This document has been prepared [redacted]

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Project Echidna

Nitrogen Dioxide Monitoring Plan

[redacted] [redacted]

Site Address:	10 Eastern Creek Drive, Eastern Creek NSW
Report Reference:	24.1069.FR3V1
Date:	6 September 2024
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Quality Control

Report	Reference	Status	Prepared by	Checked by	Authorised by
Project Echidna - Nitrogen Dioxide Monitoring Plan	24.1069.FR3V1	Final	Northstar	GCG, TD,	GCG

Report Status

Northstar References		Report Status	Report Reference	Version
Year	Job Number	(Draft: Final)	(R*x*)	(V*x*)
2024	2069	Final	3	1
Based upon the above, the specific reference for this version of the report is:				24.1069.FR3V1

Final Authority

This report must by regarded as draft until the above study components have been each marked as final, and the document has been signed and dated below. A draft report is a working document, is issued without prejudice and is subject to change.

G. Graham **6 September 2024**

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FIGURES

TABLES

1. INTRODUCTION

[redacted] Northstar Air Quality Pty Ltd (Northstar) to prepare a nitrogen dioxide monitoring plan (NDMP) for Project Echidna (the Project) located at 10 Eastern Creek Drive, Eastern Creek NSW (the Project site)

The requirement for a NDMP is set out in the Conditions of Approval (CoA) for the Project.

1.1. Conditions of Approval

The relevant Condition providing specification for the NDMP is reproduced below, with the corresponding section(s) of this NDMP that addresses each requirement.

Table 1 CoA requirements for NDMP

Requirement	Section(s)
Prior to the commencement of operation of the development, the Applicant must prepare a Nitrogen Dioxide Monitoring Procedure (NDMP) to the satisfaction of the Planning Secretary. The Plan must form part of a OEMP in accordance with condition C5 and must: (a) be prepared by a suitably qualified and experienced person(s);	1.2
(b) identify the contemporary impact assessment criteria for nitrogen dioxide emissions;	2.2
(c) describe the control measures which would be implemented to minimise the duration of each power outage event;	3
(d) outline the monitoring procedure which would be implemented during each power outage event, in accordance with the most recent version of the Approved Methods for the sampling and analysis of air pollutants in NSW (EPA, 2022); and	4
(e) described the management actions which would be taken to address any exceedances of the impact assessment criteria identified in condition (b).	5

1.2. Authority to Prepare the Plan

Northstar (ABN 52 609 741 728) has been commissioned to prepare the NDMP [redacted] Northstar is an independent specialist science consultancy, specialising in air quality, environmental management, and sustainability.

The report has been prepared by Northstar, which has considerable experience in the preparation of air quality management plans for a wide range of activities, and significant experience in the measurement and management of air emissions from generators. This report has been prepared under the direction of Gary Graham (Director, Northstar) who is an experienced and qualified air quality scientist. Gary has 30 years' experience is an air quality scientist, and is a Certified Air Quality Practitioner (CAQP) as awarded by the Clean Air Society of Australia and New Zealand (CASANZ).

2. CRITERIA RELEVANT TO NITROGEN DIOXIDE IN NSW

The following outlines the legislation and air quality criteria which are applicable to nitrogen dioxide (NO_2) emissions at the Project site, and potential impacts in the wider area.

2.1. Protection of the Environment Operations (Clean Air) Regulation

The Protection of the Environment Operations (POEO) (Clean Air) Regulation 2022 (POEO CAR) sets requirements and standards of concentration for emissions to air for industrial activities within NSW.

