



NewGenPower

Stack Emissions Management Plan (SEMP)
NewGen Power Kwinana Pty Ltd

Department: Health Safety and Environment

NPK-HSE-PLN-008

Document History

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April 2014	NPK-COR-TMP-003-0.2	Section 5.1 NOx limit increased Section 7.1 New software CEMS	Hayden Henderson, Station Chemist	M. Hammond, Station Manager	N/A
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1. Introduction

NewGen Power Kwinana Pty Ltd (hereby referred to as NPK or the premises) holds Ministerial Statement 0698 (MS698), approved on 7th November 2005 by Environmental Protection Authority (EPA) (amended on 15th August 2007 and 3rd November 2020 under Section 45C of the Environmental Protection Act 1986) for the construction, operation and maintenance of a combined cycle base load power plant in Kwinana.

The power plant has been in commercial operation since December 2008 and is part of the South West Interconnected System (SWIS). The power station comprises a 160MW combined-cycle gas turbine, with an 80MW heat recovery steam generator (HRSG) and steam turbine. An additional 80MW generation capacity is available from supplementary (or duct) firing, providing a total nominal capacity of 320MW. The premises are fired by natural gas supplied from the North-West Shelf and use low-NO_x burners.

1.1 Purpose

This Stack Emission Management Plan (SEMP) details the measures that are required to manage key atmospheric emissions from the power plant. This plan does not include Greenhouse Gas (GHG) emissions which are specifically managed via the Greenhouse Gas Abatement Plan (NPK, 2006). NPK is proposing that, in future, the GHG will be managed under the Greenhouse Gas Management Plan (NPK, 2021) which has been provided to DWER and is currently pending approval.

The key atmospheric emissions relevant to this plan are oxides of nitrogen. Oxides of nitrogen consist of nitrogen dioxide and nitric oxide. Elevated levels of nitrogen dioxide can cause detrimental impact to human health. Other minor atmospheric emissions associated with combustion efficiency and relevant to this plan includes carbon monoxide and volatile organic compounds (VOCs).

1.2 Key Environmental Factors

This SEMF specifically relates to the 'Air Quality' environmental factor (EPA, 2020), as defined by the EPA. The objective for this factor is:

'To maintain air quality and minimise emissions so that environmental values are protected.'

1.3 Relevant Ministerial Statement Conditions

This SEMF and the management of atmospheric emissions from the power plant are a requirement of the following MS698 Conditions:

Condition	Requirement	Addressed in Section
698:M8.1	<p>Prior to commencement of construction, the proponent shall prepare a Stack Emissions Management Plan, to ensure that best available practicable and efficient technologies are used to minimise total air emissions from the power station, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.</p> <p>This Plan shall address:</p> <ol style="list-style-type: none"> specific measures to minimise total air emissions from the power station to meet emission limits consistent with best practicable technology and current industry standards; monitoring of air emissions, including nitrogen oxides (NO_x) and volatile organic compounds (VOCs); and 	<p>1. Section 3.2</p> <p>2. Section 2.1 & 4.1</p> <p>3. Section 4.3 & 9</p>

	3. public reporting of air emissions and any complaints about air emissions.	
698:M8.2	The proponent shall implement the Stack Emissions Management Plan required by condition 8-1.	Section 8 & 9
698:M8.3	The proponent shall make the Stack Emissions Management Plan required by condition 8-1 publicly available.	Section 6

Table 1: Ministerial Statement Requirement and Reference

1.4 Rationale and Approach

This SEMP outlines how atmospheric emissions from the power plant are monitored and managed to maintain air quality and minimise emissions so that environmental values are protected. This objective acknowledges that emissions to air from the power plant occur and that the impacts from these can be mitigated by implementing this SEMP.

1.5 Current Air Emissions

Air emissions from the Site are currently discharged to atmosphere via the main stack located at the western end of the Project site.

The air quality in the vicinity of the Kwinana Industrial Area is dominated by industrial emissions and to a lesser extent by motor vehicles and other domestic activities in the local area and from the city of Perth. A large proportion of industrial air emissions that occur in the Perth airshed are due to industries that are located in the Kwinana Industrial Area (SLR 2020).

