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# STACK SYD01 Data Centre (SSD-82211208)

## Air Quality Impact Assessment

| | |
|---|---|
| Addressee(s): | STACK Infrastructure |
| Site Address: | 78 Lockwood Road, Erskine Park |
| Report Reference: | 25.1138.FR4V1 |
| Date: | 5 June 2026 |
| Status: | Final |

**air quality | environment | sustainability**

## Quality Control

| Report | Reference | Status | Prepared by | Checked by | Authorised by |
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| STACK SYD01 Data Centre (SSD-82211208) – Air Quality Impact Assessment | 25.1138.FR4V1 | Final | Northstar | DA, MD | MD |

## Report Status

| Northstar References | | Report Status | Report Reference | Version |
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| Year | Job Number | (Draft: Final) | (R*x*) | (V*x*) |
| 25 | 1138 | Final | R4 | V1 |
| Based upon the above, the specific reference for this version of the report is: | | | | 25.1138.FR4V1 |

## 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.

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| MDoyle | **Martin Doyle** | **5 June 2026** |

# NON-TECHNICAL SUMMARY

Northstar Air Quality Pty Ltd has been engaged by STACK Infrastructure to perform an air quality impact assessment in support of a State Significant Development Application submitted to the NSW Department of Planning, Housing and Infrastructure for the proposed construction and operation of the STACK SYD01 Data Centre at 78 Lockwood Road, Erskine Park NSW.

This assessment evaluates the potential air quality impacts associated with the construction and operation of the STACK SYD01 Data Centre following NSW Environment Protection Authority guidelines.

The assessment considers operational emissions from two key dispersion modelling scenarios: a justified worst-case scenario involving all emergency standby generators operating at 100 % load during a power supply failure, and a more realistic scenario based on controlled generator testing activities. It evaluates the associated impacts and provides where required, recommendations for management and monitoring measures to ensure compliance with relevant air quality standards and to protect nearby sensitive receptors.

During the construction phase, the potential dust soiling and human health risks are assessed as being manageable through appropriate implementation of the recommended mitigation measures.

Predicted air quality impacts under a justified worst-case scenario, with all generators operating simultaneously at full (100 %) load, have been assessed in the context of the likelihood of such conditions. This includes consideration of the probability of an electrical supply failure based on historical Endeavour Energy SAIDI performance data. The analysis demonstrates that even under a hypothetical exceedance scenario that the combined probability of both a power outage and an air quality exceedance occurring is low.

Predicted cumulative concentrations for a realistic emissions scenario during routine maintenance of the standby generators show that no exceedances are predicted to occur at any surrounding receptors for all assessed pollutants. The predicted cumulative concentrations for all assessed pollutants remain below the relevant criteria under realistic operations, where the standby generators are to be operated under an appropriate testing schedule.

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# 1. INTRODUCTION

This air quality impact assessment (AQIA) has been prepared by Northstar Air Quality Pty Ltd (Northstar) on behalf of STACK Infrastructure (STACK, the Applicant) to accompany a State Significant Development Application (SSDA) for the STACK SYD01 Data Centre development (the Proposal) at 78 Lockwood Road, Erskine Park NSW (the Proposal site).

The AQIA has been performed to support the SSDA to be submitted to NSW Department of Planning, Housing, and Infrastructure (NSW DPHI) and has been performed in accordance with the NSW Environment Protection Authority (NSW EPA) 'Approved Methods for the Modelling and Assessment of Air Pollutants in NSW' (the Approved Methods) (NSW EPA, 2022).

This AQIA identifies and examines potential air quality (including odour) impacts associated with the construction and operation of the Proposal, aligning with the NSW Planning Secretary's Environmental Assessment Requirements (SEARs) and outlines mitigation and monitoring requirements commensurate with those anticipated impacts to ensure that air quality criteria are achieved at surrounding sensitive receivers.

Based on the information available at the time, an AQIA was prepared in October 2025 (ref. 25.1138.FR1V8, dated 25 October 2025) (Northstar, 2025). Following exhibition of the SSDA, the Proposal was subsequently refined in response to ongoing design development and authority submissions which resulted in a further update to the AQIA report (ref. 25.1138.FR2V3, dated 24 March 2026) (Northstar, 2026).

Subsequent to the Response to Submissions process, further commentary was received from NSW EPA regarding the potential for generator operation in excess of 200 hours per year and the justification of the adopted emissions performance assumptions. Accordingly, a secondary revision to the AQIA has been performed, as outlined in Section 1.3 and Section 1.4 respectively.

## 1.1. Purpose of the AQIA

The purpose of this AQIA is to is assess the potential air quality impacts associated with the Proposal and to identify appropriate mitigation measures to ensure that the required environmental outcomes are achieved during both construction and operation.

The specific objectives of this AQIA are to:

- Identify existing air quality conditions and the location, extent and sensitivity of proximate receptors;
- Assess the potential impacts of the Proposal on air quality to support approvals under relevant legislation, policies and guidelines; and,
- Provide recommendations to avoid or, where avoidance is not practicable, minimise impacts on identified air quality values.

To enable assessment of the level of risk associated with the Proposal in relation to air quality, the AQIA has been performed in accordance with, and with due reference to the following legislation, policy and guidelines (in no order):

- *Protection of the Environment Operations Act* 1997 (POEO Act);
- Protection of the Environment Operations (Clean Air) Regulation 2022 (POEO CAR);
- Guidance on the Assessment of Dust from Demolition and Construction (IAQM, 2024); and
- Approved Methods for Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2022).

Appendix A provides a list of abbreviations, nomenclature and units used in this AQIA.

## 1.2. NSW Planning Secretary Environmental Assessment Requirements

This AQIA has been prepared in response to the requirements contained within the NSW Planning SEARs for Data Storage Centres, which were issued for the SSDA (SSD-82211208) on 11 April 2015. Table 1 details the SEARs coverage and indicates where requirements have been addressed within this AQIA.

**Table 1 SEARs Compliance (SSD-82211208)**

| Issue | Description of requirements | Addressed |
|---|---|---|
| Air Quality | Provide an assessment of air quality impacts, prepared in accordance with the relevant NSW Environment Protection Authority (EPA) guidelines. | This AQIA |
| | The assessment must address construction works… | Section 5.1, Section 6 Section 8.1, Appendix B |
| | … and include modelling of emissions and air pollutants from predicted operations (including testing of the back-up power system) … | Section 5.2, Section 7.2, Section 8.2.2 |
| | … and a peak emission and air pollutant scenario … | Section 5.2, Section 7.1 Section 8.2.1 |
| | … and outline the proposed mitigation, management and monitoring measures that would be implemented. | Section 8.2.5, Appendix B |

Section 9 of the Approved Methods outlines the NSW EPA's requirements for the information to be included in an AQIA. Table 2 summarises each requirement relevant to this type of development proposal and outlines where this information can be located in the AQIA.

Table 2 NSW EPA Approved Methods – impact assessment reporting requirements

| Assessment component | Addressed |
|---|---|
| **9.1 Site Plan** | |
| Layout of the site clearly showing all unit operations | Figure 2 |
| All emissions sources clearly identified | Figure 8<br>Figure 9 |
| Plant boundary | Figure 2 |
| Sensitive receptors (e.g. nearest residences) | Figure 5<br>Section 4.2<br>Table 8 |
| Topography | Figure 6<br>Section 5.2.1.3 |
| **9.2 Description of the activities carried out on the site** | |
| A detailed discussion of all unit operations carried out on the site, including all possible operational variability | Section 2.2 |
| A detailed list of all process inputs and outputs | Section 2.2<br>Section 2.3 |
| Plans, process flow diagrams and descriptions that clearly identify and explain all pollution control equipment and techniques for all processes on the premises | Figure 2 - Figure 4<br>Section 2.2 |
| A description of all aspects of the air emission control system, with particular regard to any fugitive emission capture systems (e.g. hooding, ducting), treatment systems (e.g. scrubbers, bag filters) and discharge systems (e.g. stacks) | Section 2.2<br>Section 2.3 |
| The operational parameters of all emission sources, including all operational variability, i.e. location, release type (stack, volume or area) and release parameters (e.g. stack height, stack diameter, exhaust velocity, temperature, emission concentration and rate) | Table 13<br>Section 5.2.3 |
| **9.3 Emissions Inventory** | |
| A detailed discussion of the methodology used to calculate the expected pollutant emission rates for each source | Section 5.2.3 |
| Detailed calculation of pollutant emission rates for each source | Table 13<br>Table 15 |
| Tables showing all release parameters of stack and fugitive sources (e.g. temperature, exit velocity, stack dimensions, and emission concentrations and rates)… | Table 13<br>Table 15 |
| …and all pollutant emission concentrations with a comparison of the emission concentrations against the relevant requirements of the Regulation | Table 14<br>Table 33 |
| **9.4 Meteorological data** | |
| A detailed discussion of the prevailing dispersion meteorology at the proposed site. The report should typically include wind rose diagrams, an analysis of wind speed, wind direction, stability class, ambient temperature and mixing height; and joint frequency distributions of wind speed and wind direction as a function of stability class | Section 4.3,<br>Appendix C |

| Assessment component | Addressed |
| --- | --- |
| Demonstration that the site-representative data adequately describes the expected meteorological patterns at the site under investigation (e.g. wind speed, wind direction, ambient temperature, atmospheric stability class, inversion conditions and katabatic drift) | Appendix C |
| A description of the techniques used to prepare the meteorological data into a format for use in the dispersion modelling | Section 4.3<br>Section 5.2.1.2<br>Appendix C |
| A quality assurance and quality control analysis of the meteorological data used in the dispersion modelling. Provide and discuss any relevant results of this analysis | Appendix C |
| **9.5 Background air quality data** | |
| A detailed discussion of the methodology used to calculate the background concentrations for each pollutant | Section 4.4<br>Appendix D |
| Tables summarising the ambient monitoring data | Table 10<br>Appendix D |
| **9.6 Dispersion modelling** | |
| A detailed discussion and justification of all parameters used in the dispersion modelling and the manner in which topography, building wake effects and other site-specific peculiarities that may affect plume dispersion have been treated | Section 5.2.1 |
| A detailed discussion of the methodology used to account for any atmospheric pollutant formation and chemistry | Section 5.2.7 |
| A detailed discussion of air quality impacts for all relevant pollutants, based on predicted ground-level concentrations at the plant boundary and beyond, and at all sensitive receptors | Section 7.1 - Section 7.3,<br>Section 8.2 |
| Ground-level concentrations, hazard index and risk isopleths (contours) and tables summarising the predicted concentrations of all relevant pollutants at sensitive receptors | Figure 10 - Figure 15<br>Section 7.1 – Section 7.3 |

## 1.3. Changes to the AQIA

Following exhibition of the SSDA, the Proposal was refined in response to authority submissions and ongoing design development. These refinements affected several parameters relevant to the AQIA and resulted in preparation of a revised assessment (Northstar, 2026).

The key updates incorporated into that revised assessment included:

- Updated Proposal description, including revised site layout and building elevations;
- Increase in the total number of standby generators from 170 to 188 including modification of the generator gantry footprint to accommodate the additional units;
- Revision to the proposed maintenance testing regime, including a reduction in total annual testing hours from 198 hours to 136 hours and an increase in the number of generators tested simultaneously from two to four units;

- Increase in associated diesel fuel storage capacity from 3 859 kilolitres (kL) to 4 454.75 kL;
- Inclusion of additional sensitive receptors within the dispersion modelling assessment;
- Consideration of two additional data centre developments within the cumulative impact assessment;
- Updated dispersion modelling to reflect revised operational parameters, including changes to predicted short-term $NO_2$, $PM_{10}$ and $PM_{2.5}$ impacts under Scenario 1 (justified worst case);
- Additional analysis of the likelihood of concurrent power interruption and exceedance of relevant air quality criteria, informed by System Average Interruption Duration Index (SAIDI) data for the period 2013–2014 to 2023–2024, including both normalised and unnormalised datasets;
- Provision of a Best Available Technology (BAT) review in accordance with NSW EPA direction (refer Section 1.4); and
- Minor site layout and landscaping refinements consistent with updated architectural and planning requirements.

These refinements had the potential to alter several parameters previously adopted in the AQIA, including operational equipment configuration, emission source characteristics and building form influences relevant to building wake effects.

Subsequent to the Response to Submissions process, the Applicant has further refined the proposed standby generator technology. The AQIA has been updated to be based on representative generator units compliant with United States Environmental Protection Agency (US EPA) Tier 2 emissions standards, including the Baudouin 16M55G6D2/5 as a nominated example of a compliant engine type.

This revision reflects updated emissions performance assumptions and associated dispersion modelling inputs. The change has been made in response to NSW EPA feedback regarding emissions performance and the justification of the adopted assessment assumptions (refer Section 1.4).

## 1.4. Response to Submissions

As part of the SSDA process, NSW DPHI coordinated responses to issues raised during the public exhibition and submissions process to inform the community and support the consenting authority's assessment of the Proposal. To facilitate this process, NSW DPHI requested preparation of a Submissions Report addressing matters raised by the public, Council and government agencies.

On 27 January 2026, NSW DPHI issued further direction regarding additional matters to be addressed within the Submissions Report. In addition, NSW EPA provided correspondence dated 23 January 2026 outlining recommended information and assessment requirements relevant to the submitted AQIA (Northstar, 2025). These requirements, insofar as they relate to data centre assessments were subsequently considered by NSW DPHI and are summarised in Table 3. The AQIA was updated where relevant to address these matters, with detailed responses to air quality issues incorporated within the Submissions Report.

Subsequent to the Response to Submissions (RtS) process, NSW EPA issued further correspondence titled *EPA Advice on Submissions Report – STACK SYD01 Data Centre (SSD-82211208)* dated 8 May 2026. This correspondence raised matters relating to standby generator operating hours exceeding 200 hours per year and the justification of the adopted emissions performance assumptions. In response, the Applicant has reviewed the proposed standby generator technology, including consideration of generator units compliant with US EPA Tier 2 emissions standards.

The NSW DPHI correspondence titled *STACK SYD01 Data Centre, Erskine Park – Additional Matters for Submissions Report* dated 27 May 2026 reiterated NSW EPA's advice and requested further information addressing matters raised during the assessment period.

Accordingly, the AQIA has been further revised to reflect updated generator technology, emissions performance assumptions and associated assessment inputs where relevant. All relevant air quality responses to submissions and agency advice received to date are summarised in Table 3 and presented in chronological order in accordance with the assessment process.

Table 3 Response to submissions commentary (SSD-82211208)

| Commentary | Clarification / response |
|---|---|
| **NSW DPHI – 78 Lockwood Road Data Centre – Additional Matters for Submissions Report – 27 January 2026** | |
| The Department notes that the Air Quality Impact Assessment (AQIA) in Appendix J of the EIS has modelled the pollutant emissions of generators during maintenance testing (Scenario 2) at 100 % load, however the generator testing regime in the EIS identifies the generator testing would be undertaken with a 70 % load.<br>The AQIA should be updated to provide additional justification to demonstrate the modelling undertaken is a conservative representation of the development's realistic operations. | The original AQIA (Appendix L of the EIS, (Northstar, 2025)) considered a Baudouin 16M55G3750/5 standby generator, with the dispersion modelling conducted for a maintenance testing scenario at 100 % load to inform *'predicted operations (including testing of the back-up power system)'* as per the issued SEARs for the Project. This approach was applied due to emissions data for the Baudouin unit (refer Appendix E of the original AQIA) being available at an assumed 100 % load (i.e. maximum continuous rating). The dispersion modelling was therefore carried out using the referenced emission rates and associated stack parameters from the engine datasheet. It is understood that exhaust volumetric flow rate, exit velocity and exhaust temperature parameters are load dependent however the corresponding emissions and stack data were not available for a 70 % load condition. Further detail on the approach was included in the revised AQIA. |
| **NSW EPA Advice on EIS - STACK SYD01 Data Centre - SSD-82211208 – 23 January 2026** | |
| **1. Potential for over 200 hours of generator operations** | |
| The AQIA states that the generators will be tested for 198 hours, however, it is unclear although unlikely, that this has included warm-up/cool-down periods. 198 allows for very little buffer for non-routine operation (including but not limited to emergency power use). The AQIA refers to network reliability statistics (Figure 16) that there has been an average of 82 minutes power outages in the last 10 years. However, that is the normalised data which excludes planned interruptions and Major Event Days (e.g. storms) (Ausgrid 2025 report).<br>Figure 16 shows that unnormalised power outages averaged 142.9 minutes (2.4 hours) over 10 years with a yearly maximum of 303.6 minutes (5+ hours). As the emergency generators will be required regardless of the cause of loss of power, the calculation of hours should include an adequate conservative buffer, otherwise demonstration on | The original AQIA (Northstar, 2025) adopted an annual generator testing duration of approximately 198 hours. The Applicant has since amended the proposed testing regime (refer Table 4), reducing routine testing to approximately 136 hours per year, inclusive of start-up and cool-down periods. This revised testing duration remains well within the 200 hour annual threshold for exemption from nitrogen dioxide ($NO_2$) concentration standards under Clause 73 of the POEO (Clean Air) Regulation 2022 (Schedule 2, Part 2, Division 3).<br>In relation to network reliability, the original AQIA referenced Endeavour Energy normalised average outage duration of 82 minutes per year, which excludes planned interruptions and Major Event Days. Updated SAIDI statistics were released in the 2025 Distribution Annual |

| Commentary | Clarification / response |
|---|---|
| how the applicant intends to achieve the POEO Clean Air Regulation limit for $NO_2$ for the generators must be provided.<br><br>The EPA recommends that DPHI requests from the Applicant further information and clarity on the use of the diesel generators including:<br><br>a) That testing is occurring in accordance with manufacturer specifications,<br>b) That the hours of operations are calculated based on all minutes where generators are on (i.e. ensuing that warm-up/cool-down periods are included in the calculation),<br>c) That an adequately conservative buffer is included for non-routine generator use.<br>d) If the proposed generator use exceeds 200 hours, the EPA recommends that DPHI request the applicant provide details of how the POEO Clean Air Regulation $NO_2$ limit will be achieved. | Planning Report (December 2025). For completeness, the following statistics over the past 11 financial years are noted:<br><br>• Normalised average: 81.9 minutes.<br>• Unnormalised average: 143.4 minutes.<br>• Maximum annual outage (unnormalised): 303.6 minutes.<br><br>Historical outages, including the maximum recorded year (approx. five (5) hours), are short in absolute terms. The revised AQIA considers these outage statistics in Section 8.2.1 to contextualise the likelihood of both a power supply interruption and any potential air quality impacts.<br><br>In response to NSW EPA recommendations:<br><br>a) All commissioning and routine load testing of the standby generators will be carried out in accordance with the relevant manufacturer specifications and maintenance requirements for the selected generator model, ensuring reliable operation in the event of a utility failure.<br><br>b) Annual generator operating hours (refer Table 4) include all periods during which a generator is operating. The generators are maintained in a 'service-ready' state and do not require a warm-up period, with individual start-up times of less than 20 seconds. Applicable cool-down periods are included in total operating hour calculations for compliance purposes<br><br>c) The revised routine testing regime of 136 hours per year is well within the 200 hour annual threshold for exemption from $NO_2$ in stack emission concentration standards under the POEO (Clean Air) Regulation 2022 (Schedule 2, Part 2, Division 3). Historical Endeavour Energy outage data (normalised, unnormalised, and maximum values) have been considered in the revised AQIA to provide context for potential emergency generator operation. |

| Commentary | Clarification / response |
|---|---|
| | d) Based on the revised 136-hour testing regime and inclusion of all generator 'on' time, total generator operation is expected to remain within the 200 hour annual threshold for exemption from $NO_2$ in-stack emissions concentration standards under the POEO (Clean Air) Regulation 2022. |
| **2. Justification of emission performance** | |
| Table 12 of the AQIA states that the engine performance is 15.2 g/kWh for $NO_x$ giving an emission rate of 13.9 g/s. This emission performance does not meet any emission performance level as it is below Tier 1 generator emission performance requirements of 9.2 g/kWh. The emergency scenario impacts are predicted to be over 1200% (Table 19) of the 1-hour $NO_2$ criterion. While EPA understands that the emergency scenarios for data centres of this scale all exceed the 1-hour $NO_2$ criterion and have a low probability of occurring, the use of exceedingly poor engine performance results in excessive and unnecessary adverse impacts on surrounding receptors.<br>The EPA recommends that DPHI requests the applicant to evaluate the generator emission performance against Best Available Technology (UK Emergency Generator BAT) and justify where best emission performance generators are not selected. | The nominated generator for the original AQIA (Baudouin 16M55G3750/5) exhibits a $NO_X$ emissions performance concentration of 15.2 $g{\cdot}kWh^{-1}$ (refer Appendix E) which is above the US EPA Tier 1 reference emissions standard of 9.2 $g{\cdot}kWh^{-1,}$ the US EPA Tier 2 reference emission standard of 6.4 $g{\cdot}kWh^{-1}$ and is higher than the more stringent EU Stage V and US EPA Tier 4 emissions standard of 0.67 $g{\cdot}kWh^{-1}$.<br>Emergency operation of the generators is expected to be infrequent and of short duration. Together with routine annual testing (approximately 136 hours), total generator operation is expected to remain below 200 hours per year, which is the threshold under Clause 73 of the POEO (Clean Air) Regulation 2022 (Schedule 2, Part 2, Division 3) for exemption from the nitrogen dioxide ($NO_2$) and nitric oxide (NO) concentration standards. The Baudouin 16M55G3750/5 generator unit does not meet certain international low-NOx benchmark emission values; however, it was selected to ensure operational reliability and suitability for emergency power supply at the Proposal site. Installation of additional low-$NO_X$ abatement technology, such as Selective Catalytic Reduction (SCR) has not been incorporated due to technical and operational constraints associated with intermittent emergency operation. Notwithstanding this the design of the Proposal should not preclude future retrofitting of air pollution control equipment if deemed necessary.<br>The AQIA included a Best Available Technology (BAT) review in Appendix G which evaluated the Baudouin 16M55G3750/5 generator against relevant EU Stage and US EPA Tier emission standards and UK Environment Agency BAT benchmark values and therefore providing a documented and comparative basis for that selected configuration. |

| Commentary | Clarification / response |
|---|---|
| **NSW EPA Advice on Submissions Report – STACK SYD01 Data Centre – SSD-82211208 – 8 May 2026** | |
| **Potential for over 200 hours of generator operations** | |
| The EPA recommended the applicant provide details and clarity on the use of the diesel generators including:<br>a) That testing is occurring in accordance with manufacturer specifications,<br>b) That the hours of operations are calculated based on all minutes where generators are on (i.e. ensuring that warm-up/cool-down periods are included in the calculation),<br>c) That an adequately conservative buffer is included for non-routine generator use.<br>The EPA recommended that if the proposed generator use exceeds 200 hours, the applicant must provide details of how the POEO Clean Air Regulation $NO_2$ limit will be achieved. The applicant's response: *"The revised AQIA has revised the testing scenario to include 4 generators tested at once resulting in a total of 136 hours for testing"*. The revised AQIA has provided a table that outlines the specific testing scenarios (e.g. run test, off-load run, load banking). The revised AQIA states that "*where power outages result in the generators running, this would be factored into the annual testing requirements and planned maintenance would be deferred to the following year in lieu of hours already run under load".*<br>The EPA has become aware of additional uses of back-up generators at data centres including for voltage disturbances, IT maintenance, substation maintenance, load shedding and grid firming. The EPA considers that any foreseen use of the diesel generators must be considered in both the accounting of the 200 hours and the modelling of impacts. Where the diesel generators may be used for load shedding and grid firming purposes, the number and load of generators must be clearly described and the modelled impacts must meet the impact assessment criteria in the Approved Methods, including for 1-hour $NO_2$ for all hours of the year. | The matters raised by NSW EPA have been addressed within the revised Air Quality Impact Assessment (AQIA) (Ref: 25.1138.FR4V1). In particular, Table 4 of the revised AQIA provides a detailed breakdown of generator operating scenarios, including routine testing activities, total runtime per generator and cumulative annual runtime. The assessment incorporates warm-up and shut-down periods within the reported operating hours and has been developed having regard to the manufacturers' testing and maintenance requirements.<br>The revised AQIA assesses both routine testing and emergency operation associated with a loss of external power supply. Annual generator runtime assumptions were previously reported as 198 hours in the original AQIA (Ref: 25.1138.FR1V8) and have subsequently been revised in response to NSW EPA feedback. The adopted testing regime now results in approximately 136 hours of annual testing and includes an appropriate allowance for non-routine generator operation associated with unplanned power outages and grid disturbances.<br>The AQIA has therefore been performed on the basis of the operational scenarios described in Section 5.2.2 and reflects the reasonably foreseeable use of the standby generation system.<br>In relation to potential future use of generators for grid support purposes, the Applicant acknowledges NSW EPA's comments. However, discussions with Transgrid to date have focused on the facility's ride-through capability and network resilience arrangements and do not contemplate the routine use of standby generators for load shedding, grid firming or similar grid support functions. Furthermore, the facility has been designed to achieve concurrent maintainability without reliance on standby generation during normal operations, including planned maintenance activities and substation maintenance events. |

| Commentary | Clarification / response |
| --- | --- |
| | Accordingly, the Applicant confirms that less than 200 hours of generator operation per annum is anticipated and that the AQIA has assessed the relevant and reasonably foreseeable operating scenarios associated with the development. |
| Further, the revised AQIA states: *"The generators are maintained in a 'service-ready' state and do not require a warm-up period, with individual start-up times of less than 20 seconds".* The EPA considers any state where the generators are on and producing emissions is considered operating for the purposes of calculating 200 hours under the Clean Air Regulation clause 73. As such, the applicant must provide demonstration that the proposed generators will not be operating (i.e. in any manor) for less than 200 hours a year.<br><br>The EPA has calculated that the proposed volume of diesel (4 454 kL) for the data centre would be able to supply the facility for 31.4 hours for all 188 generators operating at 100 % load. If the applicant expects they will need more than 30 hours of fuel supply for emergency use, then this is the number of hours that needs to be accounted for in determining the total number of hours the generators will operate. | The AQIA has been updated to assess generator operation on the basis of the annual operating hour framework defined in Table 4 of the updated AQIA, which underpins the assessment of routine testing operations and annual average air quality impacts. For the avoidance of doubt, the operating hours adopted within the AQIA include warm-up and shut-down periods.<br><br>The reference within the AQIA to generators being maintained in a "service-ready" condition relates to the standby status of the equipment, including charged starter batteries, available control systems and fuel systems maintained in readiness for operation. The generators are not operating and do not produce emissions while in this service-ready state.<br><br>In relation to fuel storage, the quoted diesel storage volume of 4 454 kL was provided for the purposes of regulatory classification under Schedule 1 of the *Protection of the Environment Operations Act* 1997 and was not used to derive annual generator operating hours, emissions estimates or air quality modelling inputs. Fuel storage capacity and annual operating hours are separate considerations.<br><br>The diesel storage volume has been determined to satisfy customer contractual requirements relating to fuel resilience and continuity of operations, including the provision of approximately 24 hours of fuel storage capacity. It is not indicative of expected annual generator runtime and should not be used as a proxy for estimating operational hours.<br><br>Accordingly, the AQIA has been updated using the operational assumptions outlined in Table 4 and does not require further revision on the basis of fuel storage capacity. Less than 200 hours of generator operation per annum is anticipated, including routine testing, emergency operation and allowances for non-routine use. |

| Commentary | Clarification / response |
|---|---|
| The EPA recommends that DPHI requests that the Applicant:<br>a) provides an updated accounting of diesel generator operating hours (accounting for any circumstance where the generators are on including voltage disturbances, IT maintenance, substation maintenance, load shedding and grid firming).<br>b) for each specific use of generator operation (e.g. Routine testing, IT maintenance, substation maintenance, grid firming, load shedding, power failure), the applicant must provide details on the number of generators that will be required.<br>c) for any foreseen use of generators, the applicant must model the ground level concentrations to transparently represent the proposals potential impacts. | The AQIA has been updated on the basis of the defined generator operating scenarios set out in Section 5.2.2, comprising routine testing and emergency operation during loss of external power supply. These scenarios define both the number of generators operating and the associated runtime assumptions applied within the emissions inventory and subsequent dispersion modelling.<br>The AQIA does not include additional operational modes such as voltage support, IT maintenance, substation maintenance, load shedding or grid firming, as these do not form part of the currently proposed operational regime for the facility. The Applicant has advised that the data centre is designed to achieve concurrent maintainability without reliance on standby generators during normal operations or planned maintenance activities.<br>Accordingly, the operating hour assumptions, generator numbers and air quality modelling presented within the AQIA are based on the reasonably foreseeable operating scenarios proposed as part of the development. As the additional operational modes referenced by NSW EPA do not form part of the proposed development or defined standby generator operating regime, further assessment of these scenarios is not considered necessary. |
| **Justification of emission performance** | |
| The EPA recommended the applicant evaluate the generator emission performance against Best Available Technology (UK Emergency Generator BAT) and justify where best emission performance generators are not selected. Applicant Response: "The revised AQIA acknowledges that the selected generators (Baudouin 16M55G3750/5) exceed all performance standards for $NO_x$". The revised AQIA includes a review of Best Available Technologies (section 8.2.6 and Appendix G). The revised AQIA contradicts itself by stating that the emission performance is below Tier 1 then later claiming it meets Tier 2. The generator emission specifications (provided as Appendix E) identifies that the generators do not meet any emission standard. Appendix G identifies that in comparison to UK BAT for emergency generators $NO_2$ concentration | The AQIA has been updated to reflect the selection of the Baudouin 16M55G6D2/5 generator. This generator is compliant with US EPA Tier 2 emissions standards, as documented in Appendix E of the updated AQIA.<br>The selected generator achieves a $NO_x$ emission rate of 5.34 $g{\cdot}kWh^{-1}$, which is below the applicable US EPA Tier 2 limit of 6.4 $g{\cdot}kWh^{-1}$. The updated generator specification demonstrates that an emissions-certified generator with improved emissions performance has been adopted for the development.<br>Additional information regarding generator emissions standards, alternative technologies and comparative performance assessments is provided in Appendix G of the updated AQIA.<br>The AQIA has been revised on the basis of a Tier 2 compliant generator and incorporates |

| Commentary | Clarification / response |
|---|---|
| of 2 000 mg/m$^3$ (5% $O_2$), the proposed generators for this data centre have a $NO_2$ concentration of 3 813.5 mg/m$^3$ (5% $O_2$). The revised AQIA justification that the generators selected to ensure operational reliability and suitability for emergency power supply is not adequate considering many other data centres identify back-up generators that are capable of meeting Tier 1 and even Tier 2 emission standards. The revised AQIA includes a chapter on mitigation (section 8.2.5) which includes *"liaison with suppliers should continue to investigate best-practice operation and technology improvements"*. Better emission performance generators are already available. Tier 1 was phased in from 1996 and Tier 2 from 2001 (as identified in Appendix G of the revised AQIA). Other data centres are already adopting Tier 1 and Tier 2 engines, which indicates it is reasonable and feasible to install better emission performance generators to minimise emissions and impacts.<br><br>Although the Applicant claims that the generators will only operate for less than 200 hours and that therefore the usage is low. The emergency scenario predicts up to 1 043 exceedances of the hourly $NO_2$ criteria at the worst affected receptor and up to 1 716 % of the 1-hour $NO_2$ criteria (NSW EPA's and NEPM's). The emergency scenario also predicts 68 exceedances of the $PM_{2.5}$ 24-hour criteria at the worst affected receptor. The revised AQIA states that the probability of these impacts occurring is low, but as the occurrence of power outages (per Figure 16) happens every year for at least 1 hour, the probability of exceedances of the 1-hour $NO_2$ criteria is more than 11 % and 18 % for $PM_{2.5}$ for the most impacted receptors (Table 32). This is not an insignificant occurrence and risk. | the associated emissions characteristics within the assessment of potential air quality impacts. |

| Commentary | Clarification / response |
|---|---|
| As this data centre will require a licence, EPA is required to consider the pollution likely to be caused, the likely impact of that pollution and the practical measures that could be taken to prevent, control, abate or mitigate that pollution (section 45 of the Protection of the Environment Operations Act 1997). The EPA considers that the practical measures include the selection of diesel generators that meet Tier 2 $NO_x$ emission performance. While this will not result in compliance with criteria during an emergency scenario, it has the potential to reduce $NO_2$ impacts by half to a third of currently predicted. | The AQIA has been updated to be based on representative standby generator technology compliant with US EPA Tier 2 emissions standards. The Baudouin 16M55G6D2/5 has been included as a nominated representative unit for the purposes of emissions estimation and dispersion modelling and reflects the improved emissions performance sought by NSW EPA.<br><br>The updated AQIA has therefore been prepared on the basis of a Tier 2 compliant generator and incorporates the associated emissions characteristics within the assessment of potential air quality impacts. The Applicant acknowledges that the selection of standby generator equipment requires consideration of a range of engineering and operational requirements associated with critical emergency power systems, including reliability, redundancy, transient response, integration with electrical infrastructure, maintenance requirements and supplier availability. The nominated Tier 2 compliant generator has been identified as an appropriate representative unit that satisfies both emissions performance objectives and the operational requirements of the facility. |
| The EPA recommends that DPHI requests that the Applicant:<br><br>a) must consider the installation of Tier 2 generators to ensure emissions and impacts are minimised.<br>b) must provide details of the entire power supply system, including information on the UPS system capabilities to minimise diesel generator use. | The AQIA has been updated to be based on representative standby generator technology compliant with US EPA Tier 2 emissions standards. The Baudouin 16M55G6D2/5 has been included as a nominated representative unit used to inform the updated emissions inventory and dispersion modelling assessment. Accordingly, the assessment has been undertaken on the basis of Tier 2 compliant generator technology.<br><br>The Proposal also incorporates UPS systems and a multi-redundant electrical supply arrangement as part of the overall power infrastructure design. These systems are intended to maintain continuity of supply and minimise reliance on standby diesel generation during transient power disturbances and short-duration network events. The detailed configuration and performance characteristics of the electrical and UPS systems are matters of detailed design. However, these systems form part of the facility's resilience strategy and support the minimisation of standby generator operation. |

| Commentary | Clarification / response |
|---|---|
| | The AQIA has been performed on the basis of the defined generator operating scenarios and associated emissions assumptions adopted for the development. |
| **NSW DPHI STACK SYD01 Data Centre, Erskine Park – Additional Matters for Submissions Report On Amendment Letter - 27 May 2026** | |
| **Generator Operations** | |
| 2. The Department notes that the EIS and supporting technical assessments only consider the scheduled generator maintenance testing under standard operating scenarios in which the back-up diesel generators would be operated. The Department understands there may be additional scenarios in which the generators would be operational including, but not limited to planned and unplanned maintenance, and system level testing. The operation of the back-up power system has implications for the modelling of supporting technical assessments including air quality, operational noise and direct greenhouse gas emissions. Therefore, the Department requests that all relevant technical assessments be updated to consider all operational scenarios of the back-up power system, to ensure likely impacts are accurately characterised and appropriately mitigated.<br>This should include, but not be limited to:<br>- planned and unplanned maintenance events / repair events described at 11 above, and - system level testing. | The AQIA has been prepared on the basis of the standby generator operating scenarios identified by the Applicant, comprising routine generator testing and emergency operation during loss of external power supply (blackout).<br>The Applicant has advised that the facility is designed for concurrent maintainability without reliance on standby generators under normal operating conditions. Accordingly, activities such as IT maintenance, substation maintenance, voltage support, load shedding, grid firming and similar functions do not form part of the assessed operating scenarios. The AQIA does not include separate scenarios associated with planned or unplanned maintenance, repair activities, or electrical system testing as these do not constitute standalone operating modes in which the standby generators are proposed to operate.<br>The revised AQIA adopts 136 operating hours per annum, including a contingency allowance for non-routine generator operation during power outage events, consistent with NSW EPA advice.<br>The Applicant has further advised that the standby generators are not proposed to operate for grid support or other network services. Discussions with Transgrid have focused on facility ride-through capability rather than reliance on standby generation in response to grid instability.<br>Accordingly, the AQIA assesses routine testing and emergency operation during blackout events. No additional standby generator operating scenarios have been identified that would warrant further revision of the AQIA. |

| Commentary | Clarification / response |
|---|---|
| **Air Quality** | |
| 8. The Department notes the proposed generator emissions performance is identified as being below Tier 1 performance standards. The Department agrees with the recommendations of the NSW Environment Protection Authority (EPA) dated 8 May 2026 and considers that all practical measures to reduce potential pollution emissions should be undertaken including, but not limited to, the installation of Tier 2 emissions performance generators or better. In particular, the Department notes that significant exceedances of the $NO_2$ criteria are predicted at sensitive receiver locations during an emergency scenario event and all feasible and reasonable measures to reduce and mitigate potential impacts should be thoroughly investigated and implemented accordingly. | The AQIA has been prepared on the basis of representative standby generator technology compliant with US EPA Tier 2 emissions standards. The Baudouin 16M55G6D2/5 has been included as a nominated example of a representative unit used to inform the updated emissions inventory and dispersion modelling assessment.<br><br>In response to NSW EPA feedback regarding emissions performance, the Applicant has advised that generator selection has been reviewed and that units compliant with US EPA Tier 2 emissions standards are being considered as part of the procurement and design refinement process. |
| 9. As per Item 2 above, the Air Quality Impact Assessment (AQIA) in Appendix L should be updated to consider all operational scenarios of the back-up diesel generator power system. | The AQIA has been prepared on the basis of the standby diesel generator operating scenarios defined by the Applicant, comprising routine generator testing and emergency operation during loss of external power supply (blackout).<br><br>These represent the only scenarios in which the standby generators are proposed to operate. Operational modes such as maintenance (planned and unplanned) of electrical infrastructure, repair activities, system-level testing, grid support and other network services do not constitute additional standby generator operating scenarios.<br><br>Accordingly, the AQIA already considers all defined operational scenarios of the back-up diesel generator system. No additional operational scenarios have been identified by the Applicant that would require revision of the AQIA. |

# 2. THE PROPOSAL

The following provides a description of the context, location and scale of the Proposal and a description of the processes and development activities on site. It also identifies the potential for emissions to air associated with the Proposal.

## 2.1. Environmental Setting

The Proposal site is located in the Penrith Local Government Area (LGA) and is approximately 40 kilometres (km) west of the Sydney Central Business District (CBD), 20 km west of the Parramatta CBD, and 10 km north-east of the future Western Sydney International (WSI) Airport.

The Proposal site is legally described as Lot 101 of Deposited Plan (DP) 1268632 and comprises an area of 77 241.97 $m^2$ or approximately 7.7 hectares (ha).

The Proposal site is irregular in shape and is accessed via a cul-de-sac at the eastern end of Lockwood Road, along its southern boundary. The Proposal site is part of the 'Fitzpatrick Industrial Estate', a 140 ha industrial precinct located along Lenore Drive, within the Western Sydney Employment Area (WSEA). The estate is bounded by Ropes Creek to the east, the Erskine Park residential area to the north, and the Sydney Catchment Authority pipeline to the south.

The Proposal site is surrounded by a variety of industrial land use activities and significant transport and utilities infrastructure. Immediate surrounding development includes:

- North: Bounded by Lenore Drive, directly opposite the AutoNexus facility, a provider of automotive logistics services and supply chain solutions. Beyond this lies the Erskine Park residential area.
- East: Adjoined by Ropes Creek. An artificial wetland has been established within this land to manage stormwater runoff from the industrial estate.
- South: The Sydney Catchment Authority pipeline is located approximately 540 metres (m) to the south.
- West: Adjoining industrial lands including warehouse and logistics operations, forming part of the broader Fitzpatrick Industrial Estate.

The Proposal site is currently vacant, contains no built structures and is generally flat. A drainage channel is present along the northern boundary.

A map showing the location of the Proposal site is provided in Figure 1. A full description of the sensitivity and uses of the surrounding land, and the identification of discrete receptor locations used in the AQIA, is provided in Section 4.2.

Figure 1 Proposal site location


**Source:** Northstar

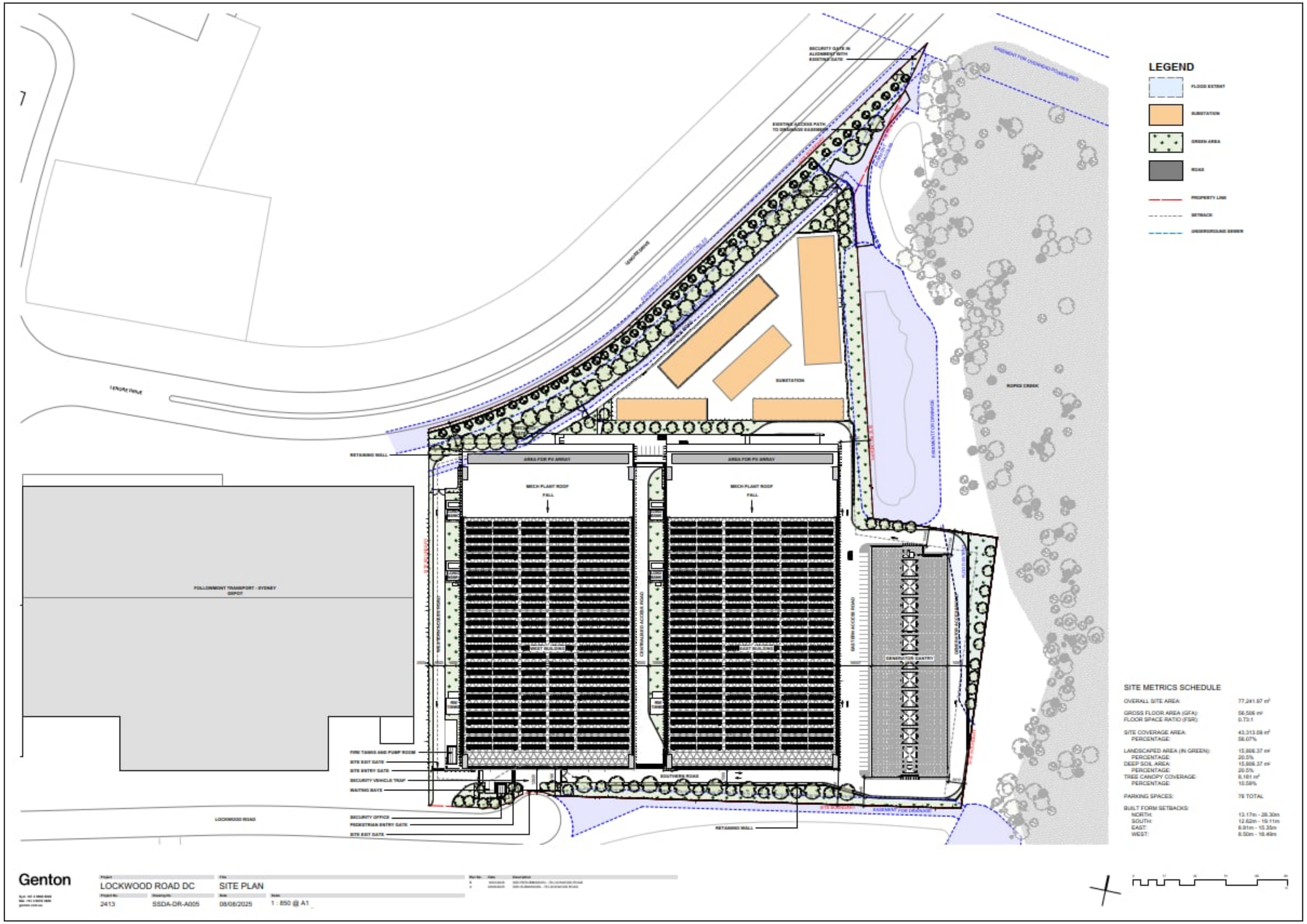
## 2.2. Proposal Overview

The Proposal comprises the construction of a data centre development including the following key components:

- Site preparation and bulk earthworks;
- Temporary construction access from Lenore Drive;
- Construction of a three (3) storey data centre comprising two (2) buildings with a maximum height of 26.5 m and a total gross floor area (GFA) of approximately 56 506 $m^2$, including technical data halls, office and administrative areas and ancillary circulation space;
- At-grade under-croft car parking (34 spaces) within the building footprint plus an additional 44 on-site spaces, providing a total of 78 parking spaces;
- Separate generator gantry accommodating 188 standby generators;
- Landscaping and associated public domain works;
- Extension and augmentation of physical infrastructure and utilities as required, including an on-site substation and water storage tanks integrated within the building footprints; and
- Off-site works comprising the installation of two (2) 330 kV transmission lines from the TransGrid Sydney West Substation to the Proposal site, utilising the existing road reserve along Lenore Drive (reported under separate cover).