Clause 73, Part 5, Division 6 of the POEO CAR provides the following in regard to the regulation of emissions from emergency electricity generation:

> *73 Exemption relating to emergency electricity generation*
> *Emergency standby plant is exempt from the air impurities standard for nitrogen dioxide and nitric oxide specified in Schedule 2, Part 2, Division 3 for the plant if –*
> *(a) the plant comprises a stationary reciprocating internal combustion engine for generating electricity, and*
> *(b) it is used for a total of not more than 200 hours per year.*

Schedule 2, Part 3 of the POEO CAR sets out standards of concentration (emission limits) relevant to unscheduled activities (including emergency and standby electricity generators), being solid particles at an emission limit concentration of 100 mg·Nm^{-3} and an opacity limit of 20 %. Although the operations may be exempt from the relevant emission limit regulations (i.e. in-stack emission concentrations) for NO_2, the Proponent would not be exempt from ensuring the emissions do not exceed ambient impact assessment criteria, which are discussed in Section 2.2.

In the event that Project Echidna is a scheduled activity under the POEO Act by virtue of fuel storage capacity is defined by Schedule 1, Part 1, Section 9(2) as:

> *"capacity to store more than 200 tonnes (liquefied gases) or 2,000 tonnes (chemicals in any other form)"*

… then the standards of concentration prescribed under POEO CAR, Schedule 2, Division 3 "General standards of concentration" would be applicable. Those standards of concentration relevant would be:

- solid particles (total) 50 mg·Nm^{-3}
- VOCs (as n-propane) 1 140 mg·Nm^{-3} (VOC) *or* 5 880 mg·Nm^{-3} (CO)
- Smoke 20 % opacity

2.2. NSW Approved Methods

The contemporary NO_2 criteria specified in the Approved Methods (NSW EPA, 2022) are the defining ambient air quality criteria for NSW. The standards adopted to protect members of the community from health impacts in NSW for NO_2 are presented in Table 2.

Table 2 NSW EPA nitrogen dioxide impact assessment criteria

Pollutant	Averaging period	Criterion
		$\mu g \cdot m^{-3}$ (a)
Nitrogen dioxide (NO_2)	1 hour	164
	Annual	31

Notes: (a): micrograms per cubic metre of air

3. NITROGEN DIOXIDE EMISSION CONTROLS

3.1. Controls to Minimise Nitrogen Dioxide Emissions

As outlined within the air quality impact assessment for the Project (Arup, 2022), the following controls have been recommended to minimise emissions of NO_X resulting from the electricity generators:

- Selection of USEPA Tier II generators with low emissions (in particular NO_X) generator equipment;
- Operation of standby generators during testing and maintenance should be minimised as far as possible; and,
- In the event of a loss of mains power, all practical measures should be taken to reduce the duration of the outage to ensure that standby generators operate for the least amount of time possible.

3.2. Controls to Minimise the Duration of a Power Outage Event

The risk of a power outage event occurring at the Project is low. To predict the likelihood of a power outage event, the reliability of the power network was considered against the NSW Transmission Reliability and Performance Standard (2017) and latest information supplied by Endeavour Energy regarding the Distribution Annual Planning Report (DAPR) (Endeavour Energy, 2023).

For Transmission Substations (TS) and Bulk Supply Points (BSPs), reliability is measured in two parts:

- Unserved Energy (USE) The unit of USE is minutes per year.
- Redundancy category – There are three redundancy categories listed in the NSW Transmission Reliability and Performance Standard (NSW Government, 2017) as shown in the extract below:

> ***Level of redundancy*** means:
>
> (i) for category 1 bulk supply points, a supply interruption may occur following the outage of a single system element;
>
> (ii) for category 2 bulk supply points, a non-zero amount of load must be supplied following the outage of a single system element; and
>
> (iii) for category 3 bulk supply points, a non-zero amount of load must be supplied following the outage of a single system element. In addition, for Inner Sydney, a non-zero amount of load must be supplied following the simultaneous outage of a single 330 kV cable and any 132 kV feeder or 330/132 kV transformer.

The Project site is to be supplied with mains power directly from one dedicated substation located towards the southeastern corner of the Proposal site. The substation is fed by 2 no. 132 kV Endeavour Energy radial feeders that are supplied from Transgrid Sydney West 330/132 kV bulk supply point. The infrastructure will then provide N+1 level of security of electrical supply.