The Department of Water and Environmental Regulation (DWER) and Kwinana Industry Council operate ambient air quality monitoring stations at various locations within the Perth metropolitan area. Eight of these sites, namely, South Lake (DWER: SO₂, NO_x, PM₁₀ and PM_{2.5}), Miguel Rd (KIC: SO₂), Fancote Ave (KIC: SO₂, PM₁₀), Wattleup (DWER: SO₂), Abercrombie Road (KIC: SO₂), Calista (DWER: NO_x, PM_{2.5}), North Rockingham (DWER: NO_x, SO₂) and Hillman Primary School (DWER: NO_x, PM_{2.5}) are close to the Kwinana Industrial area and provide useful information for establishing the existing levels of air pollutants.

A review of the most recent data from the closest monitoring station (South Lake) was used to assess the performance of the Power Station for NO_x and carbon monoxide (CO). The review showed that there have been no exceedances of the NEPM standard for NO₂ of 246µg/m³ between 2015 and 2018.

The 90th percentile concentrations (representing the highest 10% of all measurements) of NO₂ at South Lake are less than 55 µg/m³ (SLR, 2020). The annual average for the location was recorded as 14.2µg/m³ and well below guideline levels (SLR 2020). This is similar to the levels reported for other years.

1.6 Potential Impacts

The exhaust gases from the gas fired turbine and the supplementary duct firing system are emitted to the atmosphere from a 60-meter high stack. The total mass of NO_x to be emitted from the power plant was predicted to be 636 tonnes per year. NO_x consists of nitrogen dioxide and nitric oxide. Elevated levels of nitrogen dioxide can affect human health and adversely affect air quality.

Following assessment by the EPA in August 2005, it was determined that the original proposal could be managed to meet the EPA's environmental objective based on the summary below:

- Results of the dispersion modelling indicated that it is unlikely that the NEPM ambient air quality standard would be exceeded by the power plant;
- The design and construction of NPK, particularly in relation to the installation of dry low-NO_x burners; and
- Recommended Condition number 8, which requires the proponent to prepare and implement a monitoring strategy to gauge in-stack air emissions.

A change was approved to MS698 via a Section 45c application on Tuesday 3rd November 2020 to:

- Include an additional mode of operation;
- Increase the authorised limit of oxides of nitrogen (NO_x); and
- Update location maps (Figures 1 and 2).

Specifically, Table 1, Schedule 1 of MS698 (now Table 2) was amended to increase emissions to air (NO_x) from 25 - 31 parts per million by volume (ppmv) to 31ppmv (gas turbine above switchover) and 60ppmv (123mg/Nm³) (gas turbine below switchover) for an hourly averaging period and a total of 880 tonnes per year.

Prior to the approved increase in NO_x, NPK's SEMP approved by the EPA in 2014 regulated the emission to air limit for NO_x at 34ppmv or 70mg/Nm³.

Prior to the approved change, the gas turbine (GT) operated above switch over point at or below 33ppmv NO_x using 72 EV burners. Switch over point is the point in which the GT switches from pilot burner mode to pre-mix burner mode. This occurs at ~160MW combined cycle load. When the GT is operating below switch over NO_x may increase up to a maximum of 60ppmv (123mg/Nm³).

Due to market demands, NPK targeted GT operational loads at less than 57%. Once the GT is running below the switch over point (57 to 58% and vice versa) the NO_x emissions have the potential to increase up to 60ppmv (123mg/Nm³). NPK therefore proposed to run at a maximum of 60ppmv (123mg/Nm³) when the gas turbine is below switchover.

To support the requested change and assess the potential air quality impacts arising from emissions of NO_x (expressed as nitrogen dioxide (NO₂)) an air quality assessment was undertaken (Ramboll, 2019). Four scenarios were considered in the air quality assessment: one representing the existing operations, and three representing proposed operations with variable operating loads and associated emissions profiles. The cumulative impact of emissions associated with the proposed upgrade of the power plant were also assessed at nominated receptors using available ambient air quality monitoring data. Results indicated that NO₂ ground level concentrations (GLCs) in isolation and cumulatively with background concentrations for the operation scenarios would remain below both the 1-hr and the annual average NO₂ NEPM Standards. The results were similar to those associated with the prior emissions scenario. The high exhaust temperatures associated with the high load 60 ppmv (123mg/Nm³) scenarios in the new operation conditions increase the buoyancy of the plume and aids in dispersion.

Moreover, the cumulative GLCs using the maximum measured ambient NO₂ concentrations included the impact of the emissions from the power plant operating under the then existing emissions scenario and it was assumed that the maximum monitored concentration would occur at the same time as the maximum predicted concentration.