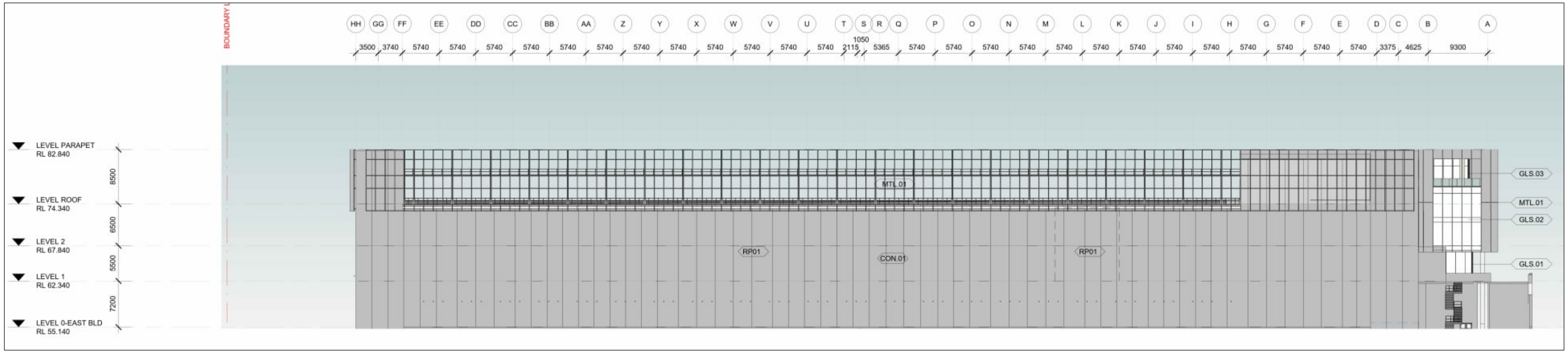
Figure 2 to Figure 4 illustrate the Proposal site layout, indicating the size, massing and height of the buildings, along with the locations of standby diesel generators.

Figure 2 Proposal site layout

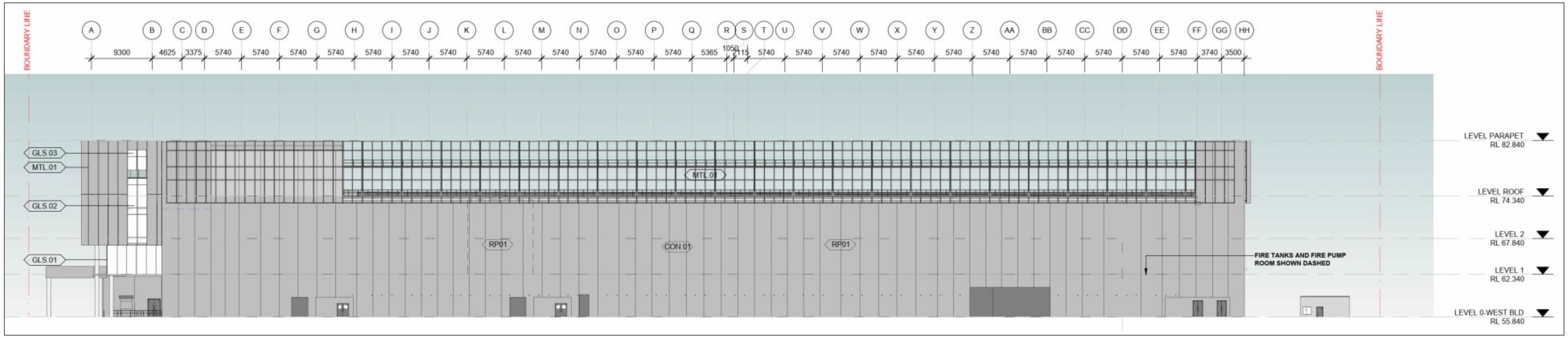



**Source:** Genton – Lockwood Road DC – 2413 – SSDA-DR-A005 – SITE PLAN

Figure 3 Proposal site layout – main buildings - elevations

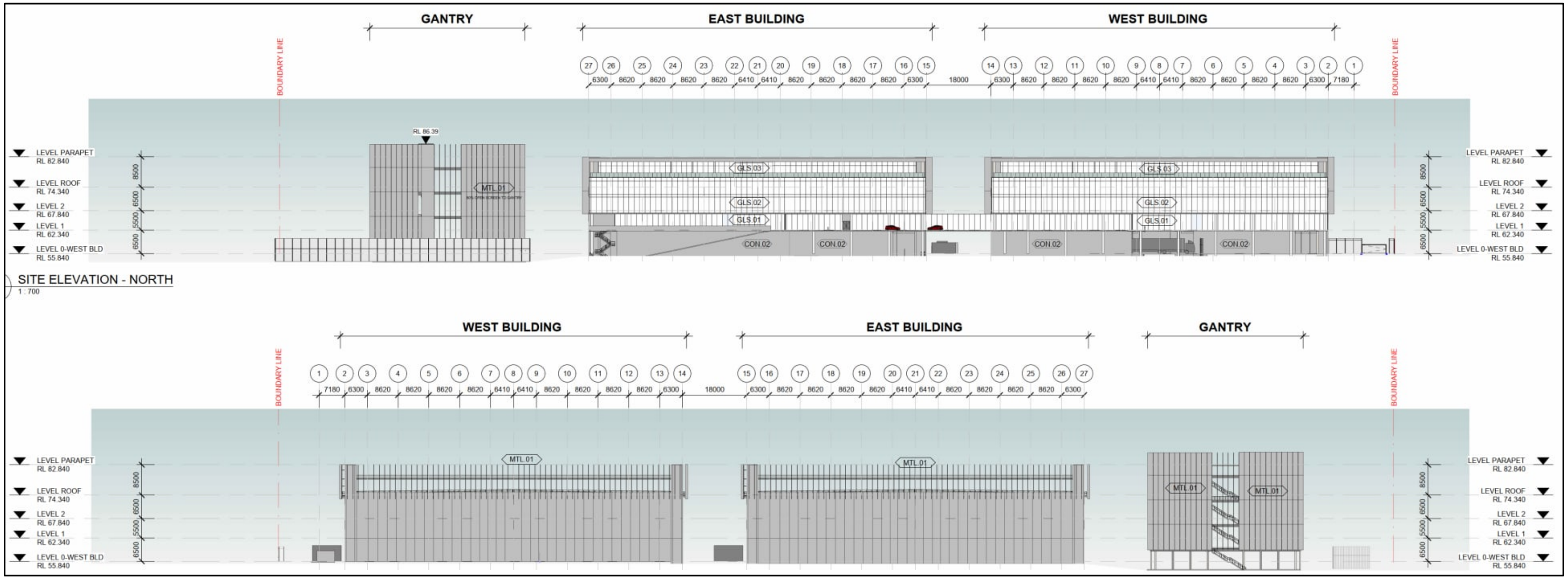


**Source:** Genton – Lockwood Road DC – 2413 – SSDA-DR-A301 – ELEVATIONS – EAST BUILDING – SHEET 1



**Source:** Genton – Lockwood Road DC – 2413 – SSDA-DR-A303 – ELEVATIONS – WEST BUILDING – SHEET 1

Figure 4 Proposal site layout – generator gantry – elevations




**Source:** Genton – Lockwood Road DC – 2413 – SSDA-DR-A300 – ELEVATIONS – SITE

## 2.3. Identification of Emissions to Atmosphere

The Proposal is likely to generate air emissions, as outlined below.

### 2.3.1. Construction Phase

The Proposal includes new buildings for data halls, a loading dock, unpacking areas, offices, staff amenities, plant and storage rooms, switch and battery rooms, and generator gantry platforms. It also involves site preparation, earthworks, parking, infrastructure, access points, and landscaping. It is noted that no demolition works are required for the Proposal.

An indicative list of plant and equipment that may be used during the construction of the Proposal includes:

- Compactors, excavators, front-end loaders (FEL), graders and roller (smooth drum and vibratory);
- Light and heavy-duty vehicles;
- Drills and pneumatic hand, or power tools; and
- Mobile cranes, elevated working platforms and piling rig.

The assessment of the potential local air quality risks from construction phase activities is presented in Section 6 and the risk assessment methodology is outlined in Appendix B.

### 2.3.2. Operational Phase

Operational emissions from the data centre are limited to diesel-fuelled standby generator operation during periodic maintenance testing and power outage events. Minor fugitive emissions may also arise from diesel storage and handling activities at the Proposal site.

#### 2.3.2.1. Emissions from Standby Generator Use

The Proposal includes the installation of 188 standby generators to support operational resilience. The generators are proposed to be housed within a dedicated four-storey gantry building located to the east of the Proposal site.

In response to NSW EPA commentary and updated design development, the AQIA has been revised to be based on representative standby diesel generator units compliant with US EPA Tier 2 emissions standards. The Baudouin 16M55G6D2/5 has been included as a nominated example of a compliant engine type used for assessment purposes. The standby generators are intended to provide backup power to maintain critical operations during utility supply interruptions. Accordingly, the emissions inventory and dispersion modelling have been updated to reflect Tier 2-equivalent performance assumptions for the assessed generator configuration.

Data storage centres are typically designed with built-in electrical and mechanical redundancy to maintain continuous operation and reduce the risk of service interruption during power supply failures or equipment malfunctions. This is achieved by duplicating critical systems such as power supply paths, uninterruptible power supplies (UPS), generators, cooling systems and switchgear so that a failure of one component does not lead to a complete loss of service.

Industry design reliability is commonly described using the Uptime Institute's tier classification system (i.e. Tier I to Tier IV) which sets out increasing levels of redundancy and fault tolerance. Many facilities adopt an N+1 configuration, meaning that for every critical component required to operate the Proposal site, one additional standby unit is provided. While this approach significantly reduces the likelihood of outages, it does not eliminate risk entirely as concurrent failures, maintenance errors or external grid disruptions affecting multiple systems can still result in downtime.

The Proposal includes a total of 188 standby generators. A subset of these units is anticipated to be held in reserve to provide redundancy, allowing the system to maintain power supply to critical loads in the event of individual generator failures. However, multiple simultaneous generator failures could still impact operations as complete system redundancy is not guaranteed.

During periods when the standby generators may be required to provide power during mains power outage events, short-term emissions of combustion related pollutants would be generated. Emissions from diesel-fuelled standby generators may include various air pollutants, as listed in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual (NPI EETM) for combustion engines (NPI, 2008).

The pollutants of concern from the operation of the standby generators includes (in no order):

- Particulate matter (PM);
- Oxides of nitrogen ($NO_X$);
- Carbon monoxide (CO);
- Sulphur dioxide ($SO_2$);
- Polycyclic aromatic hydrocarbons (PAHs);
- Volatile organic compounds (VOCs), as benzene ($C_6H_6$), toluene ($C_7H_8$) and xylene ($C_8H_{10}$); and
- Formaldehyde ($CH_2O$).

In addition to the potential operation as a standby energy source during a power outage event, the generators would be required to be run during short-term routine maintenance testing. Data centres rely on robust standby power systems to maintain continuous tenant access to data and the application of standby diesel generators are intended to minimise downtime in the event of a grid failure. Each generator would undergo commissioning testing upon installation, involving several hours of operation conducted in stages as generators are progressively installed. Following commissioning, regular load testing would be completed by using an artificial electrical load to verify ongoing performance and reliability which then would be supported by an appropriate testing regime to accommodate the required number of generators.

The Applicant has specified a maintenance and testing schedule for the standby generators supporting the data centre's power demand. As presented in Table 3 up to four generators would be operated simultaneously during specified testing activities. Additional information indicates that testing will be conducted during daylight hours, assumed to be between 7:00 am and 6:00 pm.

The schedule includes standard monthly run tests consisting of five (5) minutes in duration, quarterly off-load run tests: 10 minutes in duration; and annual load bank tests that are conducted at approximately 70 % load followed by a 10-minute cool-down period post-test.

The Applicant has confirmed that the generators do not require a warm-up period and are maintained in a "service-ready" condition. A start-up time of up to 20 seconds reflects the standby nature of the units, with all systems maintained in a state of readiness for immediate operation if required (i.e. starter batteries charged, fuel systems primed, and control systems available). The Applicant has confirmed that this does not imply the units are operating prior to activation.

In the event that a local power outage requires the generators to operate under emergency mode, the run hours would be factored into the annual requirements. Where appropriate, planned maintenance would be deferred to the following year in lieu of the hours already run under load. For the purposes of the dispersion modelling assessment, four standby generators would undergo maintenance testing simultaneously on any given day for a period of one hour.

The generator testing schedule is anticipated to have a cumulative total of not more than the 200 hour exemption limit outlined in Schedule 1 Clause 17 of the NSW *Protection of the Environment Operations Act* 1997 (refer Section 3.1), in addition to Part 5, Division 6, Clause 73 of the POEO (Clean Air) Regulation 2022 (refer Section 3.2). It is noted that should SSDA approval be granted, a condition is likely to require periodic emissions testing of the standby generators (refer Section 8.2.5).

**Table 4 Proposed standby generator maintenance testing regime**

| Test type | Period | Duration (mins) | Tests per data hall building per year | | | |
|---|---|---|---|---|---|---|
| | | | SYD01A | SYD01B | SYD01C | SYD01D |
| Run test | Monthly | 5 | 12 | 12 | 12 | 12 |
| Off-load run | Quarterly | 10 | | | | |
| Load banking | Annual | 60 | | | | |
| Cooldown period | Post test | 10 | | | | |
| **Total runtime per generator (mins)** | | | **170** | | | |
| **Total cumulative runtime (mins)** | | | **8 160** | | | |
| **Total cumulative runtime (hours)** | | | **136** | | | |

**Notes:** **Run test** – A basic systems check where the generator operates without supplying power to a load (analogous to a car idling).
**Off-load run** – Similar to the run test, conducted quarterly to verify system integrity and engine response over time.
**Load banking** – The generator is connected to a load bank, drawing power at full capacity to simulate a real power failure and ensure reliable operation under maximum load. Applicant has noted that load banking testing is at 70 % load condition.
**Cooldown period** – Generators run idle post-test to safely reduce engine temperature and stabilise emissions.
Tests to be conducted concurrently to reduce the overall testing duration, with up to four generators tested at any one time.

#### 2.3.2.2. Emissions from Fuel Storage

The Proposal will include a dedicated and appropriately sized on-site diesel fuel storage system, which may give rise to fugitive volatile organic compound (VOC) emissions associated with fuel transfer, storage and dispensing activities, as well as potential accidental spillages or leaks.

The total diesel storage capacity at the Proposal site is 4 454.75 kL.

Each standby generator will be served by an individual 22.7 kL double bunded tank and fitted with a 990 L day tank. In addition, there are two (2) diesel fire pump tanks with a combined capacity of 1 030 L, contributing to an overall total of 4 454.75 kL. The standby generators are anticipated to use low sulphur diesel fuel during operations.

The storage tank configuration at the Proposal site will include adequate containment and automated leak detection measures, in compliance with relevant Australian and New Zealand Standards (AS/NZS), including AS/NZS 1940:2017 (Storage and Handling of Flammable and Combustible Liquids) and AS/NZS 1692:2006 (Steel Tanks for Flammable and Combustible Liquids). Spill containment measures (spill kits) will also be provided at tank fill points, pumps and associated infrastructure where necessary.

Given the low potential for fugitive emissions from fuel storage and engineered containment measures, no further quantification of these emissions has been included in this AQIA.

### 2.3.3. Odour

Construction stage activities may include the operation of plant and machinery and the handling of fuels, which may give rise to minor odour impacts in the event of accidental fuel spillage. These impacts would be managed through standard site environmental controls, including the provision of spill kits.

Operational phase activities will primarily comprise periodic operation of diesel-fuelled generators for testing and standby power generation purposes, as outlined in Section 2.3.2. In addition, the on-site diesel fuel storage and handling system may give rise to fugitive VOC emissions associated with fuel transfer, storage and dispensing activities, as well as potential accidental spillages or leaks.

As described in Section 2.3.2.2, the fuel storage system will incorporate containment measures together with automated leak detection systems in accordance with relevant Australian and New Zealand Standards (AS/NZS), including AS/NZS 1940:2017 and AS/NZS 1692:2006. Spill containment measures (spill kits) will also be provided at fuel transfer and dispensing locations.

Air emissions of VOCs associated with generator operations have been considered in relation to odour impacts, with toluene ($C_7H_8$) and xylene ($C_8H_{10}$) assessed as representative compounds for odour assessment purposes. Benzene ($C_6H_6$) has been considered separately as a principal toxic air pollutant.

## 2.4. Alternative Options for Power Generation

Currently, alternatives to diesel generators are not feasible for large-scale data centres, which depend on diesel for reliability, quick startup, and robust power delivery. While emerging technologies[1] like Hydrotreated Vegetable Oil (HVO) renewable diesel, hydrogen fuel cells (HFC), microgrids and battery energy storage systems (BESS) show promise they are not yet technologically or financially viable for widespread use. The Applicant has confirmed that the diesel generators selected are HVO compatible, allowing for migration to HVO fuels in the future once more robust supply chains are established in the region.

Due to the high load density and steady load profile, solar panels covering the entire roof would only meet a small portion of the Proposal site's power requirements and mechanical equipment further limits available space for solar installations.

While batteries could provide short-term backup, the fuel needed for 24-hour autonomy to maintain critical services during extended outages is significant. Using batteries for the same duration would be prohibitively expensive and space-intensive, also posing similar risks to diesel, such as chemical spills and fire hazards.

As a consequence, diesel generators will continue to be essential for the data centre industry until feasible alternatives are commercially available.

[1] https://www.datacenterdynamics.com/en/opinions/is-it-time-to-replace-diesel-backup-generators/

# 3. LEGISLATION, REGULATION AND GUIDANCE

The following provides an overview of the legislation and air quality criteria which are applicable to the activities being performed at the Proposal site.

## 3.1. Protection of the Environment Operations Act 1997

The POEO Act sets the statutory framework for managing air quality in NSW, including establishing the licensing scheme for major industrial premises (scheduled activities) and a range of air pollution offences and penalties. Schedule 1, Part 1 of the POEO Act provides definitions for scheduled activities, and the associated threshold activity rates. For the Proposal, the thresholds associated with chemical storage (clause 9) and electricity generation (clause 17) and are most relevant, given the use of standby diesel-fuelled generators as part of the Proposal.

### 3.1.1. Chemical Storage

Clause 9 of Schedule 1, Part 1 of the POEO Act states:

*9 Chemical storage*

*(1) This clause applies to the following activities--*

*"general chemicals storage", meaning the storage or packaging in containers, bulk storage facilities or stockpiles of any chemical substance classified as a dangerous good in the Transport of Dangerous Goods Code , other than the following--*

*...*

*"petroleum products storage", meaning the storage or packaging of petroleum or petroleum products in containers, bulk storage facilities or stockpiles.*

*(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.*

*Table*

| ***Column 1*** | ***Column 2*** |
|---|---|
| *Activity* | *Criteria* |
| ... | |
| *petroleum products storage* | *capacity to store more than 200 tonnes (liquified gases) or 2,000 tonnes (chemicals in any other form)* |

As presented above, the Proposal may be deemed to be a scheduled activity due to the quantity of diesel fuel stored at the Proposal site. Should the Proposal have the capacity to store more than 2 000 tonnes (t) of diesel fuel (equivalent to 2 350 kL assuming a fuel density of 850.8 kg·m$^{-3}$) then the Proposal may be deemed to be a scheduled activity under Schedule 1, Part 1 Clause 9 of the POEO Act.

As outlined in Section 2.2, the Proposal includes storage capacity for 4 454.75 kL (approximately 3 790.1 t) of diesel fuel. Given the chemical storage threshold specified in Schedule 1 of the POEO Act, the Proposal would therefore be considered to be a scheduled activity under that provision and correspondingly an Environment Protection Licence (EPL) would be required on this basis.

### 3.1.2. Electricity Generation

Clause 17 of Schedule 1, Part 1 of the POEO Act states:

> *17 Electricity generation*
>
> *(1) This clause applies to the following activities:*
>
> *...*
>
> *metropolitan electricity works (internal combustion engines), meaning the generation of electricity by means of electricity plant:*
>
> *(a) that is based on, or uses, an internal combustion engine, and*
>
> *(b) that is situated in the metropolitan area or in the local government area of Port Stephens, Maitland, Cessnock, Singleton, Wollondilly, or Kiama.*
>
> *(1A) However, this clause does not apply to the generation of electricity by means of electricity plant that is emergency stand-by plant operating for less than 200 hours per year.*
>
> *(2) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.*

During times of stable external supply of electricity, the standby generators would only operate during scheduled maintenance events (refer Section 2.3.2). On this basis, the Proposal is not anticipated to exceed the 200-hour limit and is not deemed to be a scheduled activity under Schedule 1, Part 1, Clause 17 of the POEO Act.

### 3.1.3. Equipment Maintenance

Part 5.4 of the POEO Act outlines a number of requirements associated with air pollution. These requirements generally relate to the appropriate maintenance of plant and equipment in an efficient condition and dealing with materials in a manner as to not cause air pollution.

## 3.2. Protection of the Environment Operations (Clean Air) Regulation 2022

The POEO CAR establishes requirements and concentration standards for air emissions from industrial activities in NSW. It regulates air quality issues related to various sources, including burning activities, motor vehicle fuels, fuel usage and transfer, air impurities from activities and plants, and the storage of volatile organic liquids.

Part 5 of the POEO CAR specifically addresses air impurities from activities and plant, referring to Schedule 2 to set concentration standards for both scheduled and non-scheduled premises. The standards are in-stack emission limits and are the maximum emissions permissible.

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.*

The standards of concentration and whether they are applicable to the Proposal are summarised in Table 5.

In summary, the Proposal is classified as a scheduled activity under the POEO Act by virtue of diesel storage capacity exceeding 2 000 tonnes (refer Section 3.1.1).

Standby generators may be eligible for exemption from the $NO_2$ in-stack emission concentration limits under Clause 73 of the POEO CAR, provided that total operations do not exceed 200 hours per year. Notwithstanding any applicable in-stack emission exemptions, the Proposal is required to demonstrate compliance with ambient air quality criteria prescribed within the Approved Methods (refer Section 3.3).

Table 5 POEO CAR standards of concentrations for applicable air impurities

| Air impurity | Activity or plant | Concentration | Applicable |
|---|---|---|---|
| **Schedule 2, Part 2, Division 2 – Electricity generation (Group 6)** | | | |
| Solid particles (Total) | An activity or plant using a liquid or solid standard fuel or a non-standard fuel | 50 mg·Nm$^{-3}$ (a) | Yes - scheduled activity under Clause 9, Schedule 1, Part 1 of the POEO Act. |
| Nitrogen dioxide ($NO_2$) or nitric oxide (NO) or both, as $NO_2$ equivalent | A turbine operating on a fuel other than gas, being a turbine used in connection with an electricity generating system with a capacity of 30 MW or more | 90 mg·Nm$^{-3}$ (a) | No - exempt under Clause 73 of POEO CAR |
| **Schedule 2, Part 2, Division 3 - Scheduled premises (Group 6)** | | | |
| Solid particles (Total) | An activity or plant | 50 mg·Nm$^{-3}$ (a) | Yes - scheduled activity under Clause 9, Schedule 1, Part 1 of the POEO Act. |
| Nitrogen dioxide ($NO_2$) or nitric oxide (NO) or both, as $NO_2$ equivalent | Stationary reciprocating internal combustion engines | 450 mg·Nm$^{-3}$ (a) | No - exempt under Clause 73 of POEO CAR |
| Volatile organic compounds (VOCs), as *n*-propane | A stationary reciprocating internal combustion engine using a liquid fuel | 1 140 mg·Nm$^{-3}$ (a) VOCs *or* 5 880 mg·Nm$^{-3}$ (a) CO | Yes - scheduled activity under Clause 9, Schedule 1, Part 1 of the POEO Act. |
| Smoke | An activity or plant in connection with which liquid or gaseous fuel is burnt | 20 % opacity | Yes - scheduled activity under Clause 9, Schedule 1, Part 1 of the POEO Act. |
| **Schedule 2, Part 3 – Non-scheduled premises (Group C)** | | | |
| Solid particles (Total) | An activity or plant | 100 mg·Nm$^{-3}$ (b) | Not applicable - requirements applies to non-scheduled Premises; scheduled activity under Clause 9, Schedule 1, Part 1 of the POEO Act. |
| Smoke | An activity or plant in connection with which liquid or gaseous fuel is burnt | 20 % opacity | |

**Notes:** (a): POEO CAR Sch2, Pt 3, Div 1: dry, 273 K, 101.3 kPa, 7 % $O_2$
(b): POEO CAR Sch2, Pt 3, Div 2: dry, 273 K, 101.3 kPa, 7 % $O_2$

Part 4 Clause 20 of the POEO CAR requires that motor vehicles do not emit excessive air impurities which may be visible for a continuous period of more than 10 seconds when determined in accordance with the relevant standard. All vehicles, plant, and equipment to be used either at the Proposal site or to transport materials to and from the Proposal site would be maintained regularly and in accordance with manufacturers' requirements, where these vehicles are under the operational control of the Applicant.

## 3.3. NSW Approved Methods

State air quality guidelines are prescribed by NSW EPA in the Approved Methods, which has been consulted during the preparation of this AQIA (refer Section 1.2, Table 2).

The Approved Methods lists the statutory methods that are to be used to assess emissions of criteria air pollutants in NSW. Section 7.1 and Section 7.2 of the Approved Methods clearly outlines the impact assessment criteria for those key pollutants of interest and both individual and principal toxic air pollutants. Principal toxic air pollutants are defined in the Approved Methods on the basis that they are carcinogenic, mutagenic, highly persistent, and / or highly toxic in the environment.

The criteria listed in the Approved Methods are derived from a range of sources (including National Health and Medical Research Council [NHMRC], National Environment Protection Council [NEPC], and World Health Organisation [WHO]).

The criteria specified in the Approved Methods are the defining ambient air quality criteria for NSW. The standards adopted to protect members of the community from health impacts in NSW for relevant individual air pollutants are presented in Table 6.

To assess the potential impact of emissions of total VOCs (TVOC, which is a complex mixture of hydrocarbons), the 1-hour impact assessment criterion for benzene ($C_6H_6$) of 0.029 $mg{\cdot}m^{-3}$ (29 $\mu g{\cdot}m^{-3}$) as outlined in table 12 of the Approved Methods has been adopted.

Benzene ($C_6H_6$) is one of the primary components of TVOC emissions resulting from diesel combustion engines and compliance with the benzene ($C_6H_6$) criterion (refer Table 6) would generally result in compliance with all VOC components from a health-perspective. Additionally, formaldehyde ($CH_2O$) is assessed as a discrete VOC.

VOC emissions have additionally been assessed against the 1-hour odour impact assessment criteria for toluene ($C_7H_8$) of 0.36 $mg{\cdot}m^{-3}$ (360 $\mu g{\cdot}m^{-3}$) and xylene ($C_8H_{10}$) of 0.19 $mg{\cdot}m^{-3}$ (190 $\mu g\ m^{-3}$) to address the potential for odour impacts. Table 7 provides a summary of impact assessment criteria for principal toxic, and both individual odorous and toxic pollutants that are referenced within this AQIA, as outlined in Section 7.2 of the Approved Methods.

Table 6 NSW EPA impact assessment criteria – criteria pollutants

| Pollutant | Averaging period | Criterion ($\mu g \cdot m^{-3}$)(a) | Notes |
|---|---|---|---|
| Nitrogen dioxide ($NO_2$) | 1 hour | 164 | Numerically equivalent to the AAQ NEPM (b) standards and goals |
| | Annual | 31 | |
| Sulphur dioxide ($SO_2$) | 1 hour | 215 | |
| | 24 hours | 57 | |
| Particulates (as $PM_{10}$) | 24 hours | 50 | |
| | 1 year | 25 | |
| Particulates (as $PM_{2.5}$) | 24 hours | 25 | |
| | 1 year | 8 | |
| Particulates (as TSP) | 1 year | 90 | |
| **Pollutant** | **Averaging period** | **Criterion ($mg \cdot m^{-3}$) (c)** | **Notes** |
| Carbon monoxide (CO) | 15 minutes | 100 | Numerically equivalent to the AAQ NEPM (b) standards and goals |
| | 1 hour | 30 | |
| | 8 hours | 10 | |

**Notes:** (a): micrograms per cubic metre of air
(b): National Environment Protection (Ambient Air Quality) Measure
(c): milligrams per cubic metre of air

Table 7 NSW EPA impact assessment criteria – principal and individual toxic pollutants

| Pollutant | Averaging period | Criterion | | Notes |
|---|---|---|---|---|
| | | ppm (a) | $mg \cdot m^{-3}$ (b) | |
| Polycyclic Aromatic Hydrocarbon (PAH) as benzo(a)pyrene | 1 hour | n/a | 0.0004 | |
| Benzene ($C_6H_6$) | 1 hour | 0.009 | 0.029 | |
| Toluene ($C_7H_8$) | 1 hour | 0.06 | 0.36 | Odour |
| Xylene ($C_8H_{10}$) | 1 hour | 0.04 | 0.19 | Odour |
| Formaldehyde ($CH_2O$) | 1 hour | 0.018 | 0.02 | |

**Notes**: (a): parts per million ($10^6$)
(b): milligrams per cubic metre of air

As required under section 7.2.2 of the Approved Methods, the criteria identified in Table 7 are assessed at any location at or beyond the Proposal site boundary.

## 3.4. State Environmental Planning Policy

The Proposal site is located within the Fitzpatrick Industrial Estate as encapsulated within the WSEA. Development within the WSEA was previously governed by the State Environmental Planning Policy (Western Sydney Employment Area) 2009 (SEPP WSEA), which aimed to create employment, by providing development in the form of major warehousing distribution, freight transport, industrial and manufacturing facilities.

In March 2022, the SEPP WSEA and its provisions have been consolidated into the State Environmental Planning Policy (Industry and Employment) 2021 (SEPP IE), specifically Chapter 2, Parts 2.1 to 2.5 and is the primary planning instrument applicable to the Proposal site.

The Proposal site is zoned IN1 General Industrial under the SEPP IE. Data centres are classified as a type of 'light industry' which falls within the broader 'industry' group term. As such, data centres are permitted with consent in the IN1 zone under the SEPP IE. The proposed data centre, as part of this SSDA would support the efficient use of employment lands for data storage purposes.

The SEPP IE does not include explicit air quality provisions. As such, environmental assessment is deferred to the *Environmental Planning and Assessment Act* 1979 (EP&A Act) and relevant environmental controls, which are managed either by local consent authorities for non-scheduled activities or by NSW EPA for scheduled activities.

## 3.5. Penrith Local Environmental Plan 2010

Whilst the preeminent EPI relevant to the Proposal site is the SEPP IE, the Penrith Local Environmental Plan 2010 (PLEP2010) provides the legislative framework for developments and land use within the Penrith LGA. Specifically, the aims of the PLEP2010 are as follows:

*(aa) to protect and promote the use and development of land for arts and cultural activity, including music and other performance arts,*

*(a) to provide the mechanism and planning framework for the management, orderly and economic development, and conservation of land in Penrith,*

*(b) to promote development that is consistent with the Council's vision for Penrith, namely, one of a sustainable and prosperous region with harmony of urban and rural qualities and with a strong commitment to healthy and safe communities and environmental protection and enhancement,*

*(c) to accommodate and support Penrith's future population growth by providing a diversity of housing types, in areas well located with regard to services, facilities and transport, that meet the current and emerging needs of Penrith's communities and safeguard residential amenity,*

*(d) to foster viable employment, transport, education, agricultural production and future investment opportunities and recreational activities that are suitable for the needs and skills of residents, the workforce and visitors, allowing Penrith to fulfil its role as a regional city in the Sydney Metropolitan Region,*

(e) *to reinforce Penrith's urban growth limits by allowing rural living opportunities where they will promote the intrinsic rural values and functions of Penrith's rural lands and the social well-being of its rural communities,*

(f) *to protect and enhance the environmental values and heritage of Penrith, including places of historical, aesthetic, architectural, natural, cultural, visual and Aboriginal significance,*

(g) *to minimise the risk to the community in areas subject to environmental hazards, particularly flooding and bushfire, by managing development in sensitive areas,*

(h) *to ensure that development incorporates the principles of sustainable development through the delivery of balanced social, economic and environmental outcomes, and that development is designed in a way that assists in reducing and adapting to the likely impacts of climate change.*

It is noted that the PLEP2010 does not outline any specific requirements for the development of data centres with regard to air quality and correspondingly, potential air quality impacts would be managed under the requirements of the POEO Act, POEO CAR and the Approved Methods.

## 3.6. NSW Government Air Quality Planning

NSW EPA has formed a comprehensive strategy with the objective of driving improvements in air quality across the State. This comprises several drivers, including:

- **Legislation**: formed principally through the implementation of the POEO Act and POEO CAR. The overall objective of the legislative instruments is to achieve the requirements of the National Environment Protection (Ambient Air Quality) Measure;
- **Clean Air for NSW**: The 10-year plan for the improvement in air quality;
- **Inter-agency Taskforce on Air Quality in NSW**: a vehicle to co-ordinate cross-government incentives and action on air quality;
- **Managing Particles and Improving Air Quality in NSW**; and
- **Diesel and Marine Emission Management Strategy**.

In regard to the relevance of the NSW Government's drive to maintain and improve air quality across the State and this AQIA, it is imperative that the Proposal would lead to the development of the NSW economy (in terms of activity and employment) and concomitantly not cause a detriment in air quality in achieving its objectives.

# 4. EXISTING CONDITIONS

The following information provides context around the location of sensitive receptor locations surrounding the Proposal site, the prevailing meteorology and air quality of the surrounding area and identifies other sources of air pollutants which have the potential to impact cumulatively with the Proposal.

## 4.1. Surrounding Land Sensitivity

The Proposal site is located within an IN1 – General Industrial zone under the IE SEPP IE. Surrounding land uses include IN1 – General Industrial to the north, south, and west, and C2 – Environmental Conservation to the east, in accordance with the zoning provisions of the SEPP IE.

Additional land uses to the north include R2 – Low Density Residential and RE1 – Public Recreation, as identified in the PLEP2010.

## 4.2. Sensitive Receptor Locations

Air quality assessments typically use a desk-top mapping study to identify 'discrete receptor locations', which are intended to represent a selection of locations that may be susceptible to changes in air quality. In broad terms, the identification of sensitive receptors, refers to places at which humans may be present for a period representative of the averaging period for the pollutant being assessed.

The Approved Methods defines a sensitive receptor location to be:

> *'A location where people are likely to work or reside; this may include a dwelling, school, hospital, office or public recreational area'.*

It is noted that the assessment criteria applied to particulates and sulphur dioxide ($SO_2$) (refer Table 6) are for a 24-hour averaging period, and as such the predicted impacts need to be interpreted at commercial and industrial receptor locations with care. It is considered to be atypical for a person to be at those locations for a complete 24-hour period and as such, the exposure risks associated with those pollutants at those locations would be over-estimated by adoption of those locations in the modelling assessment. However, these locations have been included within the assessment, as required by NSW EPA.

It is important to note that the selection of discrete receptor locations does not aim to cover all sensitive receptors within the study area. Rather, the selected locations are intended to be representative of their broader surroundings and can reasonably be assumed to reflect conditions in the immediate vicinity. In cases where multiple sensitive receptors exist in close proximity (such as a school adjacent to a medical centre) the receptor closest to the emission source is typically chosen to assess potential risks to other sensitive land uses in the area.

Beyond the identified discrete receptors, the entire modelling area has been overlaid with a grid of uniform receptor points to allow presentation of contour isopleth plots of predicted impacts in a comprehensive manner. As such the accidental omission of a particular sensitive location does not invalidate the AQIA or render it incapable of assessing potential risks.

In accordance with the requirements of the Approved Methods, several receptors have been identified and the receptors adopted for use within this AQIA are presented in Table 8 and illustrated in Figure 5. Table 8 is not intended to represent a definitive list of sensitive land uses, but a cross section of available locations, that are used to characterise larger areas, or selected as they represent more sensitive locations, which may represent people who are more susceptible to changes in air pollution.

To ensure that the selection of discrete receptors for the AQIA are reflective of the locations in which the population of the area surrounding the premises reside, population density data has been examined. Population density data based on the estimated residence population for 2024 have been obtained from the Australian Bureau of Statistics (ABS) for a 1 square kilometre ($km^2$) grid, covering mainland Australia (ABS, 2025).

Using a Geographical Information System (GIS), the locations of sensitive receptor locations have been confirmed with reference to their population densities (refer Figure 5).

For clarity, the ABS use the following categories to analyse population density (persons·$km^{-2}$):

- No population Zero (0).
- Very low Up to 500.
- Low Between 500 and 2 000.
- Medium Between 2 000 and 5 000.
- High Between 5 000 and 8 000.
- Very high More than 8 000.

Using ABS data in a GIS, the population density around the Proposal site has been characterised. The immediate area surrounding the site is classified as having very low population density (i.e. up to 500 persons·$km^{-2}$), which is typical of the industrial environment in which the Proposal site is located, and consistent with the broader Fitzpatrick Industrial Estate and WSEA.

Further to the north, population density increases to a low to medium range (i.e. between 500 and 5 000 persons·$km^{-2}$), reflecting the transition into the Erskine Park and St Clair suburbs, where commercial and residential uses are more prevalent. To the immediate east of the Proposal site, no population is observed due to the environment conservation corridor encompassing Ropes Creek. An artificial wetland has been established within this land to manage stormwater runoff from the industrial estate.

Table 8 Discrete sensitive receptor locations

| Receptor ID | Location | Land use | Coordinates (UTM 56S) | |
|---|---|---|---|---|
| | | | mE | Ms |
| R1 | Cetus Pl, Erskine Park | Residential | 297 420 | 6 256 601 |
| R2 | Weaver St, Erskine Park | Residential | 297 261 | 6 256 616 |
| R3 | Weaver St, Erskine Park | Residential | 297 408 | 6 256 775 |
| R4 | Grady Cres, Erskine Park | Industrial | 297 144 | 6 256 345 |
| R5 | Grady Cres, Erskine Park | Industrial | 297 037 | 6 256 168 |
| R6 | Lockwood Rd, Erskine Park | Industrial | 297 039 | 6 256 033 |
| R7 | Lockwood Rd, Erskine Park | Industrial | 297 168 | 6 255 856 |
| R8 | Lockwood Rd, Erskine Park | Industrial | 297 047 | 6 255 841 |
| R9 | Oakdale CL, Erskine Park | Industrial | 297 780 | 6 255 350 |
| R10 | Lockwood Rd, Erskine Park | Industrial | 297 303 | 6 255 966 |
| R11 | Trinity Catholic Primary School (1) | Educational | 295 402 | 6 254 610 |
| R12 | James Erskine Primary School | Educational | 296 735 | 6 257 202 |
| R13 | Grady Cres, Erskine Park | Industrial | 296 499 | 6 256 169 |
| R14 | Lockwood Rd, Erskine Park | Industrial | 297 382 | 6 255 867 |
| R15 | Lockwood Rd, Erskine Park | Industrial | 297 451 | 6 255 789 |
| R16 | Erskine Park Community Hall | Community | 296 816 | 6 257 295 |
| R17 | Erskine Park High School | Educational | 296 704 | 6 256 945 |
| R18 | Sennar Reserve | Recreational | 297 235 | 6 257 318 |
| R19 | Peppertree Sports Complex | Recreational | 296 864 | 6 257 217 |
| R20 | Burley Rd, Horsley Park | Residential | 299 115 | 6 254 707 |
| R21 | Archbold Rd, Erskine Park | Industrial | 297 945 | 6 256 798 |
| R22 | Telopea Pl, Eastern Creek | Industrial | 299 155 | 6 256 627 |
| R23 | Millner Ave, Horsley Park | Industrial | 298 407 | 6 255 428 |
| R24 | Emporium Ave, Kemps Creek | Industrial | 296 826 | 6 255 115 |
| R25 | Old MacDonalds Child Care | Educational | 294 061 | 6 255 761 |
| R26 | Tyrone Pl, Erskine Park | Industrial | 295 936 | 6 256 081 |
| R27 | Little Smarties Early Learning Centre | Educational | 295 187 | 6 254 279 |
| R28 | Mamre Anglican School | Educational | 295 282 | 6 254 478 |
| R29 | Emmaus Catholic College (1) | Educational | 295 670 | 6 254 524 |
| R30 | Emmaus Retirement Village (1) | Aged Care | 295 780 | 6 254 828 |
| R31 | Erskine Park Children's Centre | Educational | 296 865 | 6 257 364 |
| R32 | Johnston Cres, Horsley Park | Industrial | 298 723 | 6 254 371 |
| R33 | Johnston Cres, Horsley Park | Industrial | 298 596 | 6 254 373 |
| R34 | Johnston Cres, Horsley Park | Industrial | 298 627 | 6 254 059 |
| R35 | Johnston Cres, Horsley Park | Industrial | 298 467 | 6 254 624 |
| R36 | Johnston Cres, Horsley Park | Industrial | 298 483 | 6 254 834 |
| R37 | Millner Ave, Horsley Park | Industrial | 298 554 | 6 254 936 |
| R38 | Latitude Rd, Horsley Park | Industrial | 298 796 | 6 254 886 |
| R39 | Latitude Rd, Horsley Park | Industrial | 299 017 | 6 254 983 |