In consideration of the NSW Transmission Reliability and Performance Standard (2017), both the existing substations located at the data centre at 10 Eastern Creek Drive, Eastern Creek and the Transgrid Sydney West bulk supply point are considered part of the Western Sydney transmission system, which is constituted by:

(I) Feeder number 217 and 22C;
(II) The 330/132 kV substations at Rookwood Road, Beaconsfield, Haymarket, Sydney North, Sydney South and Sydney West;
(III) Any future associated 132 kV cables and 330/132 kV substations; and
(IV) Any of Endeavour's 132 kV transmission network that links any of the above.

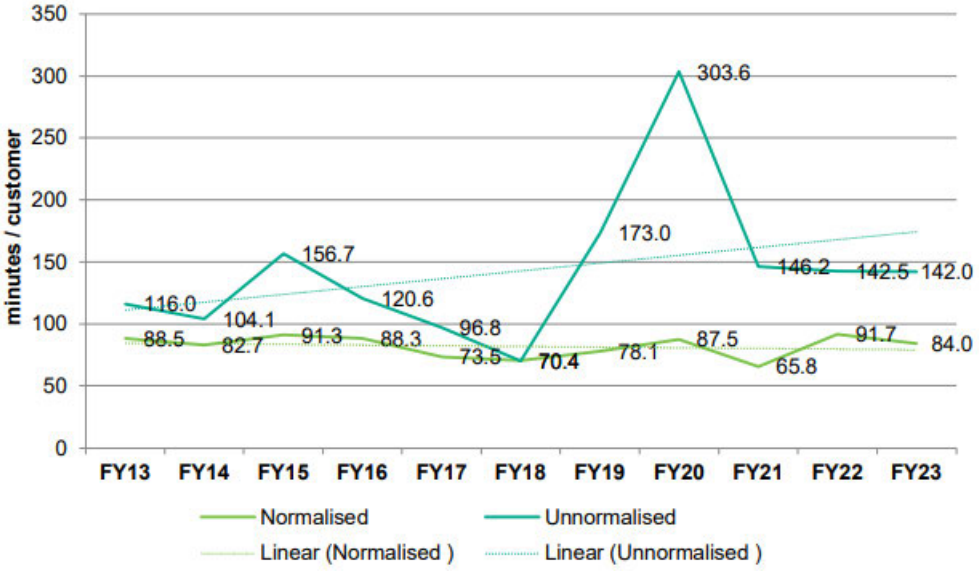
This N+1 redundancy category requirement means that even in the event of a single failure, some level of load will be able to be supplied from the network. However, as the extent of partial power failure is unable to be predicted, a full system failure has been modelled.

Based on the Distribution Annual Planning Report (Endeavour Energy, 2023) the average unplanned outage duration per year per customer from 2013 to 2023 equates to approximately 74.7 minutes, although exact duration of power outages requiring standby generators cannot be determined.

Correspondingly, the likelihood of power interruptions occurring is approximately 0.014 % of the time per year (74.7 / (8 760 × 60)) or have a probability of p=0.00014.