As mentioned in Section 1.4, the SEMP outlines how atmospheric emissions from the power plant are monitored and managed to maintain air quality and minimise emissions so that environmental values are protected. This objective acknowledges that emissions to air from the power plant occur and that the impacts from these can be mitigated by implementing this SEMP.

2. Performance Indicators

2.1 Atmospheric Emission Limits

Emissions of air pollutants from the NewGen Power Station stacks shall be below the limit(s) specified in Table 2.

Air pollutant	Operational condition ¹	Emission concentration limit ^{2,3}	Averaging period
Oxides of nitrogen	With duct firing ~320 MW	31 ppmv or 64 mg/Nm ³ (gas turbine above switchover) 60 ppmv or 123 mg/Nm ³ (gas turbine below switchover).	1-hour
	Without duct firing	31 ppmv or 64 mg/Nm ³ (gas turbine above switchover) 60 ppmv or 123 mg/Nm ³ (gas turbine below switchover).	1-hour
	All	880 tonnes	Annual
Carbon monoxide	All	50 ppmv or 63 mg/Nm ³	1-hour
	All	750 tonnes	Annual
VOCs n-propane equivalent	All	10 ppmv or 20 mg/Nm ³	1-hour
	All	2 tonnes	Annual

Table 2: Atmospheric emission limits

Note: ¹ Excluding start up, Commissioning and shutdown,

² Corrected to 15% O₂ basis,

³ mg/Nm³, referenced to 0°C, 101.3 kPa and 15% O₂,

2.2 Ambient Air Quality

Ambient concentrations of air pollutants as a result of emissions from the power station should not exceed the standards specified in Table 3.

Air Pollutant	Averaging Period	Standard ¹
Nitrogen Dioxide	1-hour	246 µg/m ³
	Annual	60 µg/m ³
Carbon Monoxide	8-hour	11 mg/m ³

Table 3: Ambient air quality standards

Note: ¹National Environment Protection (Ambient Air Quality) Measure

3. Implementation

3.1 Design/Construct

The power station has been designed and constructed to comply with the emission concentration limits specified in Section 2.1.

3.2 Operation

The Power Station shall be maintained and operated in a proper and efficient manner in accordance with the manufacturer's recommendations. The Power Station shall be operated in accordance with the manufacturer's operation and maintenance manual to ensure compliance is achieved with the emission concentration limits specified in Section 2.1.

The following measures to minimise total air emissions are implemented by NPK include:

- Start up: To minimise emissions during start-up, the duration of the start-up cycle shall be minimised as far as possible in accordance with manufacturer's specifications. A normal cold start cycle should be ~150 minutes.
- Natural gas EV burners are removed, inspected and replaced (if required) every 5 years.
- Natural gas lancers are removed, inspected and replaced (if required) every 5 years.
- Main gas control valves are overhauled every 1.5 years.
- All gas control valves are overhauled every 5 years.
- Combustion chamber equipment are replaced every 5 years.
- Gas turbine detailed combustion tuning is performed every 5 years to optimise combustion conditions.
- The plant is operated at optimum efficiency in accordance with manufacturers operation and maintenance procedures.

3.3 Benchmarking

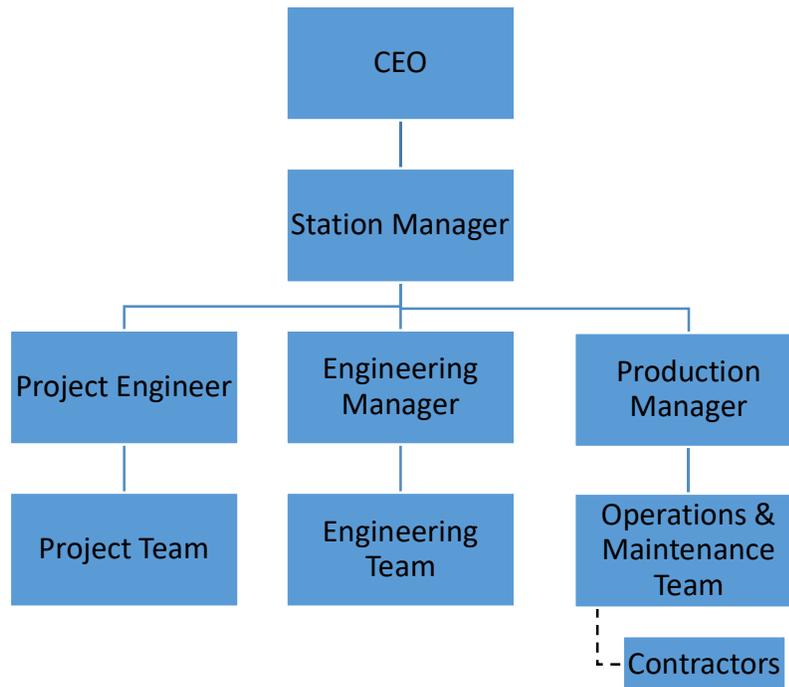
The NPK power station has been designed using best available technology (BAT) for operations to meet the air quality criteria listed in Table 2 in this document.