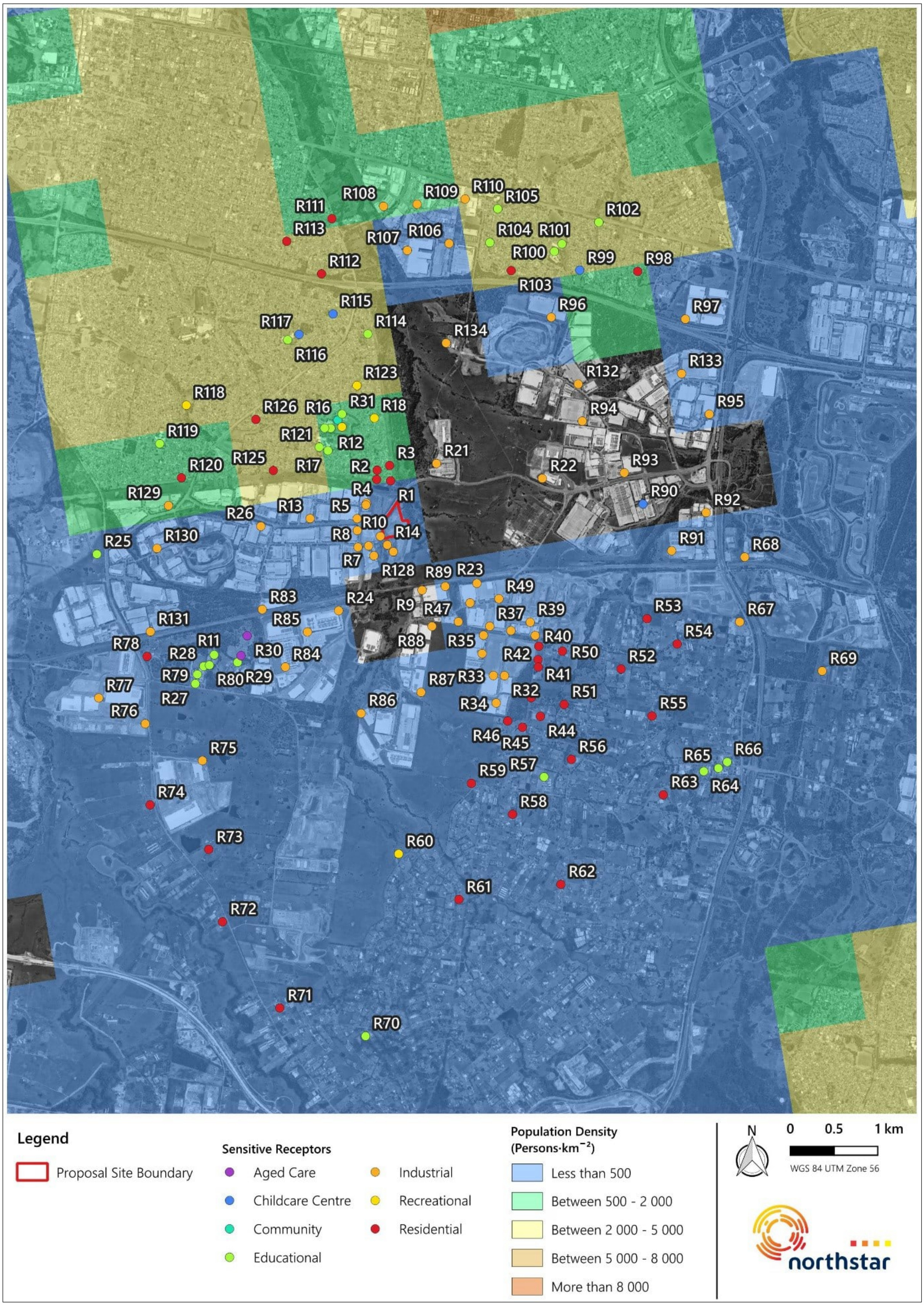
| Receptor ID | Location | Land use | Coordinates (UTM 56S) | |
|---|---|---|---|---|
| | | | mE | Ms |
| R40 | Latitude Rd, Horsley Park | Industrial | 299 074 | 6 254 831 |
| R41 | Burley Rd, Horsley Park | Residential | 299 106 | 6 254 554 |
| R42 | Burley Rd, Horsley Park | Residential | 299 109 | 6 254 470 |
| R43 | Delaware Rd, Horsley Park | Residential | 299 028 | 6 254 120 |
| R44 | Delaware Rd, Horsley Park | Residential | 299 133 | 6 253 906 |
| R45 | Greenway Pl, Horsley Park | Residential | 298 928 | 6 253 781 |
| R46 | Greenway Pl, Horsley Park | Residential | 298 759 | 6 253 853 |
| R47 | Millner Ave, Horsley Park | Industrial | 298 195 | 6 254 988 |
| R48 | Millner Ave, Kemps Creek | Industrial | 298 329 | 6 255 204 |
| R49 | Millner Ave, Horsley Park | Industrial | 298 659 | 6 255 251 |
| R50 | Burley Rd, Horsley Park | Residential | 299 385 | 6 254 651 |
| R51 | Delaware Rd, Horsley Park | Residential | 299 405 | 6 254 042 |
| R52 | Barwar Cl, Horsley Park | Residential | 300 056 | 6 254 448 |
| R53 | Burley Rd, Horsley Park | Residential | 300 353 | 6 255 023 |
| R54 | Walworth Rd, Horsley Park | Residential | 300 698 | 6 254 734 |
| R55 | Arundel Rd, Horsley Park | Residential | 300 410 | 6 253 910 |
| R56 | Delaware Rd, Horsley Park | Residential | 299 488 | 6 253 414 |
| R57 | St Narsai Assyrian Christian College | Educational | 299 175 | 6 253 213 |
| R58 | Garfeld Rd, Horsley Park | Residential | 298 815 | 6 252 786 |
| R59 | Capitol Hill Dr, Mount Vernon | Residential | 298 344 | 6 253 139 |
| R60 | Bowood Rd, Mount Vernon | Recreational | 297 512 | 6 252 333 |
| R61 | The Appian Way, Mount Vernon | Residential | 298 201 | 6 251 812 |
| R62 | Lincoln Rd, Horsley Park | Residential | 299 367 | 6 251 984 |
| R63 | Horsley Rd, Horsley Park | Residential | 300 539 | 6 253 008 |
| R64 | Horsley Kids Early Childcare Centre | Educational | 301 002 | 6 253 277 |
| R65 | Marion Catholic Primary School | Educational | 301 169 | 6 253 313 |
| R66 | Horsley Park Public School | Educational | 301 270 | 6 253 384 |
| R67 | Wallgrove Rd, Horsley Park | Industrial | 301 413 | 6 254 986 |
| R68 | Wallgrove Rd, Eastern Creek | Industrial | 301 470 | 6 255 728 |
| R69 | Chandos Rd, Horsley Park | Industrial | 302 356 | 6 254 425 |
| R70 | Early Learners of Mount Vernon | Educational | 297 134 | 6 250 248 |
| R71 | Mamre Rd, Mount Vernon | Residential | 296 153 | 6 250 570 |
| R72 | Mamre Rd, Kemps Creek | Residential | 295 497 | 6 251 556 |
| R73 | Mamre Rd, Kemps Creek | Residential | 295 340 | 6 252 384 |
| R74 | Mamre Rd, Kemps Creek | Residential | 294 670 | 6 252 893 |
| R75 | Mamre Rd, Kemps Creek | Industrial | 295 268 | 6 253 400 |
| R76 | Mamre Rd, Kemps Creek | Industrial | 294 614 | 6 253 821 |
| R77 | Mamre Rd, Kemps Creek | Industrial | 294 082 | 6 254 117 |
| R78 | Mamre Rd, Kemps Creek | Residential | 294 635 | 6 254 591 |
| R79 | Mamre Anglican School, Bakers Lane | Educational | 295 210 | 6 254 386 |

| Receptor ID | Location | Land use | Coordinates (UTM 56S) | |
|---|---|---|---|---|
| | | | mE | Ms |
| R80 | Trinity Catholic Primary School (2) | Educational | 295 348 | 6 254 492 |
| R81 | Emmaus Catholic College (2) | Educational | 295 550 | 6 254 313 |
| R82 | Emmaus Retirement Village (2) | Aged Care | 295 709 | 6 254 600 |
| R83 | Templar Rd, Erskine Park | Industrial | 295 952 | 6 255 129 |
| R84 | Emporium Ave, Kemps Creek | Industrial | 296 216 | 6 254 471 |
| R85 | Emporium Ave, Kemps Creek | Industrial | 296 469 | 6 254 871 |
| R86 | Imperata Cl, Kemps Creek | Industrial | 297 083 | 6 253 940 |
| R87 | Chelodina St, Kemps Creek | Industrial | 297 769 | 6 254 181 |
| R88 | Aristide Cl, Kemps Creek | Industrial | 297 894 | 6 254 936 |
| R89 | Oakdale Cl, Horsley Park | Industrial | 298 045 | 6 255 393 |
| R90 | Little Graces Childcare | Childcare Centre | 300 307 | 6 256 335 |
| R91 | Roussell Rd, Eastern Creek | Industrial | 300 634 | 6 255 800 |
| R92 | Clay Pl, Eastern Creek | Industrial | 301 028 | 6 256 237 |
| R93 | Old Wallgrove Rd, Eastern Creek | Industrial | 300 093 | 6 256 692 |
| R94 | Grevillea St, Eastern Creek | Industrial | 299 612 | 6 257 283 |
| R95 | Wonderland Dr, Eastern Creek | Industrial | 301 065 | 6 257 362 |
| R96 | Kangaroo Ave, Eastern Creek | Industrial | 299 257 | 6 258 471 |
| R97 | Wallgrove Rd, Eastern Creek | Industrial | 300 791 | 6 258 450 |
| R98 | Fleurs St, Minchinbury | Residential | 300 246 | 6 258 996 |
| R99 | All Areas Family Day Care | Childcare Centre | 299 583 | 6 259 010 |
| R100 | Minchinbury Public School | Educational | 299 293 | 6 259 224 |
| R101 | Kids Early Learning Minchinbury | Educational | 299 380 | 6 259 310 |
| R102 | Minchinbury Preschool & Nursery | Educational | 299 801 | 6 259 558 |
| R103 | Cobbler Cres, Minchinbury | Residential | 298 799 | 6 259 005 |
| R104 | Early Stars Childcare Centre | Educational | 298 555 | 6 259 325 |
| R105 | Minchinbury Early Learning Centre | Educational | 298 645 | 6 259 712 |
| R106 | Sargents Rd, Minchinbury | Industrial | 298 089 | 6 259 315 |
| R107 | Sargents Rd, Minchinbury | Industrial | 297 611 | 6 259 236 |
| R108 | Zeleny Rd, Minchinbury | Industrial | 297 339 | 6 259 740 |
| R109 | Sterling Rd, Minchinbury | Industrial | 297 723 | 6 259 764 |
| R110 | Sterling Rd, Minchinbury | Industrial | 298 272 | 6 259 824 |
| R111 | Roper Rd, Colyton | Residential | 296 748 | 6 259 599 |
| R112 | Hewitt St, Colyton | Residential | 296 630 | 6 258 968 |
| R113 | Andrew Thompson Pl, Colyton | Residential | 296 232 | 6 259 340 |
| R114 | Sunny Patch Preparation School | Educational | 297 160 | 6 258 280 |
| R115 | Sweetpeas Kindergarten | Childcare Centre | 296 762 | 6 258 509 |
| R116 | Clairgate Public School | Educational | 296 243 | 6 258 212 |
| R117 | Little Smarties Childcare Centre | Childcare Centre | 296 373 | 6 258 275 |
| R118 | Shakespeare Dr, St Clair | Recreational | 295 084 | 6 257 465 |
| R119 | Blackwell Public School | Educational | 294 779 | 6 257 025 |

| Receptor ID | Location | Land use | Coordinates (UTM 56S) | |
|---|---|---|---|---|
| | | | mE | Ms |
| R120 | Coowarra Dr, St Clair | Residential | 295 028 | 6 256 635 |
| R121 | Erskine Park High School | Educational | 296 604 | 6 256 986 |
| R122 | James Erskine Public School | Educational | 296 665 | 6 257 203 |
| R123 | Coowarra Dr, St Clair | Recreational | 297 035 | 6 257 691 |
| R124 | Pegasus St, Erskine Park | Residential | 297 266 | 6 256 722 |
| R125 | Dunstaffnage Pl, Erskine Park | Residential | 296 079 | 6 256 719 |
| R126 | Fauna Rd, Erskine Park | Residential | 295 879 | 6 257 302 |
| R127 | Grady Cres, Erskine Park | Industrial | 297 138 | 6 256 324 |
| R128 | Lockwood Rd, Erskine Park | Industrial | 297 229 | 6 255 743 |
| R129 | Erskine Park Rd, Erskine Park | Industrial | 294 879 | 6 256 316 |
| R130 | Erskine Park Rd, Erskine Park | Industrial | 294 748 | 6 255 827 |
| R131 | Sarah Andrews Cl, Erskine Park | Industrial | 294 673 | 6 254 875 |
| R132 | Eucalyptus Pl, Eastern Creek | Industrial | 299 566 | 6 257 707 |
| R133 | Interchange Dr, Eastern Creek | Industrial | 300 748 | 6 257 826 |
| R134 | Honeycomb Dr, Eastern Creek | Industrial | 298 055 | 6 258 176 |

**Note**: The requirements of this AQIA may vary from the specific requirements of other studies, and as such the selection and naming of receptor locations, may vary between technical reports. This does not affect or reduce the validity of those assumptions.

Figure 5 Sensitive receptors surrounding the Proposal site and population density




**Source**: Northstar

## 4.3. Meteorology

In accordance with the requirements of the Approved Methods, the AQIA is required to describe and account for the influence of the prevailing meteorological conditions.

The meteorology experienced within an area can govern the generation (in the case of wind-dependent emission sources), dispersion, transport and eventual fate of pollutants in the atmosphere. The meteorological conditions surrounding the Proposal site have been characterised using data collected by the Australian Government Bureau of Meteorology (BoM) at surrounding Automatic Weather Stations (AWS).

To characterise local wind conditions, meteorological data from the Horsley Park Equestrian Centre AWS was analysed. This station, located approximately 5.5 km south east of the Proposal site provided data from 2020 to 2024 as presented in Appendix C. Annual wind roses indicate a consistent wind distribution pattern across these years, with predominant south-westerly winds. The majority of wind speeds range between 0.5 $m \cdot s^{-1}$ and 5.5 $m \cdot s^{-1}$, with higher speeds (more than 8 $m \cdot s^{-1}$) occurring from mostly north-westerly directions. Calm conditions (less than 0.5 $m \cdot s^{-1}$) are more common, averaging 19.4 % of recorded hours.

Although the Horsley Park Equestrian Centre AWS is nearby, on site meteorological analysis is required to establish baseline conditions for the Proposal. In the absence of on-site data, site representative conditions were generated using the CALMET model for use in CALPUFF (refer Section 5.2.1.2).

To ensure representativeness, a correlation analysis of observed wind characteristics (direction and speed) at the Horsley Park Equestrian Centre AWS was conducted (refer Appendix C), along with a comparison of particulate matter data from the St Marys AQMS (refer Appendix D). Based on this analysis, 2021 was selected as the most representative year for meteorological modelling.

For this AQIA, CALMET was run in no-observations ('no-obs') mode using gridded prognostic data generated by The Air Pollution Model (TAPM, v 4.0.5), developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), to determine surface and wind characteristics at the Proposal site. A summary of the inputs and outputs of the meteorological modelling assessment, including validation of those outputs is presented in Appendix C.

## 4.4. Background Air Quality

The air quality experienced at any location will be a result of emissions generated by natural and anthropogenic sources on a variety of scales (local, regional and global). The relative contributions of sources at each of these scales to the air quality at a location, will vary based on a wide number of factors including the type, location, proximity and strength of the emission source(s), prevailing meteorology, land uses and other factors affecting the emission, dispersion and fate of those pollutants.

When assessing the impact of any particular source of emissions on the potential air quality at a location, the impact of all other sources of an individual pollutant, should also be assessed. These 'background' (sometimes called 'baseline') air quality conditions will vary depending on the pollutants to be assessed and can often be characterised by using representative air quality monitoring data.

Two AQMS have been identified within a 10 km radius of the Proposal site, operated by NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW). These locations (listed by proximity) are briefly summarised in Table 9.

**Table 9 NSW DCCEEW AQMS within 10 km of the Proposal site**

| AQMS location | Distance to Proposal site (km) | 2021 data | Measurements | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | $PM_{10}$ | $PM_{2.5}$ | TSP | $NO_2$ | CO | $SO_2$ |
| St Marys | 4.7 | ✓ | ✓ | ✓ | × | ✓ | × | × |
| Prospect | 9.7 | ✓ | ✓ | ✓ | × | ✓ | ✓ | ✓ |

The nearest NSW DCCEEW-operated AQMS to the Proposal site is located at St Marys, approximately 4.7 km to the north-west. Commissioned in October 1992, the AQMS is situated on a residential property off Mamre Road, St Marys. The St Marys AQMS monitors fine particles as $PM_{10}$ and $PM_{2.5}$, $NO_2$ and ozone ($O_3$). Given its proximity to the Proposal site, the St Marys AQMS is considered more representative of local background pollutant concentrations than the Prospect AQMS. However, it does not monitor CO or $SO_2$ which are pollutants of concern in this AQIA. Accordingly, CO and $SO_2$ data from the Prospect AQMS have been used to supplement the background data analysis for the purpose of this AQIA.

A summary of the air quality monitoring data and assumptions used to produce this AQIA are presented in Table 10. It is noted that although impacts of $O_3$ have not been considered in this assessment, $O_3$ data has been adopted to assist in calculating the conversion of $NO_X$ to $NO_2$ for the dispersion modelling assessment (refer Section 5.2.7).

It is noted that the St Marys AQMS does not measure concentrations of TSP. As this pollutant is of relevance to the expected emissions from the Proposal, other sources of data have been adopted to allow representation of the TSP environment in the area surrounding the Proposal site, and a discussion is provided in Appendix D.

In addition, a number of pollutants assessed as part of this AQIA are not routinely monitored at AQMS locations in NSW including:

- Polycyclic aromatic hydrocarbons (PAH).
- Benzene ($C_6H_6$), toluene ($C_7H_8$), and xylene ($C_8H_{10}$); and,
- Formaldehyde ($CH_2O$).

For the purposes of this AQIA, background concentrations of the abovementioned pollutants are not available as these pollutants are not routinely monitored. Section 7 of the Approved Methods sets out requirements for assessment of 1-hour incremental impacts at the 99.9th percentile for the pollutants outlined above.

Appendix D provides further analysis of the background air quality monitoring data used in this AQIA.

**Table 10 Summary of background air quality data used in the AQIA**

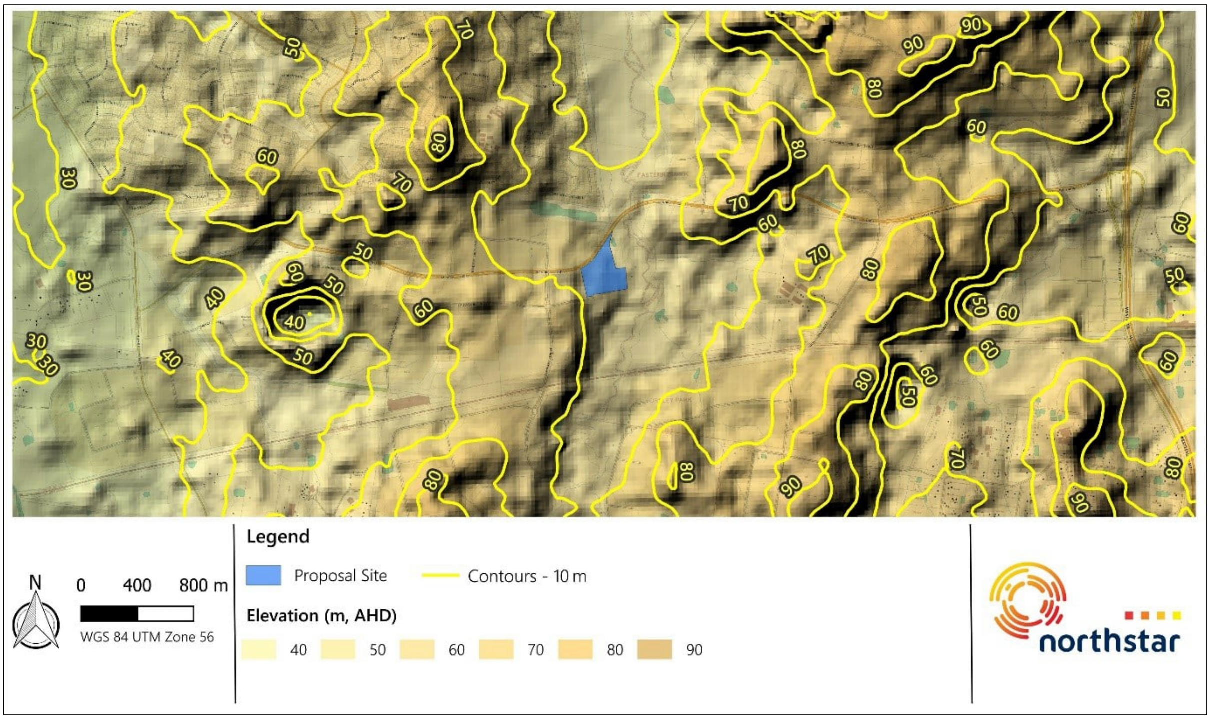
| AQMS | Pollutant | Ave. period | Units | Measured value | Notes |
|---|---|---|---|---|---|
| St Marys | Particles (as TSP) | Annual | $\mu g \cdot m^{-3}$ | 33.5 | Estimated on a TSP:$PM_{10}$ ratio of 2.0551: 1 |
| | Particles (as $PM_{10}$) | 24-hour | $\mu g \cdot m^{-3}$ | Daily varying | The 24-hour max concentration in 2021 was 54.9 $\mu g \cdot m^{-3}$ |
| | | Annual | $\mu g \cdot m^{-3}$ | 16.2 | |
| | Particles (as $PM_{2.5}$) | 24-hour | $\mu g \cdot m^{-3}$ | Daily varying | The 24-hour max concentration in 2021 was 40.3 $\mu g \cdot m^{-3}$ |
| | | Annual | $\mu g \cdot m^{-3}$ | 5.8 | |
| | Nitrogen dioxide ($NO_2$) | 1-hour | $\mu g \cdot m^{-3}$ | Hourly varying | The 1-hour max concentration in 2021 was 67.7 $\mu g \cdot m^{-3}$ |
| | | Annual | $\mu g \cdot m^{-3}$ | 8.1 | Annual average in 2021 |
| Prospect | Carbon monoxide (CO) | 15-minutes | $mg \cdot m^{-3}$ | 2.1 | Calculated from 1-hour data ( Section 5.2.8). |
| | | 1-hour | $mg \cdot m^{-3}$ | 1.6 | Max 1-hour concentration in 2021 |
| | | 8-hour | $mg \cdot m^{-3}$ | 1.3 | Max 8-hour concentration in 2021 |
| | Sulphur dioxide ($SO_2$) | 1-hour | $\mu g \cdot m^{-3}$ | 42.9 | Max 1-hour concentration in 2021 |
| | | 24-hour | $\mu g \cdot m^{-3}$ | 8.6 | Max 24-hour concentration in 2021 |

## 4.5. Topography

The elevation of the Proposal site ranges between approximately 51 m to 57 m Australian Height Datum (AHD) (refer Figure 6 ).

While topography between the site and the nearest sensitive receptors is relatively simple from an AQIA perspective its influence has been accounted for in the dispersion modelling exercise (refer Section 5.2.1.3).

Figure 6 Local topography




**Source:** Northstar

## 4.6. Potential for Cumulative Impacts

The background air quality dataset described in Section 4.4 is likely to reflect the influence of both regional pollutant sources (e.g. particulate matter) and more localised contributions from nearby roads, commercial premises, and industrial locations at or near the AQMS. However, given the separation distance between the AQMS and the Proposal site, the dataset may not fully represent site-specific pollutant concentrations or conditions.

Standard environmental assessment practice requires that the impacts of the Proposal be evaluated in the context of the existing environment, including both historical changes and the cumulative contribution of other developments. This includes existing facilities, approved but not yet operational projects, and development proposals currently under assessment. Where multiple sources have the potential to contribute emissions to shared receptor locations, the Approved Methods require cumulative impacts to be considered. While the most rigorous approach involves dispersion modelling of all contributing sources, this is often constrained by:

- A lack of detailed emissions or operational data for external sources, particularly where multiple operators are involved;
- Misalignment in assessment timeframes across developments; and,

- Differences in operating patterns, particularly where sources emit intermittently or unpredictably, such as standby generators at data centres, which may only be a source of air emissions for a short period in any year.

Given these constraints, a qualitative evaluation has been conducted with reference to the NSW Department of Planning and Environment's 'Cumulative Impact Assessment Guidelines for State Significant Proposals' (CIA Guidelines) (NSW DPIE, 2022). The CIA Guidelines state that cumulative assessments should be proportionate to the nature of the potential impacts and focus on interactions between the Proposal and 'relevant future projects' that is those within the same locality and timeframe.

Relevant future projects are defined as including:

- Other SSD or SSI Proposals;
- Designated developments requiring an EIS under Division 5.1 of the *Environmental Planning and Assessment Act* 1979 (EP&A Act);
- Controlled actions under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act); and
- Major greenfield or urban renewal developments identified via rezoning or government strategies.

Emerging projects may also be considered where there is a reasonable expectation of progression, such as:

- Developments with issued SEARs or undergoing pre-SEARs consultation;
- Publicly announced proposals with demonstrated market interest; and
- Projects identified in strategic planning instruments (e.g. the State Infrastructure Strategy).

Particular consideration has been given to other data centre proposals and operations with similar emissions characteristics (e.g. standby diesel generator exhausts via vertical stacks) within the assessment dispersion modelling domain (refer Table C3, Appendix C).

In response to feedback from NSW EPA, the scope of review has been extended to include two additional regulated premises identified by the regulator as warranting consideration due the emissions characteristics, proximity or regulatory status. These facilities differ in profile but may have the potential to contribute to cumulative air quality impacts within the local airshed.

While broader industrial operations exist in the surrounding locality, including premises regulated under the POEO Act, many of these sources operate under different duty cycles, emit different pollutant profiles or lack sufficient publicly available data for inclusion within the dispersion modelling. Nonetheless, their potential for cumulative influence has been acknowledged and considered through qualitative analysis.

The outcomes of this review informed the cumulative impact assessment presented in Section 7.5. A summary of relevant developments is provided in Table 11 and their locations illustrated in Figure 7. Further discussion of the cumulative assessment methodology is provided in Section 5.3, with results presented in Section 7.5.

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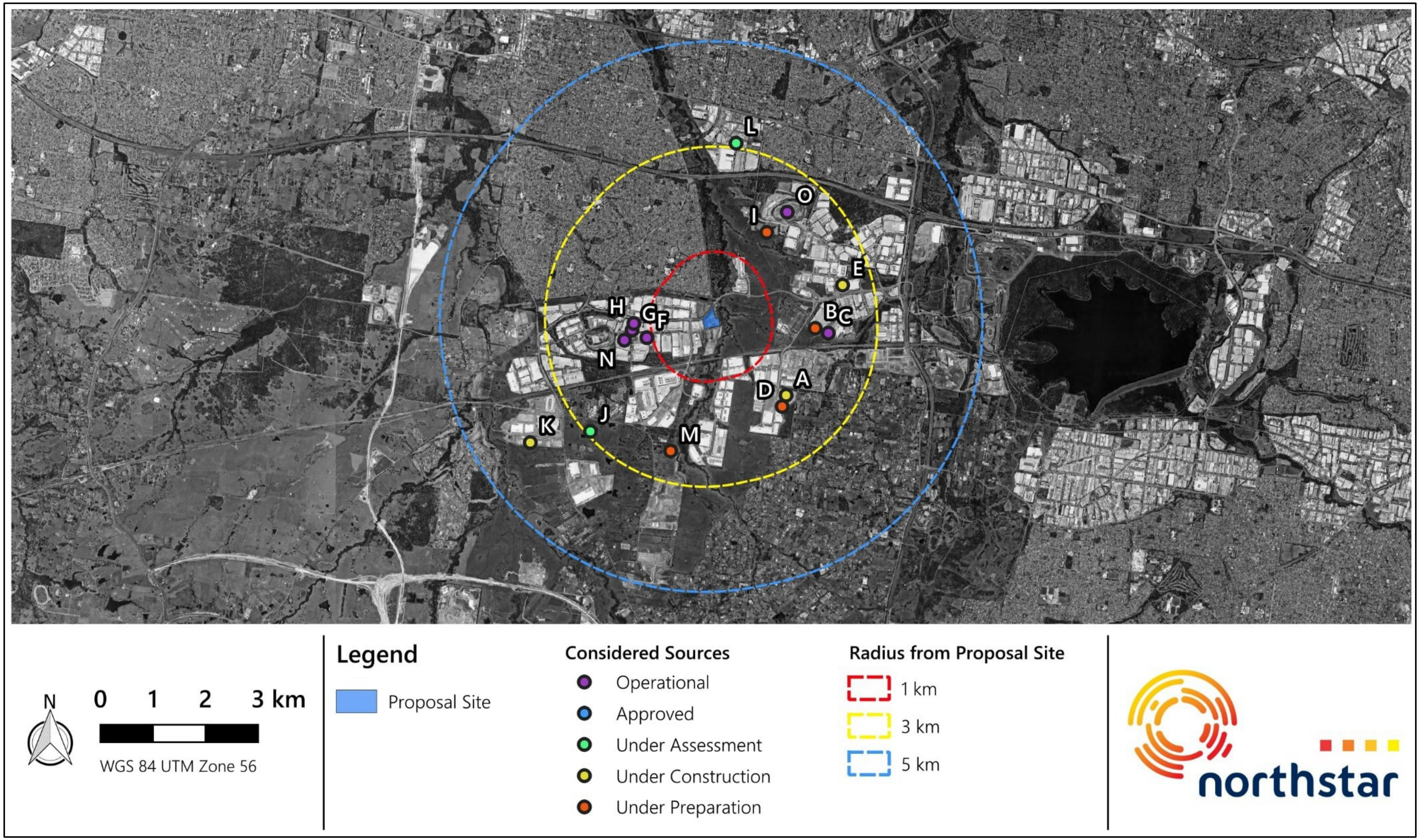
Table 11 Proximate data centres and considered NSW EPA premises for cumulative assessment

| ID | Facility | Status | Location | Approx. distance to Proposal site (km) |
|---|---|---|---|---|
| **Data Storage Centres** | | | | |
| A | NEXTDC S4 (SSD-63741210) | Under Construction | 16 Johnston Cresent, Horsley Park | 1.8 |
| B | Project Atlas (SSD-101067971) | Under Preparation | 10 Roberts Road, Eastern Creek | 1.8 |
| C | Roberts Road (SSD-10330) | Operational | 17 Roberts Road, Eastern Creek | 2.1 |
| D | NEXTDC S4 P2 (SSD-108864209) | Under Preparation | 6 Johnston Crescent, Horsley Park | 1.9 |
| E | Project Echidna (SSD-43720208) | Under Construction | 10 Eastern Creek Drive, Eastern Creek | 2.4 |
| F | Sydney SYD14 (Digital Realty) | Operational | 16 Lockwood Road, Erskine Park | 1.1 |
| G | Sydney SYD11 (Digital Realty) | Operational | 18-23 Templar Road, Erskine Park | 1.4 |
| H | Sydney SYD10 (Digital Realty) | Operational | 1-2 Templar Road, Erskine Park | 1.4 |
| I | NEXTDC S7 (SSD-113934740) | Under Preparation | Honeycomb Drive, Eastern Creek | 1.7 |
| J | Mamre Road Campus (SSD-92743706) | Under Assessment | 706-752 Mamre Road, Eastern Creek | 2.9 |
| K | Kemps Creek (SSD-10101987) | Under Construction | 757-769 Mamre Road, Kemps Creek | 3.9 |
| L | DIG SYD01 (SPP-18-01554) | Under Assessment | 42 Sargents Road, Minchinbury | 3.1 |
| M | 90 Aldington Road (SSD-112059740) | Under Preparation | 90 Aldington Road, Kemps Creek | 2.4 |
| **NSW EPA Regulated Premises** | | | | |
| N | BlueScope Steel Western Sydney Service Centre | Operational | 25-55 Templar Road, Erskine Park | 1.5 |
| O | Bingo Eastern Creek Recycling Ecology Park (& Landfill) | Operational | 1 Kangaroo Avenue, Eastern Creek | 2.0 |

Figure 7 Proximate data centres and considered NSW EPA premises for cumulative assessment




**Source**: Northstar

# 5. APPROACH TO ASSESSMENT

This report provides a qualitative assessment of dust impacts (soiling and human health) during the construction phase, adapted from (IAQM, 2024) (refer Section 5.1) and a quantitative assessment aligned with (NSW EPA, 2022) for evaluating operational phase air quality impacts (refer Section 5.2).

## 5.1. Construction Phase

Construction phase activities have the potential to generate short-term emissions of particulates. Generally, these are associated with uncontrolled (or 'fugitive') emissions and are typically experienced by neighbours as amenity impacts, such as dust deposition and visible dust plumes, rather than associated with health-related impacts. Localised engine exhaust emissions from construction machinery and vehicles may also be experienced but given the scale of the proposed works, fugitive dust emissions would have the greatest potential to give rise to downwind air quality impacts.

Modelling of dust from construction projects is generally not considered appropriate as there is a lack of reliable emission factors from construction activities upon which to make predictive assessments, and the rates would vary significantly, depending upon local conditions. In lieu of a modelling assessment, the construction-phase impacts associated with the Proposal have been assessed using a risk-based assessment procedure. The advantage of this approach is that it determines the activities that pose the greatest risk, which allows the Construction Environmental Management Plan (CEMP) to focus controls to manage that risk appropriately and reduce the impact through proactive management.

For this risk assessment, Northstar has adapted the published guidance (IAQM, 2024). The IAQM construction phase assessment approach is commonly used for evaluating fugitive dust and particulate matter emissions from construction activities in development Proposals across NSW and Australia.

Briefly, the adapted method uses a six-step process for assessing dust impact risks from construction activities, and to identify key activities for control as outlined in Appendix B.

## 5.2. Operational Phase

### 5.2.1. Dispersion Modelling Approach

The operational air emissions assessment has been conducted using quantitative dispersion modelling. This section outlines the approach adopted in the AQIA.

#### 5.2.1.1. Dispersion Model

A dispersion modelling assessment has been performed using the NSW EPA approved CALPUFF Atmospheric Dispersion Model. CALPUFF is a Lagrangian Gaussian puff dispersion model and is recognised in the Approved Methods as a widely accepted model for regulatory applications in NSW. It is used to predict pollutant concentrations from various sources typically found at industrial facilities.

The CALPUFF model uses hourly meteorological data to define conditions for plume rise, transport, diffusion, and deposition. It estimates concentrations or deposition values for each source-receptor combination on an hourly basis and calculates user-selected short-term averages. CALPUFF also accounts for local terrain, making it well-suited for modelling complex terrains, including slope flows, valley flows, terrain blocking, and kinematic effects.

Since most air quality standards are based on averages or percentiles, CALPUFF enables further analysis of results for comparison. The CALPUFF percent post-processing utility calculates the maximum concentration of a pollutant at a specific percentile over a given period, across all receptors. This percentile approach assists to omit unusual short-term meteorological events that may cause elevated concentrations, providing a more accurate representation of likely average pollutant concentrations over the averaging period.

Table 12 provides the model input configuration to assess the impact of generator emissions from the Proposal, in consideration of the Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the Approved Methods (Barclay & Scire, 2011).

**Table 12 General model parameters for CALPUFF dispersion modelling**

| Model parameter | Input |
|---|---|
| Model mode | CALPUFF Refined Mode<br>CALMET No-Observations (NOOBS) Mode |
| Meteorological data | Prognostic Data (TAPM) |
| Terrain topography | Shuttle Radar Topography Mission (SRTM) |
| Model / Grid domain size | 11 .5 km × 11.5 km × 4 km |
| Grid resolution / spacing | 0.1 km |

(Barclay & Scire, 2011) recommend using CALMET NOOBS mode for regulatory screening when good-quality gridded prognostic meteorological data are available, which has been applied in the dispersion modelling process. Given the variable topography, the terrain radius of influence was set at 5 km with a minimum of 0.1 km. Terrain data with a 1 arc-second resolution (approximately 30 m) were used, in consideration of (Barclay & Scire, 2011).

The dispersion model was run over a 11.5 km × 11.5 km grid that encompassed proximate sensitive receivers (refer Section 4.2) and covered all potentially impacted nearby land uses within the specified domain area.

### 5.2.1.2. Meteorological Modelling

Section 4 of the Approved Methods requires one-year of site-specific meteorological data or site-representative meteorological data, in the absence of site-specific data, to be used for dispersion modelling.

The 3-D meteorological dataset was derived using gridded prognostic data generated from The Air Pollution Model (TAPM, v 4.0.5) as developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), in conjunction with CALMET (refer Appendix C). Section 4.5 of the Approved Methods identifies TAPM as a commonly used prognostic meteorological model in NSW.

TAPM predicts wind speed and direction, temperature, pressure, water vapour, cloud, rainwater and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field and thus the final wind field reflects the influences of local topography and current land uses.

Appendix C contains details on the meteorological model configuration and input parameters.

### 5.2.1.3. Terrain Effects

The CALPUFF model incorporates terrain information with heights being applied to all receptors and sources. In order to account for the potential influence on pollution dispersion and varying receptor elevations across the modelling domain, a gap filled and filtered (vegetation and obstacles removed) topography file with 1 arc second resolution (approximately 30 m) derived from the Shuttle Radar Topography Mission (SRTM) data was processed using CALPUFF's terrain pre-processing tools to prepare it for use in the dispersion modelling.

### 5.2.1.4. Building Wake Effects

For dispersion modelling assessments, the influence of surrounding buildings on emission transport is a material consideration. Nearby buildings can create turbulence and a building wake that can affect pollutant dispersion, particularly through a phenomenon known as building downwash. The ratio of stack height to building height also impacts this effect; if the stack is significantly taller than the building, downwash is minimal.

Section 5.3 of the Approved Methods outlines the following requirements for determining which buildings to consider within a dispersion modelling assessment:

> *"The location and dimensions of buildings located within a distance of 5L (where L is the lesser of the height or width of the building) from each release point for buildings with a height greater than 0.4 times the stack height…"*

The Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME) uses building heights and corner locations near the stack to simulate effective dimensions. The BPIP-PRIME downwash algorithm computes these dimensions in ten-degree intervals, allowing CALPUFF to assess the impact on plume dispersion and ground-level concentrations. While simplified, this building geometry offers a reasonable estimate of how structures disrupt wind flow nearby.

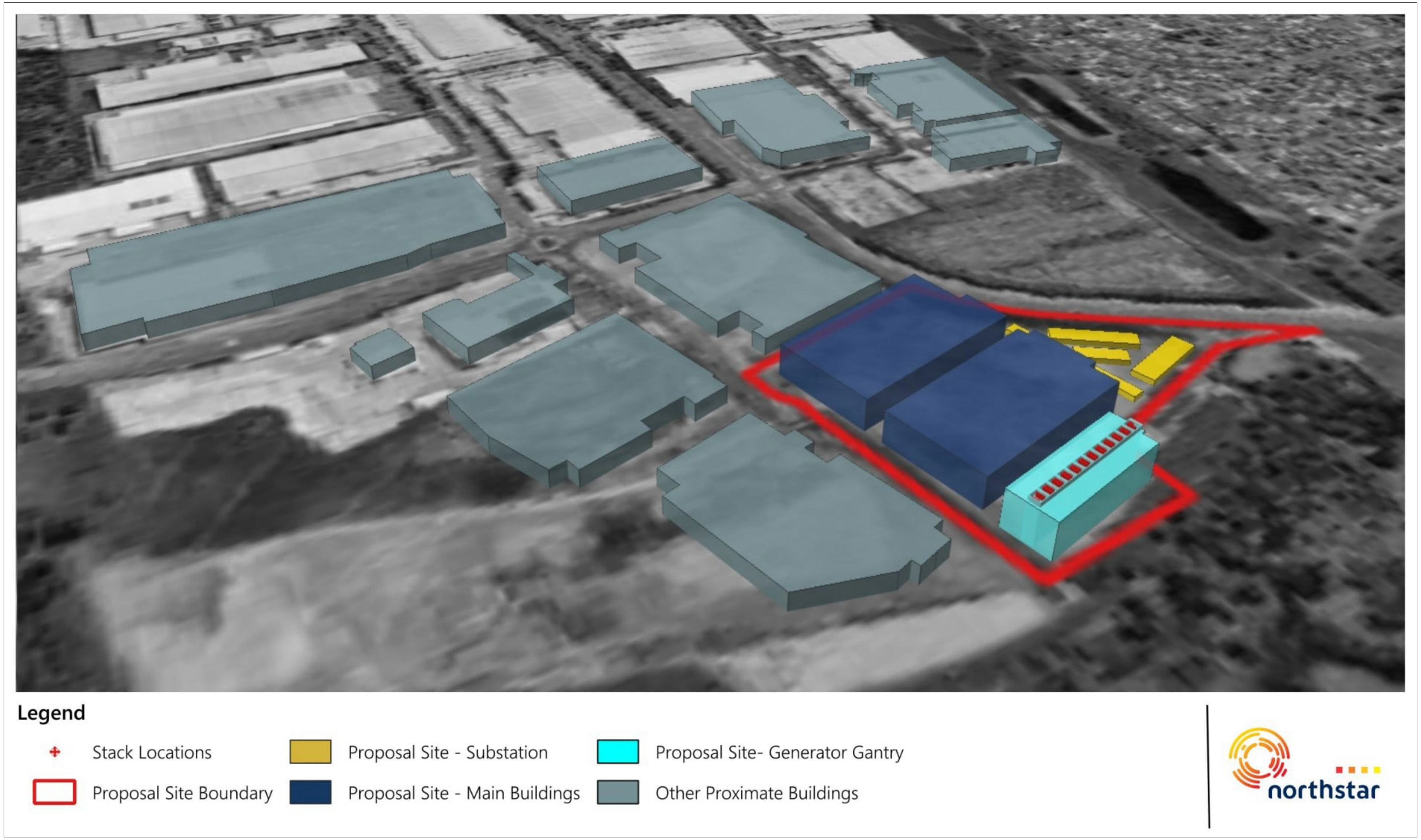
Therefore, to analyse downwash effects from point sources mimicking air emissions, the buildings surrounding the Proposal site were incorporated into the CALPUFF model.

With reference to the requirements outlined in the Approved Methods, Figure 8 and Figure 9 illustrates the locations of the buildings included in the BPIP-PRIME model for downwash calculations, which are subsequently incorporated into the CALPUFF dispersion modelling process. Also shown are the emission discharge points for each scenario modelled (refer Section 5.2.2).

It is noted that the BPIP-PRIME model has a number of limitations. It identifies a single influencing building/tier for 36 wind directions, and depending on the wind direction, the algorithm selects the largest of the building width or length, which effectively overrides any intricacies in the buildings which may be presented in the model. The main components are the largest of the length, width and height of the building. Even with the adoption of tiered structures, the algorithm has analytical and logical relationships that merge buildings and ultimately calculate one effective width, length, height, and position to represent all buildings relative to the stack(s).

The BPIP-PRIME algorithm has been shown in some studies to result in the overprediction of concentrations by a factor two to eight for certain building types, whilst result in underpredictions for certain building and terrain configurations (Petersen, 2017). In conclusion, the use of the BPIP-PRIME algorithm is required by the NSW Approved Methods, although is not an advanced method, such as computational fluid dynamics, or wind tunnel modelling. Any minor disparities in building length, height, width and stack locations are most likely within the large margin of error associated with the use of the BPIP-PRIME algorithm.

Figure 8 Buildings and discharge points considered in dispersion modelling (Scenario 1)




**Source**: Northstar

Figure 9 Buildings and discharge points considered in dispersion modelling (Scenario 2)


**Source**: Northstar

### 5.2.2. Dispersion Modelling Scenarios

The following dispersion modelling scenarios have been completed to determine the potential impacts of the Proposal under the anticipated operational conditions of the standby generators.

#### Scenario 1 – Justified Worst Case (Emergency Power Generation)

This modelling scenario assesses the emergency operation of all 188 standby generators operating concurrently at 100% (full) load. This represents a very unlikely condition that would only arise in the event of an unexpected site-wide power outage. Notwithstanding its low probability, this scenario has been assessed in the AQIA to understand the maximum potential air quality impacts associated with simultaneous generator operation.

The modelling conservatively assumes full concurrent operation at maximum capacity with no redundancy applied to represent a justified worst-case emission scenario. In practice, the generators would typically be configured to support each data hall with a degree of built-in resilience and operational redundancy across critical IT and mechanical systems; however, the specific allocation of generators between operational and redundant roles is subject to final design and has therefore not been relied upon in the modelling.

For modelling purposes, all 188 generators have been assumed to operate for 8 760 hours per year. In reality, should a catastrophic failure of the electricity supply system occur, it would likely be limited to a short duration. The use of continuous operation over a full year therefore provides a conservative assessment across all meteorological conditions.

As the standby generators are intended for short duration use in an emergency, the AQIA has assessed impacts against short-term air quality criteria only. Annual average concentrations have not been presented as they would not meaningfully reflect the nature of emergency generator operation.

The AQIA contextualises the likelihood of any exceedance of air quality criteria by considering the low probability of full capacity operation arising from a catastrophic power failure.

#### Scenario 2 – Realistic Operations (Maintenance Testing)

Scenario 2 assesses routine maintenance testing of the standby generators. The anticipated testing schedule assumes that four generators are operated simultaneously for a duration of one hour within the nominated daytime testing window of 7:00 am to 6:00 pm. This testing configuration is expected to occur regularly (refer Table 4).

While there are mathematically 51 508 751 possible combinations of four generators operating concurrently from a total installed capacity of 188 units (i.e. C(188,4)), it is not proportionate to model every permutation.

Instead, Scenario 2 adopts a representative spatial arrangement that reflects the indicative generator layout and provides appropriate coverage across the gantry area. The standby generator flues are arranged in a series of vertical stacks within the gantry structure. Eleven stacks comprise 16 flues each, with the first stack comprising four (4) flues and the final stack containing eight (8) which results in a total of 188 generators.

To inform Scenario 2, a sensitivity assessment has been performed across representative generator locations distributed across the northern, central and southern areas of the Proposal site. A worst-case generator was identified within each spatial grouping based on predicted maximum ground-level concentrations. These four generators were then carried forward for dispersion modelling purposes. This resulted in a four-generator configuration that is consistent with the Applicant's approach to standby generator maintenance testing. The adopted configuration is shown conceptually in Figure 9.

The AQIA modelled maintenance testing at 100 % generator load whereas the indicative testing regime describes the main annual load banking testing to occur at 70 % load (refer Section 2.3.2). For consistency and transparency, the dispersion modelling has adopted the single set of manufacturer emission performance data provided in Appendix E, which are understood to represent 100 % (full) load conditions. These data have been applied consistently across all modelled scenarios. Accordingly, the dispersion modelling used the emission rates and associated stack parameters from the engine datasheet for the Baudouin 16M55G6D2/5 generator (refer Table 13). It is acknowledged that exhaust characteristics (including volumetric flow rate, exit velocity and exhaust temperature) are load dependent. However, corresponding verified emissions and stack parameter data for a 70 % load condition were not available in the source manufacturer emissions data for the representative generator unit adopted within the AQIA.

Pollutant concentrations in exhaust can vary with engine load and in some cases in stack emissions concentrations at 70 % load can be higher than at 100 % load while total mass exhaust flow is generally lower. In the absence of a separate verified emission dataset measured at 70 % load the AQIA has relied on the available 100 % load emission data as the basis for modelling. While routine testing is expected to typically occur at around 70 % load in practice, the use of the 100 % load emission dataset ensures consistency across all modelled scenarios.

Comparison of impacts against both short- and long-term criteria are performed, providing another level of conservatism, as the testing schedule is modelled as occurring for every one of the hours between 7:00 am and 6:00 pm on each and every day of the year. The Proposal will be constrained to a total of 136 hours of testing time per year, in accordance with the POEO Act (refer Section 3.1). For the purposes of dispersion modelling, a total of 4 015 events were assumed (based on 11 hours of testing per day over 365 days).

This conservative approach ensures that all potential combinations of emissions and meteorological conditions are captured. As the Proposal is to utilise up to 136 testing hours annually, annual average incremental concentrations have been scaled (i.e. weighted) based on the ratio of documented operating hours (136 hours) to the total hours represented in the modelling (4 015 hours). This adjustment ensures that predicted annual average concentrations reflect the Proposal's actual emission load (refer Table 4).

### 5.2.3. Generator Emission Rates and Source Characteristics

As per NSW EPA direction (refer Section 1.4), the AQIA has adopted representative standby diesel generator specifications for assessment purposes, based on units compliant with US EPA Tier 2 emissions standards. The Baudouin 16M55G6D2/5 has been included as a nominated example of a representative generator type.

The standby generators are proposed to be located within the four-storey gantry building to the east of the Proposal site.

A summary of the standby generator stack design parameters used to model each scenario is provided in Table 13. Technical specifications for the representative generator unit are provided in Appendix E. The Baudouin 16M55G6D2/5 generator specifications apply only to emergency standby and prime operations, with the measured emissions data provided for under standby power.