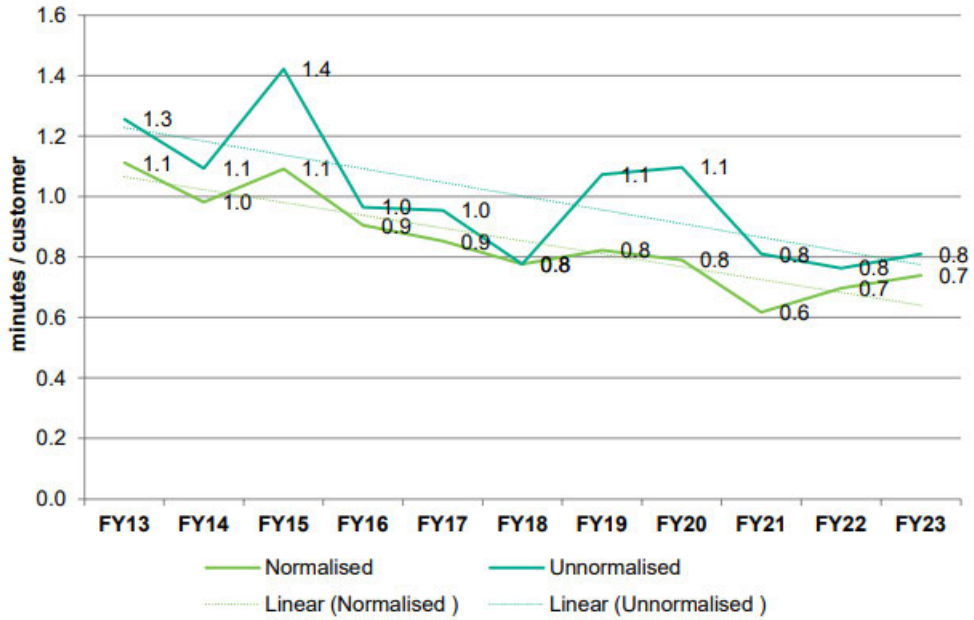
Figure 1 depicts the trends regarding system average interruption duration index (SAIDI, in minutes) and Figure 2 presents the system average interruption frequency index (SAIFI, interruptions per customer) over an eleven financial-year period from 2012/2013 to 2022/2023.

Figure 1 Endeavour Energy SAIDI Performance Information



Source: (Endeavour Energy, 2023)

Figure 2 Endeavour Energy SAIFI Performance Information



Source: (Endeavour Energy, 2023)

4. NITROGEN DIOXIDE MONITORING PROCEDURE

4.1. Identified Constraints

The wording of the Condition relates to controls at source during a power outage event, and also an inferred expectation that monitoring will be performed to confirm that emissions during a power outage event do not give rise to off-site impacts as defined in Table 2 (i.e. the impact assessment criteria).

There are significant identified constraints with monitoring during a power outage event and these are outlined in Appendix A.

4.2. Monitoring Plan and Procedure

In light of the limitations outlined in Appendix A, and the acknowledgement that there is an established SPR linkage that has demonstrated compliance with the impact assessment criteria outlined in Section 2.2 and Table 2, the NDMP provides a procedure that:

- Will be performed in accordance with methods prescribed in the AMSAAP (NSW EPA, 2022b);
- Will be performed in a manner to remove the limitations identified above; and
- Will be used to evaluate the performance of the generators to achieve the air quality impacts benchmarked in the approved AQIA report.

Presented in Table 3 is a summary of the proposed NDMP. The results from the NDMP would be compared with the emissions data as adopted in the AQIA as reproduced in Table 4).

Compliance would be determined through the application of the criteria as outlined in Table 5.

Table 3 Summary of NDMP

Generator	Number	Load	Parameters	Test Method(s)	Frequency
House Generator (MTU 16V2000G76F)	1	• 25 % • 50 % • 75 % • 100 %	Gas flow, velocity, temperature	TM-1, TM-2	• Commissioning
			NO_x	TM-11	• Commissioning
	1	• Cold start to 100 % load	Gas flow, velocity, temperature	TM-1, TM-2	• Commissioning
			NO_x	TM-11	• Commissioning
Critical Generator (MTU 20V4000G94)	1	• 25 % • 50 % • 75 %	Gas flow, velocity, temperature	TM-1, TM-2	• Commissioning • 1 year following commissioning

Generator	Number	Load	Parameters	Test Method(s)	Frequency
		• 100 %			• Every 5 years thereafter
			NO_x	TM-11	• Commissioning • 1 year • Every 5 years
	1	• Cold start to 100 % load	Gas flow, velocity, temperature	TM-1, TM-2	• Commissioning • 1 year following commissioning • Every 5 years thereafter
			NO_x	TM-11	• Commissioning • 1 year following commissioning • Every 5 years thereafter

