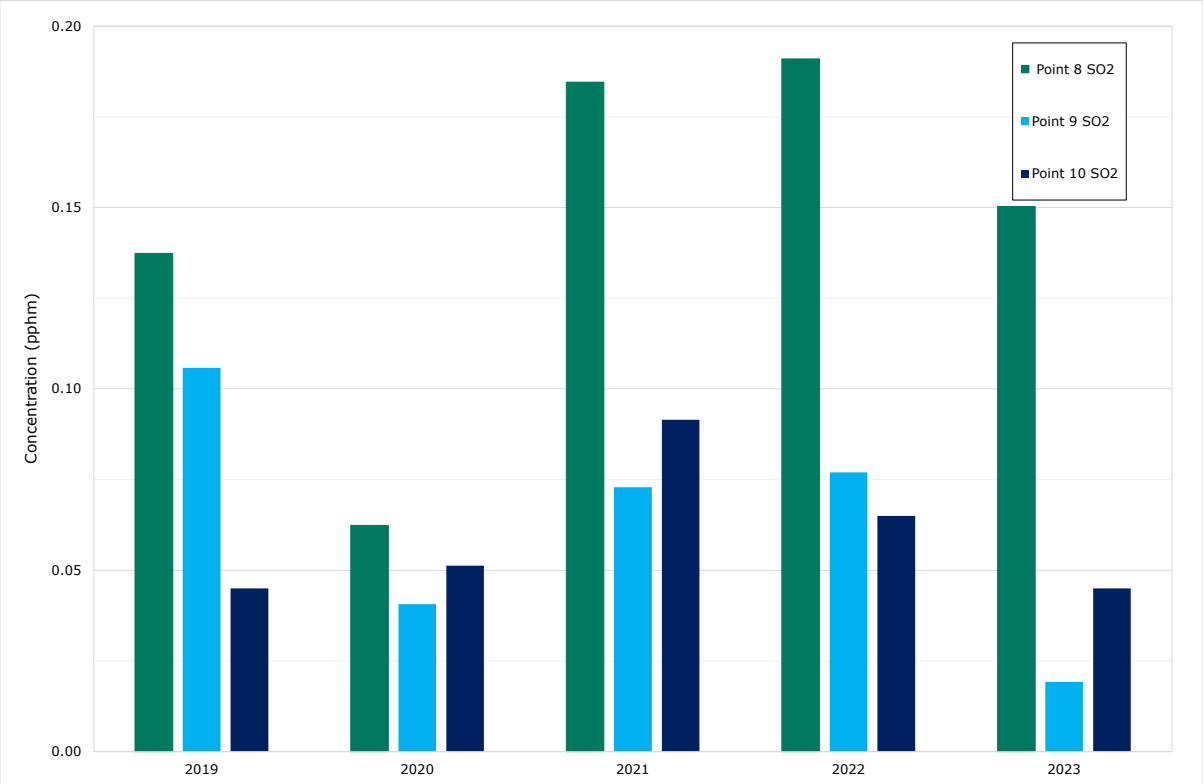


FIGURE 3.19 AMBIENT AIR MONITORING – POINT 8 (BLACKMANS FLAT)