**Table 13 Standby generator emissions and stack parameters**

| Parameter | Units | Scenario 1 (justified worst case) | Scenario 2 (realistic operations) |
|---|---|---|---|
| **Dispersion modelling scenarios summary** | | | |
| Hour start | hr | 00:00 | 07:00 |
| Hour end | hr | 24:00 | 18:00 |
| % load | % | 100 | 100 |
| Number of generators active | no. | 188 | 4 |
| **Discharge characteristics** | | | |
| **Standby generator model** | | **Baudouin 16M55G6D2/5** | |
| Diesel consumption rate (per generator) | $L \cdot hr^{-1}$ | 787.0 | |
| Gross engine output | kWm | 3 300 | |
| Stack height [(a)] | m AGL | 34.1 | |
| Stack diameter [(b)] | mm | 600 | |
| Stack cross sectional area (CSA) | $m^2$ | 0.283 | |
| Discharge rate | $Am^3 \cdot s^{-1}$ | 12.8 | |
| | $Am^3 \cdot min^{-1}$ | 766.7 | |
| Exit temperature | °C | 550 | |
| Exit velocity | $m \cdot s^{-1}$ | 45.2 | |
| **Generator emission specification** | | | |
| $NO_X$ | $g \cdot kWh^{-1}$ | 5.34 | |
| PM | $g \cdot kWh^{-1}$ | 0.09 | |
| CO | $g \cdot kWh^{-1}$ | 0.56 | |
| HC | $g \cdot kWh^{-1}$ | 0.37 | |

| Parameter | Units | Scenario 1 (justified worst case) | Scenario 2 (realistic operations) |
|---|---|---|---|
| **Calculated pollutant emission rates** | | | |
| $NO_X$ (c) | $g{\cdot}s^{-1}$ | 4.90E+00 | |
| CO (c) | $g{\cdot}s^{-1}$ | 5.13E-01 | |
| TVOC (c) | $g{\cdot}s^{-1}$ | 3.39E-01 | |
| PM ($PM_{10}$ and $PM_{2.5}$) (c)(f) | $g{\cdot}s^{-1}$ | 8.25E-02 | |
| $SO_2$ (e) | $g{\cdot}s^{-1}$ | 3.72E-03 | |
| Benzene ($C_6H_6$) (d) | $g{\cdot}s^{-1}$ | 3.29E-03 | |
| Toluene ($C_7H_8$) (d) | $g{\cdot}s^{-1}$ | 1.19E-03 | |
| Xylene ($C_8H_{10}$) (d) | $g{\cdot}s^{-1}$ | 8.27E-04 | |
| Formaldehyde ($CH_2O$) (d) | $g{\cdot}s^{-1}$ | 4.88E-08 | |
| PAHs (d) | $g{\cdot}s^{-1}$ | 3.34E-04 | |

**Notes**: (a): Provided by Applicant.
(b): Measured from associated SYD01 technical plans.
(c): Emission rates based on values contained in technical specification (refer Appendix E).
(d): Emission rates factored from TVOC using the emission factors from Table 43 of (NPI, 2008). Refer Section 5.2.5.
(e): Based on permissible level of sulphur content in non-road diesel fuel (10 ppm).
(f): 100 % of PM is emitted as $PM_{2.5}$, and $PM_{2.5}$ = $PM_{10}$.

### 5.2.4. POEO CAR Calculated Standards of Concentration

As listed in Table 2, NSW EPA request that the generator emission concentrations are calculated and compared to the applicable standards of concentration, as specified within Schedule 2 of the POEO CAR depending on whether the Proposal site is to conduct scheduled or non-scheduled activities.

To inform the benchmark comparison, in-stack emission concentrations have been calculated and presented in Table 14 for the representative standby generator unit adopted within the AQIA.

**Table 14 POEO CAR – calculated in-stack emissions concentrations**

| Air impurity | Baudouin 16M55G6D2/5 | |
|---|---|---|
| | Measured emission data at 5 % $O_2$ ($mg{\cdot}Nm^{-3}$) | Adjusted to 7 % $O_2$ ($mg{\cdot}Nm^{-3}$) |
| Solid particles (total) | 19.5 | 17.0 |
| VOCs (as VOC) | 34.8 | 30.5 |
| VOCs (as CO) | 62.7 | 54.9 |

**Note:** Nitrogen dioxide ($NO_2$) is exempt from the standards of concentration under Clause 73, Part 5, Division 6 of the POEO CAR, as the Applicant has specified generator usage to be below the 200 hour exemption (refer Section 3.2). Accordingly, $NO_2$ has not been included in the calculation.

The emission specifications for the representative standby generator unit adopted within the AQIA have been sourced from the corresponding exhaust gas emissions test report (refer Appendix E), with values expressed at STP, dry gas, and corrected to 5 % oxygen ($O_2$) content. For the purposes of comparison with the POEO CAR Schedule 2 standards of concentration, these values have been adjusted to 7 % $O_2$ in accordance with regulatory requirements. A comparison against the respective POEO CAR standards of concentrations applicable for the Proposal is provided in Section 7.4.

### 5.2.5. Speciated VOCs

The technical specification documents presented in Appendix E presents data for total VOCs, which includes a range of speciated VOCs. To appropriately factor the emissions for benzene ($C_6H_6$), toluene ($C_7H_8$) and xylene ($C_8H_{10}$), reference has been made to the emission factors (EF) presented in table 43 of (NPI, 2008) which relate to stationary large (more than 450 kW) diesel engines.

The emission factors for TVOC and the respective speciated VOCs have been factored to calculate the mass fractions of those species within TVOC. Table 15 presents the speciated VOC fraction assumptions that are used for this AQIA. . The impacts of odorants (toluene ($C_7H_8$) and xylene ($C_8H_{10}$)) have been similarly assessed on a pro-rata basis as a fraction of TVOC as published in the NPI (NPI, 2008) multiplied by the measured source-specific TVOC emission rate.

**Table 15 Speciated VOC fractions**

| Species | Emission rate ($kg \cdot m^{-3}$ $_{(fuel)}$) Table 43 of (NPI, 2008) | Emission rate relative to HC |
|---|---|---|
| TVOC (as HC) | 1.32E+00 | 1.00E+00 |
| Benzene ($C_6H_6$) | 1.28E-02 | 9.70E-03 |
| Toluene ($C_7H_8$) | 4.62E-03 | 3.50E-03 |
| Xylene ($C_8H_{10}$) | 3.22E-03 | 2.44E-03 |
| PAHs | 1.90E-07 | 1.44E-07 |
| Formaldehyde ($CH_2O$) | 1.30E-03 | 9.58E-04 |

### 5.2.6. Particle Size Fractions

In regard to particulates from diesel, virtually 100 % of diesel particles are less than 1 µm in diameter (i.e. $PM_1$) and consequently particulates from diesel combustion are assessed as $PM_{2.5}$. In this AQIA, the emission rate of $PM_{2.5}$ will be the same as $PM_{10}$ as all $PM_{10}$ particles are assessed as being ≤2.5 µm in diameter ($PM_{2.5}$).

### 5.2.7. $NO_x$ to $NO_2$ Conversion

Emissions of $NO_X$ have been calculated, with subsequent ground level concentrations (GLCs) predicted using dispersion modelling techniques. Given that $NO_X$ is predominantly a mixture of $NO_2$ and nitric oxide (NO), conversion of $NO_X$ predictions to $NO_2$ concentrations may be performed.

Approximately 90 % - 95 % of $NO_X$ from a combustion process will be emitted as NO, with the remaining 5 % - 10 % emitted directly as $NO_2$. Over time and after the point of discharge, NO in ambient air will be transformed by secondary atmospheric reactions to form $NO_2$, and this reaction often occurs at a considerable distance downwind from the point of emission, and by which time the plume will have dispersed and diluted significantly from the concentration at point of discharge.

AQIAs are required to account for the conversion of NO to $NO_2$ to enable a comparison against the air quality criterion for $NO_2$. To perform this, various techniques are common, which are briefly outlined below:

- **Method 1 - 100 % conversion**: the most conservative assumption is to assume that 100 % of the total $NO_X$ emitted is discharged as $NO_2$, and that further reactions do not occur.
- **Method 2 - Ozone limiting method (OLM)**: this method uses contemporaneous ozone data to estimate that rate at which NO is oxidised to $NO_2$ hour-on-hour using an established relationship.
- **Method 3 – Janssen method**: where the location is represented by good monitoring data for NO and $NO_X$, the empirical relationship between NO and $NO_2$ to derive 'steady state' relationships.

Section 8.1 of the Approved Methods outlines the approach to $NO_2$ assessment, which clearly indicates that each stage should be performed sequentially. That is, Method 1, Level 1 should be performed first and *"if the impact assessment criteria are exceeded, a more refined assessment should be undertaken and/or additional management practices or emission controls applied"*.

If exceedances are predicted, then Method 1, Level 2 should be performed, with the same assessment of the potential for exceedance of the 1-hour $NO_2$ criterion applied. The process then continues through Method 2 (Level 1 and Level 2), and Method 3 (Level 1 and Level 2).

This AQIA has used Method 3 to approximate the conversion of $NO_X$ to $NO_2$, in accordance with the empirical equation described in (NSW EPA, 2022):

$$NO_2 \;/\; NO_x = A(1 - \exp(-\alpha x))$$

Where:

$x$ = distance from the source

$A$ and $\alpha$ are classified according to $O_3$ concentration, wind speed and season, with (Janssen, Van Wakeren, Van Duuren, & Elshout, 1988) providing values for $A$ and $\alpha$.

At each receptor, the hourly varying $NO_2$ / $NO_x$ relationship has been calculated, based on the season, hourly varying $O_3$ concentration, and wind speed. Results are presented in Section 7 for the maximum predicted incremental $NO_X$ / $NO_2$ concentration and the maximum predicted cumulative $NO_2$ concentration using the relevant $NO_X$ / $NO_2$ conversion method(s).

### 5.2.8. Short Term Pollutant Concentrations

With reference to criteria air pollutants with sub-hourly criteria (i.e. CO, refer Section 3.3), hourly dispersion model outputs are required to be adjusted to allow provision of data on those timescales. The following Power Law adjustment has been applied:

$$C_{p,t} = C_{p,60}\left[\frac{60}{t}\right]^{0.2}$$

Where:

$C_{p,t}$ = concentration of pollutant ($p$) at averaging time (mins) ($t$)

$C_{p,60}$ = concentration of pollutant ($p$) at averaging time (60 mins)

$t$ = time (mins)

## 5.3. Assessment of Cumulative Impacts

The Cumulative Impact Assessment (CIA) methodology adopted for this AQIA is based on the CIA Guidelines (NSW DPIE, 2022), which recognise that cumulative assessments can be carried out at either a strategic or project level.

This AQIA represents a Project-level CIA, following the approach outlined in the CIA Guidelines. These Guidelines define cumulative impacts as those arising from the incremental, sustained, and combined effects of human actions and natural variations over time, which may be either adverse or beneficial. Such impacts can result from the compounding impacts of a single project or multiple projects in an area, and from the accumulation of impacts associated with past, present, and foreseeable future activities.

As noted in the CIA Guidelines (NSW DPIE, 2022):

> *"The cumulative impact assessment undertaken for a particular State significant projects are to be proportionate to the scale and potential significance of the cumulative impacts of the project combined with the impacts of other relevant future projects. This assessment is to focus on the key matters that could be materially affected by the cumulative impacts of the project and other relevant future projects - not on every conceivable cumulative impact on every matter."*

### 5.3.1. Assessment Approach

The methodology for the CIA involved the following steps:

- Identification of relevant future projects, based on publicly available information, and the associated issues that could contribute to cumulative impacts, using the screening criteria outlined in Section 3.4 of the CIA Guidelines;
- Determination of the applicable level of assessment (detailed, standard, or not applicable) for air quality matters, in accordance with Appendix B of the CIA Guidelines;
- Identification of the proposed approach and key uncertainties in assessing cumulative impacts; and,
- Assessment of cumulative impacts and recommendation of mitigation measures to minimise the Proposal's contribution.

In consultation with NSW EPA, two additional developments in the locality (though not data centres) were identified for consideration in the cumulative impact assessment. While not originally scoped their potential for concurrent emissions have been assessed qualitatively in accordance with the CIA Guidelines.

### 5.3.2. Study Area and Scope

The study area for the CIA assessment aligns with the dispersion modelling domain (refer Appendix C). This approach is consistent with section 2.3 of the CIA Guidelines, which state:

> *"This assessment need only focus on the key matters that are within the immediate geographical area of influence of the project (i.e. within proximity to the project site) and within the relevant strategic context. It is not practical or reasonable to require proponents to assess cumulative impacts for all matters or across large areas."*

The scope of assessment includes:

- Review of the nature and scale of potential air quality impacts anticipated during the Proposal's timeframe, based on publicly available planning documents for relevant future Proposals;
- Evaluation of the potential for cumulative air quality impacts arising from these identified projects in combination with this Proposal, including dust generation and gaseous emissions during construction, and gaseous emissions during operation; and,
- Identification and recommendation of mitigation measures, where necessary.

Cumulative impacts from this Proposal and nearby sources are presented in Section 7.5.

# 6. CONSTRUCTION PHASE RISK ASSESSMENT

Northstar have adapted the methodology from the IAQM construction dust guidance (IAQM, 2024) to assess construction phase risk. This approach employed a six-step process to evaluate the risks associated with dust impact from construction activities (refer Appendix B). It considers receptor sensitivity and potential impact magnitude to identify key control measures, as detailed in Section 5.1.

## 6.1. Risk (Pre-Mitigation)

Given the sensitivity of the identified receptors is classified as 'medium' for dust soiling, and 'low' for health impacts, and the dust emission magnitudes for the various construction phase activities as presented in Appendix B, the resulting risk of air quality impacts (without mitigation) is as presented in Table 16.

**Table 16 Risk of air quality impacts from construction activities**

| Sensitivity of area | DEM | | | | | Preliminary risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Demolition | Earthworks | Construction | Track-out | Const. traffic | Demolition | Earthworks | Construction | Track-out | Const. traffic |
| **Dust soiling** | | | | | | | | | | |
| Med | N/A | Med. | Large | Med | Large | N/A | Med. | Med. | Med. | Med. |
| **Human health** | | | | | | | | | | |
| Low | N/A | Med. | Large | Med | Large | N/A | Low | Low | Low | Low |

**Note**: Med. = Medium, N/A. = Not Applicable, Neg. = Negligible

Table 16 shows that dust soiling impacts are classified as a medium risk for all performed construction activities For human health, the specified construction activities are associated with low risk, assuming no mitigation measures are in place to control emissions during the construction phase.

## 6.2. Risk (Post-Mitigation)

The adapted methodology emphasises the aim of preventing significant effects on receptors during construction activities through the implementation of effective mitigation measures. Experience demonstrates that achieving this goal is feasible. Considering the size of the Proposal site, the distance to sensitive receptors, and the nature of activities involved, residual impacts related to fugitive dust emissions from the Proposal are expected to be 'negligible' if the mitigation measures outlined in Appendix B are implemented appropriately.

# 7. OPERATIONAL PHASE IMPACT ASSESSMENT

This section presents the results of the dispersion modelling assessment and uses the following terminology:

- **Incremental impact** – relates to the concentrations predicted as a result of the operation of the Proposal in isolation.
- **Cumulative impact** – relates to the incremental concentrations predicted as a result of the operation of the Proposal PLUS the background air quality concentrations discussed in Section 4.4.

The results are presented in this manner to allow examination of the likely impact of the facility in isolation and the contribution to air quality impacts in a broader sense. In the presentation of results, the tables included shaded cells which represent the following:

| Model prediction | Pollutant concentration / deposition rate less than the relevant criterion | Pollutant concentration / deposition rate equal to, or greater than the relevant criterion |
|---|---|---|

Details of each dispersion modelled scenario are provided in Section 5.2.2. The results presented below represent the maximum predicted concentrations for each scenario, with the top 10 impacted receptors summarised in the following tables and results for all considered receptors provided in Appendix F.

## 7.1. Scenario 1 – Justified Worst Case

The following presents modelling results for Scenario 1 (refer Section 5.2.2), which assumes all 188 standby generators operate at 100 % (full) load, with background pollutant concentrations included where appropriate (refer Section 4.4). Results in this section are focused on short term criteria only (i.e. ≤ 24 hours).

**Note:** Care should be taken when interpreting 24-hour average impacts, as power outages are typically much shorter in duration. The assessment adopts a conservative approach by assuming generator operation over a full 24-hour period. Comparison against annual average criteria is not meaningful in this context given that generator use is limited to occasional, short-term operation during emergency scenarios.

Assessment of annual average impacts is presented separately under Scenario 2 (maintenance testing).

### 7.1.1. Particulate Matter

Results are presented in this section for the predictions of particulate matter ($PM_{10}$ and $PM_{2.5}$) associated with Scenario 1. The averaging periods associated with the criteria for these pollutants is 24-hour as specified in Table 6. The emissions adopted for Scenario 1 reflect the operational profile of the Proposal over that averaging period (refer Section 5.2.2).

#### 7.1.1.1. Daily (24-Hour) $PM_{10}$ and $PM_{2.5}$ Concentrations

Table 17 shows the predicted 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations for the top 10 impacted receptors under Scenario 1. No background concentrations are included within this table.

**Table 17 Predicted incremental 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations – Scenario 1**

| Receptor | Predicted incremental 24-hour concentration ($\mu g \cdot m^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| Criterion | 50 | 25 |
| Max. % of criterion | 275.8 | 551.6 |
| R15 | 137.9 | 137.9 |
| R4 | 114.6 | 114.6 |
| R127 | 105.3 | 105.3 |
| R5 | 103.1 | 103.1 |
| R14 | 97.2 | 97.2 |
| R128 | 88.0 | 88.0 |
| R6 | 81.2 | 81.2 |
| R2 | 74.4 | 74.4 |
| R21 | 73.2 | 73.2 |
| R124 | 67.8 | 67.8 |

**Note**: All PM is assumed to be < 1 µm in diameter and therefore assessed as $PM_{2.5}$. In this instance, emissions of $PM_{2.5}$ will be the same as $PM_{10}$ ($PM_{2.5}$ is a subset of $PM_{10}$) and therefore the results will be consistent between $PM_{10}$ and $PM_{2.5}$.
Care must be applied when assessing 24-hour average impacts as the likely duration of a power outage event is likely to be significantly less than 24-hours, and as such the assessment should be considered to be highly conservative (i.e. reflective of the operation of standby generators for an entire 24-hour period).

Table 17 indicates that the highest 24-hour average $PM_{10}$ and $PM_{2.5}$ incremental concentrations related to the Proposal are predicted at receptor R15.

A contemporaneous analysis of the 24-hour $PM_{10}$ and $PM_{2.5}$ data has been performed where each predicted incremental concentration is added to the corresponding monitored background concentration, in accordance with Section 11.2.3(b) of the Approved Methods.

Table 18 and Table 19 present the predicted maximum 24-hour average $PM_{10}$ and $PM_{2.5}$ concentrations resulting from the operation of the Proposal through Scenario 1, with the corresponding background included for each day. Results are presented in Table 18 and Table 19 for those receptors at which the greatest impacts have been predicted (refer Table 17). The left side of the tables show the predicted maximum cumulative impacts (typically the days with the highest regional background), and the right side shows the total predicted concentration on days with the highest predicted incremental concentrations respectively.

For both $PM_{10}$ and $PM_{2.5}$, the maximum cumulative impact (the left-hand side of Table 18 and Table 16) and the highest maximum incremental impact (the right-hand side of Table 18 and Table 16) is predicted at receptor R15. Both tables highlight that exceedances of the respective air quality criteria are primarily driven by the additional of incremental impacts to background concentrations.

A contour isopleth plot of the predicted incremental 24-hour $PM_{10}$ concentrations associated with the Proposal under Scenario 1 are presented in Figure 10 to illustrate the spatial distribution of particulate matter in the area surrounding the Proposal site.

The number of additional exceedances of the 24-hour $PM_{10}$ and $PM_{2.5}$ criteria predicted at various receptors resulting from emergency generator operation is presented in Section 7.3. Further analysis and interpretation of the above predictions are discussed in Section 8.2.

**Table 18 Summary of contemporaneous 24-hour $PM_{10}$ concentrations – Scenario 1**

| Date | 24-hour $PM_{10}$ concentration ($\mu g{\cdot}m^{-3}$) – Receptor R15 | | | Date | 24-hour $PM_{10}$ concentration ($\mu g{\cdot}m^{-3}$) – Receptor R15 | | |
|---|---|---|---|---|---|---|---|
| | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. |
| 3/09/2021 | 137.9 | 19.8 | 157.7 | 3/09/2021 | 137.9 | 19.8 | 157.7 |
| 25/01/2021 | 93.7 | 33.5 | 127.2 | 25/01/2021 | 93.7 | 33.5 | 127.2 |
| 12/02/2021 | 78.7 | 32.0 | 110.7 | 18/12/2021 | 88.4 | 18.4 | 106.7 |
| 29/09/2021 | 86.7 | 21.0 | 107.7 | 29/09/2021 | 86.7 | 21.0 | 107.7 |
| 31/07/2021 | 84.1 | 23.1 | 107.2 | 31/07/2021 | 84.1 | 23.1 | 107.2 |
| 18/12/2021 | 88.4 | 18.4 | 106.7 | 12/02/2021 | 78.7 | 32.0 | 110.7 |
| 2/09/2021 | 66.6 | 36.0 | 102.6 | 25/05/2021 | 77.7 | 9.6 | 87.3 |
| 23/08/2021 | 70.9 | 25.4 | 96.3 | 6/02/2021 | 76.9 | 13.6 | 90.5 |
| 24/01/2021 | 69.6 | 25.4 | 95.0 | 23/07/2021 | 75.5 | 13.5 | 89.0 |
| 18/11/2021 | 70.6 | 22.0 | 92.6 | 23/06/2021 | 74.1 | 7.8 | 81.9 |
| These data represent the highest Cumulative Impact 24-hour $PM_{10}$ predictions (**outlined in red**) as a result of the operation of the Proposal | | | | These data represent the highest Incremental Impact 24-hour $PM_{10}$ predictions (**outlined in blue**) as a result of the operation of the Proposal. | | | |

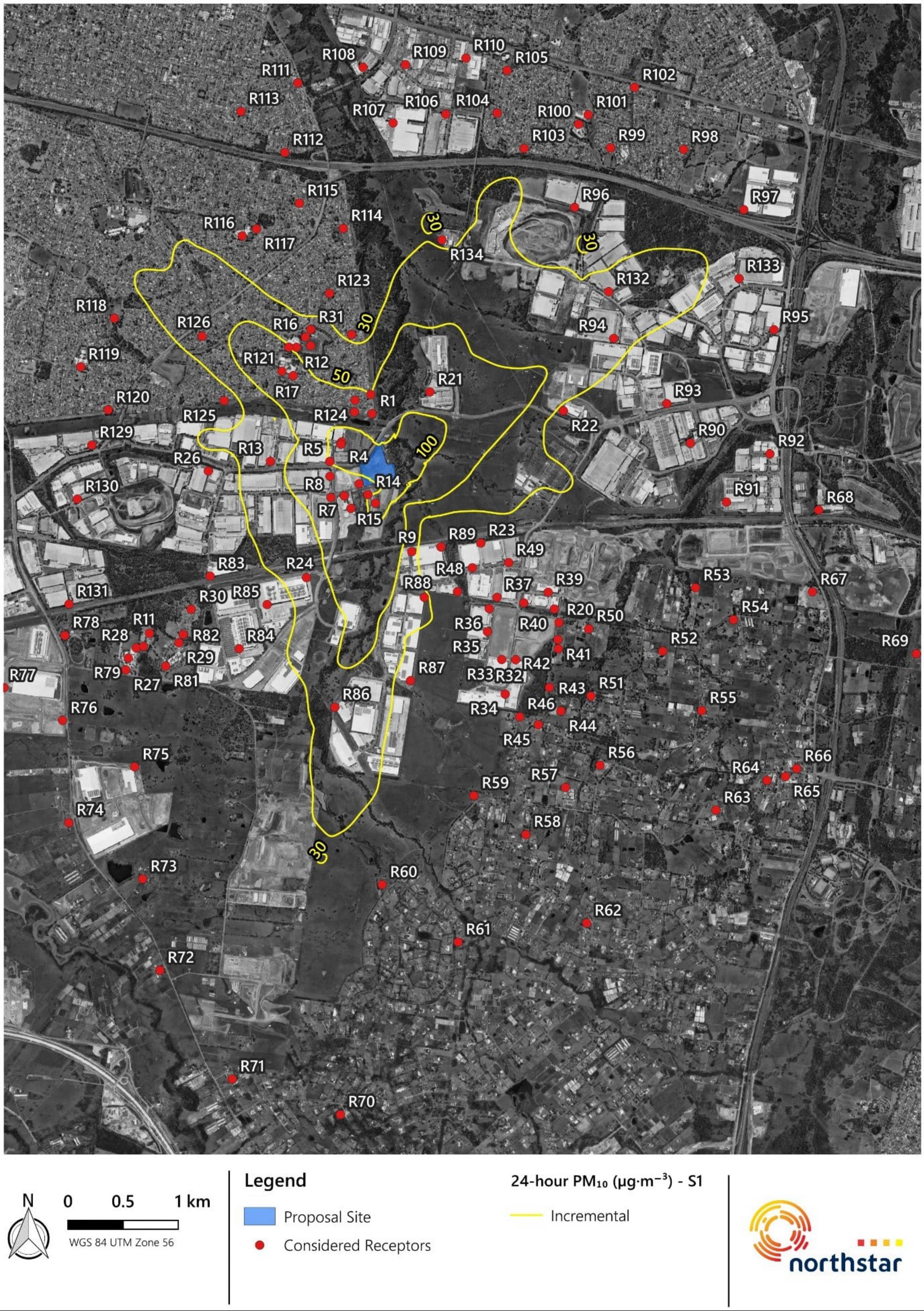
**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table 19 Summary of contemporaneous 24-hour $PM_{2.5}$ concentrations – Scenario 1

| Date | 24-hour $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – Receptor R15 | | | Date | 24-hour $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – Receptor R15 | | |
|---|---|---|---|---|---|---|---|
| | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. |
| 3/09/2021 | 137.9 | 6.7 | 144.6 | 3/09/2021 | 137.9 | 6.7 | 144.6 |
| 25/01/2021 | 93.7 | 12.6 | 106.3 | 25/01/2021 | 93.7 | 12.6 | 106.3 |
| 31/07/2021 | 84.1 | 10.6 | 94.7 | 18/12/2021 | 88.4 | 3.7 | 92.0 |
| 29/09/2021 | 86.7 | 6.2 | 92.9 | 29/09/2021 | 86.7 | 6.2 | 92.9 |
| 18/12/2021 | 88.4 | 3.7 | 92.0 | 31/07/2021 | 84.1 | 10.6 | 94.7 |
| 12/02/2021 | 78.7 | 11.0 | 89.7 | 12/02/2021 | 78.7 | 11.0 | 89.7 |
| 23/08/2021 | 70.9 | 14.7 | 85.6 | 25/05/2021 | 77.7 | 6.4 | 84.1 |
| 25/05/2021 | 77.7 | 6.4 | 84.1 | 6/02/2021 | 76.9 | 6.5 | 83.4 |
| 23/07/2021 | 75.5 | 8.0 | 83.5 | 23/07/2021 | 75.5 | 8.0 | 83.5 |
| 6/02/2021 | 76.9 | 6.5 | 83.4 | 23/06/2021 | 74.1 | 5.6 | 79.7 |
| These data represent the highest Cumulative Impact 24-hour $PM_{10}$ predictions (**outlined in red**) as a result of the operation of the Proposal | | | | These data represent the highest Incremental Impact 24-hour $PM_{10}$ predictions (**outlined in blue**) as a result of the operation of the Proposal. | | | |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Figure 10 Predicted incremental 24-hour $PM_{10}$ impacts – Scenario 1




**Source:** Northstar

### 7.1.2. Nitrogen Dioxide

Results are presented in this section for the predictions of nitrogen dioxide ($NO_2$) under the assumptions of Scenario 1 (refer Section 5.2.2). The averaging period associated with the criterion for $NO_2$ is 1-hour as specified in Table 6. Note that impacts have not been compared with the annual average criterion for $NO_2$ as the generators would not be operating for an entire year, and the results would be meaningless.

Emissions of $NO_X$ have been calculated with subsequent ground-level concentrations predicted using dispersion modelling techniques. Given that $NO_X$ is a mixture of $NO_2$ and nitric oxide (NO), conversion of $NO_X$ predictions to $NO_2$ concentrations may be performed. Within this AQIA, the Janssen method (Method 3) has been adopted as outlined in Section 5.2.7.

The predicted 1-hour $NO_2$ concentrations resulting from the Proposal operations for the top 10 impacted receptors under Scenario 1 are presented in Table 20.

**Table 20 Predicted 1-hour $NO_2$ concentrations – Scenario 1**

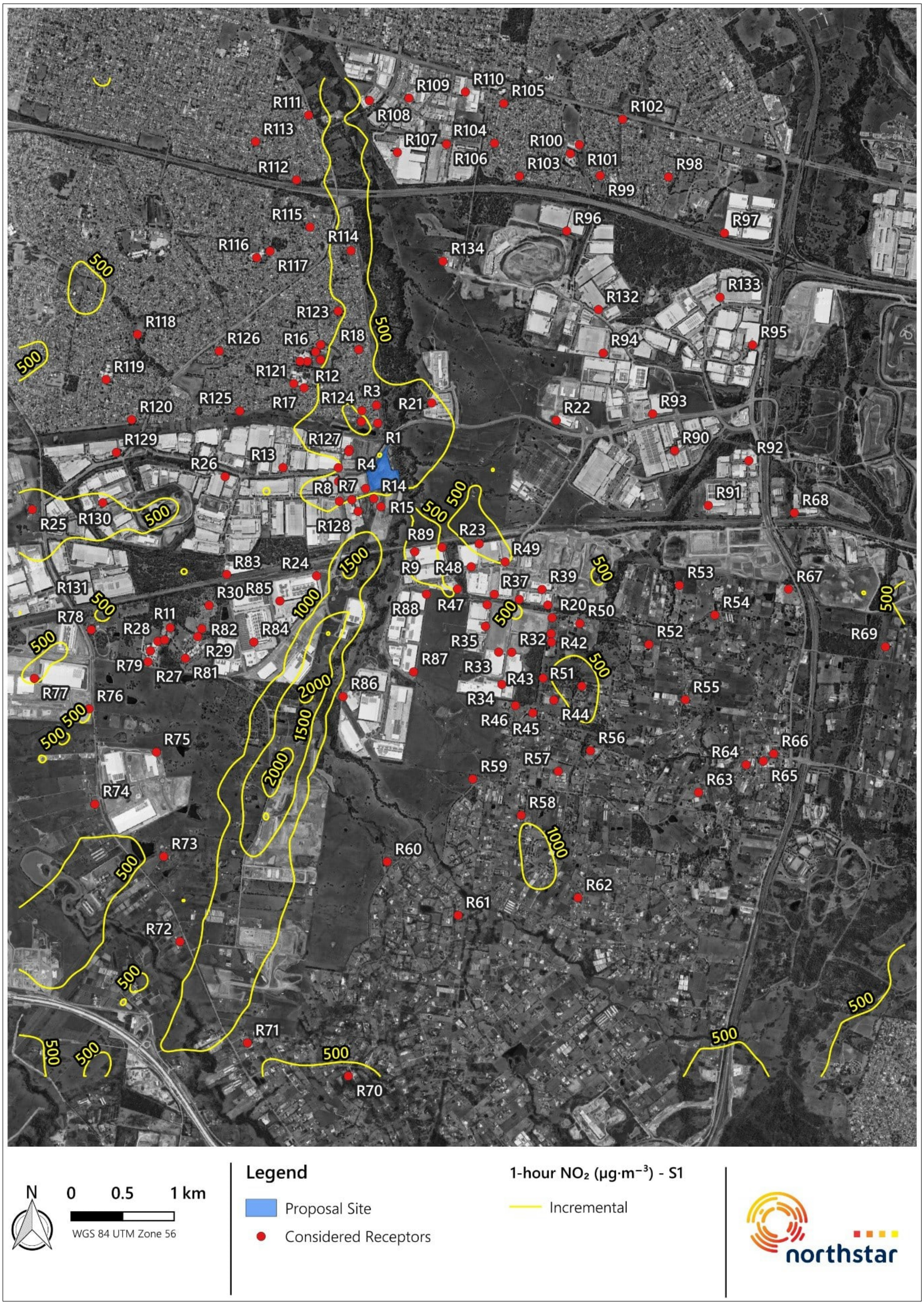
| Receptor | Nitrogen dioxide ($NO_2$) concentration (µg·m$^{-3}$) | | |
|---|---|---|---|
| | 1-hour | | |
| | Incremental impact | Background | Cumulative impact |
| Criterion | 164 | | |
| Max % of criterion | 597.1 | 8.7 | 603.4 |
| R58 | 979.3 | 10.2 | 989.5 |
| R109 | 932.4 | 10.2 | 942.7 |
| R132 | 916.6 | 2.0 | 918.7 |
| R30 | 878.5 | 14.3 | 892.8 |
| R11 | 862.9 | 14.3 | 877.3 |
| R28 | 849.4 | 14.3 | 863.7 |
| R107 | 838.3 | 10.2 | 848.6 |
| R62 | 823.4 | 10.2 | 833.7 |
| R98 | 818.3 | < 0.1 | 818.3 |
| R80 | 811.6 | 14.3 | 825.9 |

The results indicate that there are a number of exceedances associated with cumulative concentrations of $NO_2$ under Scenario 1.

Figure 11 presents a contour isopleth plot of the predicted 1-hour incremental $NO_2$ impacts for Scenario 1, based on the Janssen method for converting $NO_X$ to $NO_2$ (refer Section 5.2.7).

The number of additional exceedances of the 1-hour $NO_2$ criterion predicted at each receptor resulting from emergency generator operation is presented in Section 7.3. These values are discussed further in Section 8.2.

Figure 11 Predicted incremental 1-hour $NO_2$ impacts – Scenario 1




Source: Northstar

### 7.1.3. All Other Pollutants

The following presents the predicted ground level concentrations associated with Scenario 1 for all other pollutants assessed in this AQIA (refer Section 5.2.2).

Presented in Table 21 to Table 23 are the predicted concentrations of CO, $SO_2$, PAHs, VOCs and formaldehyde ($CH_2O$) at varying averaging periods (≤ 24 hours) at the top 10 impacted receptors.

Contemporaneous background concentrations for CO and $SO_2$ have been derived from monitoring data obtained from the Prospect AQMS (refer Section 4.4). As these pollutants are assessed against short-term averaging periods of up to 24 hours (refer Table 6), predicted incremental concentrations from the dispersion model have been combined with the corresponding background concentrations occurring at the same time to provide a contemporaneous assessment of cumulative concentrations. The maximum observed background concentrations (refer Table 10) and maximum modelled incremental concentrations reported in this AQIA indicate that, under a conservative combination of these values the corresponding cumulative concentrations would remain below the applicable assessment criteria.

**Note:** care must be applied when assessing 24-hour average impacts as the likely duration of a power outage event is likely to be significantly less than 24-hours, and as such the assessment should be considered to be highly conservative (i.e. reflective of the operation of standby generators for an entire 24-hour period).

The predicted cumulative concentrations for CO are below the relevant criteria for all averaging periods at all receptors as shown in Table 18.

The results presented in Table 19 indicate that predicted incremental impacts of $SO_2$ at all receptors are less than 5.3 % of the 1-hour criterion and less than 10.9 % of the respective 24-hour criterion. The addition of background concentrations does not result in any exceedances at any receptor.

Results in Table 20 indicate no exceedances of the 1-hour criteria for benzene ($C_6H_6$) are predicted at any identified receptors with the maximum predicted impact to be experienced at receptor R15 (23.1 % of the relevant criterion).

Figure 12 presents a contour isopleth plot of the predicted 1-hour incremental benzene ($C_6H_6$) impact for Scenario 1.

Table 21 Predicted 15-minutes, 1-hour and 8-hour CO concentrations – Scenario 1

| Carbon monoxide (CO) concentration ($mg{\cdot}m^{-3}$) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Receptor | 15-minute | | | Receptor | 1-hour | | | Receptor | 8-hour | | |
| | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. |
| Criterion | 100 | | | | 30 | | | | 10 | | |
| Max. % of criterion | 2.1 | 0.5 | 2.4 | - | 5.3 | 1.3 | 6.0 | - | 9.7 | 1.6 | 11.0 |
| R9 | 2.1 | 0.3 | 2.4 | R9 | 1.6 | 0.3 | 1.8 | R15 | 1.0 | 0.2 | 1.1 |
| R23 | 1.5 | 0.5 | 2.0 | R23 | 1.1 | 0.4 | 1.5 | R5 | 0.9 | < 0.1 | 1.0 |
| R15 | 1.5 | < 0.1 | 1.5 | R15 | 1.1 | < 0.1 | 1.1 | R14 | 0.9 | < 0.1 | 0.9 |
| R89 | 1.5 | 0.2 | 1.6 | R89 | 1.1 | 0.1 | 1.2 | R4 | 0.9 | < 0.1 | 0.9 |
| R14 | 1.4 | < 0.1 | 1.4 | R14 | 1.1 | < 0.1 | 1.1 | R127 | 0.8 | < 0.1 | 0.8 |
| R128 | 1.4 | < 0.1 | 1.4 | R128 | 1.1 | < 0.1 | 1.1 | R21 | 0.8 | 0.1 | 0.9 |
| R48 | 1.4 | 0.2 | 1.6 | R48 | 1.1 | 0.1 | 1.2 | R128 | 0.8 | < 0.1 | 0.8 |
| R10 | 1.3 | 0.5 | 1.8 | R10 | 1.0 | 0.4 | 1.4 | R6 | 0.8 | < 0.1 | 0.8 |
| R21 | 1.3 | 0.5 | 1.8 | R21 | 1.0 | 0.4 | 1.4 | R7 | 0.7 | < 0.1 | 0.7 |
| R7 | 1.3 | < 0.1 | 1.3 | R7 | 1.0 | < 0.1 | 1.0 | R8 | 0.7 | < 0.1 | 0.7 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table 22 Predicted 1-hour and 24-hour $SO_2$ concentrations – Scenario 1

| Sulphur dioxide ($SO_2$) concentration ($\mu g{\cdot}m^{-3}$) | | | |
|---|---|---|---|
| Receptor | 1-hour | | |
| | Incr. | Bkg. | Cumul. |
| Criterion | 215 | | |
| Max. % of criterion | 5.3 | 2.7 | 6.4 |
| R9 | 11.3 | < 0.1 | 11.3 |
| R23 | 8.3 | 2.9 | 11.1 |
| R15 | 8.0 | 5.7 | 13.8 |
| R89 | 8.0 | < 0.1 | 8.0 |
| R14 | 7.7 | < 0.1 | 7.7 |
| R128 | 7.7 | < 0.1 | 7.7 |
| R48 | 7.6 | < 0.1 | 7.6 |
| R10 | 7.4 | 2.9 | 10.3 |
| R21 | 7.2 | 2.9 | 10.1 |
| R7 | 7.1 | < 0.1 | 7.1 |

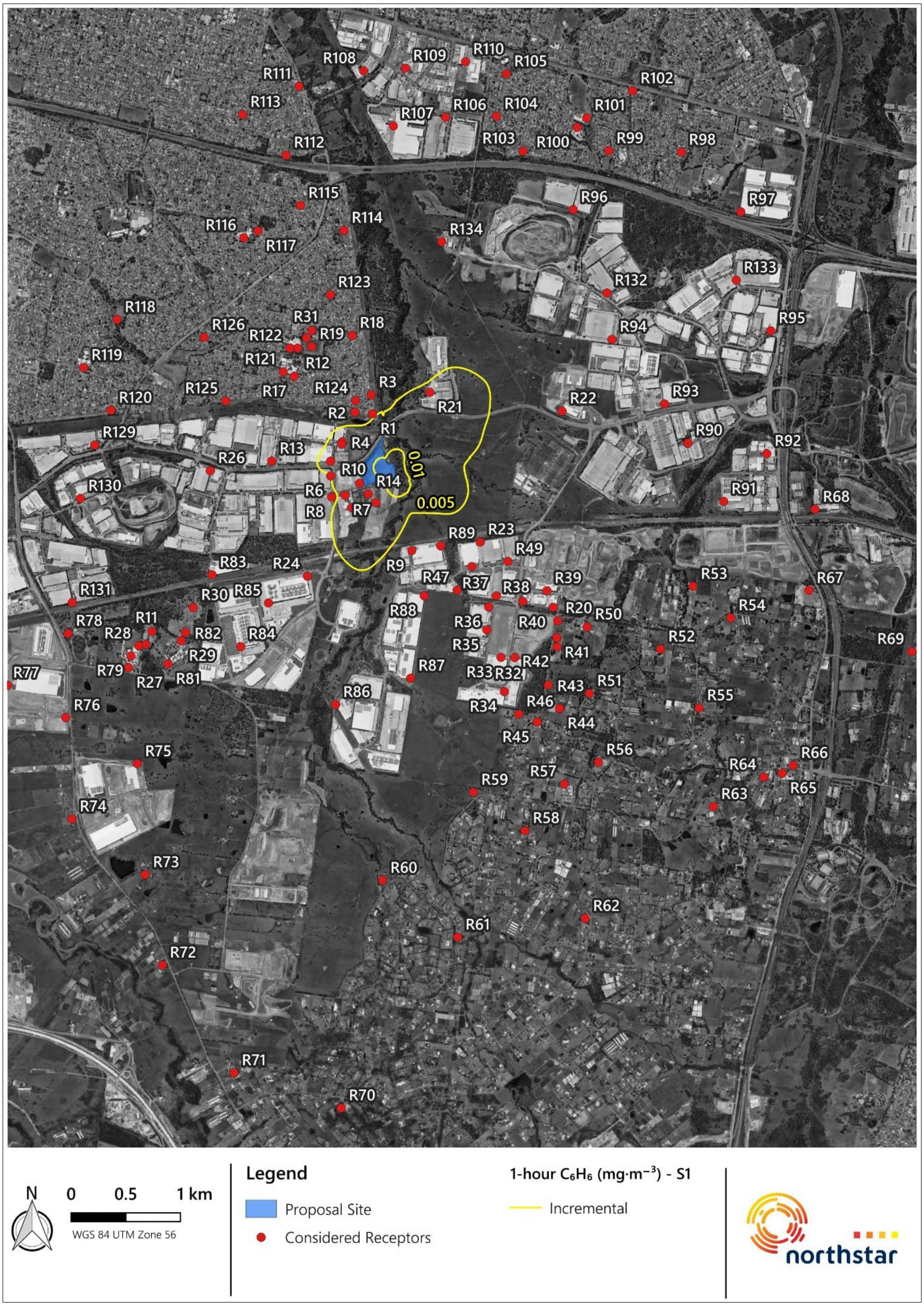
| Sulphur dioxide ($SO_2$) concentration ($\mu g{\cdot}m^{-3}$) | | | |
|---|---|---|---|
| Receptor | 24-hour | | |
| | Incr. | Bkg. | Cumul. |
| Criterion | 57 | | |
| Max. % of criterion | 10.9 | 14.4 | 25.3 |
| R15 | 6.2 | 8.2 | 14.4 |
| R4 | 5.2 | < 0.1 | 5.2 |
| R127 | 4.7 | < 0.1 | 4.7 |
| R5 | 4.6 | < 0.1 | 4.6 |
| R14 | 4.4 | 5.8 | 10.2 |
| R128 | 4.0 | 5.8 | 9.8 |
| R6 | 3.7 | 0.4 | 4.0 |
| R2 | 3.4 | < 0.1 | 3.4 |
| R21 | 3.3 | 0.1 | 3.4 |
| R124 | 3.1 | < 0.1 | 3.1 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table 23 Predicted incremental 1-hour (99.9$^{th}$ %ile) PAH and VOC concentrations – Scenario 1

| Receptor | Predicted 1-hour (99.9$^{th}$ %ile) concentration ($mg \cdot m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| Criterion | 0.0004 | 0.029 | 0.36 | 0.19 | 0.02 |
| Max. % of criterion | 0.0 | 23.1 | 0.7 | 0.9 | 3.4 |
| Max. % at boundary | 0.1 | 89.7 | 2.6 | 3.5 | 13.5 |
| R15 | 9.94E-08 | 6.70E-03 | 2.40E-03 | 1.70E-03 | 6.80E-04 |
| R128 | 9.17E-08 | 6.20E-03 | 2.20E-03 | 1.60E-03 | 6.27E-04 |
| R14 | 9.06E-08 | 6.10E-03 | 2.20E-03 | 1.50E-03 | 6.20E-04 |
| R5 | 8.28E-08 | 5.60E-03 | 2.00E-03 | 1.40E-03 | 5.67E-04 |
| R4 | 8.16E-08 | 5.50E-03 | 2.00E-03 | 1.40E-03 | 5.58E-04 |
| R21 | 7.78E-08 | 5.20E-03 | 1.90E-03 | 1.30E-03 | 5.33E-04 |
| R7 | 7.72E-08 | 5.20E-03 | 1.90E-03 | 1.30E-03 | 5.28E-04 |
| R127 | 7.71E-08 | 5.20E-03 | 1.90E-03 | 1.30E-03 | 5.28E-04 |
| R10 | 7.64E-08 | 5.10E-03 | 1.90E-03 | 1.30E-03 | 5.22E-04 |
| R6 | 7.78E-08 | 4.90E-03 | 1.90E-03 | 1.30E-03 | 5.33E-04 |

Figure 12 Predicted 99.9th percentile incremental 1-hour $C_6H_6$ impacts – Scenario 1




**Source:** Northstar

## 7.2. Scenario 2 – Maintenance Testing

Presented below are the results of the modelling assessment under the assumptions of Scenario 2 (refer Section 5.2.2) with four standby generators operating for each specified testing hour. It is noted that the maintenance scenario involves up to four generators operating simultaneously during daytime hours (7:00 am to 6:00 pm) (refer Table 4). Annual average increments under this scenario have been factored according to the anticipated number of hours of testing each year (refer Section 2.3.2).