Table 4 shows that the NPK NO_x targets meets the standard benchmarked for gas-fired power stations in Western Australia.

Site	Licence	Parameter	Target <u>above</u> ~60% Maximum load	Target <u>below</u> ~60% Maximum load
NewGen Power Kwinana		NO _x	64 mg/Nm ³	123 mg/Nm ³
Kwinana Cogeneration Plant	L8247/2008/1	NO _x	85-370 mg/m ³	N/A
NewGen Neerabup	L8356/2009/2	NO _x	51 mg/Nm ³	No Target
Pinjar Power Station	L8395/2009/2	NO _x	No Target	No Target
Cockburn No 1 Power Station	L7860/2003/5	NO _x	70 mg/m ³	113 mg/m ³
Wagerup Power Station	L8174/2007/5	NO _x	No Target	No Target
Coal Fired Power Station				
Collie A Power Station	L6637/1995/15	NO _x	800 mg/m ³	N/A
<i>Note: Coal fired target NO_x inserted for comparative purposes only</i>				

Table 4: Point source emission targets benchmarking for gas-fired power stations (not all current)

3.4 Roles and Responsibilities



Role	Responsibility
Chief Executive Officer (CEO)	<ul style="list-style-type: none"> • Ensure review of compliance with this SEMP (conducted as required). • Ensure all licences and permits are obtained and maintained. • Ensure all obligations and commitments are communicated and actioned. • Maintain effective relationships with stakeholders including regulatory authorities and Cockburn Sound Management Council.
Station Manager	<ul style="list-style-type: none"> • Ensure contract documentation specifies the responsibilities of contractors in regard to the requirements of this SEMP. • Assist with review of compliance with this SEMP. • Assist with meeting environmental monitoring and reporting requirements. • Responsible for compliance with legislative requirements. • Ensure effective communication with Team Leaders. • Liaison with stakeholders and regulatory authorities as required.
Project Engineer, Engineering Manager and Production Manager	<ul style="list-style-type: none"> • Ensure staff and contractors are familiar with the requirements of this SEMP. • Responsible for compliance with the administering authority. • Responsible for the development of appropriate work procedures and ensuring that staff are trained in their use.

Role	Responsibility
	<ul style="list-style-type: none"> • Ensure staff are trained to competently conduct tasks required by this SEMP, appropriate licences and other legal requirements. • Ensure instances of breach or potential breach of any legislation or licence conditions are identified, reported and actioned as required by regulation or the Site Access Agreement with Synergy. • Ensure potential environmental hazards are identified and reported. • Ensure ongoing effective communication with staff and contractors.
Project Team, Engineering Team and Operations & Maintenance Team	<ul style="list-style-type: none"> • Every NewGen staff member has a general environmental duty that will be undertaken through appropriate training, work practices and event reporting. • It is the responsibility of every NewGen staff member to report instances of breach or potential breach of any legislation or licence conditions. • Comply with directions and procedures required by this SEMP. • Ensure that contractors and other persons working at NewGen sites undertake works in accordance with this SEMP.
Contractors	<ul style="list-style-type: none"> • Shall comply with this SEMP as if they were NewGen staff members.

4. Monitoring

4.1 Atmospheric Emissions

Sampling and analysis of air pollutants shall be undertaken to determine the emission parameters specified in Table 5. Sampling will be undertaken in the Power Station exhaust stack at a location established in accordance with the requirements of Australian Standard AS4323.1 – 1995 - Stationary source emission method 1 – selection of sampling positions.