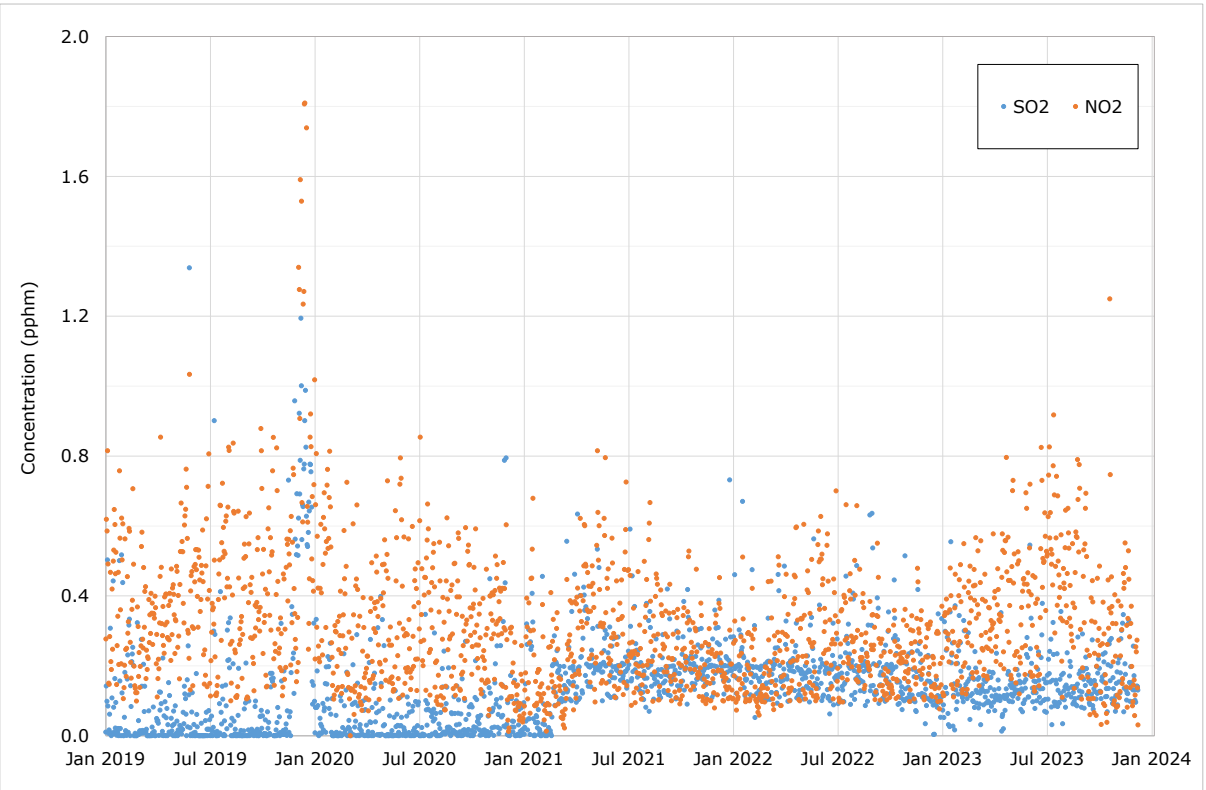


FIGURE 3.20 AMBIENT AIR MONITORING – POINT 9 (WALLERAWANG)