### 7.2.1. Particulate Matter

#### 7.2.1.1. Annual TSP, $PM_{10}$ and $PM_{2.5}$ Concentrations

The predicted annual particulate matter concentrations (as TSP, $PM_{10}$ and $PM_{2.5}$) resulting from Scenario 2 operations are presented in Table 24 for the top 10 impacted receptors. Predicted incremental concentrations of TSP, $PM_{10}$ and $PM_{2.5}$ at all receptor locations are low. The Proposal's operation under the modelled testing regime is predicted to not result in any exceedances of the relevant criteria.

**Table 24 Predicted annual TSP, $PM_{10}$ and $PM_{2.5}$ concentrations – Scenario 2**

| Receptor | Annual particulate matter concentration (µg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TSP | | | $PM_{10}$ | | | $PM_{2.5}$ | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 90 | | | 25 | | | 8 | | |
| Max. % of criterion | < 0.1 | 37.2 | 37.2 | < 0.1 | 65.2 | 65.2 | < 0.1 | 72.5 | 72.5 |
| R15 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R14 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R128 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R10 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R1 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R2 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R4 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R127 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R7 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R124 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

#### 7.2.1.2. Daily (24-Hour) $PM_{10}$ and $PM_{2.5}$ Concentrations

Table 25 shows the predicted 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations for the top 10 impacted receptors under Scenario 2. No background concentrations are included within this table.

Table 25 Predicted incremental 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations – Scenario 2

| Receptor | Predicted incremental 24-hour concentration ($\mu g \cdot m^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| Criterion | 50 | 25 |
| Max. % of criterion | 1.8 | 3.6 |
| R4 | 1.2 | 1.2 |
| R14 | 1.2 | 1.2 |
| R127 | 1.2 | 1.2 |
| R15 | 1.2 | 1.2 |
| R5 | 1.0 | 1.0 |
| R6 | 1.0 | 1.0 |
| R1 | 1.0 | 1.0 |
| R2 | 0.9 | 0.9 |
| R7 | 0.9 | 0.9 |
| R128 | 0.9 | 0.9 |

**Note**: All PM is assumed to be < 1 µm in diameter and therefore assessed as $PM_{2.5}$. In this instance, emissions of $PM_{2.5}$ will be the same as $PM_{10}$ ($PM_{2.5}$ is a subset of $PM_{10}$) and therefore the results will be consistent between $PM_{10}$ and $PM_{2.5}$.
Care must be applied when assessing 24-hour average impacts as the likely duration of a testing event is likely to be significantly less than 24-hours, and as such the assessment should be considered to be highly conservative.

Table 25 indicates that the highest 24-hour average $PM_{10}$ and $PM_{2.5}$ incremental concentrations related to the Proposal are predicted at receptor R4 (refer Figure 5).

As per Scenario 1, a contemporaneous analysis of the 24-hour $PM_{10}$ and $PM_{2.5}$ data has been performed where each predicted incremental concentration is added to the corresponding monitored background concentration, in accordance with Section 11.2.3(b) of the Approved Methods. For $PM_{10}$ and $PM_{2.5}$ the maximum cumulative impact (left side of Table 26 and Table 27) are predicted at receptor R2 and maximum incremental impact (right side of Table 26 and Table 27) are predicted at receptor R4.

Both Table 26 and Table 27 each show a single exceedance of the relevant 24-hour criteria for cumulative $PM_{10}$ and $PM_{2.5}$ impacts, respectively. These exceedances are attributed to elevated background concentrations of 54.9 $\mu g \cdot m^{-3}$ (for $PM_{10}$) and 40.3 $\mu g \cdot m^{-3}$ (for $PM_{2.5}$), rather than incremental emissions associated from the Proposal. Importantly, the addition of the Proposal's predicted contributions, as presented in Table 25 does not result in any further exceedances of the applicable air quality criteria.

The 2021 NSW air quality compliance report (NSW DPE, 2023) notes that these readings were recorded at the St Marys AQMS on 4 May, due to an exceptional event (as a hazard reduction burn). In NSW, exceedances caused by exceptional events are not counted toward the National Environment Protection (Ambient Air Quality) Measure (NEPM) goal of *"no days exceeding the particle standards in a year."*

A contour isopleth plot of the predicted incremental 24-hour $PM_{10}$ concentrations associated with the Proposal under Scenario 2 are presented in Figure 13 to illustrate the spatial distribution of particulate matter in the area surrounding the Proposal site.

Table 26 Summary of contemporaneous 24-hour $PM_{10}$ concentrations – Scenario 2

| Date | 24-hour $PM_{10}$ concentration ($\mu g \cdot m^{-3}$) – Receptor R2 | | | Date | 24-hour $PM_{10}$ concentration ($\mu g \cdot m^{-3}$) – Receptor R4 | | |
|---|---|---|---|---|---|---|---|
| | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. |
| 4/05/2021 | 0.4 | 54.9 | 55.3 | 28/01/2021 | 1.2 | 16.0 | 17.2 |
| 20/04/2021 | < 0.1 | 46.2 | 46.2 | 17/03/2021 | 1.0 | 13.5 | 14.5 |
| 28/10/2021 | < 0.1 | 36.6 | 36.6 | 18/03/2021 | 0.9 | 9.1 | 10.0 |
| 29/04/2021 | < 0.1 | 36.0 | 36.0 | 18/02/2021 | 0.9 | 13.9 | 14.8 |
| 2/09/2021 | < 0.1 | 36.0 | 36.0 | 9/02/2021 | 0.9 | 19.8 | 20.7 |
| 18/01/2021 | < 0.1 | 35.8 | 35.8 | 23/12/2021 | 0.7 | 14.3 | 15.0 |
| 27/04/2021 | 0.1 | 35.4 | 35.5 | 17/02/2021 | 0.7 | 14.1 | 14.8 |
| 10/09/2021 | < 0.1 | 35.5 | 35.5 | 1/01/2021 | 0.7 | 12.1 | 12.7 |
| 21/08/2021 | < 0.1 | 34.6 | 34.6 | 5/12/2021 | 0.6 | 14.7 | 15.3 |
| 20/08/2021 | < 0.1 | 34.1 | 34.1 | 20/03/2021 | 0.6 | 9.9 | 10.5 |
| These data represent the highest Cumulative Impact 24-hour $PM_{10}$ predictions (**outlined in red**) as a result of the operation of the Proposal | | | | These data represent the highest Incremental Impact 24-hour $PM_{10}$ predictions (**outlined in blue**) as a result of the operation of the Proposal. | | | |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table 27 Summary of contemporaneous 24-hour $PM_{2.5}$ concentrations – Scenario 2

| Date | 24-hour $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – Receptor R2 | | | Date | 24-hour $PM_{2.5}$ concentration ($\mu g \cdot m^{-3}$) – Receptor R4 | | |
|---|---|---|---|---|---|---|---|
| | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. |
| 4/05/2021 | 0.4 | 40.3 | 40.7 | 28/01/2021 | 1.2 | 8.3 | 9.6 |
| 29/04/2021 | < 0.1 | 21.8 | 21.8 | 17/03/2021 | 1.0 | 3.3 | 4.3 |
| 23/04/2021 | < 0.1 | 19.5 | 19.5 | 18/03/2021 | 0.9 | 2.5 | 3.4 |
| 20/08/2021 | < 0.1 | 19.2 | 19.2 | 18/02/2021 | 0.9 | 3.9 | 4.8 |
| 10/10/2021 | 0.1 | 16.9 | 17.0 | 9/02/2021 | 0.9 | 8.3 | 9.2 |
| 15/08/2021 | < 0.1 | 16.1 | 16.1 | 23/12/2021 | 0.7 | 5.2 | 5.9 |
| 3/05/2021 | < 0.1 | 14.9 | 14.9 | 17/02/2021 | 0.7 | 4.8 | 5.4 |
| 23/08/2021 | < 0.1 | 14.7 | 14.7 | 1/01/2021 | 0.7 | 1.7 | 2.3 |
| 14/08/2021 | 0.1 | 14.3 | 14.4 | 5/12/2021 | 0.6 | 4.3 | 4.9 |
| 19/01/2021 | 0.4 | 13.8 | 14.2 | 20/03/2021 | 0.6 | 1.5 | 2.1 |
| These data represent the highest Cumulative Impact 24-hour $PM_{10}$ predictions (**outlined in red**) as a result of the operation of the Proposal | | | | These data represent the highest Incremental Impact 24-hour $PM_{10}$ predictions (**outlined in blue**) as a result of the operation of the Proposal. | | | |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative

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Figure 13 Predicted incremental 24-hour $PM_{10}$ impacts – Scenario 2


Source: Northstar

### 7.2.2. Nitrogen Dioxide

Results are presented in this section for the predictions of nitrogen dioxide ($NO_2$) under Scenario 2 for the top 10 impacted receptors. The relevant assessment criteria for $NO_2$ are 1-hour and annual, as specified in Table 6. The predicted 1-hour and annual $NO_2$ concentrations resulting from the assumptions under Scenario 2 are presented in Table 28.

The results indicate that predicted incremental and cumulative $NO_2$ concentrations are below the criteria at the top 10 receptor locations. The performance of the Proposal under Scenario 2 does not result in any exceedances of the criteria for $NO_2$.

Figure 14 shows a contour isopleth plot of the predicted 1-hour incremental $NO_2$ impacts for Scenario 2 based on the Janssen method for converting $NO_X$ to $NO_2$ (refer Section 5.2.7)

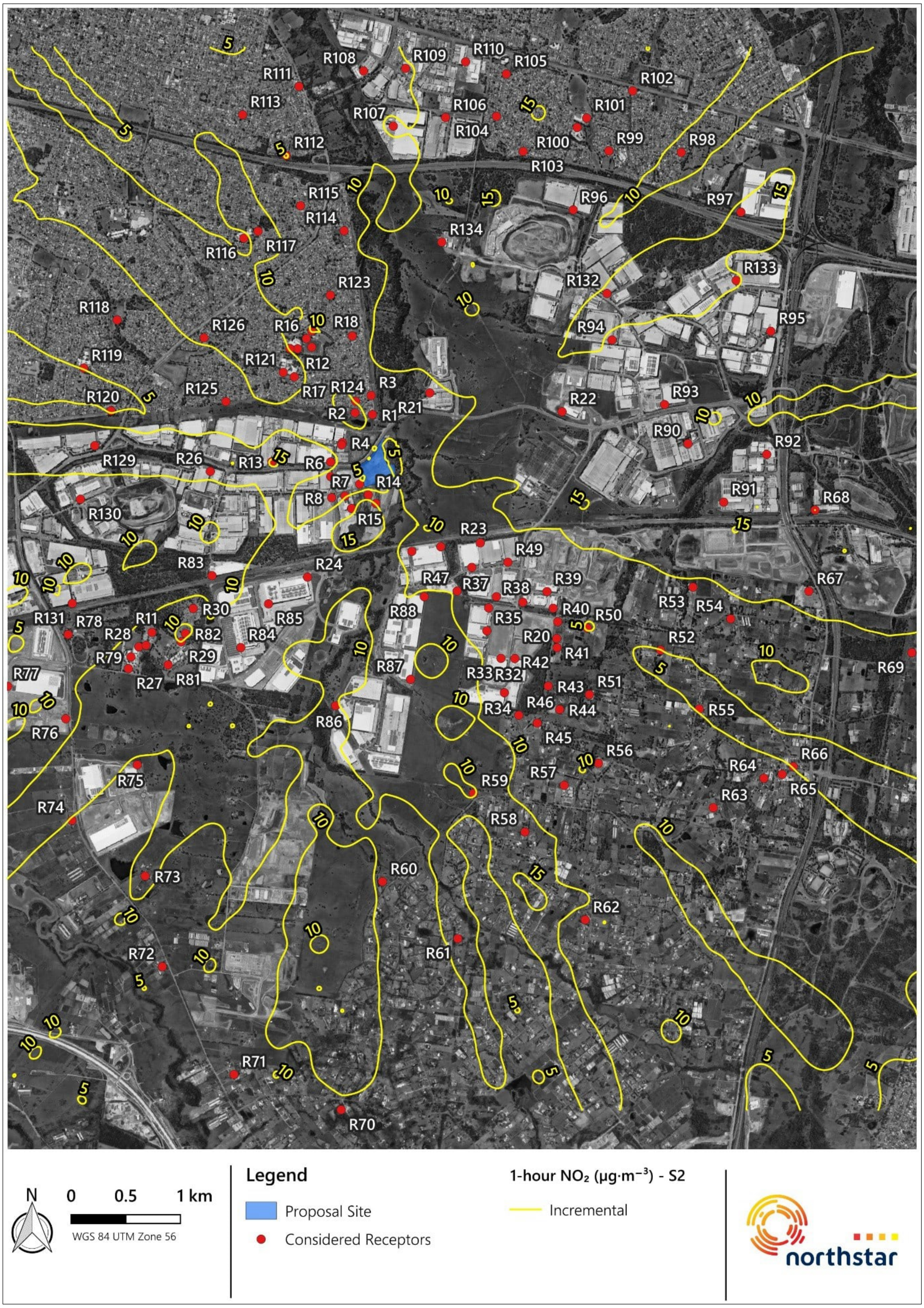
**Table 28 Predicted 1-hour and annual $NO_2$ concentrations – Scenario 2**

| Nitrogen dioxide ($NO_2$) concentration ($\mu g{\cdot}m^{-3}$) | | | |
|---|---|---|---|
| Receptor | 1-hour | | |
| | Incr. | Bkg. | Cumul. |
| Criterion | 164 | | |
| Max. % of criterion | 9.8 | 7.5 | 16.5 |
| R97 | 16.0 | 0.0 | 16.0 |
| R133 | 15.9 | 6.1 | 22.1 |
| R13 | 15.7 | 0.0 | 15.7 |
| R132 | 15.4 | 0.0 | 15.4 |
| R129 | 15.0 | 0.0 | 15.0 |
| R15 | 14.7 | 12.3 | 27.0 |
| R105 | 14.3 | 0.0 | 14.3 |
| R103 | 14.1 | 6.1 | 20.3 |
| R94 | 14.1 | 4.1 | 18.2 |
| R90 | 14.1 | 2.0 | 16.1 |

| Nitrogen dioxide ($NO_2$) concentration ($\mu g{\cdot}m^{-3}$) | | | |
|---|---|---|---|
| Receptor | Annual | | |
| | Incr. | Bkg. | Cumul. |
| Criterion | 31 | | |
| Max. % of criterion | < 0.1 | 26.8 | 26.8 |
| R2 | < 0.1 | 8.3 | 8.3 |
| R128 | < 0.1 | 8.3 | 8.3 |
| R124 | < 0.1 | 8.3 | 8.3 |
| R15 | < 0.1 | 8.3 | 8.3 |
| R1 | < 0.1 | 8.3 | 8.3 |
| R3 | < 0.1 | 8.3 | 8.3 |
| R4 | < 0.1 | 8.3 | 8.3 |
| R14 | < 0.1 | 8.3 | 8.3 |
| R17 | < 0.1 | 8.3 | 8.3 |
| R127 | < 0.1 | 8.3 | 8.3 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Figure 14 Predicted incremental 1-hour $NO_2$ impacts – Scenario 2




**Source:** Northstar

### 7.2.3. All Other Pollutants

The following presents the predicted concentrations associated with Scenario 2 for all other pollutants assessed in this AQIA (refer Section 5.2.2).

Presented in Table 29 to Table 31 are the predicted concentrations of CO, $SO_2$, PAHs, VOCs and formaldehyde ($CH_2O$) at varying averaging periods at the top 10 impacted receptors. The predicted incremental concentrations for all of the abovementioned pollutants are below the relevant criteria for all averaging periods at all receptors.

A contour isopleth plot of the predicted 1-hour 99.9th percentile 1-hour incremental benzene ($C_6H_6$) impact under Scenario 2 is presented in Figure 15.

**Table 29 Predicted 15-minute, 1-hour and 8-hour average CO concentrations – Scenario 2**

| Carbon monoxide (CO) concentration ($mg \cdot m^{-3}$) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Receptor | 15-minute | | | Receptor | 1-hour | | | Receptor | 8-hour | | |
| | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. | | Incr. | Bkg. | Cumul. |
| Criterion | 100 | | | 30 | | | | 10 | | | |
| Max. % of criterion | < 0.1 | 0.7 | 0.7 | - | < 0.1 | 1.7 | 1.7 | - | 0.2 | 0.8 | 1.0 |
| R9 | < 0.1 | 0.3 | 0.4 | R9 | < 0.1 | 0.3 | 0.3 | R14 | < 0.1 | < 0.1 | < 0.1 |
| R23 | < 0.1 | 0.5 | 0.5 | R23 | < 0.1 | 0.4 | 0.4 | R15 | < 0.1 | 0.1 | 0.1 |
| R89 | < 0.1 | 0.3 | 0.4 | R89 | < 0.1 | 0.3 | 0.3 | R4 | < 0.1 | < 0.1 | < 0.1 |
| R10 | < 0.1 | 0.5 | 0.5 | R10 | < 0.1 | 0.4 | 0.4 | R127 | < 0.1 | < 0.1 | < 0.1 |
| R14 | < 0.1 | < 0.1 | < 0.1 | R14 | < 0.1 | < 0.1 | < 0.1 | R1 | < 0.1 | < 0.1 | < 0.1 |
| R128 | < 0.1 | < 0.1 | < 0.1 | R128 | < 0.1 | < 0.1 | < 0.1 | R6 | < 0.1 | < 0.1 | 0.1 |
| R15 | < 0.1 | 0.3 | 0.4 | R15 | < 0.1 | 0.3 | 0.3 | R2 | < 0.1 | < 0.1 | < 0.1 |
| R88 | < 0.1 | 0.3 | 0.4 | R88 | < 0.1 | 0.3 | 0.3 | R5 | < 0.1 | < 0.1 | < 0.1 |
| R21 | < 0.1 | 0.7 | 0.7 | R21 | < 0.1 | 0.5 | 0.5 | R7 | < 0.1 | < 0.1 | < 0.1 |
| R48 | < 0.1 | 0.3 | 0.4 | R48 | < 0.1 | 0.3 | 0.3 | R128 | < 0.1 | < 0.1 | < 0.1 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative

Table 30 Predicted 1-hour and 24-hour $SO_2$ concentrations – Scenario 2

| Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | |
|---|---|---|---|
| Receptor | 1-hour | | |
| | Incr. | Bkg. | Cumul. |
| Criterion | 215 | | |
| Max. % of criterion | 0.1 | 1.3 | 1.4 |
| R9 | 0.3 | < 0.1 | 0.3 |
| R23 | 0.2 | 2.9 | 3.0 |
| R89 | 0.2 | 2.9 | 3.0 |
| R10 | 0.2 | 2.9 | 3.0 |
| R14 | 0.2 | < 0.1 | 0.2 |
| R128 | 0.2 | < 0.1 | 0.2 |
| R15 | 0.2 | 2.9 | 3.0 |
| R88 | 0.2 | < 0.1 | 0.2 |
| R21 | 0.2 | 2.9 | 3.0 |
| R48 | 0.1 | 2.9 | 3.0 |

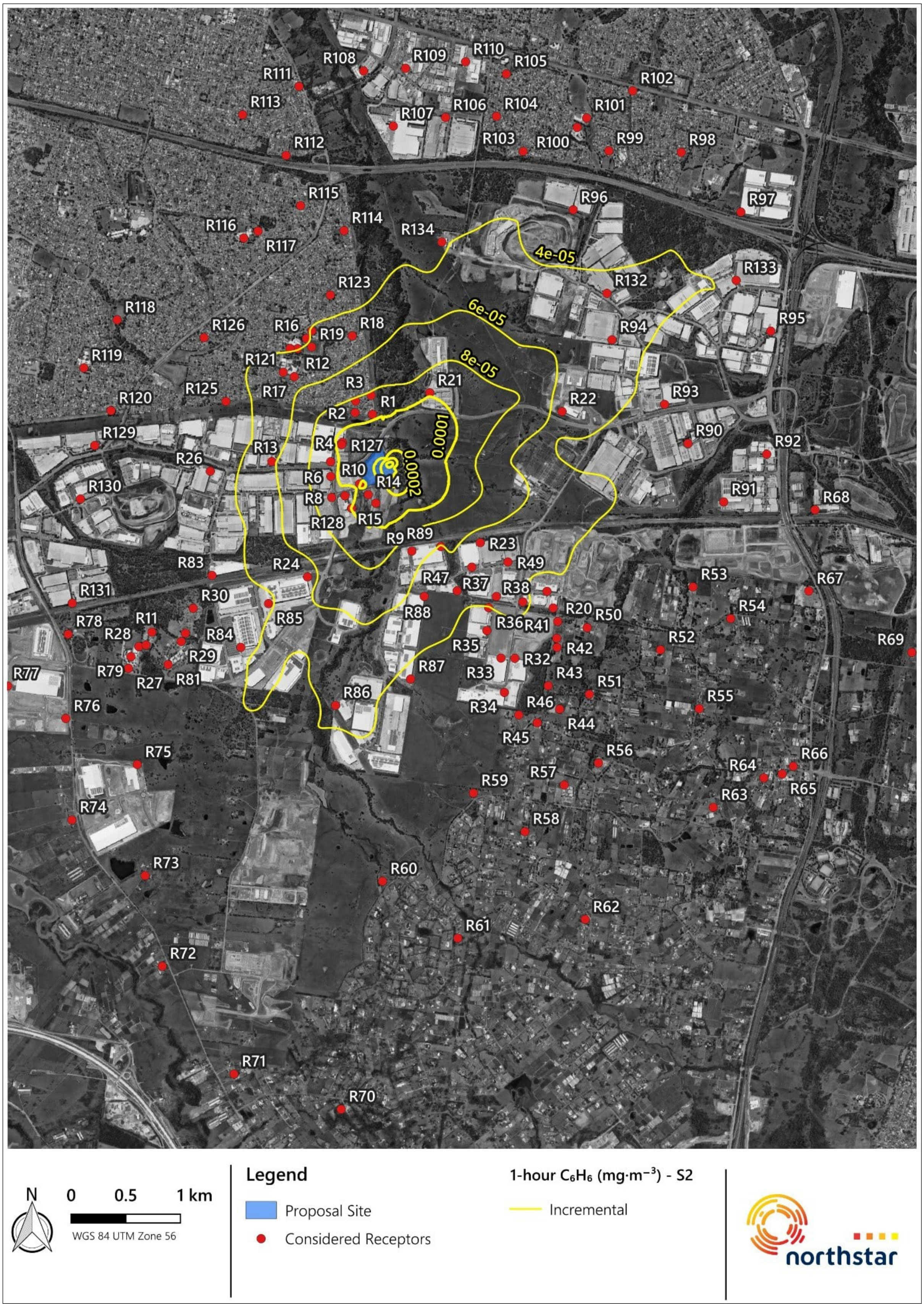
| Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | |
|---|---|---|---|
| Receptor | 24-hour | | |
| | Incr. | Bkg. | Cumul. |
| Criterion | 57 | | |
| Max. % of criterion | 0.1 | 14.4 | 14.6 |
| R4 | 0.1 | < 0.1 | 0.1 |
| R14 | 0.1 | 5.8 | 5.9 |
| R127 | 0.1 | < 0.1 | 0.1 |
| R15 | 0.1 | 8.2 | 8.3 |
| R5 | < 0.1 | < 0.1 | < 0.1 |
| R6 | < 0.1 | 0.4 | 0.4 |
| R1 | < 0.1 | 0.2 | 0.3 |
| R2 | < 0.1 | < 0.1 | < 0.1 |
| R7 | < 0.1 | 1.3 | 1.4 |
| R128 | < 0.1 | 5.8 | 5.9 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table 31 Predicted incremental 1-hour (99.9th %ile) PAH and VOC concentrations - Scenario 2

| Receptor | Predicted 1-hour (99.9th %ile) concentration (mg·m$^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| Criterion | 0.0004 | 0.029 | 0.36 | 0.19 | 0.02 |
| Max. % of criterion | < 0.1 | 0.4 | < 0.1 | < 0.1 | 0.1 |
| Max. % at boundary | < 0.1 | 1.6 | < 0.1 | 0.1 | 0.2 |
| R15 | 1.72E-09 | 1.16E-04 | 4.18E-05 | 2.91E-05 | 1.17E-05 |
| R14 | 1.70E-09 | 1.14E-04 | 4.13E-05 | 2.88E-05 | 1.16E-05 |
| R4 | 1.59E-09 | 1.07E-04 | 3.88E-05 | 2.70E-05 | 1.09E-05 |
| R127 | 1.56E-09 | 1.05E-04 | 3.78E-05 | 2.64E-05 | 1.06E-05 |
| R5 | 1.37E-09 | 9.25E-05 | 3.34E-05 | 2.33E-05 | 9.39E-06 |
| R128 | 1.49E-09 | 1.01E-04 | 3.63E-05 | 2.53E-05 | 1.02E-05 |
| R6 | 1.43E-09 | 9.63E-05 | 3.48E-05 | 2.42E-05 | 9.78E-06 |
| R21 | 1.42E-09 | 9.59E-05 | 3.46E-05 | 2.41E-05 | 9.74E-06 |
| R1 | 1.40E-09 | 9.42E-05 | 3.40E-05 | 2.37E-05 | 9.57E-06 |
| R5 | 1.37E-09 | 9.25E-05 | 3.34E-05 | 2.33E-05 | 9.39E-06 |

Figure 15 Predicted 99.9th percentile incremental 1-hour $C_6H_6$ impacts – Scenario 2




**Source:** Northstar

## 7.3. Assessment of Criteria Exceedances

Presented in Table 32 is a summary of the number of additional exceedances of the short-term $PM_{10}$, $PM_{2.5}$ and $NO_2$ criteria predicted under Scenario 1 (justified worst case) for the considered receptors and those values presented as a probability (*p*) (*p*=0 being impossible, *p*=1 being certain). These values are discussed further in Section 8.2.

**Table 32 Assessment of the number of additional exceedances – Scenario 1**

| Receptor | Number of additional exceedances of the criterion (no.) | | | Probability that an exceedance is Predicted in one year (*p*) | | |
|---|---|---|---|---|---|---|
| | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ |
| R1 | 14 | 38 | 255 | 0.0384 | 0.1041 | 0.0291 |
| R2 | 13 | 42 | 274 | 0.0356 | 0.1151 | 0.0313 |
| R3 | 6 | 25 | 240 | 0.0164 | 0.0685 | 0.0274 |
| R4 | 12 | 31 | 209 | 0.0329 | 0.0849 | 0.0239 |
| R5 | 7 | 23 | 138 | 0.0192 | 0.0630 | 0.0158 |
| R6 | 9 | 28 | 117 | 0.0247 | 0.0767 | 0.0134 |
| R7 | 20 | 46 | 144 | 0.0548 | 0.1260 | 0.0164 |
| R8 | 9 | 31 | 175 | 0.0247 | 0.0849 | 0.0200 |
| R9 | - | 9 | 86 | - | 0.0247 | 0.0098 |
| R10 | 18 | 43 | 43 | 0.0493 | 0.1178 | 0.0049 |
| R11 | - | 1 | 144 | - | 0.0027 | 0.0164 |
| R12 | 1 | 7 | 228 | 0.0027 | 0.0192 | 0.0260 |
| R13 | 2 | 8 | 162 | 0.0055 | 0.0219 | 0.0185 |
| R14 | 44 | 76 | 89 | 0.1205 | 0.2082 | 0.0102 |
| R15 | 66 | 87 | 186 | 0.1808 | 0.2384 | 0.0212 |
| R16 | - | 4 | 192 | - | 0.0110 | 0.0219 |
| R17 | 5 | 15 | 283 | 0.0137 | 0.0411 | 0.0323 |
| R18 | - | 3 | 178 | - | 0.0082 | 0.0203 |
| R19 | - | 7 | 213 | - | 0.0192 | 0.0243 |
| R20 | 1 | 1 | 60 | 0.0027 | 0.0027 | 0.0068 |
| R21 | 28 | 65 | 482 | 0.0767 | 0.1781 | 0.0550 |
| R22 | - | 3 | 155 | - | 0.0082 | 0.0177 |
| R23 | 1 | 3 | 65 | 0.0027 | 0.0082 | 0.0074 |
| R24 | 3 | 15 | 273 | 0.0082 | 0.0411 | 0.0312 |
| R25 | - | - | 52 | - | - | 0.0059 |
| R26 | - | 1 | 116 | - | 0.0027 | 0.0132 |
| R27 | - | 1 | 148 | - | 0.0027 | 0.0169 |
| R28 | - | 1 | 141 | - | 0.0027 | 0.0161 |
| R29 | - | 1 | 164 | - | 0.0027 | 0.0187 |
| R30 | - | 1 | 168 | - | 0.0027 | 0.0192 |
| R31 | - | 2 | 189 | - | 0.0055 | 0.0216 |

| Receptor | Number of additional exceedances of the criterion (no.) | | | Probability that an exceedance is Predicted in one year (*p*) | | |
|---|---|---|---|---|---|---|
| | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ |
| R32 | 1 | 2 | 64 | 0.0027 | 0.0055 | 0.0073 |
| R33 | 1 | 2 | 48 | 0.0027 | 0.0055 | 0.0055 |
| R34 | - | 1 | 67 | - | 0.0027 | 0.0076 |
| R35 | 1 | 2 | 49 | 0.0027 | 0.0055 | 0.0056 |
| R36 | 1 | 2 | 58 | 0.0027 | 0.0055 | 0.0066 |
| R37 | 1 | 3 | 55 | 0.0027 | 0.0082 | 0.0063 |
| R38 | 1 | 2 | 56 | 0.0027 | 0.0055 | 0.0064 |
| R39 | 1 | 1 | 70 | 0.0027 | 0.0027 | 0.0080 |
| R40 | 1 | 1 | 59 | 0.0027 | 0.0027 | 0.0067 |
| R41 | 1 | 2 | 62 | 0.0027 | 0.0055 | 0.0071 |
| R42 | 1 | 2 | 65 | 0.0027 | 0.0055 | 0.0074 |
| R43 | 1 | 1 | 53 | 0.0027 | 0.0027 | 0.0061 |
| R44 | 1 | 1 | 50 | 0.0027 | 0.0027 | 0.0057 |
| R45 | - | - | 58 | - | - | 0.0066 |
| R46 | - | 1 | 68 | - | 0.0027 | 0.0078 |
| R47 | 1 | 2 | 49 | 0.0027 | 0.0055 | 0.0056 |
| R48 | 1 | 3 | 57 | 0.0027 | 0.0082 | 0.0065 |
| R49 | 1 | 1 | 63 | 0.0027 | 0.0027 | 0.0072 |
| R50 | 1 | - | 52 | 0.0027 | - | 0.0059 |
| R51 | 1 | 1 | 51 | 0.0027 | 0.0027 | 0.0058 |
| R52 | 1 | - | 47 | 0.0027 | - | 0.0054 |
| R53 | - | - | 76 | - | - | 0.0087 |
| R54 | - | - | 83 | - | - | 0.0095 |
| R55 | 1 | - | 47 | 0.0027 | - | 0.0054 |
| R56 | 1 | 1 | 49 | 0.0027 | 0.0027 | 0.0056 |
| R57 | - | - | 58 | - | - | 0.0066 |
| R58 | - | 1 | 95 | - | 0.0027 | 0.0108 |
| R59 | - | 1 | 89 | - | 0.0027 | 0.0102 |
| R60 | - | 1 | 144 | - | 0.0027 | 0.0164 |
| R61 | - | - | 95 | - | - | 0.0108 |
| R62 | - | - | 69 | - | - | 0.0079 |
| R63 | 1 | 1 | 58 | 0.0027 | 0.0027 | 0.0066 |
| R64 | 1 | - | 44 | 0.0027 | - | 0.0050 |
| R65 | - | - | 48 | - | - | 0.0055 |
| R66 | - | - | 50 | - | - | 0.0057 |
| R67 | - | - | 68 | - | - | 0.0078 |
| R68 | - | - | 82 | - | - | 0.0094 |
| R69 | - | - | 55 | - | - | 0.0063 |
| R70 | - | - | 82 | - | - | 0.0094 |

| Receptor | Number of additional exceedances of the criterion (no.) | | | Probability that an exceedance is Predicted in one year ($p$) | | |
|---|---|---|---|---|---|---|
| | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ |
| R71 | - | - | 169 | - | - | 0.0193 |
| R72 | - | - | 128 | - | - | 0.0146 |
| R73 | - | - | 130 | - | - | 0.0148 |
| R74 | - | - | 101 | - | - | 0.0115 |
| R75 | - | - | 125 | - | - | 0.0143 |
| R76 | - | - | 101 | - | - | 0.0115 |
| R77 | - | 1 | 78 | - | 0.0027 | 0.0089 |
| R78 | - | 1 | 84 | - | 0.0027 | 0.0096 |
| R79 | - | 1 | 141 | - | 0.0027 | 0.0161 |
| R80 | - | 1 | 145 | - | 0.0027 | 0.0166 |
| R81 | - | 1 | 149 | - | 0.0027 | 0.0170 |
| R82 | - | 2 | 157 | - | 0.0055 | 0.0179 |
| R83 | - | 1 | 153 | - | 0.0027 | 0.0175 |
| R84 | - | 2 | 222 | - | 0.0055 | 0.0253 |
| R85 | - | 4 | 232 | - | 0.0110 | 0.0265 |
| R86 | 3 | 13 | 291 | 0.0082 | 0.0356 | 0.0332 |
| R87 | - | 6 | 118 | - | 0.0164 | 0.0135 |
| R88 | - | 7 | 99 | - | 0.0192 | 0.0113 |
| R89 | 1 | 3 | 48 | 0.0027 | 0.0082 | 0.0055 |
| R90 | - | - | 90 | - | - | 0.0103 |
| R91 | - | - | 84 | - | - | 0.0096 |
| R92 | - | - | 84 | - | - | 0.0096 |
| R93 | - | 1 | 129 | - | 0.0027 | 0.0147 |
| R94 | 1 | 12 | 293 | 0.0027 | 0.0329 | 0.0334 |
| R95 | - | - | 147 | - | - | 0.0168 |
| R96 | - | 8 | 345 | - | 0.0219 | 0.0394 |
| R97 | - | 2 | 241 | - | 0.0055 | 0.0275 |
| R98 | - | 2 | 288 | - | 0.0055 | 0.0329 |
| R99 | - | 2 | 314 | - | 0.0055 | 0.0358 |
| R100 | - | 2 | 291 | - | 0.0055 | 0.0332 |
| R101 | - | 1 | 284 | - | 0.0027 | 0.0324 |
| R102 | - | 3 | 310 | - | 0.0082 | 0.0354 |
| R103 | 1 | 2 | 276 | 0.0027 | 0.0055 | 0.0315 |
| R104 | - | - | 241 | - | - | 0.0275 |
| R105 | - | - | 242 | - | - | 0.0276 |
| R106 | - | 1 | 173 | - | 0.0027 | 0.0197 |
| R107 | - | - | 127 | - | - | 0.0145 |
| R108 | - | - | 113 | - | - | 0.0129 |
| R109 | - | - | 135 | - | - | 0.0154 |

| Receptor | Number of additional exceedances of the criterion (no.) | | | Probability that an exceedance is Predicted in one year (*p*) | | |
|---|---|---|---|---|---|---|
| | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1- hour $NO_2$ |
| R110 | - | - | 183 | - | - | 0.0209 |
| R111 | - | - | 101 | - | - | 0.0115 |
| R112 | - | - | 122 | - | - | 0.0139 |
| R113 | - | - | 134 | - | - | 0.0153 |
| R114 | - | - | 127 | - | - | 0.0145 |
| R115 | - | - | 132 | - | - | 0.0151 |
| R116 | - | - | 137 | - | - | 0.0156 |
| R117 | - | - | 142 | - | - | 0.0162 |
| R118 | - | 1 | 90 | - | 0.0027 | 0.0103 |
| R119 | - | - | 40 | - | - | 0.0046 |
| R120 | - | - | 62 | - | - | 0.0071 |
| R121 | 4 | 12 | 283 | 0.0110 | 0.0329 | 0.0323 |
| R122 | 2 | 9 | 232 | 0.0055 | 0.0247 | 0.0265 |
| R123 | - | 2 | 168 | - | 0.0055 | 0.0192 |
| R124 | 8 | 30 | 279 | 0.0219 | 0.0822 | 0.0318 |
| R125 | - | 1 | 93 | - | 0.0027 | 0.0106 |
| R126 | 1 | 4 | 177 | 0.0027 | 0.0110 | 0.0202 |
| R127 | 14 | 29 | 165 | 0.0384 | 0.0795 | 0.0188 |
| R128 | 32 | 60 | 247 | 0.0877 | 0.1644 | 0.0282 |
| R129 | - | - | 77 | - | - | 0.0088 |
| R130 | - | - | 61 | - | - | 0.0070 |
| R131 | - | 1 | 71 | - | 0.0027 | 0.0081 |
| R132 | 2 | 11 | 329 | 0.0055 | 0.0301 | 0.0376 |
| R133 | - | 3 | 246 | - | 0.0082 | 0.0281 |
| R134 | - | 6 | 258 | - | 0.0164 | 0.0295 |

**Note:** Care must be applied when assessing 24-hour average impacts as the likely duration of a power outage event is likely to be significantly less than 24-hours, and as such the assessment should be considered to be highly conservative (i.e. relevant to the operation of standby generators for an entire 24-hour period).

## 7.4. Comparison with POEO CAR Standards of Concentrations

Section 3.2 outlines the context of the POEO CAR and the emission standards applicable to scheduled and non-scheduled activities under the regulation.

As detailed in Section 2.2 and Section 2.3, the Proposal includes the following relevant characteristics:

- 188 diesel-fuelled standby generators for emergency power generation;
- A maintenance testing regime of approximately 136 hours per year; and,
- Diesel fuel storage capacity of 4 454.75 kL (approximately 3 790.1 t).

Clause 73, Part 5, Division 6 of the POEO CAR provides exemptions from certain Schedule 2 air impurity standards for nitrogen oxide ($NO_2$) and nitric oxide (NO) for stationary internal combustion engines used for emergency electricity generation, where operating hours do not exceed legislated thresholds (i.e. 200 hours per year).

Based on the information presented in Section 2 and Section 3, the Proposal includes emergency standby electricity generation and associated diesel storage activities. Classification under the POEO framework is dependent on the applicable activity thresholds as outlined in Section 3.1 and Section 3.2. Applicable emission concentration standards are identified in Section 3.2.

The applicable emission concentration standards are identified in Table 5.

Table 33 compares predicted in-stack emissions from the representative standby generator unit adopted within the AQIA against the relevant POEO CAR Schedule 2 concentration standards. The results demonstrate compliance with the applicable standards.

**Table 33 POEO CAR – Standards of concentrations comparison**

| Air impurity | Standard of concentration ($mg \cdot m^{-3}$) (a)(b) | Standby generator emissions (per generator) ($mg \cdot Nm^{-3}$) |
|---|---|---|
| | | Baudouin 16M55G6D2/5 |
| Solid particles (Total) | 50 | 17.0 |
| Nitrogen dioxide ($NO_2$) or nitric oxide (NO) or both, as $NO_2$ equivalent | 450 | Not Applicable |
| Volatile organic compounds (VOCs) as *n*-propane | 1 140 (as VOCs) | 30.5 |
| | 5 880 (as CO) | 54.9 |

**Notes:** (a): Standard of emissions concentration under dry, 273 K, 101.3 kPa, 7 % $O_2$ conditions

(b): Group 6 limits.

## 7.5. Cumulative Impact Assessment

Table 34 presents an assessment of potential cumulative air quality impacts arising from the Proposal in combination with other relevant emission sources, as identified in Section 4.6.

The assessment considers cumulative impacts on nearby sensitive receptors during both the construction and operational phases. This includes potential dust soiling and human health effects from overlapping construction activities, as well as operational impacts under grid outage scenarios, where emergency generators at the Proposal site and nearby facilities may operate concurrently and during routine maintenance testing, which may also present limited potential for overlap.

While the CIA Guidelines recommend consideration of all relevant future projects, this assessment adopts a proportionate approach based on the status and likely influence of surrounding data centre developments. Background air quality data has been used to characterise existing ambient conditions, independent of the Proposal. However, given the location of the St Marys and Prospect AQMS (4.7 km and 9.7 km from the Proposal site respectively (refer Table 9)) and their separation from identified sources (refer Figure 7 and Table 11), emissions from some nearby operations, particularly those newly approved, under construction, or still in planning may not be fully representative in the adopted background dataset.

Following NSW EPA consultation, two additional non data centre developments were included in the cumulative assessment and considered in a qualitative manner as per the CIA Guidelines.

Accordingly, all identified sources including those data centres, and the two NSW EPA regulated premises are discussed in Table 34. Reference should be made to Section 8.3 which discusses the outcomes of the CIA.