Table 4 Air emissions data adopted in AQIA

Generator	Parameter	Adopted value at 100 % load[(A)]
House Generator (MTU 16V2000G76F)	NO_x emission rate (100 % rate)	3.666 $g \cdot s^{-1}$
Critical Generator (MTU 20V4000G94)	NO_x emission rate (100 % rate)	6.103 $g \cdot s^{-1}$

Note: As assessed in the AQIA

Table 5 Compliance criteria for NDMP

Parameter	Compliance criterion
NO_2 emission rate	Measured ≤ Table 4

5. COMPLIANCE MANAGEMENT

5.1. Identified Non-Compliance

The results of the emission testing outlined in Table 3 will be provided to the Department within six weeks of the completion of the testing program.

Any identified non-compliance will be immediately reviewed to determine the reasons why the generator(s) was not performing to the design specifications and the identified remedial action report provided to the Department.

5.2. Ongoing Review

The NDMP will be reviewed annually.

APPENDIX A

Identified NDMP Constraints

The performance of an emissions monitoring program during power outage event poses significant logistical and timing challenges.

The Condition references a testing program compliant with the *Approved Methods for the sampling and analysis of air pollutants in NSW* (NSW EPA, 2022b) (AMSAAP), which is identified in table 1 of the guidance as reproduced in Table 6 Relevant emissions monitoring test methods.

Table 6 Relevant emissions monitoring test methods

Test method	Parameter measured	Method	Additional notes
TM-1	Selection of sampling positions	AS 4323.1 or USEPA Method 1	-
TM-2	Velocity or volumetric flow rate or temperature or pressure of stack gases	USEPA Method 2, 2C, 2F, 2G or 2H, or ISO10780	-
TM-11	Nitrogen dioxide (NO_2) or nitric oxide (NO)	USEPA Method 7, 7A, 7B, 7C, 7D, 7E or 320 ISO Method 10396	Where instrumental analysis is used, both NO and NO_x must be directly measured.

To understand the timing and logistical constraints for implementation of the above test methods, a National Association of Testing Authorities (NATA) Accredited testing company has been requested to provide the typical time required to prepare and mobilise for an emission test, and that opinion has been used in the estimates as outlined in Table 7.

Table 7 Emission testing time requirements

Component	Details	Typical Time
Preparation	Equipment preparation, staff availability, and attendance at site	~1-2 weeks
Mobilisation (on site)	Unpacking vehicle, moving the equipment to the testing location, set up, analyser zero and calibration	~2 hours
Flow tests	TM-2 testing	~10-20 mins
NO_x testing	TM-11 testing	1 hour

Based upon the above, the biggest constraint is the availability of appropriately trained and equipped testing personnel to perform the testing. Typical time estimates provided suggest that a lead time of 1-2 weeks might be reasonable.

However, leaving aside the significant preparation time (1-2 weeks) and assuming the equipment and personnel were already on-site and ready to be mobilised at the start of the power outage event (which would

be a 24/7 standby requirement), a lead time of around 2 hours would be required for on-site mobilisation, a further 10-20 minutes to perform the flow testing and an hour to complete the emissions monitoring for NO_X (per generator).

With reference to the statistics presented in Section 3.2, the average consumer annual outage duration 2013 to 2023 was 74.7 minutes. Even if the Project had appropriately trained and available personal and equipment available at the time of the outage, the testing would not be able to be performed on any generator at the Project in any year over the last 13 years.

Given the discussion provided above, it is considered that a requirement to perform air emissions testing in accordance with the AMSAAP would result in non-compliance with the Condition, and therefore this option would not be recommended.

Ambient Monitoring

The performance of an ambient monitoring program during power outage event poses even more significant logistical and timing challenges, as well as site selection issues.