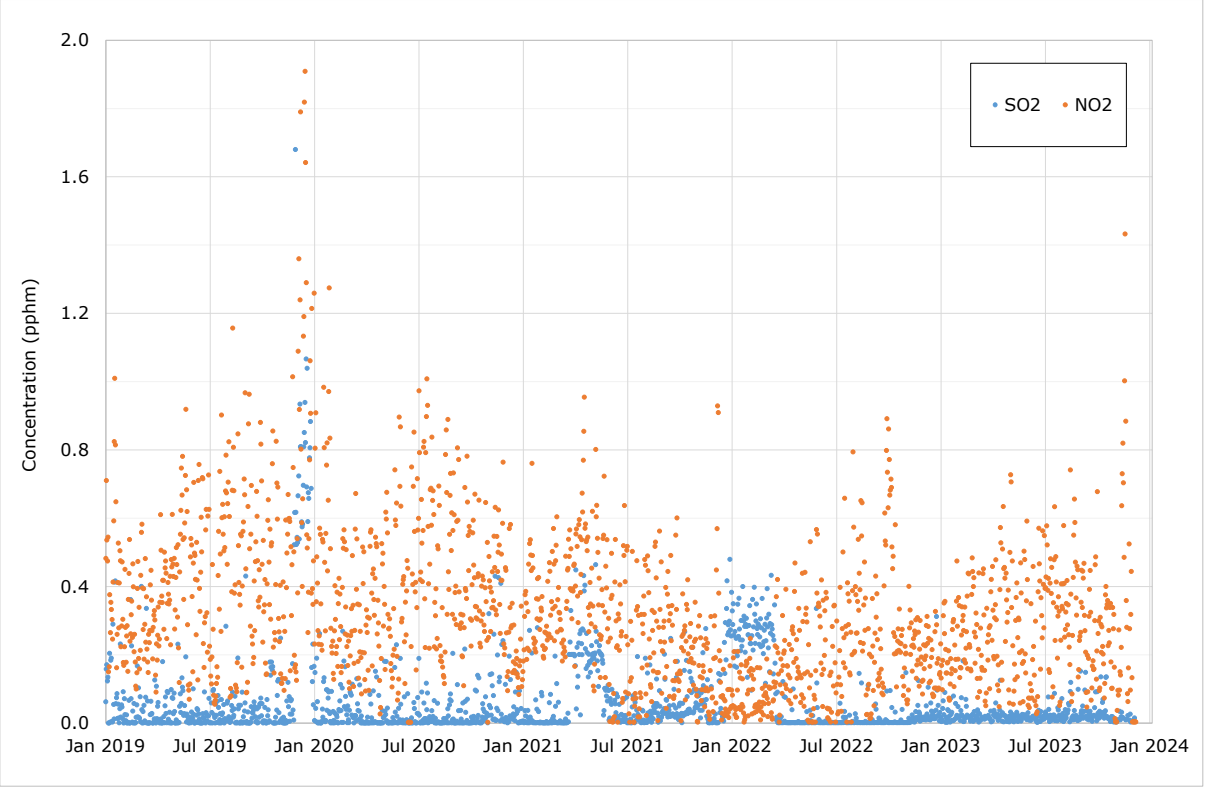
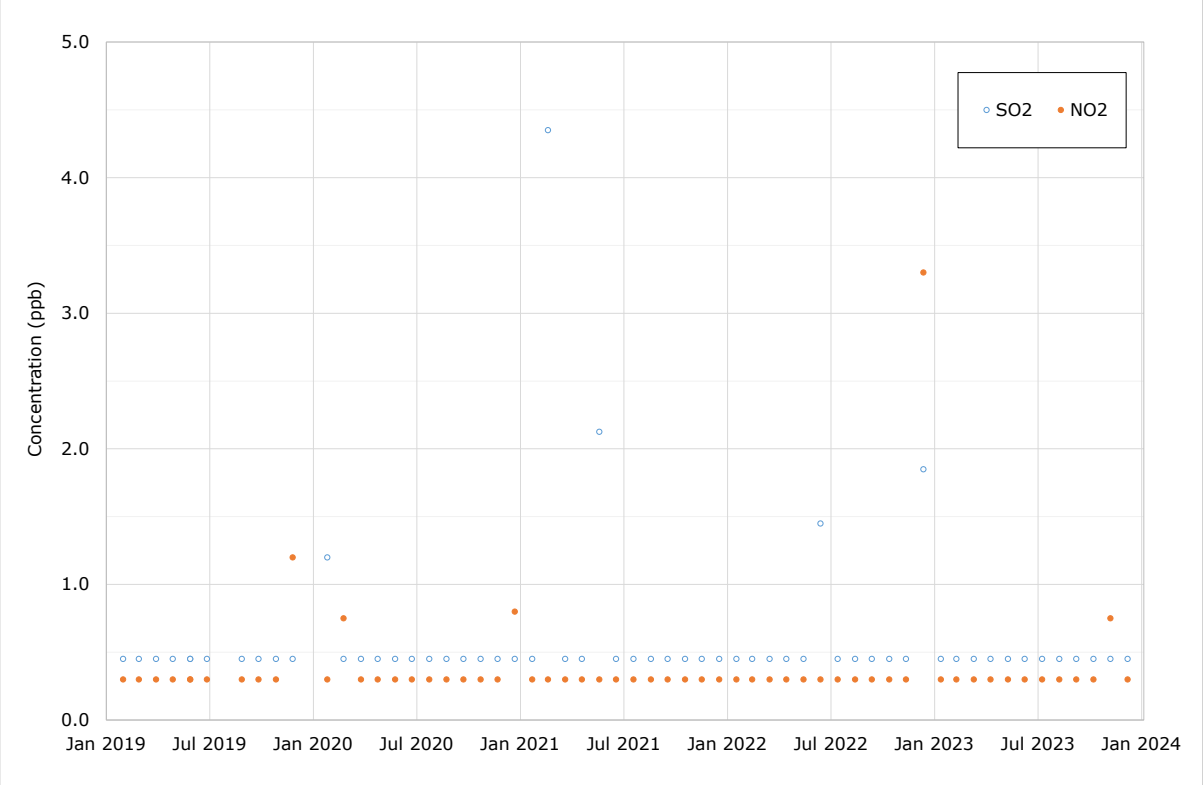


FIGURE 3.21 AMBIENT AIR MONITORING – POINT 10 (NEWNES PLATEAU)



4. DETAILED CALCULATIONS OF 2023 BOILER EMISSIONS

The annual emissions associated with the stack emission listed in R1.9 are detailed in this section. The annual emissions are either estimated from the CEMS data or the stack test results. The calculation method of annual emissions, based on data type, are detailed in the sections below.

4.1 NO_X AND SO_2 – CEMS

NO_x and SO_2 annual emission are determined using CEMS data. Monthly emissions are determined then summed for the annual reporting periods. The monthly emissions are calculated based on:

- Unit 1 and Unit 2's Continuous Emission Monitoring System (CEMS) daily monitoring concentration were used to obtain monthly weighted average (based on MWh) stack concentrations in dry, STP, 7% O_2 part per millions (ppm).
- The monthly volume of flue gas emitted from the stacks is calculated by EnergyAustralia based on the combustion reaction stoichiometry, i.e. based on gases present in the combustion air, elements present in the coal and fuel oil, and combustion products and by-products. The volume is calculation at dry, STP and 7% O_2 conditions.
- The monthly emissions are calculated by multiplying the CEMS ppm and the calculated volume of flue gas, divided by the ideal gas molar density and converted to the units of kilograms.
- The average CEMs value is determined from the average monthly values. The sums of the monthly values are reported as the annual emissions and the reported maximum and minimum are based on the hourly data.