Table 34 Identified air pollutant sources with potential for cumulative impacts

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| **Data Storage Centres** | | | |
| A) NEXTDC S4 (SSD-63741210) | Approved - 24/12/2025: Involves the construction and 24/7 operation of a data centre with a power consumption of 294 MW comprising two, four-storey adjoined data centre buildings (Buildings AB & CD), two 330Kv transmissions lines with a length of 2.6 km, substation upgrade works, electrical substation and switching station, diesel generators and diesel storage, car parking and ancillary office space and civil infrastructure works. | Construction and completion of the development would occur over a period of approximately five years, and comprise the following stages: Stage 1 – Building C, HV switching building, 330 kV substation, HV transmission line route, site entrance, security and water tanks, Stage 2 – Building D, Stage 3 – Building A, Stage 4 – Building B. Total GFA of 61 695 $m^2$ comprising 56 464 $m^2$ of data hall space and 5 231 $m^2$ of ancillary office space. | The Proposal is unlikely to result in significant cumulative impacts during construction, due to the separation between construction sites and the implementation of CEMPs with appropriate mitigation measures at each location. |
| | | Each building incorporates a generator stack housing 30 generators (120 total). The site layout also provides for above-ground diesel storage tanks and industrial water tanks, which are located within the north-eastern portion of the site. Up to two generators to be tested up to 100 % load with 1-2 load banks per test and 33 test per day on a quarterly frequency. Generator tests to be during standard daytime hours (8:00 am to 6:00 pm) on Mon to Sat or PH and 8:00 am and 6:00 pm on Sun, totalling 170 hours per year. Routine testing poses limited cumulative impact risk due to short, staggered schedules. However, during widespread grid outages simultaneous standby generator operation at this facility and the Proposal may temporarily increase local emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with south easterly and north westerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| B) Project Atlas (SSD-101067971) | Under Preparation - SEARs issued on 16 Jan 2026. Development consent is sought under an SSDA for the demolition of existing buildings and construction/operation of a 500MVA data centre at 10 Roberts Road, including offsite enabling infrastructure. | Construction timing unknown at this stage. Demolition of existing buildings, hardstand structures and select tree removal on site will be required to accommodate the proposal. GFA of 99 310 $m^2$ (including 2 665 $m^2$ for ancillary office). Two data centre buildings positioned and setback along the eastern and western site boundaries, with a ring road buffer around the site, with generator gantries internally facing and ancillary office orientated towards side boundaries. Fuel and water storage located centrally within the site. Substation within the northern corner of the site. | The Proposal is unlikely to result in significant cumulative impacts during construction, due to separation between construction sites and the implementation of CEMPs with appropriate mitigation measures at each location. |
| | | The site is designed for a total of 246 low voltage generators rated to supply the data centre critical loads, admin load and life safety loads. All generators are containerised and located externally on a generator gantry, positioned centrally within the site. No publicly held information with regard to the proposed maintenance testing regime however, the tests are likely to run during day time hours. Routine testing poses limited cumulative impact risk due to short, staggered schedules. However, during widespread grid outages, simultaneous standby generator operation at this facility and the Proposal which may temporarily increase local emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with easterly and westerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| C) Roberts Road (SSD-10330) | Operational – Approved on 14 July 2020. MOD2 is Under Assessment - SSD-10330 approved the Construction and operation of three (3) additional data centre buildings, including a 3-storey data centre building ('Building 4' which has been constructed) and two other data centre buildings at the western end of the site which are currently under construction. 48 diesel standby generators, including 12 existing generators installed under CDC-19-01926. Diesel fuel storage for up to 1 914 000 litres (L) across the whole site. MOD2 - total number of standby diesel generators approved under SSD-10330 from 48 generators to 72 generators equating to a total of 87 generators (inclusive of generators approved / constructed under SSD-10330 and other applications). Maximum potential diesel storage to increase to 3 282 800 L. Adjustment of generator testing regime | Staged construction of three data centre buildings including ancillary office space, associated infrastructure, landscaping, car parking. Construction of the site is largely complete. The remainder construction for Building 5 and 6 and the installation of the additional generators will adhere to the relevant measures within an approved CEMP as governed by conditions C2 - C4 of the original SSDA. The delivery of proposed modifications to the standby diesel generators are managed under the CEMP established under the original SSDA consent. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | There is potential for cumulative operational impacts between this data centre and the Proposal particularly under emergency conditions. In the event of a widespread grid outage affecting the area, it is likely that both facilities would be impacted simultaneously, triggering concurrent operation of standby generators. Generator testing regime is to be modified to reflect: - Monthly testing (no load) with 5 generators concurrently per test, 18 tests per month and at 15 minutes duration. - Annual testing (full load) with one generator tested per test with 87 tests per year and at 60 minutes duration. Total annual testing time is being modified from 174 hours to 141 hours. There is limited potential for cumulative impacts if testing overlaps with the Proposal's schedule, though this is considered unlikely due to limited duration and staggered operation. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with easterly and westerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| D) NEXTDC S4 Phase 2 (SSD-108864209) | Under Preparation – Project specific SEARs have been issued on 8 April 2026 for the construction and operation of a data centre facility with a maximum power consumption of 134.4 megawatts comprising of two data centre buildings, plant and equipment, diesel storage and associated site infrastructure. | Construction timing has not yet been confirmed however publicly available information denotes construction as one stage of development. The development is expected to include multiple data halls, associated building infrastructure, and ancillary works. Details of the construction programme are not currently available. | The Proposal is unlikely to result in significant cumulative impacts during construction, due to the physical separation between construction sites and the implementation of CEMPs with appropriate mitigation measures at each location. |
| | | Publicly available information denotes that the proposed data centre includes approximately 70 prime-rated diesel generator sets, each with a capacity of 3.1 MW. The generators are intended to provide resilient backup power to support data hall IT systems and associated mechanical and electrical infrastructure, ensuring continuity of operations in the event of a grid supply interruption. In addition, a number of smaller ancillary generator sets may be installed to service operational and essential services. Based on standard industry practice generator testing would likely occur during daytime hours. Routine testing is expected to pose limited cumulative air quality risk due to the typically short duration and staggered scheduling of tests. Notwithstanding this, during widespread electricity grid outages, simultaneous operation of standby generators at both this facility and the Proposal could temporarily increase local air emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with south easterly and north westerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| E) Project Echidna (SSD-47320208) | Under Construction – Approved on 5 April 2024<br>Project is for the construction and operation of a Data Centre with an operational capacity of 35MW including data hall fit out, associated emergency back-up generators and cooling plant, office space, equipment rooms and car parking. | The project will be delivered as a single planning stage, constructed in two phases: Phase 1 with Initial construction and fit-out (data centre shell, admin areas) and Phase 2 with remaining internal fit-out, subject to demand. Construction is expected to take around two years, with Phase 1 spanning 18 months and Phase 2 an additional six months. A gap may occur between phases. Construction started in early 2023. | The Proposal is unlikely to result in significant cumulative impacts during construction, due to the physical separation between construction sites and the implementation of CEMPs with appropriate mitigation measures at each location. |
| | | Up to three generators will be tested concurrently under the fortnightly no-load scenario, while quarterly and yearly tests (at 70 % and 100 % load, respectively) will involve one generator at a time. Total annual test runtime is estimated at 162 hours. As a mission-critical facility, the data centre includes 18 standby generators (2.8 MW each) to support critical loads. While there is limited potential for cumulative impacts if testing overlaps with the Proposal, this is considered unlikely due to the short duration and staggered nature of testing. However, under emergency conditions, concurrent operation of standby generators at this facility and the Proposal could temporarily increase localised emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with east north easterly and west south westerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| F) Sydney SYD14 (Digital Realty) | Operational - Commissioned in 2021, the facility is designed to support customer colocation needs and features a dual-feed power supply. It is located within one mile of key digital infrastructure and has a total capacity of 7.2 MW. | No potential overlap as this development is already operational. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | There is no publicly available information on standby generator use, maintenance schedules, or the number of generators at this facility. While routine testing may present limited potential for cumulative impacts if it overlaps with the Proposal, this is considered unlikely due to the short duration and staggered timing of activities. In the event of a widespread grid outage, however, concurrent operation of standby generators at this facility and the Proposal could temporarily increase localised emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with west south westerly and east north easterly components. |
| G) Sydney SYD11 (Digital Realty) | Operational - Construction of a two-level data centre incorporating six data halls and an administration office. It is a 19 MW facility built in phases with 9 MW ready in Q4, 2018 | No potential overlap as this development is already operational. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | No publicly available information is available regarding standby generator use, maintenance schedules, or the number of generators at this facility. While there is limited potential for cumulative impacts if routine testing overlaps with the Proposal, this is considered unlikely due to the short duration and staggered timing of such activities. Under emergency conditions, concurrent operation of standby generators at this facility and the Proposal could temporarily increase localised emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with west south westerly and east north easterly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| H) Sydney SYD10 (Digital Realty) | Operational - Located in Erskine Park, within the Western Sydney Employment Hub, 1-23 Templar Road was opened in November 2012. The site features 6 MW of power. | No potential overlap as this development is already operational. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | There is no publicly available information on standby generator use, maintenance schedules, or the number of generators at this facility. While routine testing may present limited potential for cumulative impacts if it overlaps with the Proposal, this is considered unlikely due to the short duration and staggered timing of activities. Should a widespread grid outage occur then concurrent operation of standby generators at this facility and the Proposal may temporarily increase localised emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with westerly and easterly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| I) NEXTDC S7 (SSD-113934740) | Under Preparation – Project specific SEARs have been issued on 6 May 2026 for the Construction and operation of a data centre with an operational capacity of 612 MW comprising of three, two-storey data storage buildings including 340 back-up diesel generators, diesel fuel storage, on-site substation, site works and car parking. | On the basis of publicly available information (limited to press releases), the timing of any future construction at the site is unknown. Accordingly, the potential for cumulative air quality impacts during construction cannot be ruled out, although no concurrent construction is currently confirmed. | Given the spatial separation and implementation of CEMPs with appropriate mitigation measures, the Proposal is unlikely to materially increase cumulative air quality risks during construction, noting that the potential for overlap ultimately depends on the timing of future works at this site, which is currently unknown. |
| | | Details of generator number, fuel type, and testing regime are unknown; based on standard data centre practice, generators would likely operate cumulatively for less than 200 hours per year. Some overlap could occur during testing, although this is unlikely as the timing of operations at the other site is unknown. Cumulative impacts could occur during emergency generator operation, but such events are expected to be infrequent. Contingent on the final design and approval of this facility however occasional short-term overlaps (e.g., during generator testing or emergency operation) cannot be ruled out. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with north north easterly and south south westerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| J) Mamre Road Campus (SSD-92743706) | Under Assessment - SEARs issued 30 Sept 2025. Development is for the construction and operation of a data centre campus with a power capacity of 1 GW including six four-storey data centre buildings, 936 cooling units, 852 diesel standby generators and 14 430 kL of diesel storage, internal roads and car parking. | Construction timeframe unknown at time of assessment however staged construction to include at grade car parking, 24 shells across four (4) storeys (four (4) shells per building), electrical substations and one (1) incoming electrical switching station and campus electrical substation, and one (1) static synchronous compensator. | No significant cumulative construction impacts are anticipated due to spatial separation. CEMPs will be in place at both sites to minimise impacts. |
| | | A total of 852 standby generators is proposed, with no details provided on the maintenance testing regime. Testing is likely to occur during daytime hours in line with standard data centre operations. Routine, staggered testing is expected to have limited cumulative impact. However, a widespread grid outage could result in simultaneous generator operation at this facility and the Proposal temporarily increasing local emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with south westerly and north easterly components. |
| K) Kemps Creek (SSD-10101987) | Under Construction – Approved on 13 July 2023. Development consent to construct and operate a data centre comprising of two, two-storey data centre buildings including 60 data halls, an electrical switchyard, diesel fuel storage tanks, 62 emergency standby generators, 120 car parking spaces; and internal access roads, driveways and landscaping. The development would operate 24 hours a day, seven days a week. | There is no potential for cumulative air quality impacts as construction is expected to be completed by late 2025. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | Up to two generators will be tested concurrently under the bi-monthly no-load scenario, with quarterly and annual tests (70% and 100% load) undertaken on a single generator. Total annual test runtime is ~197 hours. The data centre comprises 62 standby generators (60 × 3 MW, 2 × 500 kW). Cumulative impacts from coincident testing with the Proposal are unlikely due to short, staggered test durations. Under emergency conditions, concurrent operation across both facilities could temporarily increase local emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with south westerly and north easterly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| L) DIG SYD01 (SPP-18-01554) | Under Assessment- SPP-18-01554 approved 28 Feb 2020. Subsequent modifications include MOD-20-0115 approved 7 May 2020 and MOD-23-00711 approved 28 June 2024. SPP-18-01554 is noted as construction and operation of a data centre including 6 data halls, 2 tech spaces, office facilities, amenities and external plant zones. Operation of the data centre is specified at 24 hours a day, 7 days a week, 365 days a year. | The proposed GFA is 8 228 m$^2$, consisting of 4 192 m$^2$ on the ground floor and 4 036 m$^2$ on the first floor. The proposal comprises of 7 813 m$^2$ of all other areas and 415 m$^2$ of office space. No publicly available information on construction staging and timeframe. | The Proposal is unlikely to result in significant cumulative impacts during construction, due to the separation between each construction site. CEMPs implemented to minimise risks. |
| | | No publicly available information regarding the number of generators or the operational testing regime for this site. However, based on standard industry practice generator testing would likely occur during daytime hours. Routine testing is expected to pose limited cumulative air quality risk due to the typically short duration and staggered scheduling of tests. Notwithstanding this, during widespread electricity grid outages, simultaneous operation of standby generators at both this facility and the Proposal could temporarily increase local air emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with northerly and southerly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| M) 90 Aldington Road Data Centre (SSD- | Under Preparation. Project SEARs issued on 24 April 2026 for the Construction and operation of a 245-megawatt data centre with a maximum building height of up to 27m and a one-gigawatt substation. | The proposed development seeks consent for a data centre comprising approximately 12 data halls (14 MW per hall) and a building height of up to 27 m, supported by an approximately 1 000 MW substation to serve the facility and future surrounding demand. The development will be delivered in stages. Stage 1 includes construction of the substation compound (including switchgear and provision for initial transformers), delivery of the data centre shell and core with fit out of two to four data halls, construction of front-of-house areas (offices, amenities and support spaces), and enabling works including car parking, landscaping and site infrastructure. Subsequent stages will complete fit out of remaining data halls in response to demand, with additional transformers installed within the substation as load increases. | The Proposal is unlikely to result in significant cumulative impacts during construction, due to the physical separation between construction sites and the implementation of CEMPs with appropriate mitigation measures at each location. |
| | | Publicly available information indicates that the testing regime will be determined by the data centre operator. At the time of writing, annual testing is anticipated to be approximately 152 hours however the number of generators to be held on site are unknown. Based on standard industry practice, generator testing is typically undertaken during daytime hours. Routine testing is expected to present limited cumulative air quality risk due to its short duration and staggered scheduling. However, in the event of widespread grid outages, concurrent operation of standby generators at both facilities could result in temporary increases in localised air emissions. | The Proposal may result in significant cumulative air quality impacts. Most likely in winds with south westerly and north easterly components. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| **NSW EPA Regulated Premises** | | | |
| N) BlueScope Steel Western Sydney Service Centre | Operational - The Western Sydney Service Centre is a key component of BlueScope Steel's supply chain, primarily servicing customers in the building and manufacturing sectors. The facility includes a continuous paint line with a production capacity of up to 120 000 tonnes of painted steel per year and is supported by ancillary infrastructure such as an evaporative cooling tower and rainwater harvesting system. Operations at the site are regulated under EPL 12495. | There is no potential for cumulative air quality impacts during construction, as this development is already operational. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | The Proposal involves the operation of standby diesel generators, which may emit $NO_X$, PM, and VOCs during grid outage events or routine maintenance testing. These emissions are intermittent and of short duration. The BlueScope facility comprises multiple emission sources, including three dedicated stacks associated with pre-treatment, coating, and strip cooling processes, on-site storage of paint, chemicals, and oils, and minor fugitive dust emissions from exposed surfaces. Emissions are managed under EPL 12495 and an Environmental Management Plan, with ongoing monitoring of total VOCs and $NO_X$, including stack testing and oven performance verification since commissioning. While both the Proposal and the BlueScope facility emit $NO_X$ and VOCs, their emission profiles differ. The Proposal's emissions would occur primarily during generator testing or power outages. In contrast, BlueScope's emissions occur during operational shifts with intermittent activity and downtime and are controlled through established management and monitoring protocols. | Due to the differing timing and control of emissions from the Proposal and BlueScope, the risk of significant cumulative air quality impacts is considered limited. The Proposal's episodic generator emissions are unlikely to coincide with BlueScope's shift-based operations at peak levels. Existing management and monitoring at BlueScope further mitigate potential combined effects. |

| Reference / Project | Project status / indicative timeframe / overlap | Potential overlap between impact of Proposal on assessment matter and impact of other project on the same assessment matter | Potential cumulative risk |
|---|---|---|---|
| O) Bingo Eastern Creek Recycling Ecology Park (& Landfill) | Operational - The facility operates under two EPLs EPL 20121 for resource recovery and EPL 13426 for landfill operations. It is licensed to accept up to 2 million tonnes per annum (Mtpa) of construction and demolition (C&D) and commercial and industrial (C&I) waste, and to landfill up to 1 Mtpa of non-putrescible waste, including asbestos. The facility also undertakes crushing, grinding, and separation of masonry materials within a designated Segregated Materials Area and is permitted to stockpile up to 50 tonnes of waste tyres and 20 000 tonnes of green waste. | There is no potential for cumulative air quality impacts during construction, as this development is already operational. | The Proposal does not result in cumulative air quality impacts during construction. |
| | | The landfill facility generates air quality impacts primarily from dust, odour, and landfill gas (LFG) emissions associated with waste handling, material processing, and flaring activities. These emissions are ongoing and managed under approved strategies, including an Operational Air Quality Management Plan (OAQMP) and Landfill Gas Management Plan (LFGMP), with controls such as dust suppression, gas flaring, and monitoring. In contrast, the Proposal involves intermittent emissions of $NO_X$, PM, and VOCs from standby generators during routine testing or grid outages. Given the differing sources, pollutant profiles, and emission patterns, any cumulative overlap are anticipated to be limited. | Potential cumulative risk is considered limited, noting the Proposal's emissions are short in duration, episodic, and engine-based, while the landfill generates more diffuse, ongoing emissions primarily related to dust and odour. The distinct emission sources and operational profiles, combined with site-specific management measures, including scheduled generator testing, dust suppression systems, and landfill gas flaring mean the likelihood of material cumulative air quality impacts on nearby sensitive receptors is minimal. |

# 8. DISCUSSION

This AQIA evaluates the potential air quality impacts associated with the construction and operation of the STACK SYD01 Data Centre sited at 78 Lockwood Road, Erskine Park NSW. Construction-related impacts are primarily associated with dust generation, including dust soiling and increases in particulate matter concentrations, while operational impacts are driven by combustion emissions from standby diesel generators.

Publicly available environmental data were used to characterise existing conditions and inform the AQIA. Once operational, routine testing and emergency use of standby diesel generators have the potential to result in elevated pollutant concentrations at nearby sensitive receptors. Accordingly, operational impacts have been assessed using realistic yet conservative worst-case emissions scenarios to support a robust evaluation of potential air quality risks.

The following section discusses the findings of the AQIA, including construction-phase risk assessment, operational-phase dispersion modelling, evaluation of cumulative impacts from nearby data centre developments, and contextualisation of any predicted short-term criteria exceedances under Scenario 1 with reference to the respective power grid SAIDI statistics and the overall likelihood of such events, and a benchmark comparison of the in-stack emission concentrations calculate for each candidate generator against POEO CAR standards.

## 8.1. Construction Phase Risk Assessment

The construction phase risk assessment for the Proposal, presented in Section 6 indicates that dust soiling impacts equate to a medium risk level for earthworks, construction, trackout and construction-traffic related activities. In terms of human health impacts, low risks are attributed to earthworks, construction, trackout and construction-traffic activities, if no mitigation measures were to be applied to control emissions.

Based upon that assessment, a range of mitigation measures are recommended to ensure that short-term impacts associated with construction phase activities are minimised, as presented in Appendix B.

## 8.2. Operational Phase Impact Assessment

The predicted impacts of operational phase activities under justified worst case (Scenario 1) and realistic operational scenarios (Scenario 2) are presented in Section 7.

### 8.2.1. Scenario 1 – Justified Worst Case (Emergency Power Generation)

Under the justified worst-case standby generator operational scenario (Scenario 1), exceedances of short-term air quality criteria for $NO_2$, $PM_{10}$ and $PM_{2.5}$ are predicted.

**Note:** care must be applied when assessing 24-hour average impacts as the likely duration of a power outage event is likely to be significantly less than 24-hours, and as such the assessment should be considered to be highly conservative (i.e. relevant to the operation of standby generators for an entire 24-hour period).

That scenario assumes that all 188 generators would be operational at one time. The predicted incremental concentrations under Scenario 1 show exceedances of particulate matter and $NO_2$ at sensitive receptor locations if a power outage occurred, and all 188 emergency generators were operating at 100 % load continuously (refer Section 7.1) to assess emissions under all potential meteorological conditions.

An assessment of the probability *(p)* of exceedance of the relevant short-term criteria has been undertaken (refer Section 7.3), where p = 0 represents an impossible event and p = 1 represents certainty. The maximum predicted annual probabilities across all receptors are:

An assessment of the probability (*p*) of an exceedance of the relevant short-term criteria has been performed and is presented in Section 7.3. As a maximum across all receptors, the probability of an exceedance of the $NO_2$, $PM_{10}$ or $PM_{2.5}$ criterion (where *p*=0 is an impossible event, and *p*=1 is a certain event) in any year is:

- $NO_2$: $p = 0.0550$;
- $PM_{10}$: $p = 0.1808$; and,
- $PM_{2.5}$: $p = 0.2384$.

To contextualise the likelihood of concurrent occurrence of a power interruption and a predicted exceedance condition, historical network reliability data from Endeavour Energy's 2025 Distribution Annual Planning Report (DAPR) have been applied (Endeavour Energy, 2025).

Based on recorded SAIDI data over the period FY2013/14 to FY2024/25, the average unplanned (normalised) outage duration is approximately 81.9 minutes per customer per year, with an unnormalised average of 143.5 minutes per year. The maximum recorded unnormalised annual outage duration within the dataset was 303.6 minutes. These outage durations have been expressed as an equivalent proportion of total annual time to derive an annualised outage probability range of approximately:

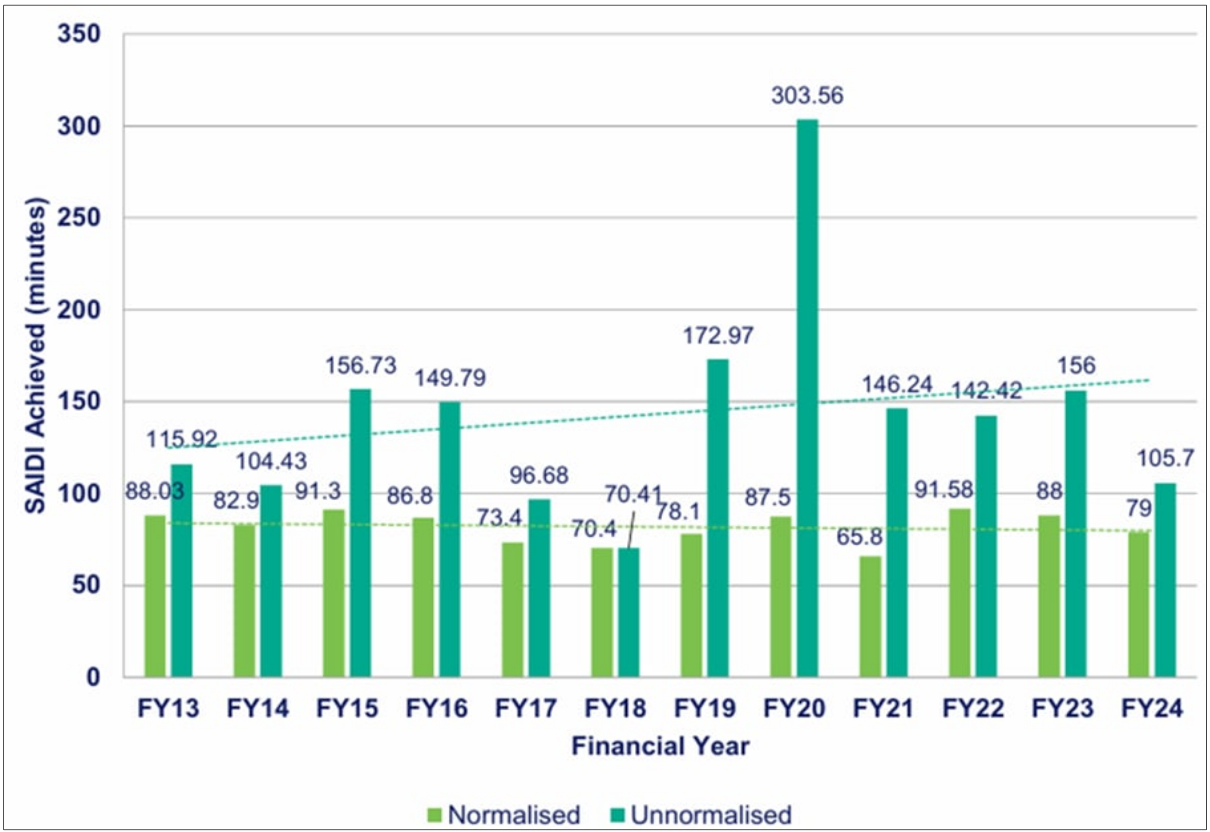
- Normalised average: $p = 0.00016$
- Unnormalised average: $p = 0.00027$
- Unnormalised maximum: $p = 0.00058$

The joint probability of a power interruption coinciding with modelled exceedance conditions has been estimated by combining the outage probability with the predicted exceedance probabilities. The resulting values are presented in Table 35.

Figure 17 presents SAIDI trends (normalised and unnormalised) over the period FY2013/14 to FY2023/24.

Overall, the combined probability estimates indicate that the concurrent occurrence of a qualifying power interruption and a modelled exceedance condition is limited in relative terms across the assessment period, based on historical network reliability data and the modelling assumptions adopted.

**Figure 16 Endeavour Energy SAIDI trend (unnormalised and AER normalised)**




**Source:** (Endeavour Energy, 2025)

**Table 35 Probability of an exceedance during a power outage**

| Number of years | Probability of additional short-term criterion exceedance during a power outage (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Normalised SAIDI | | | Unnormalised SAIDI | | | Unnormalised max | | |
| | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1-hour $NO_2$ | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1-hour $NO_2$ | 24-hour $PM_{10}$ | 24-hour $PM_{2.5}$ | 1-hour $NO_2$ |
| 100 | 0.3 | 0.4 | 0.1 | 0.5 | 0.6 | 0.2 | 1.0 | 1.4 | 0.3 |
| 200 | 0.6 | 0.7 | 0.2 | 1.0 | 1.3 | 0.3 | 2.1 | 2.7 | 0.6 |
| 500 | 1.4 | 1.8 | 0.4 | 2.4 | 3.2 | 0.7 | 5.1 | 6.7 | 1.6 |
| 1 000 | 2.8 | 3.6 | 0.9 | 4.8 | 6.3 | 1.5 | 9.9 | 12.9 | 3.1 |
| 1 250 | 3.5 | 4.5 | 1.1 | 6.0 | 7.8 | 1.9 | 12.2 | 15.8 | 3.9 |

### 8.2.2. Scenario 2 – Realistic Operations (Maintenance Testing)

Annual average particulate matter concentrations (as TSP, $PM_{10}$ and $PM_{2.5}$) resulting from Scenario 2 are predicted to comply with the relevant impact assessment criteria, with no exceedances predicted.

Under Scenario 2, no additional exceedances of the cumulative impact assessment criteria for 24-hour $PM_{10}$ and 24-hour $PM_{2.5}$ are predicted as a result of the Proposal. While an exceedance of the 24-hour $PM_{10}$ and $PM_{2.5}$ criteria are identified in Table 26 and Table 27 these are attributable to elevated background concentrations that already exceed the respective criteria and are not related to emissions from the Proposal.

For 1-hour and annual average $NO_2$, no cumulative exceedances are predicted due to the Proposal. Predicted incremental and cumulative 1-hour $NO_2$ concentrations remain below the relevant criteria at all considered receptor locations.

Predicted concentrations of CO, $SO_2$, PAHs, VOCs, and $CH_2O$ across all assessed averaging periods are also below the relevant impact assessment criteria at all receptor locations under Scenario 2.

Correspondingly, it is anticipated that under operation of the testing schedule (refer Section 2.3.2) no significant air quality impacts are predicted to be experienced at sensitive receptors during routine operations.

### 8.2.3. Odour

Toluene ($C_7H_8$) and xylene ($C_8H_{10}$) emissions have been assessed and compared against the relevant odour impact assessment criteria.

No exceedances of the relevant odour criteria are predicted during either emergency or realistic operations.

### 8.2.4. POEO CAR Standard of Concentrations

Section 7.4 contains a benchmark comparison of the calculated in-stack emissions concentrations from each candidate generator against the applicable POEO CAR standards for the Proposal, demonstrating compliance with the relevant Group 6 requirements.

Although the operations may be exempt from the relevant emission limit regulations pertaining to $NO_2$ (i.e. in-stack emission concentrations), the Applicant would not be exempt from ensuring the emissions do not exceed ambient air quality criteria.

### 8.2.5. Mitigation and Regulatory Controls

Dispersion modelling under Scenario 2 indicates that maintenance testing is not predicted to cause exceedances of the assessed criteria at sensitive receptors surrounding the Proposal site. To minimise potential operational impacts, maintenance testing should be performed in general accordance with the operational assumptions adopted within this AQIA and, where practicable, scheduled to avoid periods of elevated background air quality conditions, typically associated with regional air quality events (e.g. bushfire smoke or dust events).

Consideration should also be given to coordination of routine maintenance testing activities with other proximate data centre operators, where practicable, to minimise the potential for concurrent emissions from multiple facilities. Routine inspection, maintenance and servicing programs should be implemented for all standby generators to ensure operation in accordance with manufacturer specifications and design performance requirements. Ongoing engagement with equipment suppliers should continue to identify best-practice operational and emissions reduction opportunities where feasible.

In the event of a loss of mains power, standby generators would operate only for the duration required to maintain critical operations until normal power supply is restored. All practical measures within the Applicant's control would be implemented to minimise generator operating duration where feasible, noting restoration of grid power would generally rely upon third-party network operators e.g. Endeavour Energy, TransGrid

As the Proposal is likely to constitute a scheduled activity under the POEO Act (refer Section 3.1), an Environment Protection Licence (EPL) may be required for operation of the facility. In this context, operational controls and monitoring requirements may be further refined through the development consent and EPL conditions.

To reduce pollutant emissions and ensure future flexibility for emissions control, the following recommended measures are provided:

- It is recommended that the Applicant ensures that the design, installation and operation of the standby generators and associated enclosures do not preclude the future retrofitting of additional suitable air pollution control (APC) equipment. Such equipment may be installed at a later stage if circumstances or regulatory drivers change and/or the standby generators are required to operate more frequently than originally anticipated.
- It is recommended that the operation of the standby generators (including testing) does not exceed 200 hours cumulatively per year;
- The performance of the maintenance testing should not be performed at times during periods of elevated background air quality conditions (e.g. in regional events such as bush fires, dust storms); and,
- The performance of maintenance testing may be performed at times when other proximate data centres are not performing similar maintenance testing (e.g. maintenance on alternative days). This

will involve communication and co-ordination between data centre operators to minimise simultaneous emissions.

**Note:** For the purposes of calculating annual operational hours, concurrent testing of multiple generators is counted as a single hour. For example, two generators tested simultaneously over one hour would count as one hour toward the annual threshold.

It is also anticipated that any future development consent and / or EPL would restrict the use of the standby generators to emergency operation and routine maintenance testing and would preclude operation for continuous electricity export or load curtailment purposes. Periodic emissions testing may also be required as part of future regulatory approvals and/or EPL conditions.

### 8.2.6. Review of Best Available Technologies (BAT)

A range of additional measures considered to be Best Available Technology (BAT) has been reviewed and discussed in Appendix F. For context, the Proposal is predicted not to exceed relevant air quality criteria under the assumed maintenance testing schedule (refer Section 2.3.2.1) and the BAT review illustrates how air quality impacts could be further reduced.

The feasibility of BAT and associated low emission technologies and operational practices have been considered including both design stage and operational measures to minimise emissions. Technologies evaluated include Selective Catalytic Reduction (SCR) systems, Diesel Oxidation Catalysts (DOC), Diesel Particulate Filters (DPF), and low $NO_X$ engine designs. While these options can provide incremental emission reductions, their overall benefit is limited for a standby generation facility of this scale such as a large data storage centre with intermittent and short-duration generator use. Periodic review of emerging BAT options is recommended to identify future opportunities for emission reduction.

Alternative low emission technologies were also evaluated. Battery Energy Storage Systems (BESS) provide rapid response with zero on-site emissions but have high capital costs and reliance on grid electricity. Hydrogen Fuel Cells (HFC) are efficient but constrained by infrastructure, storage and cost. Hydrotreated Vegetable Oil (HVO) is a renewable diesel substitute offering up to 90 % lifecycle carbon dioxide ($CO_2$) reduction with minimal retrofitting required and thus represents a practicable mid-term emissions-reduction option.

Diesel generators remain a commonly adopted standby power solution for data centres due to their proven reliability, rapid start capability and ability to provide high electrical loads during emergency operating conditions. Benchmarking of the representative standby generator unit adopted within the AQIA (Baudouin 16M55G6D2/5 as a nominated example) against relevant international emissions standards (refer Table G5, Appendix G) indicates compliance with the US EPA Tier 2 requirements. Manufacturer performance data also indicate that CO emissions are comparable with US EPA Tier 4 and EU Stage V benchmark values. However, the unit does not achieve the more stringent US EPA Tier 4 or EU Stage V emissions performance for $NO_X$

and particulate matter (PM) without incorporation of supplementary exhaust after-treatment systems, such as selective catalytic reduction (SCR) and / or particulate filtration technologies.

SCR systems require sustained high exhaust temperatures to efficiently convert $NO_X$. At data centres facilities, standby generators typically operate intermittently and often for short-duration maintenance testing (typically up to one (1) hour) or during unplanned outages and as such exhaust temperatures frequently fall below the effective catalyst activation range. This reduces $NO_X$ conversion efficiency and can cause urea crystallisation which may lead to operational and maintenance issues. Consequently, the capital and maintenance costs of SCR are disproportionate to the benefits for intermittent duty cycles.

$NO_X$ emissions can be effectively managed through operational strategies, including optimised engine tuning, minimising test durations, and scheduling routine testing during periods with favourable atmospheric dispersion. While the Applicant is seeking to operate up to four generators concurrently during any one test, emissions can still be reduced through these measures and the use of low emission fuels such as HVO, providing a practicable and reliable approach for standby power operations. Implementation of these measures, along with periodic review of emerging technologies, will help ensure that air quality risks remain as low as reasonably practicable.

## 8.3. Cumulative Impacts

The potential for cumulative air quality impacts has been evaluated in accordance with relevant CIA guidance (NSW DPIE, 2022), as presented in Section 7.5. The assessment identifies potential cumulative operational air quality impacts arising from several proximate sources, including data centres and two additional NSW EPA regulated premises specified through consultation (Refer Table 11, Section 4.6).

While the assessment procedure highlights the potential for cumulative impacts, it does not provide detailed guidance on quantifying the risk of such impacts. Consideration of cumulative risk incorporates factors like:

- The physical distance between the contributing sources;
- The incidence of contributing sources operating on common electricity power supplies;
- The SAIDI statistics for the respective power supplies;
- The physical distance from contributing sources and receptors along common wind vectors;
- The prevalence of those wind vectors occurring; and,
- The probability of emissions from (a) emergency operation and (b) during routine testing.

There is the potential for cumulative air quality impacts to arise from nearby data centres during concurrent operations (refer Section 7.5) particularly in the event of a regional grid outage where all facilities including the Proposal simultaneously activate standby diesel generators. Such emergency operation scenarios which may occur during widespread grid failures are recognised by NSW EPA and subject to regulatory allowances. The probability of concurrent power feeder failures is considered to be low, particularly as it is common for data centres to be served by multiple power supply feeders to reduce this risk.

Routine maintenance testing may also contribute to cumulative impacts since most facilities conduct tests during daytime hours. Due to the distances between the Proposal, other facilities and sensitive receptors as well as the low likelihood of concurrent testing with emissions transported downwind, these impacts are anticipated to be limited. Furthermore, generator operating hours are typically limited under development consent or EPL conditions (e.g. 200 hours per year) to minimise routine emissions with testing and maintenance regulated to control pollutant impacts.

The BlueScope Steel facility and Bingo Eastern Creek Recycling Ecology Park (& Landfill) operate under EPLs with environmental management plans addressing industrial emissions, dust, and landfill gas. Given their differing operational profiles, and mitigation measures, the risk of cumulative air quality impacts with the Proposal is considered limited.

Limited cumulative impacts may also arise during overlapping construction phases, primarily related to dust soiling and human health risks. Nonetheless, each development is required to have a CEMP, including waste and traffic management measures. Dust emissions from construction are well understood and can be effectively mitigated to minimise significant cumulative impacts.

# 9. CONCLUSION

This AQIA has been prepared by Northstar for STACK to assess the potential air quality impacts associated with the construction and operation of the proposed STACK SYD01 Data Centre located at 78 Lockwood Road, Erskine Park NSW.

The assessment considers construction-phase dust emissions, including dust soiling and increases in particulate matter concentrations, as well as operational emissions from standby diesel generators. Publicly available environmental data were used to characterise existing conditions and inform the AQIA.

During construction, potential dust soiling and human health risks were assessed as manageable through the implementation of recommended mitigation measures. With these controls incorporated into a CEMP, residual construction phase air quality impacts are deemed to be not significant.

During operation, routine testing and emergency use of standby diesel generators were identified as the primary potential sources of air quality impacts. Operational impacts were therefore assessed using realistic yet conservative worst-case emissions scenarios. Based on the assessment findings, the normal operation of the Proposal is not expected to result in exceedances of relevant air quality criteria at any identified sensitive receptor. Under realistic operating conditions, including adherence to an appropriate testing regime, predicted incremental pollutant concentrations remain below applicable criteria when background air quality is considered.

Cumulative air quality impacts have been assessed in accordance with the CIA Guidelines, considering the regulatory context, available information and the scale and influence of surrounding developments. Potential cumulative impacts during overlapping construction phases, primarily related to dust emissions are anticipated to be effectively mitigated through site specific CEMPs and appropriate controls across each project.

During operation, a potential cumulative scenario was identified under regional or catastrophic grid outage conditions, where multiple data centres could operate standby generators simultaneously, resulting in a temporary increase in emissions. Such events are recognised within the NSW EPA regulatory framework and are subject to applicable allowances and controls. Routine maintenance testing is not anticipated to result in material cumulative impacts due to the short duration of testing, staggered scheduling, physical separation of facilities and adherence to regulatory EPL limits including the 200 hour annual operating cap under the POEO Act for in-stack $NO_2$ emissions concentrations.

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# APPENDIX A

## Commonly Used Abbreviations and Units

## Units Used in the Report

Units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units.

### Commonly used SI units

The following units are commonly used in Northstar reports.

| Symbol | Name | Quantity |
|---|---|---|
| **SI base units** | | |
| K | Kelvin | thermodynamic temperature |
| kg | kilogram | mass |
| m | metre | length |
| mol | mole | amount of substance |
| s | seconds | time |
| **Non-SI units mentioned in the SI or accepted for use** | | |
| ° | degree | plane angle |
| d | day | time |
| h | hour | time |
| ha | hectare | area |
| J | joule | energy |
| L | litre | volume |
| min | minute | time |
| N | newton | force or weight |
| t | tonne | mass |
| V | volt | electrical potential |
| W | watt | power |

### Multiples of SI and non-SI units

The following prefixes are added to unit names to produce multiples and sub-multiples of units:

| Prefix | Symbol | Factor |
|---|---|---|
| T | tera- | $10^{12}$ |
| G | giga- | $10^{9}$ |
| M | mega- | $10^{6}$ |
| k | kilo- | $10^{3}$ |
| h | hector- | $10^{2}$ |
| da | deca- | $10^{1}$ |

| Prefix | Symbol | Factor |
|---|---|---|
| p | pico- | $10^{-12}$ |
| n | nano- | $10^{-9}$ |
| µ | micro- | $10^{-6}$ |
| m | milli- | $10^{-3}$ |
| c | centi- | $10^{-2}$ |
| d | deci- | $10^{-1}$ |

In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol.

For example:

- 50 micrograms per cubic metre would be presented as 50 $\mu g \cdot m^{-3}$ and not 50 $\mu g/m^3$; and,
- 0.2 kilograms per hectare per hour would be presented as 0.2 $kg \cdot ha^{-1} \cdot hr^{-1}$ and not 0.2 kg/ha/hr.

### Commonly used SI-derived and non-SI units

| Symbol | Name | Quantity |
|---|---|---|
| $g \cdot m^{-2} \cdot s^{-1}$ | gram per square metre per second | rate of mass deposition per unit area |
| $g \cdot s^{-1}$ | gram per second | rate of mass emission |
| $kg \cdot ha^{-1} \cdot hr^{-1}$ | kilogram per hectare per hour | rate of mass deposition per unit area |
| $kg \cdot m^{-3}$ | kilogram per cubic metre | density |
| $L \cdot s^{-1}$ | litres per second | volumetric rate |
| $m^2$ | square metre | area |
| $m^3$ | cubic metre | volume |
| $m \cdot s^{-1}$ | metre per second | speed and velocity |
| $mg \cdot m^{-3}$ | milligram per cubic metre | mass concentration per unit volume |
| $mg \cdot Nm^{-3}$ | milligram per normalised cubic metre (of air) | mass concentration per unit volume |
| $\mu g \cdot m^{-3}$ | microgram per cubic metre | mass concentration per unit volume |
| $mg \cdot m^{-3}$ | milligram per cubic metre | mass concentration per unit volume |
| Pa | pascal | pressure |
| ppb | parts per billion ($1x10^{-9}$) | volumetric concentration |
| pphm | parts per hundred million ($1 \times 10^{-5}$) | volumetric concentration |
| ppm | parts per million ($1x10^{-6}$) | volumetric concentration |

### Commonly used abbreviations

| Abbreviation | Term |
|---|---|
| ABS | Australian Bureau of Statistics |
| ACT | Australian Commonwealth Territory |
| AGL | above ground level |
| AHD | Australian height datum |
| APC | air pollution control |
| AQI | air quality index |
| AQIA | air quality impact assessment |
| AQMS | air quality monitoring station |
| AQRA | air quality risk assessment |
| ARPANSA | Australian Radiation Protection and Nuclear Safety Agency |
| AS/NZS | Australian Standard / New Zealand Standard |
| AWS | automatic weather station |
| BCA | Building Code of Australia |
| BGL | below ground level |
| BOM | Bureau of Meteorology |

| Abbreviation | Term |
|---|---|
| CEMP | construction environment management plan |
| $CH_4$ | methane |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DEM | digital elevation model |
| EETM | emission estimation technique manual |
| EPA VIC | Environmental Protection Authority Victoria |
| EPBC | Environment Protection and Biodiversity Conservation Act |
| FIBC | flexible intermediate bulk container |
| GIS | geographical information system |
| IAQM | UK Institute of Air Quality Management |
| IBC | intermediate bulk container |
| ID | internal diameter |
| LLV | low level waste |
| LoM | life of mine |
| MSDS | Material Safety Data Sheet |
| NCAA | National Clean Air Agreement |
| NEPM | National Environment Protection Measure |
| $NH_3$ | ammonia |
| NO | nitric oxide |
| $NO_X$ | oxides of nitrogen |
| $NO_2$ | nitrogen dioxide |
| NORM | naturally occurring radioactive material |
| NSW | New South Wales |
| NSW DCCEEW | New South Wales Department of Climate Change, Energy, the Environment and Water |
| NSW DPE | New South Wales Department of Planning and Environment |
| NSW DPHI | New South Wales Department of Planning, Housing and Infrastructure |
| NSW EPA | New South Wales Environment Protection Authority |
| NT | Northern Territory |
| OEMP | operational environmental management plan |
| $O_3$ | ozone |
| OU | odour unit |
| $OU{\cdot}m^3{\cdot}s^{-1}$ | odour units times metres cubed per second |
| $OU{\cdot}s^{-1}$ | odour units per second |
| Pb | lead |
| PM | particulate matter |
| $PM_{10}$ | particulate matter with an aerodynamic diameter of 10 µm or less |
| $PM_{2.5}$ | particulate matter with an aerodynamic diameter of 2.5 µm or less |
| ROM | run of mine |
| SA | South Australia |

| Abbreviation | Term |
|---|---|
| SEPP | State Environmental Protection Policy |
| $SO_X$ | oxides of sulphur |
| $SO_2$ | sulphur dioxide |
| SRTM3 | Shuttle Radar Topography Mission |
| SVOC | semi-volatile organic compound |
| TAPM | The Air Pollution Model |
| TAS | Tasmania |
| TEU | twenty-foot equivalent unit |
| TSP | total suspended particulates |
| TVOC | total volatile organic compounds |
| TWA | time weighted average |
| US EPA | United States Environmental Protection Agency |
| UTM | Universal Transverse Mercator |
| VIC | Victoria |
| VLLW | very low-level waste |
| VOC | volatile organic compound |

# APPENDIX B

## Construction Phase Dust Risk Assessment

Provided below is a summary of the risk assessment methodology applied in this AQIA which is based upon the UK IAQM's *Guidance on the assessment of dust from demolition and construction* (IAQM, 2024) and adapted by Northstar.

### Adaptions to the Published Methodology Made by Northstar

The adaptions made by Northstar from the IAQM published methodology are:

- **$PM_{10}$ criterion**: an amended criterion representing the annual average $PM_{10}$ criterion relevant to Australia rather than the UK;
- **Nomenclature**: a change in nomenclature from 'receptor sensitivity' to 'land use value' to avoid misinterpretation of values attributed to 'receptor sensitivity' and 'sensitivity of the area' which may be assessed as having different values;
- **Construction traffic**: assessed separately from on-site demolition, earthworks and construction activities. While the IAQM methodology defines four risk categories (demolition, earthworks, construction and trackout), Northstar introduces a fifth category for construction traffic; and,
- **Tables**: minor adjustments in the visualisation of some tables.

### Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located:

- Beyond a distance of 250 m from the Proposal site boundary; and,
- At a distance greater than 50 m from the route(s) used by construction vehicles on public roads from the Proposal site entrance and extending past 250 m from the Proposal site entrance.

This step is noted as having deliberately been chosen to be conservative and would require assessments for most developments. It is observed that there are sensitive receptor locations surrounding the Proposal site (i.e. within 50 m) and as such no screening has been performed. The requirement for the level of dust control would be determined by the potential impacts at the closest adjacent receptors.

Application of the step one screening process is summarised in Table B1.

**Table B1 Application of Step 1 screening**

| Construction impact | Screening criteria | screening | Comments |
|---|---|---|---|
| Demolition | 250 m from boundary, 250 m from site entrance(s) | Not applicable | Receptors identified within the screening distance |
| Earthworks | 250 m from boundary, 250 m from site entrance(s) | Not screened | |
| Construction | 250 m from boundary, 250 m from site entrance(s) | Not screened | |
| Trackout | 250 m from site entrance(s) | Not screened | |
| Construction Traffic | 50 m from roadside, 250 m from site entrance(s) | Not screened | |

### Step 2 – Define the Potential Dust Emission Magnitude

Step 2 of the assessment categorises dust-generating activities as demolition, earthworks, construction, track-out (material transported onto public roads), and construction traffic, by their 'dust emissions magnitude' (Small, Medium, or Large), as defined in Table B2.

**Table B2 Dust emission magnitude activities**

| Activity | Small | Medium | Large |
|---|---|---|---|
| **Demolition** | | | |
| Total building volume | < 12 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | > 75 000 $m^3$ |
| Demolition height | < 6 m AGL | 6 m and 12 m AGL | > 12 m AGL |
| Onsite crushing | no | no | yes |
| Onsite screening | no | no | yes |
| Demolition of materials with high dust potential | no | yes | yes |
| Demolition timing | wet months only | any time of the year | any time of the year |
| **Earthworks** | | | |
| Total area | < 18 000$m^2$ | 18 000 $m^2$ to 110 000 $m^2$ | > 110 000 $m^2$ |
| Soil types | soil type with large grain size (e.g. sand) | moderately dusty soil type (e.g. silt) | potentially dusty soil type (e.g. clay) |
| Heavy earth moving vehicles | < 5 heavy earth moving vehicles active at any one time | 5 to 10 heavy earth moving vehicles active at any one time | > 10 heavy earth moving vehicles active at any time |
| Formation of bunds | < 3 m AGL | 3 m to 6 m AGL | > 6 m AGL |
| **Construction** | | | |
| Total building volume | < 12 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | > 75 000 $m^3$ |
| Concrete batching | no | yes | yes |
| Sandblasting | no | no | yes |
| Materials | metal cladding or timber | concrete | concrete |
| **Trackout** | | | |
| Outward heavy vehicles movements per day | < 20 | 20 to 50 | > 50 |
| Surface materials | low potential | moderate potential | high potential |
| Unpaved road length | < 50 m | 50 m to 100 m | > 100 m |
| **Construction traffic (from construction site entrance to construction vehicle origin)** | | | |
| Demolition traffic - total building volume | < 12 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | > 75 000 $m^3$ |
| Earthworks traffic total area | < 18 000$m^2$ | 18 000 $m^2$ to 110 000 $m^2$ | > 110 000 $m^2$ |

| Activity | Small | Medium | Large |
|---|---|---|---|
| Earthworks traffic soil types | soil type with large grain size (e.g. sand) | moderately dusty soil type (e.g. silt) | potentially dusty soil type (e.g. clay) |
| Construction traffic total building volume | < 12 000 $m^3$ | 12 000 $m^3$ to 75 000 $m^3$ | > 75 000 $m^3$ |
| Total traffic outward heavy vehicles movements per day | < 20 | 20 to 50 | > 50 |

Construction is anticipated to be delivered in two staged phases.