The Condition references a testing program compliant with the AMSAAP (NSW EPA, 2022b), although it is noted that this version of that guidance does not present ambient air quality testing methods. Reference has been made to the *Table of AM-Coded Methods for Ambient Air Monitoring* (NSW EPA, 2021) and *Ambient Air Monitoring Guidance Note* (NSW EPA, 2022c), which are not referenced in the Condition but are reasonably considered to represent the required benchmark.

Table 8 Relevant ambient air quality test methods

Test method	Parameter measured	Method	Method name
AM-1	Guide for the siting of sampling units	AS/NZS 3580.1.1* (previously AS 2922)	Methods for sampling and analysis of ambient air: Guide to siting air monitoring equipment
AM-12	Nitrogen oxides (NO_x)	AS 3580.5.1	Methods for sampling and analysis of ambient air: Determination of oxides of nitrogen – Direct-reading instrumental method

As above, to understand the timing and logistical constraints for implementation of the above test methods, a NATA Accredited testing company has been requested provide input into the monitoring requirements, as outlined in Table 9.

Table 9 Ambient air quality testing time requirements

Component	Details	Typical Time
Preparation	Equipment preparation, staff availability, and attendance at site	~2-4 weeks
Mobilisation (on site)	Unpacking vehicle, moving the equipment to the testing location, set up enclosure, connection to power supply, equipment warm up and calibration	14-15 hours
NO_x monitoring	AM-12	1 hour (minimum to measure a single data point)

Based upon the above, the biggest constraint is the availability of appropriately trained and equipped testing personnel to perform the testing. Typical time estimates provided suggest that a lead time of between 2-4 weeks might be optimistic but achievable.

Site selection to determine an appropriate monitoring location is a significant issue, as this would be highly dependent upon a large number of factors including (but not limited to):

- the number and location of the generators operating;
- the prevailing wind speed and direction;
- time of day (affecting mixing height);
- site access;
- provision of power supply; and/or
- safety and equipment security.

Even in the event that a location could be identified and accessed, and power was available, there still remains the question whether that location is representative of maximum exposure and also highly prone to changing or fluctuating conditions.

Clearly, deploying, setting up, and calibrating an ambient air quality monitoring station is not achievable in the time window generally associated with a power outage event, and therefore it would be more likely that a location would be selected and operational prior to the outage event occurring. As described above, an element of chance then exists as to whether the maximum impacts would be experienced at that monitoring location during the outage event, which is considered to be highly unlikely.

Similarly the installation of a fixed ambient air quality monitoring station would have limited utility given (a) its fixed location and (b) its proximity to the source of emissions when the point of plume grounding is likely to be further away from the data centre.

The chances of measuring that maximum impact could be increased by increasing the number of ambient monitoring stations, although this comes at significant cost and would not be recommended.

Given the discussion provided above it is considered that A requirement to perform ambient air monitoring in accordance with the relevant NSW EPA guidance is highly likely to result in non-compliance with the Condition, and therefore this option would not be recommended.

Established Source-Pathway-Receptor Linkage

The AQIA supporting the DA established the linkage between the source ⇨ pathway ⇨ receptors (SPR linakges) through the dispersion modelling study within the AQIA.

Given that linkage has been established, reviewed and approved it may be utilised in the formation of this NDMP. The critical component of that linkage is at the source, as emissions greater than those assessed would lead to impacts greater than predicted.

This NDMP is therefore based upon that linkage, and confirmation testing of emissions to confirm that emissions are not greater than previously assessed.

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air quality	Northstar specialises in all aspects of air quality, dust, and odour management, covering monitoring, modelling and assessment, due diligence and process specification, licencing and regulatory advice, peer review and expert witness.
environment	Our team has extensive experience in environmental management, covering environmental policy and management plans, licencing, compliance reporting, auditing, data, and spatial analysis.
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