Pollutant/parameter	Units of measure	Method	Frequency
Oxides of nitrogen	mg/m ³	USEPA Method 7E (stack testing) or USEPA – PS-16 for continuous monitoring ¹	Post commissioning and continuous
Carbon monoxide	mg/m ³	USEPA Method 10	Post commissioning and annual
Velocity, temperature and volumetric flow rate	m/s, °C, m ³ /s	USEPA Method 2	Post commissioning and annual

¹ The DER (now DWER) has approved the replacement of the NPK hardware CEMS system with a software PEMS system provided that the system is compliant to USEPA PS-16 which the NewGen system is. A quality manual has been developed for this system and can be submitted to the DWER on request

Pollutant/parameter	Units of measure	Method	Frequency
Moisture content	% H ₂ O of stack gas	USEPA Method 4 or USEPA Alt-008	Post commissioning and annual
Dry gas density, molecular weight	kg/m ³ , g/gmol	USEPA Method 3	Post commissioning and annual
Carbon dioxide, oxygen	%, v/v	USEPA Method 3A	Post commissioning and annual
VOCs n-propane equivalent	mg/m ³	USEPA Method 18	Post commissioning and annually

Table 5: Emissions monitoring parameters

4.2 Operational Parameters

NewGen will continuously monitor the Power Station operational parameters in accordance with the manufacturer's operation and maintenance manual.

4.3 Complaints

An online complaint system (MYOSH) has been established to record complaints from the community including those associated with air emissions from the power station. The following information about each complaint shall be recorded if a complaint is received:

- Name of complainant (anonymous if preferred);
- Address/general location of complainant when incident occurred;
- Nature of incident (e.g. odour, dust, fallout);
- Detailed description of incident (e.g. if odour, what did the odour smell like?); and
- Date/time including:
 - When complaint logged;
 - When incident occurred; and
 - If ongoing, frequency and duration of incidents.

The Power Station Operator shall investigate all complaints and, where the power station is likely to be the cause of the incident the Operator shall take actions to ensure that the cause is rectified and implement measures to ensure that there is minimal risk of the incident recurring.

The following information shall be recorded following a complaint:

- Details of the activities undertaken at the time of the incident (e.g. normal operations at X% capacity, shut down, upset);
- Details of the nature of any abnormal activities or operational conditions;
- Results of on-site observations and investigations;
- Results of on-site observations of wind speed, wind direction and cloud cover;
- Details of actions taken on-site, if any required, to alter activities to alleviate or mitigate the effects of the incident;
- Operator's conclusion as to the cause of the incident including:
 - Is the incident likely to be due to on-site activities? and
 - If the incident is likely to be due to on-site activities, detail the specific activities responsible and mitigation measures that will be implemented to reduce the risk of the incident recurring.
- Steps taken to notify complainant of the outcomes.

5. Contingencies

The following mechanisms have been established and will continue to be implemented to identify actual and apparent non-conformance with the SEMP:

Trigger	Action	Response
Lapse in continuous monitoring of NO _x data via PEMS	Alarm to sound in control room with internal notification stating NO _x is not being monitored continuously	Initiate investigation of cause and implement remedial strategies as appropriate prior to non-compliance occurring Report incident and duration of event(s) with explanation of cause and remedial strategies in AER to DWER.
Lapse in continuous monitoring of process parameters to ensure combustion efficiency and power station efficiencies are maintained at optimum levels	Alarm to sound in control room with internal notification stating process parameters are not being monitored continuously	Initiate investigation of cause and implement remedial strategies as appropriate prior to non-compliance occurring (where possible) Report incident and duration of event(s) with explanation of cause and remedial strategies in AER to DWER.
Exceedance of the emission to air limits specified in Table 1 (either via PEMS for NO _x or on a campaign basis in accordance with Table 4).	Alarm to sound in control room with internal notification stating NO _x 1 hour average has been exceeded	Continue to monitor as per requirements of plan Determine cause of exceedance and where necessary initiate investigation of cause and implement remedial strategies as appropriate prior to non-compliance occurring (where possible) Report incident and duration of event(s) with explanation of cause and remedial strategies in AER to DWER.

Table 6: Trigger Action Response Table

6. Stakeholder Consultation

Comments received from stakeholders during the original development have been incorporated into this SEMP. The Kwinana Progress Association and the KABZ Community Group stated that in-line NO_x monitoring should be done, and this has been included in the Power Station design. These comments were published in NewGen Power's Environmental Protection Statement July 2005.

The SEMP is publicly available via the NewGen Power Kwinana website (<http://newgenpowerkwinana.com.au/>). Should the SEMP be revised or amended, the new revision will be uploaded to the website.

NewGen Power will respond directly to all comments received from stakeholders on the SEMP and will report on stakeholder communications in its annual report.