- Stage 1: Eastern data centre building, on-site substation, generator gantry, external plant and equipment, new Lockwood Road access, internal roads, car parking, and landscaping, External HV Cabling Route.
- Stage 2: Western data centre building, gantry expansion, external plant and equipment, additional car parking and landscaping.

Demolition activities are considered to be not applicable given that the Proposal site comprises of vacant land and does not contain any existing built form structures. Further, the Proposal site is generally flat and has been largely cleared of vegetation.

Earthworks at the Proposal site are required for site preparation, achieving target cut/fill balances for both buildings and road levels, and ensuring stable foundations for the buildings, infrastructure, landscaping, and associated public domain works. The affected area covers the primary data centre land, ancillary office spaces, and a new on-site substation totalling 77 241.97 $m^2$. During the earthworks phase, it is anticipated that up to 10 heavy earth-moving vehicles will be in operation at any time. Bunds will be formed with materials up to 3 m high, stored in mounds and protected by wind and soil erosion fences in accordance with Landcom Managing Urban Stormwater Guidelines. The Proposal site's fill and natural soils are predominantly clay-based.

The Proposal involves the construction of a new data centre, including site preparation and bulk earthworks, covering a total GFA of approximately 56 506 $m^2$. Key components of the development include two buildings at three storeys each, featuring data halls across two levels and a separate generator gantry area to house standby generators. A total of 78 parking spaces is to be provided. Additional works will include landscaping, public domain improvements, and the extension and augmentation of physical infrastructure and utilities, including a new on-site substation to the north. Construction works at the Proposal site are anticipated to generate over 75 000 $m^3$ of building volume. Construction would involve delivery of large-scale building elements and associated infrastructure, resulting in substantial on-site built form. The primary structural system would comprise structural steelwork to reduce dead load and maximise off-site prefabrication. The majority of façade and enclosure materials, including metal cladding and screening elements, would have low inherent dust generation potential. On-site concrete batching is not anticipated.

The Proposal site is located in a suburb of Western Sydney which is primarily characterised by industrial and residential areas, with a mix of commercial and logistics operations. The area is experiencing growth due to ongoing industrial development and its proximity to key infrastructure, including the Western Sydney International Airport (currently under construction), as well as large industrial estates, warehouses, and business parks. As such, the Proposal site is easily accessible via major arterial roads, including Erskine Park Road, Mamre Road, and Old Wallgrove Road. Construction traffic will primarily use the existing road network to access the Proposal site, with ingress and egress via a dedicated entrance positioned at Lockwood Road. From there, vehicles will proceed onto Lenore Drive and Old Wallgrove Road to access the M7 Motorway to the east or travel northbound along Erskine Park Road towards the M4 Motorway.

At this stage of development, a typical 'standard construction day' is expected to involve up to 10 outbound heavy-duty vehicle (HDV) movements to service the Proposal. During peak construction periods, such as concrete pours, this number may increase to around 30 HDV movements per day.

Based upon the discussion provided above and the criteria presented in Table B2, the assessed dust emission magnitudes are as presented in Table B3.

**Table B3 Construction phase impact categorisation of dust emission magnitude**

| Activity | Dust emission magnitude (DEM) |
|---|---|
| Demolition | Not Applicable |
| Earthworks and enabling works | Medium |
| Construction | Large |
| Trackout | Medium |
| Construction traffic routes | Large |

### Step 3 – Sensitivity of the Area

Step 3 of the process requires the sensitivity of the area to be defined. The sensitivity of the area considers:

- Specific sensitivities that identified land use values may have to dust deposition and health impacts;
- The proximity and number of those receptors locations;
- In the case of $PM_{10}$, the local background concentration; and
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.

### Land Use Value

Individual receptor locations are assigned land use values (low, medium, or high) based on the land use and its sensitivity to dust deposition and human health impacts. The land use value reflects the expected level of amenity for a given land use. The IAQM methodology provides guidance on assigning land use values for dust soiling and human health impacts, as shown in Table B4. It is noted that amenity expectations (e.g. tolerance to dust soiling) depend on existing background deposition levels.

In the surrounding locality, receptors within 100 m of the Proposal site boundary are predominantly industrial in nature, corresponding to a 'medium' land use sensitivity with respect to dust soiling and health impacts. The nearest residential dwellings are located along Cetus Place, approximately 220 m from the Proposal site boundary. To ensure a conservative assessment, the land use sensitivity has been classified as 'high,' due to the presence of residential receptors within the screening distance of 250 m which are considered highly sensitive to air quality impacts (refer Table B1 and Table B5).

**Table B4 IAQM guidance for categorising land use value**

| Land use value | Low | Medium | High |
|---|---|---|---|
| Dust soiling | The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics, or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of normal land use. | Users would expect to enjoy a reasonable level of amenity but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or the people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of normal land use. | Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of normal land use. |
| *Examples* | *Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.* | *Parks and places of work.* | *Dwellings, museums, and other culturally important collections, medium- and long-term car parks and car showrooms* |
| Health impacts | Locations where human exposure is transient. | Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for $PM_{10}$ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for 8 hours or more). | Locations where the public are exposed over a time period relevant to the air quality objective for $PM_{10}$ (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for 8 hours or more). |
| *Examples* | *Public footpaths, playing fields, parks, and shopping street.* | *Office and shop workers but would generally not include workers occupationally exposed to $PM_{10}$.* | *Residential properties, hospitals, schools, and residential care homes.* |

## Dust Soiling Impacts

To assess dust soiling impacts, the sensitivity of the local area is determined by considering the receptors and their quantity, as detailed in Table B5.

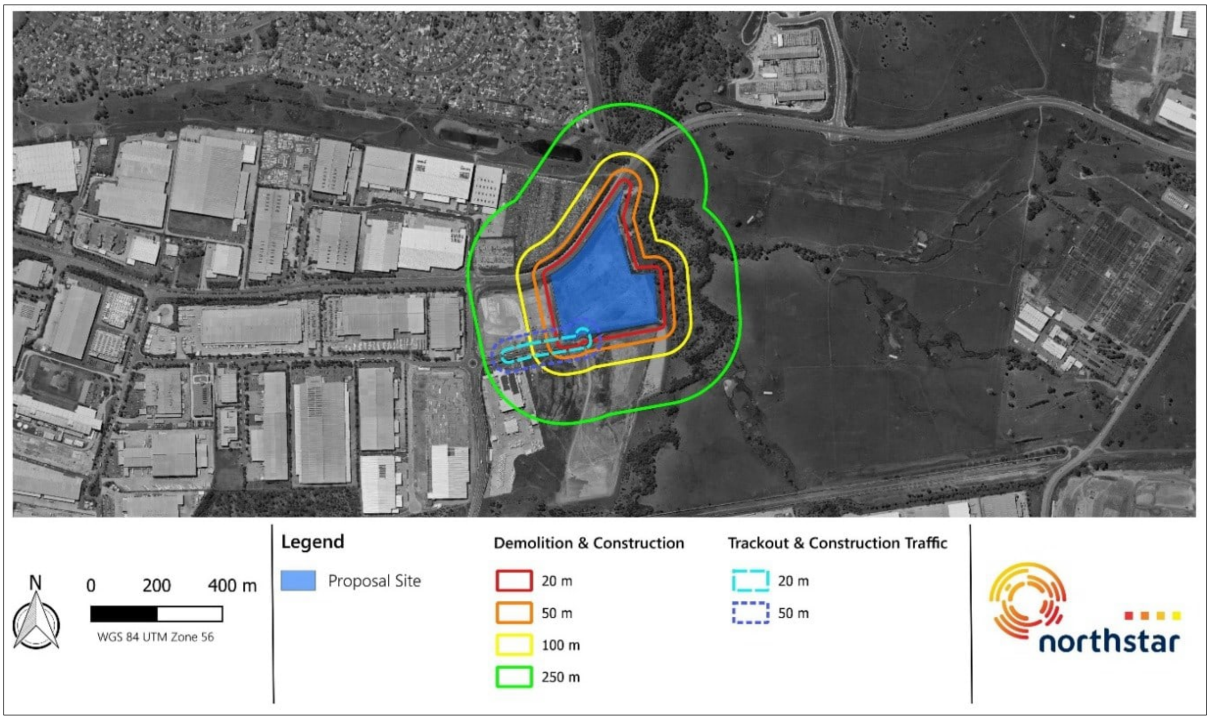
**Table B5 IAQM guidance for categorising the sensitivity of an area to dust soiling impacts**

| Land use value | Number of receptors[a] | Distance from the source (m)[b] | | | |
|---|---|---|---|---|---|
| | | < 20 | < 50 | < 100 | < 250 |
| Low | > 1 | Low | Low | Low | Low |
| Medium | > 1 | Medium | Low | Low | Low |
| High | 1 – 10 | Medium | Low | Low | Low |
| | 10 – 100 | High | Medium | Low | Low |
| | > 100 | High | High | Medium | Low |

**Notes:** (a) Estimate the total number of receptors within the stated distance. Only the highest level of area sensitivity from the table needs to be considered. (b) With regard to potential 'construction traffic' impacts, the distance criteria of less than 20 m and less than 50 m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50 m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is negligible'.

Figure B1 illustrates the extent of works considered for this AQIA, delineating the outer envelope boundary of the anticipated construction works, the IAQM distance bands and the positions of receptors. Note that the buffers for trackout and construction traffic have been produced to account for potential construction routes.

**Figure B1 Scope of construction activities, buffer distances and surrounding environment**




**Source:** Northstar

IAQM guidance does not require an exact count of receptors; instead, professional judgement is used to estimate the number of buildings within each distance band, applying the highest area sensitivity level from Table B5. The Proposal site is situated in a largely industrial area, including warehousing, logistics, and data centre developments, within the Fitzpatrick Industrial Estate, zoned as IN1 – General Industrial under the SEPP IE. It is estimated that up to 10 receptors are located within 250 m of the Proposal site boundary. Based on land use and receptor density, the sensitivity to dust soiling impacts is considered 'medium.'

### Human Health Impacts

The assessed land use value (as described in Table B4) is then used to assess the sensitivity of the area surrounding the active construction area, considering the proximity and number of those receptors, and the local background $PM_{10}$ concentration (in the case of potential health impacts) and other site-specific factors.

Additional factors to consider when determining the sensitivity of the area include:

- History of dust-generating activities in the area;
- Likelihood of concurrent dust-generating activities on nearby sites;
- Presence of existing screening between the source and receptors;
- Local meteorological conditions representative of the area and, where relevant, the season of works;
- Local topography;
- Duration of the potential impact, noting that receptor sensitivity may change over time; and,
- Specific receptor sensitivities beyond the classifications provided in (IAQM, 2024).

The IAQM guidance for assessing the sensitivity of an area of human health impacts is shown in Table B6. The background annual average $PM_{10}$ concentration at Prospect AQMS in 2021 was 17.2 $\mu g \cdot m^{-3}$ (refer Table D2).

Together with the calculated land use value, this classifies the sensitivity as 'low' for human health impacts related to the Proposal.

**Table B6 IAQM guidance for categorising the sensitivity of an area to human health impacts**

| Land use value | Annual mean $PM_{10}$ concentration ($\mu g \cdot m^{-3}$) | Number of receptors[a] | Distance from the source (m)[b] | | | |
|---|---|---|---|---|---|---|
| | | | < 20 | < 50 | < 100 | < 250 |
| Low | - | > 1 | Low | Low | Low | Low |
| Medium | ≤ 22 | 1-10 | Low | Low | Low | Low |
| | | > 10 | Low | Low | Low | Low |
| | 22 - 26 | 1-10 | Low | Low | Low | Low |
| | | > 10 | Low | Low | Low | Low |
| | 26 - 30 | 1-10 | Low | Low | Low | Low |
| | | > 10 | Medium | Low | Low | Low |
| | > 30 | 1-10 | Medium | Low | Low | Low |
| | | >10 | High | Medium | Low | Low |

| Land use value | Annual mean $PM_{10}$ concentration ($\mu g \cdot m^{-3}$) | Number of receptors[a] | Distance from the source (m)[b] | | | |
|---|---|---|---|---|---|---|
| | | | < 20 | < 50 | < 100 | < 250 |
| High | ≤ 22 | 1-10 | Low | Low | Low | Low |
| | | 10-100 | Low | Low | Low | Low |
| | | > 100 | Medium | Low | Low | Low |
| | 22 – 26 | 1-10 | Medium | Low | Low | Low |
| | | 10-100 | High | Medium | Low | Low |
| | | > 100 | High | Medium | Low | Low |
| | 26 – 30 | 1-10 | High | Medium | Low | Low |
| | | 10-100 | High | Medium | Low | Low |
| | | > 100 | High | High | Medium | Low |
| | > 30 | 1-10 | High | Medium | Low | Low |
| | | 10-100 | High | High | Medium | Low |
| | | > 100 | High | High | High | Medium |

**Notes**: (a) Estimate the total within the stated distance (e.g. the total within 250 m and not the number between 100 m and 250 m), noting that only the highest level of area sensitivity from the table needs to be considered. In the case of high sensitivity areas with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties. (b) With regard to potential 'construction traffic' impacts, the distance criteria of less than 20 m and less than 50 m from the source (roadside) are used (i.e. the first two columns only). Any locations beyond 50 m may be screened out of the assessment (as per Step 1) and the corresponding sensitivity is negligible'.

### Step 4 - Risk Assessment (Pre-Mitigation)

The matrices shown in Table B7 for each activity determine the risk category with no mitigation applied.

**Table B7 Pre-mitigated risk of dust impacts from construction related activities**

| Sensitivity of area | Pre-mitigated dust emission magnitude (DEM) | | |
|---|---|---|---|
| | Small | Medium | Large |
| **Demolition** | | | |
| Low | Negligible risk | Low risk | Medium risk |
| Medium | Low risk | Medium risk | High risk |
| High | Medium risk | Medium risk | High risk |
| **Earthworks, Construction and Trackout** | | | |
| Low | Negligible risk | Low risk | Low risk |
| Medium | Low risk | Medium risk | Medium risk |
| High | Low risk | Medium risk | High risk |
| **Construction traffic (from construction site entrance to origin)** | | | |
| Low | Negligible risk | Low risk | Low risk |
| Medium | Negligible risk | Low risk | Medium risk |
| High | Low risk | Medium risk | High risk |

Given the sensitivity of the identified receptors is classified as medium for dust soiling and low for human health impacts, and the dust emission magnitudes for the various construction phase activities as shown in Table B3, the resulting risk of air quality impacts (without mitigation) is presented in Table B8.

Table B8 Risk of air quality impacts from construction activities – pre-mitigation

| Sensitivity of area | Dust emission magnitude (DEM) | | | | | Preliminary risk | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Demolition | Earthworks | Construction | Track-out | Const. traffic | Demolition | Earthworks | Construction | Track-out | Const. traffic |
| **Dust soiling** | | | | | | | | | | |
| Med. | N/A | Med | Large | Med | Large | N/A | Med | Med | Med | Med |
| **Human health** | | | | | | | | | | |
| Low | N/A | Med | Large | Med | Large | N/A | Low | Low | Low | Low |

**Note**: Med. = Medium, N/A = Not Applicable, Neg. = Negligible

Table B8 shows that dust soiling impacts are considered a medium risk for all construction activities. For human health, construction activities are considered a low risk, assuming no mitigation measures are in place to control emissions during the construction phase.

### Step 5 – Identify Mitigation

Once the risk categories are determined for each of the relevant activities, site-specific management measures can be identified based on whether the site is a low, medium or high-risk site.

The identified mitigation measures are presented as follows:

N Not required (although they may be implemented voluntarily);

D Desirable (to be considered as part of the CEMP, but may be discounted if justification is provided);

H Highly recommended (to be implemented as part of the CEMP and should only be discounted if site-specific conditions render the requirement invalid or otherwise undesirable).

The mitigation measures outlined in Table B9 are commensurate with the identified risks and are recommended for implementation to ensure that dust emissions are effectively managed during construction.

### Step 6 – Risk Assessment (post-mitigation)

Following Step 5, the residual impact is determined.

With the implementation of the identified mitigation measures, construction phase risks are anticipated to be reduced to an acceptable level which corresponds in low to negligible residual risk. Considering the Proposal site size, distance to sensitive receptors and the nature of the proposed activities, residual impacts from fugitive dust emissions are therefore anticipated to be negligible, provided the mitigation measures are appropriately implemented.

Table B9 Site specific management and mitigation measures

| | Identified mitigation | Unmitigated risk |
|---|---|---|
| **1** | **Communications** | **Medium** |
| 1.1 | Develop and implement a stakeholder communications plan that includes community engagement before work commences on site. | H |
| 1.2 | Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager. | H |
| 1.3 | Display the head or regional office contact information. | H |
| 1.4 | Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the relevant regulatory bodies. | H |
| **2** | **Site management** | **Medium** |
| 2.1 | Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken. | H |
| 2.2 | Make the complaints log available to the relevant authority when asked. | H |
| 2.3 | Record any exceptional incidents that cause dust and/or air emissions, either on- or offsite, and the action taken to resolve the situation in the log book. | H |
| 2.4 | Hold regular liaison meetings with other high-risk construction sites within 500 m of the site boundary, to ensure plans are coordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/ deliveries which might be using the same strategic road network routes. | N |
| **3** | **Monitoring** | **Medium** |
| 3.1 | Undertake daily on-site and off-site inspections where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the relevant authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary. | D |
| 3.2 | Carry out regular site inspections to monitor compliance with the dust management plan / CEMP, record inspection results, and maintain an inspection log available to the relevant authority when asked. | H |
| 3.3 | Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions. | H |
| **4** | **Preparing and maintaining the site** | **Medium** |
| 4.1 | Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. | H |
| 4.2 | Erect solid screens or barriers around dusty activities or the site boundary that they are at least as high as any stockpiles on site. | H |
| 4.3 | Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period. | H |
| 4.4 | Avoid site runoff of water or mud. | H |
| 4.5 | Keep site fencing, barriers and scaffolding clean using wet methods. | H |

| | Identified mitigation | Unmitigated risk |
|---|---|---|
| 4.6 | Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below | H |
| 4.7 | Cover, seed or fence stockpiles to prevent wind erosion | H |
| **5** | **Operating vehicle/machinery and sustainable travel** | **Medium** |
| 5.1 | Ensure all on-road vehicles comply with relevant vehicle emission standards, where applicable | H |
| 5.2 | Ensure all vehicles switch off engines when stationary - no idling vehicles | H |
| 5.3 | Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable | H |
| 5.4 | Impose and signpost a maximum speed limit of 25 km·hr$^{-1}$ on sealed haul roads and 15 km·hr$^{-1}$ on unsealed haul roads and work areas. Where long haul routes are required, higher speed limits may be considered only where supported by additional appropriate control measures and subject to approval by the nominated principal contractor and the relevant authority, where applicable. | D |
| 5.5 | Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials. | N |
| 5.6 | Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing) | D |
| **6** | **Operations** | **Medium** |
| 6.1 | Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems | H |
| 6.2 | Ensure an adequate water supply on the site for effective dust/particulate matter suppression/ mitigation, using non-potable water where possible and appropriate | H |
| 6.3 | Use enclosed chutes and conveyors and covered skips | H |
| 6.4 | Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate | H |
| 6.5 | Ensure equipment is readily available on site to clean any dry spillages and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods. | H |
| **7** | **Waste management** | **Medium** |
| 7.1 | Avoid bonfires and burning of waste materials. | H |
| **8** | **Measures specific to demolition** | **N/A** |
| 8.1 | Soft strip inside buildings before demolition (retaining walls and windows in the rest of the building where possible, to provide a screen against dust). | N |
| 8.2 | Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition, high volume water suppression systems, manually controlled, can produce fine water droplets that effectively capture dust particles. | N |
| 8.3 | Avoid explosive blasting, using appropriate manual or mechanical alternatives. | N |
| 8.4 | Bag and remove any biological debris or damp down such material before demolition. | N |

| Identified mitigation | | Unmitigated risk |
|---|---|---|
| **9** | **Measures specific to earthworks** | **Medium** |
| 9.1 | Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable. | D |
| 9.2 | Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable. | D |
| 9.3 | Only remove the cover in small areas during work and not all at once. | D |
| **10** | **Measures specific to construction** | **Medium** |
| 10.1 | Avoid scabbling (roughening of concrete surfaces) if possible | D |
| 10.2 | Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place | H |
| 10.3 | Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery. | D |
| 10.4 | For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust | D |
| **11** | **Measures specific to Trackout** | **Medium** |
| 11.1 | Use water-assisted dust sweeper(s) on the access and local roads to remove, as necessary, any material tracked out of the site. | H |
| 11.2 | Avoid dry sweeping of large areas. | H |
| 11.3 | Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport. | H |
| 11.4 | Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable. | H |
| 11.5 | Record all inspections of haul routes and any subsequent action in a site log book. | H |
| 11.6 | Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned. | H |
| 11.7 | Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable). | H |
| 11.8 | Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permit. | H |
| 11.9 | Access gates to be located at least 10 m from receptors where possible. | H |

# APPENDIX C

## Meteorology

## Meteorological Stations

A meteorological modelling exercise has been performed to characterise the meteorology of the Proposal site in the absence of site-specific measurements. The meteorological monitoring has been based on measurements acquired from surrounding automatic weather stations (AWS) operated by the Australian Government Bureau of Meteorology (BoM).

A summary of the relevant monitoring sites located within a distance of 20 km of the Proposal site is provided in Table C1.

**Table C1 BoM meteorological monitoring sites within 20 km of the Proposal site**

| Site name | Station # | Approximate location | | Approximate distance (km) |
|---|---|---|---|---|
| | | mE | mS | |
| Horsley Park Equestrian Centre AWS | 067119 | 301 708 | 6 252 298 | 5.7 |
| Badgerys Creek AWS | 067108 | 289 920 | 6 246 951 | 11.9 |
| Penrith Lakes AWS | 067113 | 284 871 | 6 266 524 | 16.3 |
| Bankstown Airport AWS | 066137 | 313 855 | 6 245 099 | 19.7 |

**Note**: Climate statistics available at http://www.bom.gov.au/climate/data/index.shtml

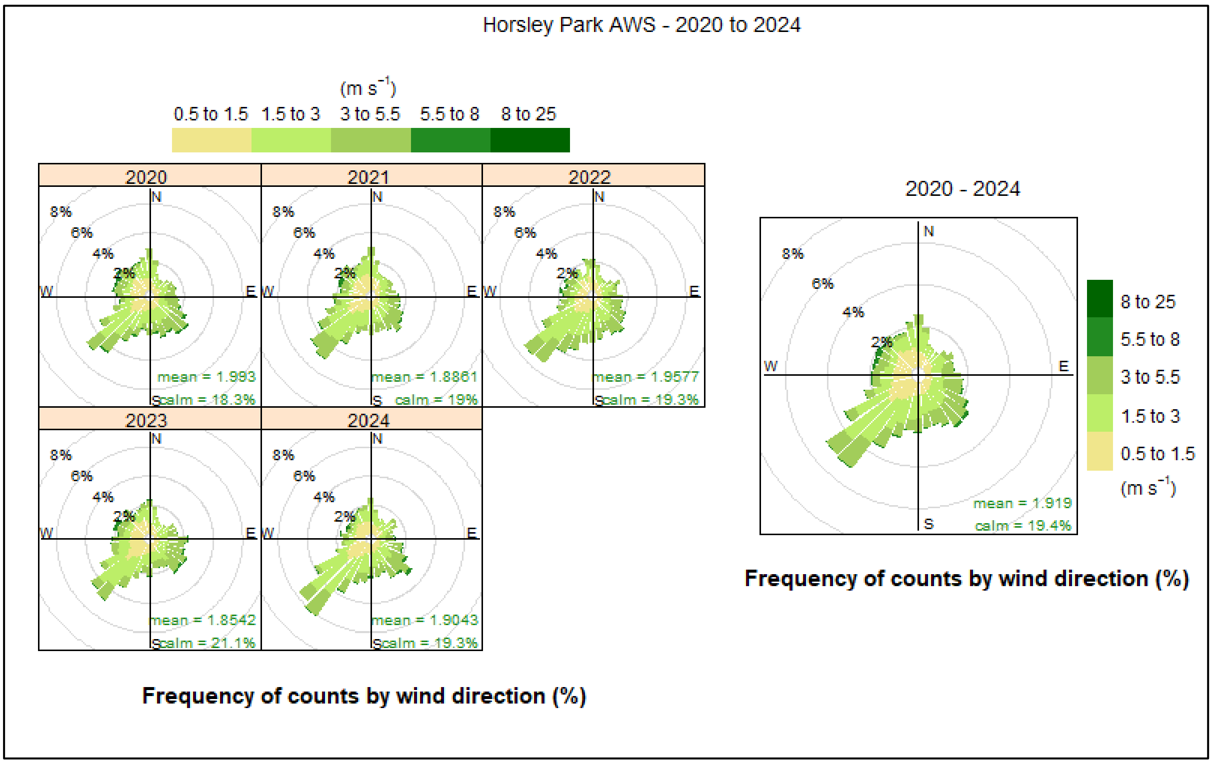
As outlined in Section 4.3, metrological conditions at Horsley Park Equestrian Centre AWS have been examined to be determine a 'typical' or representative dataset for use in dispersion modelling. Annual wind roses for the most recent years of data (2020 to 2024) are presented in Figure C1. The annual wind speed frequency distribution for the five-year period is presented in Figure C2.

The wind roses indicate that from 2020 to 2024, winds at Horsley Park Equestrian Centre AWS show generally similar wind distribution patterns across the years assessed, with predominant south westerly wind directions evident.

The majority of wind speeds experienced at Horsley Park Equestrian Centre AWS between 2020 and 2024 are generally in the range 0.5 meters per second ($m \cdot s^{-1}$) to 5.5 $m \cdot s^{-1}$ with the highest wind speeds (greater than 8 $m \cdot s^{-1}$) occurring from mostly north westerly directions. Calm winds (less than 0.5 $m \cdot s^{-1}$) are more common and occur during 19.4 % of hours on average across the years between 2020 and 2024.

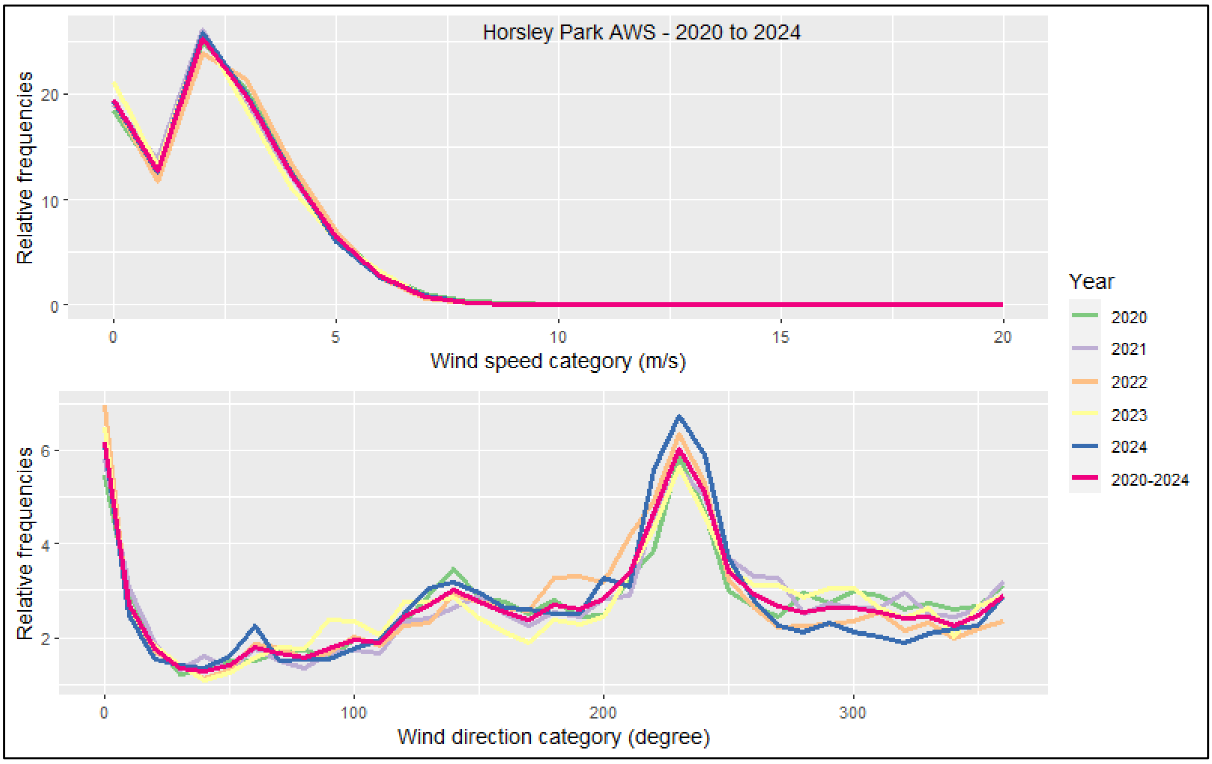
The correlation coefficient between each year and the five-year period for the distribution of wind characteristics (direction and speed) and nitrogen dioxide ($NO_2$) are summarised in Table C2. The correlation coefficients were ranked and aggregated to select the representative year for the meteorological modelling. The rankings are also presented in Table C2.

Figure C1 Annual wind roses – Horsley Park Equestrian Centre AWS (2020 – 2024)




**Source:** Northstar

Figure C2 Wind direction and speed frequency distribution – Horsley Park Equestrian Centre AWS (2020 – 2024)




**Source:** Northstar

Table C2 Correlation – Horsley Park Equestrian Centre AWS and St Marys AQMS (2020 – 2024)

| Parameter | Wind speed | | Wind direction | | Nitrogen dioxide ($NO_2$) | | Aggregated rank |
|---|---|---|---|---|---|---|---|
| | Corr. | Rank | Corr. | Rank | Corr. | Rank | |
| 2020 | 0.9993 | 2 | 0.9680 | 4 | 0.9806 | 4 | 4 |
| 2021 | 0.9989 | 3 | 0.9744 | 1 | 0.9903 | 2 | 1 |
| 2022 | 0.9974 | 5 | 0.9730 | 2 | 0.9984 | 1 | 3 |
| 2023 | 0.9975 | 4 | 0.9640 | 5 | 0.9596 | 5 | 5 |
| 2024 | 0.9998 | 1 | 0.9708 | 3 | 0.9829 | 3 | 2 |
| **2020-2024** | **1** | - | **1** | - | **1** | - | - |

**Note**: Corr. = Correlation

Wind speed observations for each year correlated well against the wind speed over the four-year period, with each year having a correlation coefficient greater than 0.99. The year 2024 is the highest ranked for correlation against the wind speed over the five-year period. Wind direction observations for each year are well correlated against the wind direction over the four-year period, with each year having a correlation coefficient greater than of 0.96. The year 2021 is the highest ranked for correlation against the wind direction over the five-year period.

Nitrogen dioxide ($NO_2$) concentrations for each year are also well correlated against $NO_2$ concentrations over the five-year period. Each year resulted in having a correlation coefficient greater than 0.95. The year 2022 is the highest ranked year for $NO_2$.

Based on the aggregated rankings, the 2021 observations of wind characteristics (direction and speed) and $NO_2$ most closely mirror the overall five-year (2020 – 2024) period. Consequently, the 2021 meteorological dataset is deemed suitably representative for the purposes of meteorological and dispersion modelling and is therefore adopted for the purposes of this AQIA.

### Meteorological Processing

The BoM data adequately covers the issues of data quality assurance; however, it is limited by its location compared to the Proposal site. To address these uncertainties, a multi-phased assessment of the meteorology data has been performed.

In absence of any measured onsite meteorological data, site representative meteorological data for this Proposal was generated using the CALMET meteorological model in a format suitable for using in the CALPUFF dispersion model (refer Section 5.2.1).

CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field and thus the final wind field reflects the influences of local topography and current land uses.

For this AQIA, CALMET has been run in no-observations (NOOBS) mode using gridded prognostic data generated by The Air Pollution Model (TAPM, v 4.0.5), developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The TAPM model is cited in the 'Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia' (Barclay & Scire, 2011) as a suitable prognostic meteorological model for applications involving complex meteorological conditions.

TAPM is a prognostic model which predicts wind speed and direction, temperature, pressure, water vapour, cloud, rainwater, and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

It is noted that outputs from the TAPM meteorological modelling run were validated through comparison with the observed meteorological data collected at the Horsley Park Equestrian Centre AWS. These data broadly compare and correspondingly, the initial TAPM modelling run has been used to represent meteorological parameters at the Proposal site in CALMET.

The parameters used in TAPM and CALMET modelling are presented in Table C3. Further, as per (Barclay & Scire, 2011), the seven critical parameters used in the CALMET modelling are presented in Table C4.

**Table C3 CALMET and TAPM meteorological modelling parameters**

| **TAPM v 4.0.5** | |
|---|---|
| Modelling period | 1 January 2021 to 31 December 2021 |
| Centre of analysis | 297 152 mE, 6 256 012 mS (UTM Coordinates) |
| Number of grid points | 40 × 40 × 25 |
| Number of grids (spacing) | 5 (30 km, 10 km, 3 km, 1 km, 300 m) |
| Terrain | AUSLIG 9 second DEM |
| Data assimilation | No data assimilation |
| **CALMET** | |
| Modelling period | 1 January 2021 to 31 December 2021 |
| Southwest corner of analysis | 291 239 mE, 6 250 155 mS (UTM Coordinates) |
| Meteorological grid domain (resolution) | 11.5 km × 11.5 km (0.1 km) |
| Vertical resolution (cell heights) | 10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1 200 m, 2 000 m, 3 000 m, 4 000 m) |
| Data assimilation | No-obs approach using TAPM – 3D.DAT file |

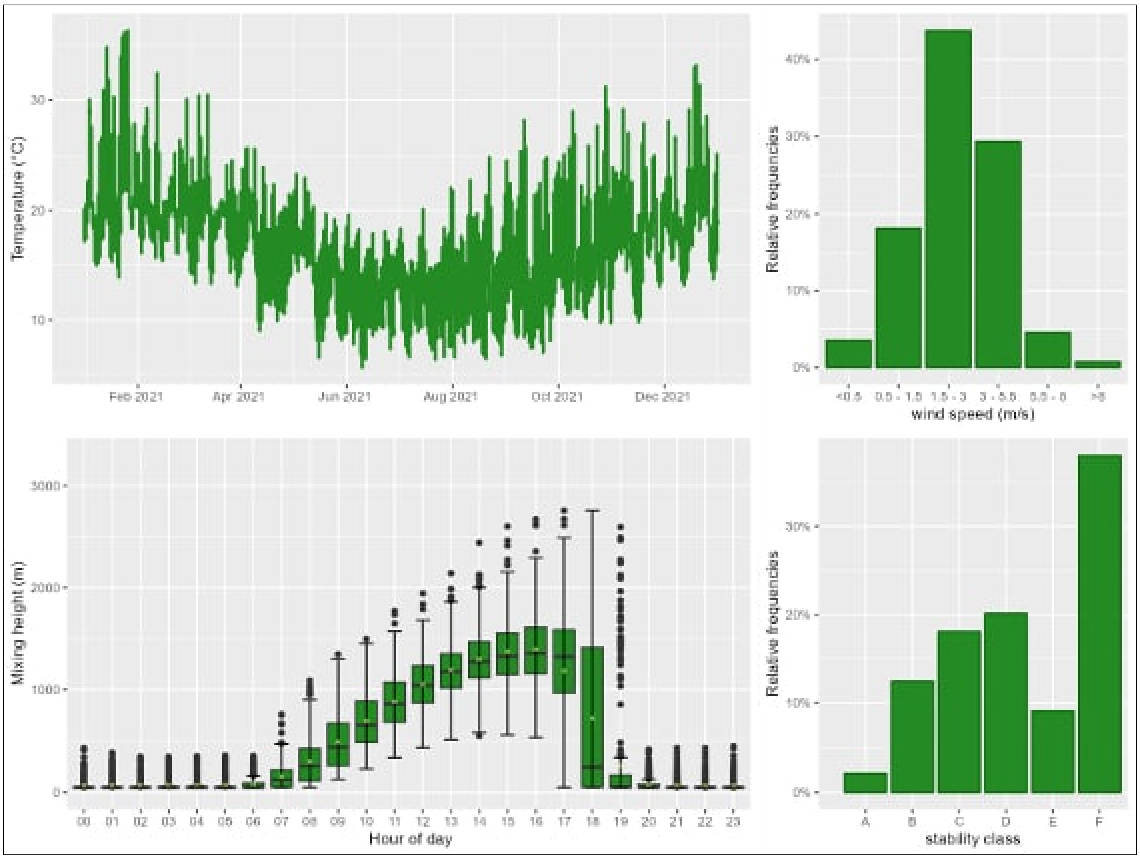
Table C4 Seven critical meteorological parameters used in CALMET

| Parameter | Value |
|---|---|
| TERRAD | 5.0 |
| IEXTRP | 1 |
| BIAS (NZ) | 0 x 10 |
| R1 and R2 | 0, 0 |
| RMAX1 and RMAX2 | 0, 0 |

NSW EPA typically require a summary of the modelled meteorological dataset at the Proposal Site. Given the nature of the pollutant emission sources at the Proposal site, detail discussion of the humidity, evaporation, cloud cover, katabatic air drainage and air recirculation potential of the Proposal site has not been provided. Details of the predictions of wind speed and direction, mixing height and temperature at the Proposal site are provided below.

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Proposal site during 2021 are illustrated in Figure C3. As expected, an increase in mixing height during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground-based temperature inversions and growth of the convective mixing layer.

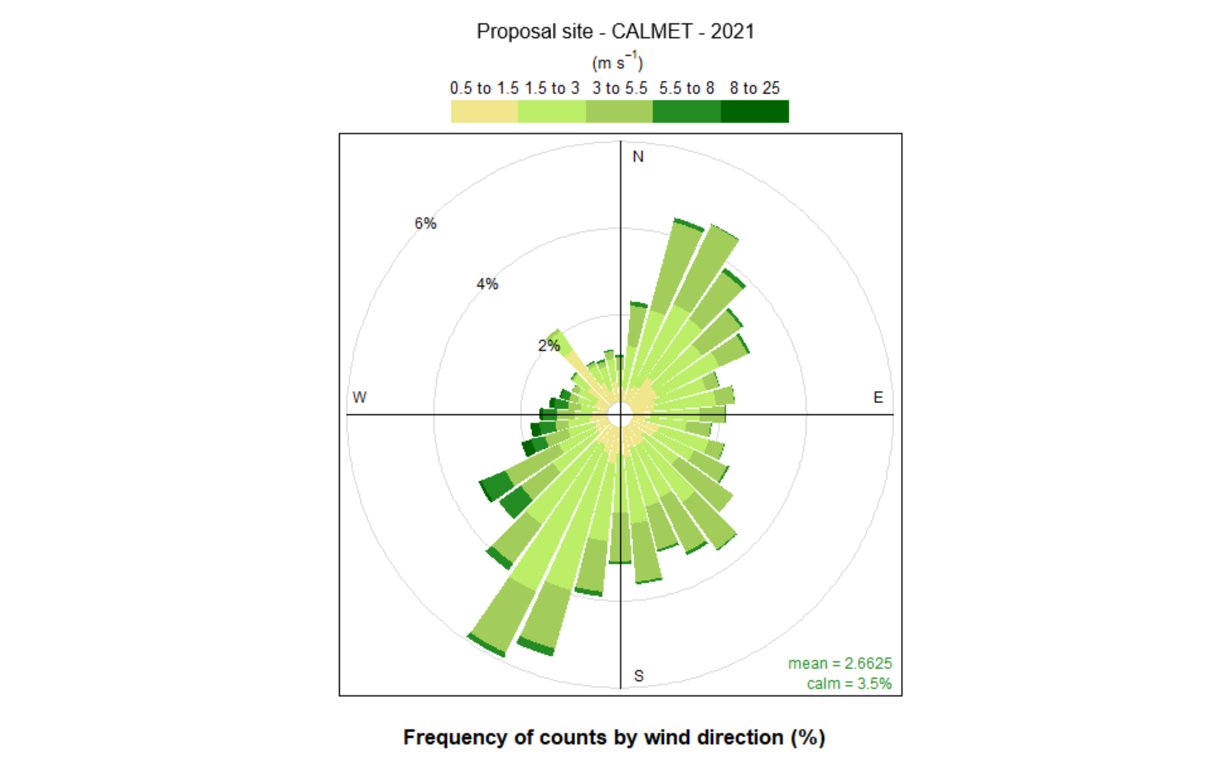
Figure C3 Predicted mixing height, wind and stability class frequency at the Proposal site (2021)




Source: Northstar

The modelled wind speed and direction at the Proposal site during 2021 are presented in Figure C4.

**Figure C4 Predicted wind characteristics – Proposal site (2021)**




**Source:** Northstar

# APPENDIX D

## Background Air Quality Data

### Air Quality Monitoring Stations

Air quality is not monitored at the Proposal site and therefore air quality monitoring data measured at a representative location has been adopted for the purposes of this AQIA. Determination of data to be used as a location representative of the Proposal site and during a representative year can be complicated by factors which include:

- The sources of air pollutant emissions around the Proposal site and representative AQMS; and
- The variability of particulate matter concentrations (often impacted by natural climate variability).

Air quality monitoring is performed by NSW DCCEEW at stations positioned within 10 km of the Proposal site, with details provided in Table 9 of this AQIA. As outlined in Section 4.4, the nearest NSW DCCEEW-operated AQMS to the Proposal site is located at St Marys, approximately 4.7 km to the north west and monitors key pollutants of relevance for this AQIA, specifically fine particles as $PM_{10}$ and $PM_{2.5}$, $NO_2$ and $O_3$.

Given its proximity to the Proposal site, the data acquired from the St Marys AQMS is considered representative of local background pollutant concentrations. However, it does not monitor CO or $SO_2$ which are pollutants also of concern in this AQIA. Accordingly, CO and $SO_2$ data from the Prospect AQMS, located approximately 9.7 km to the east north east have been used to supplement the background data analysis for the purpose of this AQIA.

Concentrations of TSP are not measured at any AQMS surrounding the Proposal site. An analysis of co-located measurements of TSP and $PM_{10}$ in the Lower Hunter (1999 to 2011), Illawarra (2002 to 2004), and Sydney Metropolitan (1999 to 2004) regions is presented in Figure D2.

The analysis concludes that, on the basis of the measurements collected in all regions between 1999 to 2011, the derivation of a broad TSP:$PM_{10}$ ratio of 2.0551 : 1 (i.e. $PM_{10}$ represents ~ 49 % of TSP) from the Sydney Metropolitan location is appropriate. In the absence of any more specific information, this ratio has been adopted within this AQIA, resulting in a background annual average TSP concentration of 33.4 $\mu g \cdot m^{-3}$.

Summary statistics for the selected data from the considered AQMSs are provided in Table D1.

Graphs presenting the daily varying $PM_{10}$, $PM_{2.5}$, and hourly varying $NO_2$ and $O_3$ data recorded at St Marys AQMS in 2021 are presented in Figure D3 to Figure D6 respectively.

Table D1 Background air quality statistics – St Marys and Prospect AQMS (2021)

| AQMS | St Marys | | | | Prospect | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pollutant | TSP | $PM_{10}$ | $PM_{2.5}$ | $NO_2$ | $O_3$ | CO | CO | CO | $SO_2$ | $SO_2$ |
| **Averaging period** | **Annual** | **24-hour** | **24-hour** | **1-hour** | **1-hour** | **15-minute** | **1-hour** | **8-hour (rolling)** | **1-hour** | **24-hour** |
| **Units** | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $mg \cdot m^{-3}$ | $mg \cdot m^{-3}$ | $mg \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ | $\mu g \cdot m^{-3}$ |
| **Statistics** | | | | | | | | | | |
| Data Points | 351 | 351 | 349 | 8 055 | 7 894 | 8 190 | 8 190 | 8 549 | 8 193 | 354 |
| Mean | 33.5 | 16.3 | 5.8 | 8.1 | 32.7 | 0.1 | 0.1 | 0.1 | 1.5 | 1.4 |
| Standard deviation | - | 7.7 | 3.7 | 8.0 | 25.7 | 0.2 | 0.2 | 0.1 | 2.8 | 1.9 |
| *Skew*[1] | - | *1.1* | *3.4* | *1.5* | *0.6* | *2.8* | *2.8* | *2.4* | *4.6* | *1.3* |
| *Kurtosis*[2] | - | *1.9* | *23.7* | *3.1* | *- 0.1* | *11.5* | *11.5* | *7.9* | *36.9* | *1.2* |
| Minimum | - | 2.4 | - 0.2 | - 4.1 | - 2.1 | - 0.2 | - 0.1 | - 0.1 | - 2.9 | 0.0 |
| **Percentiles** | | | | | | | | | | |
| 25th | - | 10.6 | 3.6 | 2.1 | 8.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 50th | - | 14.5 | 5.1 | 6.2 | 30.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 75th | - | 20.2 | 7.0 | 12.3 | 51.4 | 0.2 | 0.1 | 0.1 | 2.9 | 2.9 |
| 90th | - | 26.1 | 9.5 | 18.5 | 66.3 | 0.3 | 0.3 | 0.3 | 2.9 | 2.9 |
| 95th | - | 31.5 | 12.0 | 24.6 | 74.9 | 0.5 | 0.4 | 0.4 | 5.7 | 5.7 |
| 97th | - | 33.7 | 13.8 | 28.7 | 85.6 | 0.7 | 0.5 | 0.5 | 8.6 | 5.7 |
| 98th | - | 35.4 | 14.7 | 30.8 | 92.0 | 0.8 | 0.6 | 0.5 | 8.6 | 5.7 |
| 99th | - | 36.0 | 18.1 | 34.9 | 98.4 | 1.0 | 0.8 | 0.6 | 11.4 | 7.1 |
| **Maximum** | **33.5** | **54.9** | **40.3** | **67.7** | **149.8** | **2.1** | **1.6** | **1.3** | **42.9** | **8.6** |
| **Data Capture (%)** | **95.9** | **95.9** | **95.4** | **91.7** | **89.9** | **93.2** | **93.2** | **97.3** | **93.3** | **96.7** |

**Notes**: 1: Skew represents an expression of the distribution of measured values around the derived mean. Positive skew represents a distribution tending towards values higher than the mean, and negative skew represents a distribution tending towards values lower than the mean. Skew is dimensionless. 2: Kurtosis represents an expression of the value of measured values in relation to a normal distribution. Positive kurtosis represents a more peaked distribution, and negative kurtosis represents a distribution more flattened than a normal distribution. Kurtosis is dimensionless.