4.2 OTHER POLLUTANTS – STACK TESTS

Stack test data and flue gas volumes were used by EnergyAustralia to estimate the 2023 annual pollutant loads for the majority of applicable pollutants. It is noted that in the annual returns TVOCs are reported using the NPI EET Manual emission factor that estimates emissions due to fuel storage only. The estimated PAH emissions were based on a site-specific emission factor (i.e. 5.90 x 10^{-08} kg/tonne of coal as received), which has been used since 2007.

Metal emissions are estimated as the product of measured flue gas concentrations and corresponding flue gas volumes. For each boiler, the flue gas volume is estimated as an output-weighted (MWh) proportion of the combined MPPS flue gas volume. The in-stack concentration for each 6-month period is assumed equal to the average of the two (A and B) duct measurements. It is noted that Unit 1 copper, zinc, lead and nickel annual emission estimates are based on concentration measurements performed during the first half of 2023 due to anomalies in Unit 1 emission measurements conducted during the second half of the year. These anomalies are discussed in Section 3.2.9, and Appendix B.

5. COAL ASH MONITORING

This section has been prepared to satisfy conditions M9.1 and R4.4 under EPL13007. Coal ash from the Mt Piper Power Station is disposed of in the Mt Piper Ash Repository (MPAR) and the Lamberts North Ash Repository (LNAR) which are both dry ash repositories.

The MPAR is approved under Development Consent DA80/10060. Water conditioned ash (WCA) was placed at MPAR up to reduced level (RL) 946 m, brine condition ash (BCA) has been placed above RL 946 m up to the maximum approved height of RL 980 m. MPAR has reached its maximum approved ash storage capacity and is in the process of being decommissioned. The eastern batter has been capped with mine overburden and seeded to stabilise the landform. It is proposed to cap the top of MPAR with a high-density polyethylene (HDPE) liner or equivalent which is the subject of a Modification Application being prepared for submission to the Department of Planning, Housing and Infrastructure (DPHI).

The LNAR operates under Project Approval 09_0186 and LNAR is managed in accordance with its approved Operational Environment Management Plan (OEMP). The OEMP provides the framework to manage the environmental aspects associated with the operation of the LNAR. The OEMP can be found on the EnergyAustralia website[1]. LNAR has been lined with a leachate barrier management system. WCA was placed below the liner and BCA is placed above the liner on LNAR.

Solid salt and mixed lime salts from the Springvale Water Treatment Plant (SWTP) are approved to be co-disposed at the MPAR and LNAR. LNAR and parts of MPAR will be capped with a HDPE liner or equivalent that will allow for future access and beneficial reuse of the stored coal ash.

Table 5-1 and Table 5-2 provides a summary of coal ash quantities for the 2023 reporting period.

TABLE 5-1: SUMMARY OF COAL ASH QUANTITIES

Item	Coal Ash	Tonnes
1	Coal consumed for electricity generation at the premises	2,536,555
2	Fly ash generated at the premises	618,274
3	Fly ash deposited and/or stored at the premises	*432,974
4	Bottom ash generated at the premises	68,697
5	Bottom ash deposited and/or stored at the premises	68,697

** Grade of fly ash is unknown.*

[1] Lamberts North Ash Repository | EnergyAustralia

TABLE 5-2: TRANSPORTED COAL ASH

Item	Transported from the premises	Tonnes	Location
6	Fly ash	179,944	Fly Ash Australia Pty Ltd
7	Repository reclaimed fly ash	5,347	Holcim Australia Pty Ltd
8	Repository reclaimed fly ash	311	Regional Quarries Australia Pty Ltd
9	Bottom ash	0	N/A

Note: N/A – Not Applicable

It is noted that the sum of transported, stored and deposited fly ash does not directly add to the amount generated. Transported fly ash can include reclaimed fly ash that has been generated and stored in years prior to the current reporting period.

6. SUMMARY OF COMPLIANCE WITH REPORTING CONDITIONS

This report has been completed to comply with EPL13007 Conditions R1.9, M9.1 and R4.4. The study has reviewed stack test reports, CEMS monitoring results and ambient monitoring results from 2019 to 2023.