7. Auditing

Annual internal audits and an annual external audit will be conducted as specified in the Operational Environmental Management Plan. These audits will assess compliance with this SEMP.

8. Review and Revision

Review of this SEMP will be undertaken by the Engineering Team on an annual basis and updated where necessary or:

- following a significant environmental incident; or
- when there is a need to improve performance in an area of environmental impact.

9. Reporting

9.1 Annual Report

In accordance with MS698 Condition 5.1, an annual report will be prepared within three months of completion of the first year of operation and annually thereafter, that:

- Summarises compliance with the SEMP conditions;
- Provides details of any incidents of non-compliance with the SEMP conditions;
- Summarises air pollution monitoring data collected as part of this SEMP;
- Summarises complaints; and
- Summarises outcomes of auditing.

The report will be prepared in accordance with the Department of Water and Environmental Regulation's guidelines for performance and compliance reporting. The annual report will be made publicly available.

9.2 Annual Environmental Report

NPK will also prepare an Annual Environmental Report (AER) in accordance with L8271/2008/1 submitted to DWER. The AER will be submitted within 60 calendar days following the end of the annual period in the format and forms specified in Table 4.2.1 of the Licence.

The following information will be provided in the AER:

- Summary of any failure or malfunction of any pollution control equipment or any incidents that have occurred during the year and any action taken;
- Annual Audit Compliance Report;
- Complaints summary;
- Limit and target exceedances;
- Emissions to Air: Volumetric flow rate, carbon dioxide, oxygen, moisture content, nitrogen oxides;
- Emissions to surface water: Residual chlorine and temperature;
- Temperature of cooling water;
- List of quality assurance procedures required to ensure compliance with the licence: and
- Assessment of the information contained within the report against previous monitoring results and Licence limits and/or targets.

9.3 Record Keeping

The following records are to be kept on site and made available to an EPA representative on request:

- Emissions monitoring reports and data;
- All environmental complaints – maintain complaints register;
- External reporting to EPA, including annual reports; and
- Daily checklists.

10. Key Management Actions Table

Ref #	Timing/Phase	Key Management Action	DWER Reporting/Evidence	Status
SEMP1	Post-commissioning	Monitor emissions from the exhaust stack as specified in EMP Section 2.1	Result submitted to DWER in post-commissioning compliance report	
SEMP2	Ongoing	Monitor NOx emissions from the exhaust stack as specified in Section 2.1	Notification letter sent to DWER in the event of an exceedance, summarise performance in annual report, logged data available on request.	
SEMP3	Ongoing	Monitor power plant operational parameters as specified in Section 4.2	Summarise performance in annual report, logged data available on request.	
SEMP4	Ongoing	Monitor and respond to community complaints, record actions as specified in Section 4.3	Summarise performance in annual report, logged data available on request.	
SEMP5	Annual	Monitor carbon monoxide, VOCs and other stack parameters as specified in Section 4.1	Summarise performance in annual report, logged data available on request.	
SEMP6	Annual	Prepare annual compliance report	Analyse monitoring results, submit to DWER with annual report	
SEMP7	Ongoing	Preventative maintenance	Complete maintenance log, logged data available on request	

Table 7: Key management actions

11. References

Reference
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Ramboll (2019). Kwinana NewGen Power Station Air Quality Impact Assessment. Ramboll, Perth WA. SLR (2020). Bypass Diverter Damper System - Air Quality Impact Assessment. SLR Consulting Australia Pty Ltd.
Standards Association of Australia (1995). AS 4323.1-1995: Stationary source emission method 1 – selection of sampling positions. Homebush, NSW.

12. Acronyms

Acronym	Definition
AER	Annual Environmental Report
CC	Combined Cycle
CCGT	Combined Cycle Gas Turbine
CO	Carbon Monoxide
DWER	Department of Water and Environmental Regulation
EPA	Environmental Protection Authority
GGAP	Greenhouse Gas Abatement Programme
GHG	Greenhouse Gas
GLG	Ground Level Concentrations
GT	Gas Turbine
HRSG	Heat Recovery Steam Generator
KIC	Kwinana Industries Council
MS698	Ministerial Statement 698
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxides
PEMS	Predictive Emission Monitoring System

PPMV	Parts per million by volume
SC	Simple Cycle
SEMP	Stack Emissions Management Plan
SO ₂	Sulfur Dioxide
SWIS	South West Interconnected System
VOC	Volatile Organic Compounds