Table 6-1 summarises the study's findings in relation to the EPL13007 Conditions R1.9, M9.1 and R4.4 requirements and where additional detail can be found in this report.

TABLE 6-1 EPL13007 CONDITIONS AND STUDY SUMMARY

Conditions		Review Comment	Compliant
R1.9			
a)	*a comprehensive summary (tabulated and graphical) of all periodic and continuous monitoring data as required by condition M2.2 of this licence, including a comparison with the concentration limits specified in condition L3.2 and L3.3;*	All monitoring results were reviewed and summarised in tables and graphs.	Yes
b)	*analysis of trends in emission performance for all pollutants monitored as required under condition M2.2. Trend analysis must include comparison of emission performance during the reporting period with emission performance from the previous 4 years;*	Historical monitoring data and coal quality from the most recent five years (2019 to 2023) were reviewed and analysed. No significant changes were identified in emission performance over this time period. Coal quality in 2023 is generally consistent with the previous four years. The observed variability in the stack monitoring data for 2023 is within the range of variability observed over the previous four years.	Yes
c)	*details of any exceedances of air emission licence limits and details of plant operating conditions at the times the exceedances occurred;*	There were no exceedances of air emission licence limits during the reporting period.	Yes
d)	*details of plant operating conditions, including Boiler load (MW), during sampling for each Boiler;*	The operation condition, including boiler load, during sampling for each boiler is presented in Table 2-1.	Yes
e)	*demonstrated compliance with the CEMS Quality Assurance and Control Procedures prepared for the premises;*	The procedure was reviewed no non-compliances were found.	Yes
f)	*summary of fuel usage, including:* *i) total coal and other permitted fuels consumed in each Boiler (including start-up);* *ii) a statement about the representativeness of fuel quality during periodic air emission sampling compared to non-sampling periods;*	The total coal consumption and coal quality during the reporting period is summarised in Table 3-1. The daily fuel consumption during stack sampling is shown in Table 2-1. Based on the review of the coal composition during 2023 and the long-term trends of coal quality, the coal quality during stack testing is	Yes

Conditions		Review Comment	Compliant
	ii) total fuel consumed by each Boiler during times when periodic air emission sampling was undertaken; *and*	representative of typical operating conditions.	
g)	*detailed calculations used to determine the aggregated pollutant emission rates for each boiler.*	The detailed methodology to determine the pollutant emission rates for each boiler has been presented in this report. Methods used to determine annual emission for reporting to the annual returns have also been provided.	Yes
M9.1			
a)	*Quantity of coal used for electricity generation at the premises;*	Quantities provided in Table 5-1.	Yes
b)	*Quantity of bottom ash; and quantity of fly ash, generated at the premises and the grade of fly ash produced (if the grade is known);*		
c)	*Quantity of bottom ash; and quantity of fly ash, deposited, and/or stored at the premises with a description of how it is stored and the processes for managing the storage;*		
d)	*Quantity of bottom ash; and quantity of fly ash, transported from the premises together with identification of the destination; and*	Quantities provided in Table 5-2.	Yes
e)	*Management measures used for coal ash repositories on the premises to maintain the viability of ash reuse, including identification of any other materials being stored concurrently with newly deposited coal ash.*	Description of management measures provided in Section 5.	Yes
R4.4			
The licensee must prepare an Annual Coal Ash Monitoring Report that details information required under condition M9.1 in respect of generation, deposition, storage, transport and reuse of coal ash generated at the premises for each Annual Return reporting period.		Provided in Section 5.	Yes

7. STATEMENT OF LIMITATIONS

1. This report is based solely on the scope of work described in our proposal P0659047 dated September 2023, and approved December 2023 (Scope of Work) and performed by Environmental Resources Management Australia Pty Ltd (ERM) for EnergyAustralia NSW Pty Ltd (the Client). The Scope of Work was governed by a contract between ERM and the Client (Contract).
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between January and February 2024 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.
5. This report is based on analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:
    a. did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
    b. assumes no responsibility or liability for errors in data obtained from,
    c. the Client, any third parties or external sources (including regulatory agencies).
6. Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.
7. Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:
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8. This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.

9. Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:
   a. has been prepared and is intended only for the exclusive use of the Client;
   b. must not to be relied upon or used by any other party;
   c. has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
   d. does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the site(s); and
   e. does not purport to provide, nor should be construed as, legal advice.

8. REFERENCES

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APPENDIX A 2023 EMISSION TESTING REPORTS

APPENDIX B HRL ASSESSMENT OF JULY 2023 FLUE GAS METAL RESULTS

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