Figure D1 Co-located TSP and $PM_{10}$ measurements – Lower Hunter, Sydney Metro and Illawarra

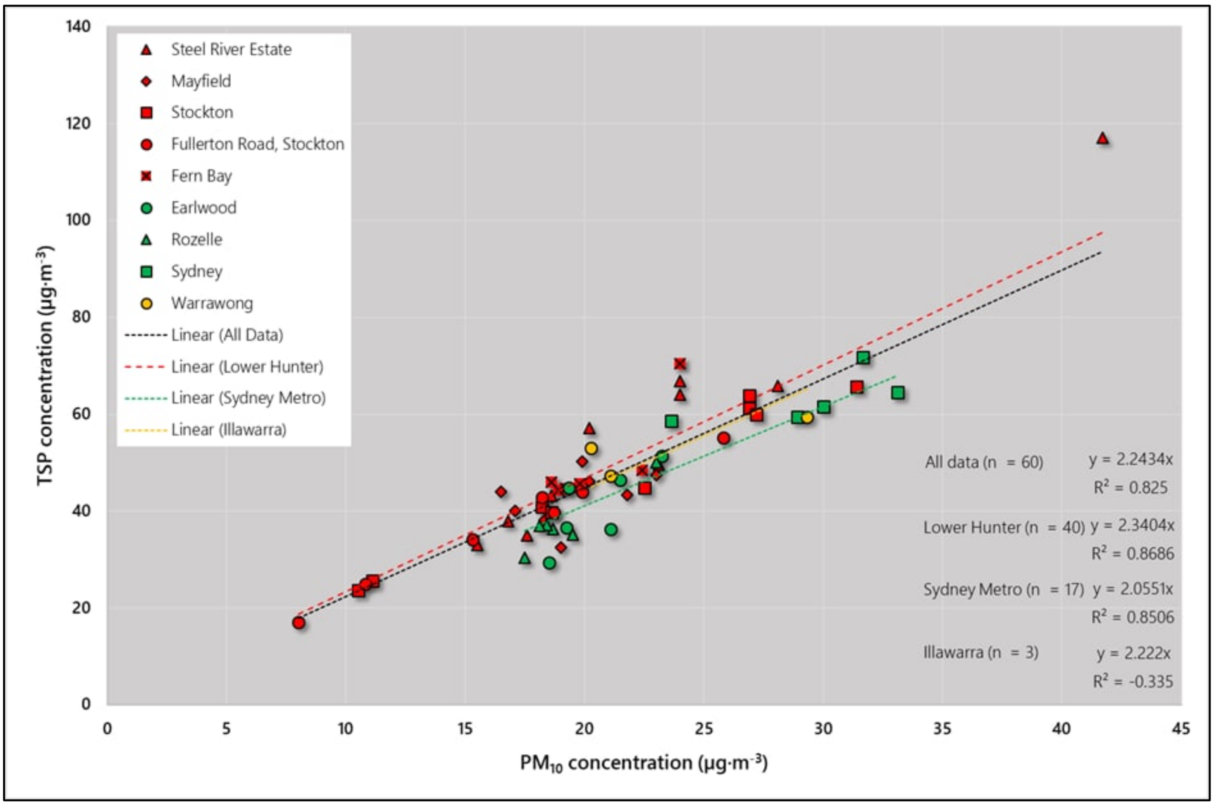
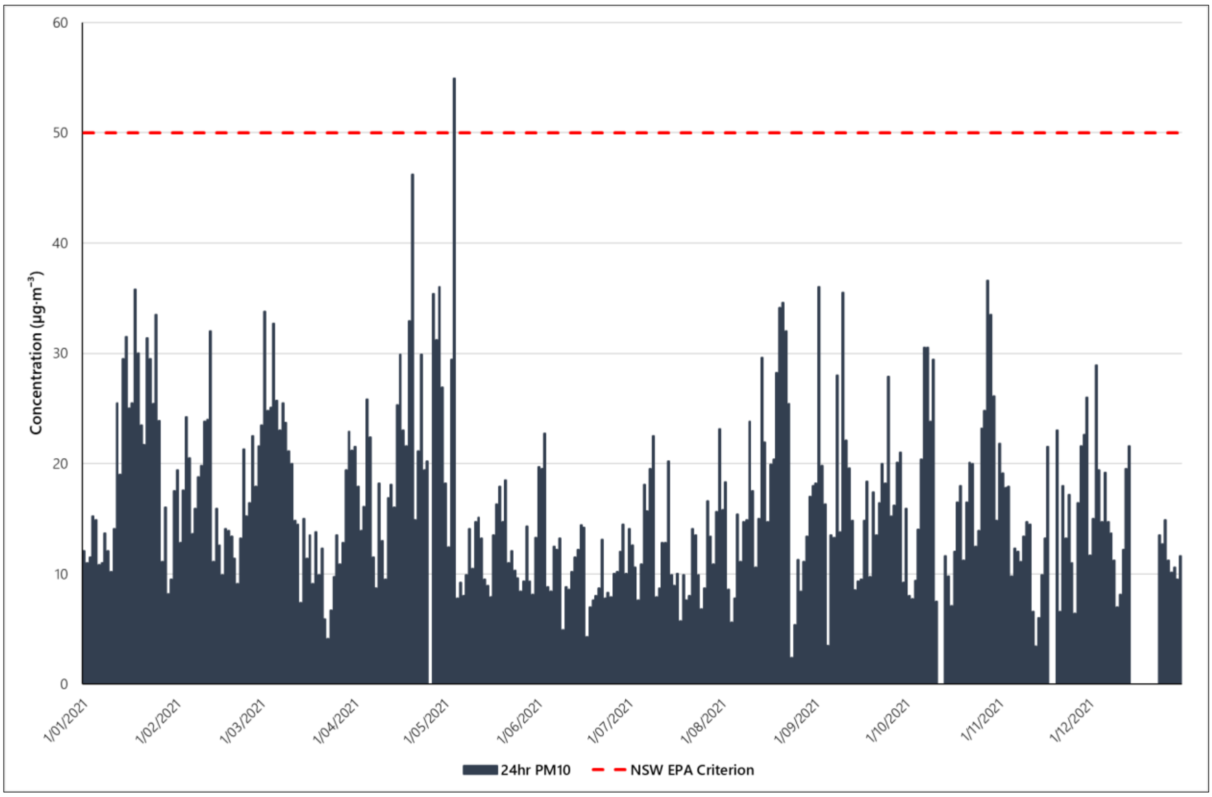
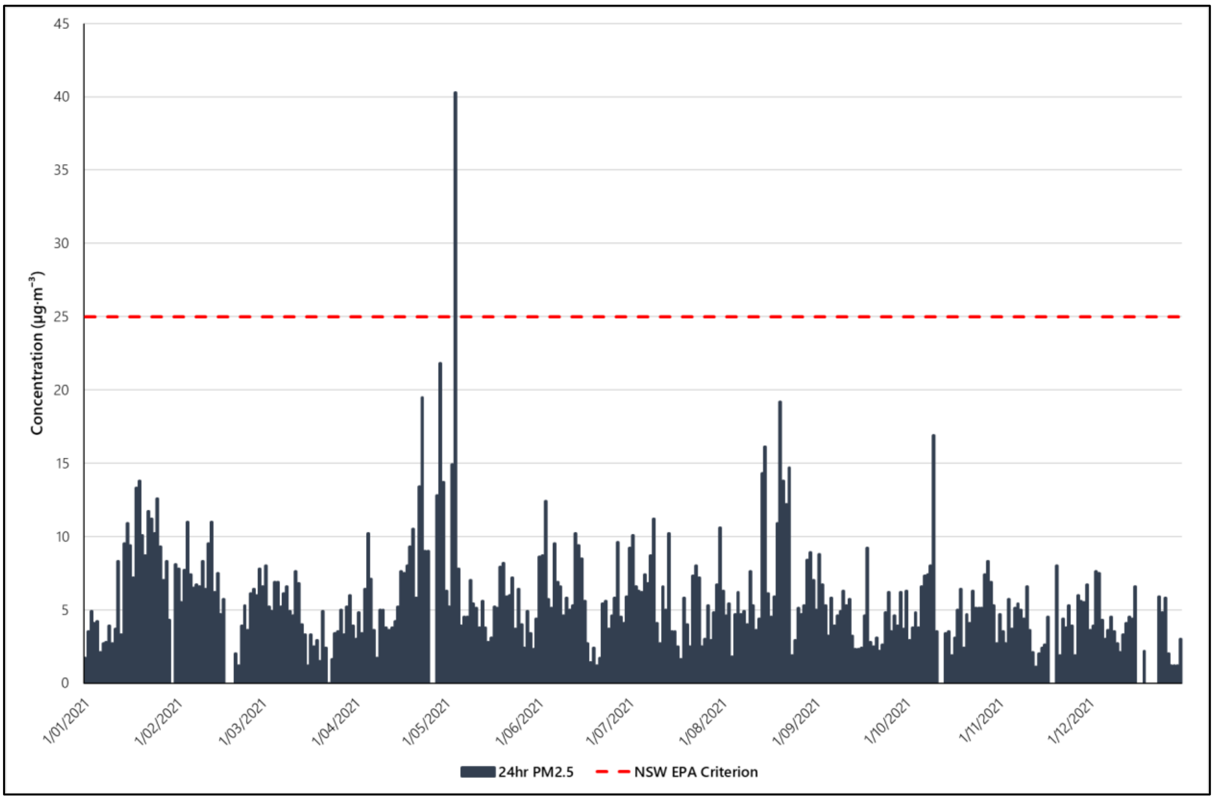



Figure D2 Daily varying $PM_{10}$ measurements – St Marys AQMS (2021)



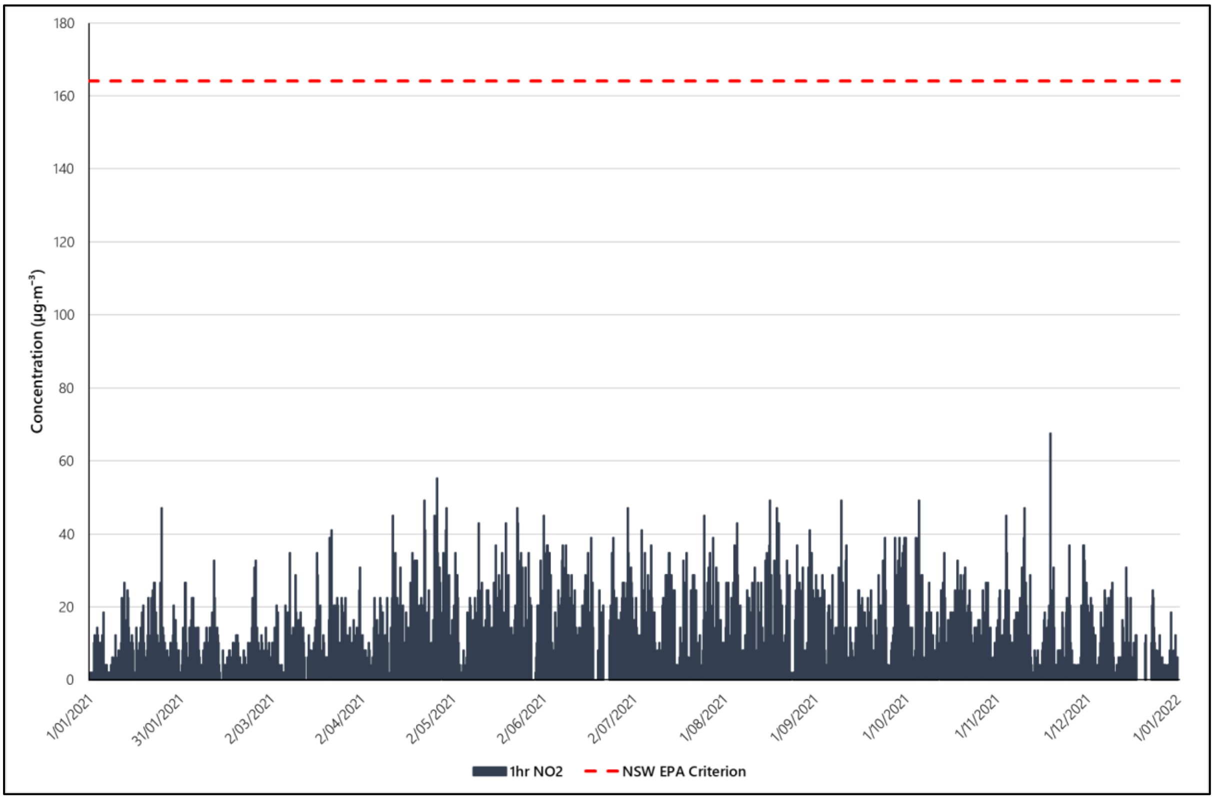

**Source**: Northstar

Figure D3 Daily varying $PM_{2.5}$ measurements – St Marys AQMS (2021)



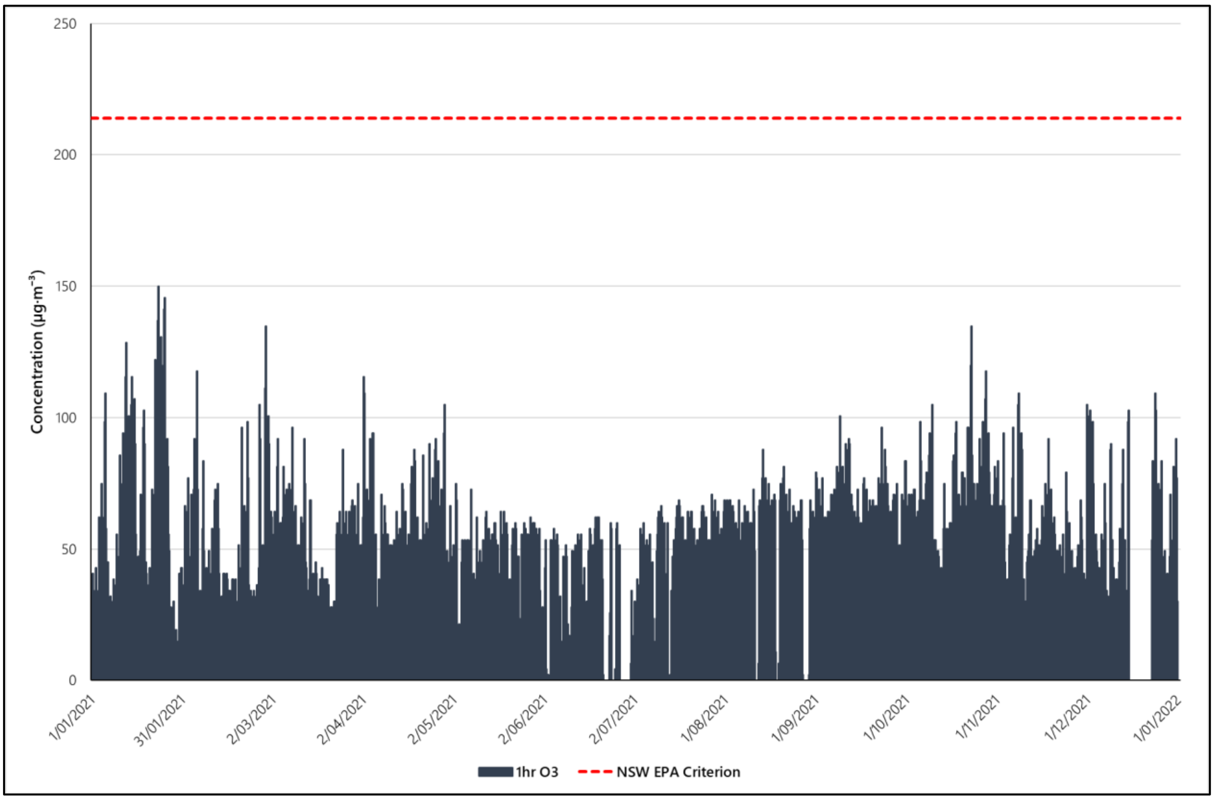

**Source**: Northstar

Figure D4 Hourly varying $NO_2$ measurements – St Marys AQMS (2021)




**Source:** Northstar

Figure D5 Hourly varying $O_3$ measurements – St Marys AQMS (2021)




**Source:** Northstar

It can be observed from Figure D3 and Figure D4 that in 2021, the St Marys AQMS recorded exceedances of the respective 24-hour $PM_{10}$ and $PM_{2.5}$ criteria. Table D3 provides further details on the 24-hour $PM_{10}$ and $PM_{2.5}$ exceedances recorded at the St Marys AQMS in 2021.

The NSW 2021 annual compliance report (NSW DPE, 2023) attributes 2021 $PM_{10}$ and $PM_{2.5}$ exceedances primarily to hazard reduction burns in the Sydney region. These were classified as exceptional events under the National Environment Protection (Ambient Air Quality) Measure (NEPM) framework.

Table D3 Calendar days in 2021 of 24-hour $PM_{10}$ and $PM_{2.5}$ criteria exceedances - St Marys AQMS

| Date | Measured concentration (µg·m⁻³) | Comments |
|---|---|---|
| **24-hour $PM_{10}$ concentrations** | | |
| 4 May 2021 | 54.9 | Exceptional – hazard reduction burning |
| **24-hour $PM_{2.5}$ concentrations** | | |
| 4 May 2021 | 40.3 | Exceptional – hazard reduction burning |

# APPENDIX E

## Generator Technical Specifications

| MOTEURS Baudouin | Model : 16M55G6D2/5 | Rev : 04 |
|---|---|---|
| | PowerKit Engine Datasheet | Page : 1 / 4 |

Ratings

| RPM | Gross Engine Output | | | Net Engine Output * | | |
|---|---|---|---|---|---|---|
| | PRP | DCP | ESP | PRP | DCP | ESP |
| | kWm | kWm | kWm | kWm | kWm | kWm |
| 1500 | 2900 | 2900 | 3300 | 2898.4 | 2898.4 | 3298.4 |

1 kWm = 1.34 BHP

* This data is calculated without radiator.

## Basic data

| | |
|---|---|
| Engine model | 16M55G6D2/5 |
| N° of Cylinders / Valves | 16 / 64 |
| Cylinders arrangement | At Vee |
| Bore x Stroke (mm) | 180 x 215 |
| Displacement (L) | 87.5 |
| Thermodynamic Cycle | Diesel 4 stroke |
| Mean Piston Speed (m/s) | 10.8 |
| BMEP @ ESP (Bar) | 30.17 |
| Cooling System | Liquid (water + 50% antifreeze) |
| Injection System | Direct |
| Fuel System | High Pressure Common Rail |
| Aspiration | Turbocharged and Aftercooled |
| Compression ratio | 16.5 : 1 |
| Flywheel housing | SAE 00 |
| Flywheel | 21" |
| N° of teeth on flywheel ring gear | 202 |
| Inertia of flywheel (kg•m²) | 20.78 |
| Inertia of crankshaft (kg•m²) | 17.1 |
| Emission standard | EPA Tier2 |
| Overall Dimensions without radiator (Length x Width x Height) (mm) | 4161×1953×2468 |
| Engine dry weight without radiator and without radiator pipes (kg) | 11500 |



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| Baudouin | Model : 16M55G6D2/5 | Rev : 04 |
|---|---|---|
| | PowerKit Engine Datasheet | Page : 2 / 4 |

## Air intake system

Air intake temperature rise (°C) ........ ≤ 5
Air intake restriction clean filter (mBar) ........ ≤ 35
Air intake restriction dirty filter (mBar) ........ ≤ 75
Recommended air flow @ PRP (m³/min) ........ 225.4
Recommended air flow @ ESP (m³/min) ........ 237.0
Min. diameter of intake pipe (mm) ........ 140

## Aftercooling system

Aftercooler system type ........ Air to Water
Max. intake temperature @ 25°C ambient temperature (°C) ........ 55
Max. difference between intake temperature and ambient temperature (°C) ........ 30
Max. intake pressure drop of aftercooler (mBar) ........ 60

## Lubrication system

Oil capacity Low / High (L) ........ 445 / 500
Oil pressure in normal condition idle speed (Bar) ........ ≥ 1.8
Oil pressure in normal condition at 1500 Rpm @ PRP (Bar) ........ 4 - 6.5
Lowest oil pressure alarm (shutdown) (Bar) ........ 1.8
Max. oil temperature (°C) ........ 105
Oil flow at 1500 Rpm (L/min) ........ 1460
Oil fuel consumption ratio based on engine fuel consumption data ........ ≤ 0.2 %
Total system capacity (including filters) (L) ........ 582

## Heat balance test data (with ambient temperature 25 °C)

Total heat dissipation @ ESP (kJ/s) ........ 4738
- Heat Rejection to HT Circuit @ ESP (kJ/s) ........ 1219
- Heat Rejection to LT Circuit @ ESP (kJ/s) ........ 734
- Radiated Heat to Ambient @ ESP (kJ/s) ........ 249
- Heat Rejected to Exhaust @ ESP (kJ/s) ........ 2536

## Exhaust system

Max. exhaust back pressure (mBar) ........ 150
Max. exhaust temperature before turbocharger (°C) ........ 740
Max. exhaust temperature after turbocharger (°C) ........ 550
Exhaust flow @ PRP (m³/min) ........ 723.6
Exhaust flow @ ESP (m³/min) ........ 766.7
Min. diameter of exhaust pipe (mm) ........ 280
Max. bending moment of exhaust gas exit flange (Nm) ........ 10

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| | PowerKit Engine Datasheet | Page : 3 / 4 |

## Cooling system

Min. inside diameter of coolant outlet pipe LT/HT(mm) ........ 76 / 96

Coolant alarm (shutdown) temperature (°C) ........ 112

Thermostat opening temperature / full open temperature (°C) ........ 82 / 92

Coolant capacity of the engine (L) ........ 350.3

Max. additional restriction for external cooling circuit (Bar) ........ HT 0.6 / LT 0.4

Max additional restriction - Duct allowance (Pa) ........ 150

## Fuel system

Governor ........ ECU

Governor steady state speed stability at constant load (ISO 8528-5 Class G3) [1] ........ ≤ +/- 0.5 %

Max. restriction at fuel inlet (Bar) ........ 0.1

Max. pressure at fuel inlet (Bar) ........ 0.5

Max. fuel return restriction (Bar) ........ 0.2

Max. fuel inlet temperature (°C) ........ 70

Fuel supply flow (L/hr) ........ 3800

Min. internal diameter of inlet pipe (mm) ........ 19

Min. internal diameter of return pipe (mm) ........ 19

## Electrical system

Electrical system voltage (negative to ground) (Vdc) ........ 24

Starter power (kW) ........ 2 x 10

Battery charger current (A) ........ 55

Battery charger absorbed power (kW) ........ 1.6

Battery discharge current requirement at -18℃ (CCA) ........ 1800 - 2800

Max. electric resistance of starting circuit (Ω) ........ 0.008

Min. sectional area of wire ($mm^2$) ........ 2 x 95

Min. ambient cold start temperature without auxiliary starting device (°C) [2] ........ -10

Min. ambient cold start temperature with auxiliary starting device (°C) [2] ........ TBD

[1] This refers only to the frequency response of the engine and should not be confused with the performance class of the Generator Set, which is subject to additional contributing factors such as alternator selection and control settings.

[2] Engines used in emergency standby application or applications that require immediate start under load, they must be equipped with coolant heaters. Baudouin recommend heaters installation to be executed by providing constant coolant circulation across all the engine components. Two heaters are required for V-type engines, one per each side.

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| Baudouin | Model : 16M55G6D2/5 | Rev : 04 |
|---|---|---|
| | PowerKit Engine Datasheet | Page : 4 / 4 |

## Noise

Diesel engine noise (Acoustic power level) (dB(A)) ........ 124.2
Noise - upper side (dB(A)) ........ 107.2
Noise - right side (view from flywheel) (dB(A)) ........ 106.9
Noise - left side (view from flywheel) (dB(A)) ........ 106.2
Noise – front (radiator) side (dB(A)) ........ 102.6
Noise – rear (flywheel) side (dB(A)) ........ 102.3

Notes :

a) Noise test made at 100% of the ESP power, at 1 mt. distance, on engine without radiator, without cooling fan and without silencer.
b) Noise test refers to GB/T 1859 norm : "Reciprocating internal combustion engines. Measurement of emitted airborne noise. Engineering method and survey method".

## Fuel consumption

| Rating | gr/kWh | L/hr |
|---|---|---|
| 100% ESP | 200.1 | 787 |
| 100% PRP | 209.6 | 723.7 |
| 75% PRP | 220.1 | 569.9 |
| 50% PRP | 225.2 | 388.8 |
| 25% PRP | 248 | 214 |
| | Fuel consumption tolerance + 3 % | |

## Ratings definitions

**Emergency Standby Power (ESP)**
Emergency Standby Power is the maximum power available for a varying load for the duration of a main power network failure. The average load factor over 24 hours of operation should not exceed 70% of the engine's ESP power rating. Typical operational hours of the engine is 200 hours per year, with a maximum usage of 500 hours per year. This includes an annual maximum of 25 hours per year at the ESP power rating. No overload capability is allowed. The engine is not to be used for sustained utility paralleling applications.

**Prime Power (PRP)**
Prime Power is the maximum power available for unlimited hours of usage in a variable load application. The average load factor should not exceed 70% of the engine's PRP power rating during any 24 hour period. An overload capability of 10% is available, however, this is limited to 1 hour within every 12 hour period.

**Data Centre Power (DCP)**
Data Centre Power is defined as being the maximum power which a generating set is capable of delivering while supplying a variable or continuous electrical load and during unlimited run hours. Depending on the sites to supply and the availability of reliable utility, the generating set manufacturer is responsible to define what power level he is able to supply to fulfil that requirement including hardware or software or maintenance plan adaptation.
Note : The engine driven alternating current generating set is a reliable source of power for the data centre and it can be also used to back up a reliable utility. Prolonged operation at load in parallel with a utility is not permitted.

1) All ratings are based on operating conditions under ISO 8528-1, ISO 3046, DIN6271. Performance tolerance of ±5%.
2) Test conditions : 100 kPa, 25°C air inlet temperature, relative humidity of 30%, with fuel density 0.84 kg/L. Derating may be required for conditions outside these; please contact the factory for details.
3) Power output curves are based on the engine operating with fuel system, water pump and lubricating oil pump; not included are battery charging alternator, fan and optional equipment.

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| Moteurs Baudouin | Model : 16M55G6D2/5 | Date : 17/11/22 |
|---|---|---|
| | PowerKit Engine<br>Exhaust Gas Emissions Test Report | Page : 1 / 1 |

## Engine Basic data

Engine model .................... 16M55G6D2/5
Max Rated Power of Engine on Test Bench at 1500 Rpm @ kWm .................... 3300
N° of Cylinders / Valves .................... 16 / 64
Cylinders arrangement .................... At Vee
Displacement (L) .................... 87.5
Thermodynamic Cycle .................... Diesel 4 stroke
Cooling System .................... Liquid (water + 50% antifreeze)
Injection System .................... Direct
Fuel System .................... High Pressure Common Rail
Aspiration .................... Turbocharged and Aftercooled
Fuel type .................... Diesel

## Test information

Test Date .................... 01/11/21
Test Cell n° .................... B08
Test Procedure .................... ISO 8178*(1)

## Measured data*(2)(3)

**NOx** (gr/kWh) .................... **5.34**
**NOx** (mgr/Nm³) .................... **2603.3**
**PM** (gr/kWh) .................... **0.09**
**PM** (mgr/Nm³) .................... ——
**CO** (gr/kWh) .................... **0.56**
**CO** (mgr/Nm³) .................... **62.7**
**HC** (gr/kWh) .................... **0.37**
**HC** (mgr/Nm³) .................... **34.8**

* Notes: 1. Steady-Stage emissions recorded per ISO8178-1 during operation at rated engine speed (+/2%) and stated constant load (+/-2%) with engine temperatures, pressures and emission rates stabilized.

2. mg/Nm3 and PPM values are measured dry and corrected to 5% O2 content and tested in standby power. gr/kWh values are tested in a duty cycle according to ISO8178.

3. This data was taken from a single engine test according to the Test Methods and Conditions specified.This data is subject to instrumentation, measurement, and engine-to-engine variability. Field emissions test data is not guarantee to these levels. For air permit programs, please contact Application Engineering for expected site variation.



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# APPENDIX F

## Schedule of Results

Scenario 1 – Justified Worst Case (Emergency Power Generation)

Table F1 Predicted incremental 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations – Scenario 1

| Receptor | Predicted incremental 24-hour concentration ($\mu g \cdot m^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| Criterion | 50 | 25 |
| Max. % of criterion | 275.8 | 551.6 |
| R1 | 66.8 | 66.8 |
| R2 | 74.4 | 74.4 |
| R3 | 49.6 | 49.6 |
| R4 | 114.6 | 114.6 |
| R5 | 103.1 | 103.1 |
| R6 | 81.2 | 81.2 |
| R7 | 64.5 | 64.5 |
| R8 | 61.2 | 61.2 |
| R9 | 34.7 | 34.7 |
| R10 | 58.4 | 58.4 |
| R11 | 13.3 | 13.3 |
| R12 | 40.2 | 40.2 |
| R13 | 45.6 | 45.6 |
| R14 | 97.2 | 97.2 |
| R15 | 137.9 | 137.9 |
| R16 | 30.5 | 30.5 |
| R17 | 64.1 | 64.1 |
| R18 | 26.8 | 26.8 |
| R19 | 33.5 | 33.5 |
| R20 | 13.0 | 13.0 |
| R21 | 73.2 | 73.2 |
| R22 | 26.8 | 26.8 |
| R23 | 19.3 | 19.3 |
| R24 | 41.9 | 41.9 |
| R25 | 7.8 | 7.8 |
| R26 | 16.1 | 16.1 |
| R27 | 14.4 | 14.4 |
| R28 | 13.3 | 13.3 |
| R29 | 16.7 | 16.7 |
| R30 | 17.5 | 17.5 |
| R31 | 33.3 | 33.3 |
| R32 | 11.9 | 11.9 |
| R33 | 13.4 | 13.4 |
| R34 | 14.8 | 14.8 |

| Receptor | Predicted incremental 24-hour concentration ($\mu g{\cdot}m^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| R35 | 13.7 | 13.7 |
| R36 | 13.9 | 13.9 |
| R37 | 17.8 | 17.8 |
| R38 | 16.1 | 16.1 |
| R39 | 13.2 | 13.2 |
| R40 | 12.6 | 12.6 |
| R41 | 15.5 | 15.5 |
| R42 | 16.6 | 16.6 |
| R43 | 10.2 | 10.2 |
| R44 | 8.3 | 8.3 |
| R45 | 12.5 | 12.5 |
| R46 | 14.4 | 14.4 |
| R47 | 16.4 | 16.4 |
| R48 | 20.9 | 20.9 |
| R49 | 14.2 | 14.2 |
| R50 | 9.7 | 9.7 |
| R51 | 11.4 | 11.4 |
| R52 | 8.4 | 8.4 |
| R53 | 12.1 | 12.1 |
| R54 | 10.5 | 10.5 |
| R55 | 6.4 | 6.4 |
| R56 | 6.9 | 6.9 |
| R57 | 10.8 | 10.8 |
| R58 | 17.6 | 17.6 |
| R59 | 16.6 | 16.6 |
| R60 | 21.6 | 21.6 |
| R61 | 12.8 | 12.8 |
| R62 | 10.3 | 10.3 |
| R63 | 9.6 | 9.6 |
| R64 | 5.6 | 5.6 |
| R65 | 6.2 | 6.2 |
| R66 | 6.5 | 6.5 |
| R67 | 6.8 | 6.8 |
| R68 | 13.4 | 13.4 |
| R69 | 5.5 | 5.5 |
| R70 | 9.0 | 9.0 |
| R71 | 9.4 | 9.4 |
| R72 | 9.0 | 9.0 |
| R73 | 6.2 | 6.2 |

| Receptor | Predicted incremental 24-hour concentration ($\mu g \cdot m^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| R74 | 6.1 | 6.1 |
| R75 | 9.2 | 9.2 |
| R76 | 9.2 | 9.2 |
| R77 | 6.7 | 6.7 |
| R78 | 7.8 | 7.8 |
| R79 | 13.5 | 13.5 |
| R80 | 13.9 | 13.9 |
| R81 | 13.0 | 13.0 |
| R82 | 17.6 | 17.6 |
| R83 | 18.8 | 18.8 |
| R84 | 25.4 | 25.4 |
| R85 | 25.0 | 25.0 |
| R86 | 45.0 | 45.0 |
| R87 | 23.1 | 23.1 |
| R88 | 32.9 | 32.9 |
| R89 | 19.4 | 19.4 |
| R90 | 15.0 | 15.0 |
| R91 | 16.7 | 16.7 |
| R92 | 11.3 | 11.3 |
| R93 | 14.5 | 14.5 |
| R94 | 36.7 | 36.7 |
| R95 | 13.0 | 13.0 |
| R96 | 25.1 | 25.1 |
| R97 | 23.8 | 23.8 |
| R98 | 22.8 | 22.8 |
| R99 | 22.7 | 22.7 |
| R100 | 19.2 | 19.2 |
| R101 | 17.3 | 17.3 |
| R102 | 23.2 | 23.2 |
| R103 | 27.7 | 27.7 |
| R104 | 16.3 | 16.3 |
| R105 | 16.1 | 16.1 |
| R106 | 23.0 | 23.0 |
| R107 | 13.7 | 13.7 |
| R108 | 8.1 | 8.1 |
| R109 | 13.1 | 13.1 |
| R110 | 20.5 | 20.5 |
| R111 | 8.3 | 8.3 |
| R112 | 13.1 | 13.1 |
| R113 | 13.2 | 13.2 |

| Receptor | Predicted incremental 24-hour concentration (µg·m$^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| R114 | 13.0 | 13.0 |
| R115 | 15.7 | 15.7 |
| R116 | 14.9 | 14.9 |
| R117 | 19.0 | 19.0 |
| R118 | 17.0 | 17.0 |
| R119 | 10.7 | 10.7 |
| R120 | 17.7 | 17.7 |
| R121 | 61.2 | 61.2 |
| R122 | 52.9 | 52.9 |
| R123 | 23.7 | 23.7 |
| R124 | 67.8 | 67.8 |
| R125 | 18.7 | 18.7 |
| R126 | 45.9 | 45.9 |
| R127 | 105.3 | 105.3 |
| R128 | 88.0 | 88.0 |
| R129 | 16.1 | 16.1 |
| R130 | 11.1 | 11.1 |
| R131 | 9.6 | 9.6 |
| R132 | 38.6 | 38.6 |
| R133 | 25.7 | 25.7 |
| R134 | 27.1 | 27.1 |

**Note**: all PM is assumed to be <1 µg in diameter and therefore assessed as $PM_{2.5}$. In this instance, emissions of $PM_{2.5}$ will be the same as $PM_{10}$ ($PM_{2.5}$ is a subset of $PM_{10}$) and therefore the results will be consistent between $PM_{10}$ and $PM_{2.5}$.

Table F2 Predicted 1-hour $NO_2$ concentrations – Scenario 1

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g \cdot m^{-3}$) | | |
|---|---|---|---|
| | 1-hour | | |
| | Incremental impact | Background | Cumulative impact |
| Criterion | 164 | | |
| Max % of criterion | 597.1 | 22.5 | 603.4 |
| R1 | 337.6 | 10.2 | 347.9 |
| R2 | 565.5 | 2.0 | 567.5 |
| R3 | 362.1 | 8.2 | 370.3 |
| R4 | 394.5 | 10.2 | 404.7 |
| R5 | 525.7 | 4.1 | 529.8 |
| R6 | 392.2 | 6.1 | 398.3 |
| R7 | 508.0 | 12.3 | 520.3 |
| R8 | 477.9 | 14.3 | 492.3 |
| R9 | 409.1 | < 0.1 | 409.1 |
| R10 | 28< 0.1 | 4.1 | 284.1 |
| R11 | 862.9 | 14.3 | 877.3 |
| R12 | 513.0 | < 0.1 | 513.0 |
| R13 | 732.5 | < 0.1 | 732.5 |
| R14 | 678.3 | 12.3 | 690.6 |
| R15 | 770.7 | 12.3 | 783.0 |
| R16 | 539.3 | 4.1 | 543.4 |
| R17 | 561.7 | 2.0 | 563.7 |
| R18 | 442.7 | 10.2 | 452.9 |
| R19 | 528.1 | 4.1 | 532.2 |
| R20 | 639.6 | 6.1 | 645.7 |
| R21 | 432.7 | 4.1 | 436.8 |
| R22 | 673.2 | 2.0 | 675.3 |
| R23 | 373.8 | 8.2 | 382.0 |
| R24 | 661.1 | 12.3 | 673.4 |
| R25 | 432.7 | 2.0 | 434.8 |
| R26 | 606.0 | 4.1 | 610.1 |
| R27 | 672.8 | 14.3 | 687.2 |
| R28 | 849.4 | 14.3 | 863.7 |
| R29 | 611.9 | 14.3 | 626.2 |
| R30 | 878.5 | 14.3 | 892.8 |
| R31 | 573.3 | 4.1 | 577.4 |
| R32 | 590.5 | 4.1 | 594.6 |
| R33 | 589.4 | 4.1 | 593.5 |
| R34 | 699.1 | 8.2 | 707.3 |
| R35 | 62< 0.1 | 4.1 | 624.1 |
| R36 | 662.7 | 4.1 | 666.8 |

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g{\cdot}m^{-3}$) | | |
|---|---|---|---|
| | 1-hour | | |
| | Incremental impact | Background | Cumulative impact |
| R37 | 555.0 | 4.1 | 559.1 |
| R38 | 519.4 | 6.1 | 525.5 |
| R39 | 576.1 | 2.0 | 578.1 |
| R40 | 541.7 | 2.0 | 543.8 |
| R41 | 605.6 | 4.1 | 609.7 |
| R42 | 616.8 | 8.2 | 625.0 |
| R43 | 528.7 | 10.2 | 539.0 |
| R44 | 545.0 | 4.1 | 549.1 |
| R45 | 693.1 | 8.2 | 701.3 |
| R46 | 726.3 | 8.2 | 734.5 |
| R47 | 589.8 | 4.1 | 593.9 |
| R48 | 684.1 | 4.1 | 688.2 |
| R49 | 494.2 | 2.0 | 496.2 |
| R50 | 555.5 | 2.0 | 557.6 |
| R51 | 512.6 | 8.2 | 520.8 |
| R52 | 619.7 | 8.2 | 627.9 |
| R53 | 671.0 | 2.0 | 673.1 |
| R54 | 714.9 | 6.1 | 721.0 |
| R55 | 526.7 | 16.4 | 543.1 |
| R56 | 545.5 | 4.1 | 549.6 |
| R57 | 659.9 | 8.2 | 668.1 |
| R58 | 979.3 | 10.2 | 989.5 |
| R59 | 715.7 | 10.2 | 726.0 |
| R60 | 648.1 | 8.2 | 656.3 |
| R61 | 668.0 | 8.2 | 676.2 |
| R62 | 823.4 | 10.2 | 833.7 |
| R63 | 623.0 | 32.8 | 655.8 |
| R64 | 646.9 | 4.1 | 651.0 |
| R65 | 632.1 | 4.1 | 636.2 |
| R66 | 708.2 | 16.4 | 724.6 |
| R67 | 609.2 | < 0.1 | 609.2 |
| R68 | 701.1 | 4.1 | 705.2 |
| R69 | 592.0 | 2.0 | 594.0 |
| R70 | 413.1 | 36.9 | 45< 0.1 |
| R71 | 517.8 | 10.2 | 528.0 |
| R72 | 500.9 | 14.3 | 515.2 |
| R73 | 693.6 | 10.2 | 703.8 |
| R74 | 581.1 | 14.3 | 595.4 |
| R75 | 581.8 | 14.3 | 596.2 |

| Receptor | Nitrogen dioxide ($NO_2$) concentration (µg·m$^{-3}$) | | |
|---|---|---|---|
| | 1-hour | | |
| | Incremental impact | Background | Cumulative impact |
| R76 | 504.2 | 11.3 | 515.5 |
| R77 | 472.4 | 12.3 | 484.7 |
| R78 | 545.5 | 22.6 | 568.0 |
| R79 | 809.1 | 14.3 | 823.5 |
| R80 | 811.6 | 14.3 | 825.9 |
| R81 | 636.1 | 10.2 | 646.4 |
| R82 | 597.3 | 24.6 | 621.9 |
| R83 | 554.0 | 12.3 | 566.3 |
| R84 | 699.6 | 14.3 | 714.0 |
| R85 | 698.1 | 14.3 | 712.5 |
| R86 | 624.1 | 10.2 | 634.3 |
| R87 | 667.2 | 24.6 | 691.8 |
| R88 | 590.2 | 10.2 | 600.5 |
| R89 | 525.9 | 4.1 | 53< 0.1 |
| R90 | 711.1 | 2.0 | 713.1 |
| R91 | 670.5 | 4.1 | 674.6 |
| R92 | 681.9 | < 0.1 | 681.9 |
| R93 | 653.1 | 4.1 | 657.2 |
| R94 | 801.5 | 2.0 | 803.5 |
| R95 | 716.0 | < 0.1 | 716.0 |
| R96 | 745.9 | 2.0 | 747.9 |
| R97 | 779.6 | < 0.1 | 779.6 |
| R98 | 818.3 | < 0.1 | 818.3 |
| R99 | 711.5 | < 0.1 | 711.5 |
| R100 | 640.6 | 4.1 | 644.7 |
| R101 | 597.0 | 2.0 | 599.0 |
| R102 | 789.3 | < 0.1 | 789.3 |
| R103 | 674.2 | < 0.1 | 674.2 |
| R104 | 749.4 | 10.2 | 759.7 |
| R105 | 716.9 | 10.2 | 727.2 |
| R106 | 699.2 | 4.1 | 703.3 |
| R107 | 838.3 | 10.2 | 848.6 |
| R108 | 518.3 | 8.2 | 526.5 |
| R109 | 932.4 | 10.2 | 942.7 |
| R110 | 719.8 | 4.1 | 723.9 |
| R111 | 618.5 | 2.0 | 620.5 |
| R112 | 684.3 | 2.0 | 686.3 |
| R113 | 656.1 | 4.1 | 660.2 |
| R114 | 435.9 | 10.2 | 446.2 |

| Receptor | Nitrogen dioxide ($NO_2$) concentration (µg·m$^{-3}$) | | |
|---|---|---|---|
| | 1-hour | | |
| | Incremental impact | Background | Cumulative impact |
| R115 | 603.1 | 2.0 | 605.2 |
| R116 | 571.2 | 2.0 | 573.2 |
| R117 | 715.0 | 4.1 | 719.1 |
| R118 | 499.2 | 6.1 | 505.4 |
| R119 | 518.3 | < 0.1 | 518.3 |
| R120 | 590.5 | 16.4 | 606.9 |
| R121 | 628.9 | 2.0 | 631.0 |
| R122 | 546.7 | 8.2 | 554.9 |
| R123 | 534.5 | 10.2 | 544.7 |
| R124 | 465.3 | 2.0 | 467.4 |
| R125 | 551.8 | 4.1 | 555.9 |
| R126 | 578.1 | 4.1 | 582.2 |
| R127 | 423.9 | 10.2 | 434.2 |
| R128 | 605.8 | 12.3 | 618.1 |
| R129 | 679.8 | < 0.1 | 679.8 |
| R130 | 465.0 | 2.0 | 467.1 |
| R131 | 574.6 | 4.1 | 578.7 |
| R132 | 916.6 | 2.0 | 918.7 |
| R133 | 754.9 | 6.1 | 761.1 |
| R134 | 587.6 | 10.2 | 597.9 |

Table F3 Predicted 15-minutes, 1-hour and 8-hour CO concentrations – Scenario 1

| Receptor | Carbon monoxide (CO) concentration (mg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 100 | | | 30 | | | 10 | | |
| Max. % of criterion | 2.1 | 0.7 | 2.4 | 5.3 | 1.7 | 6.0 | 9.7 | 5.2 | 11.0 |
| R1 | 1.2 | < 0.1 | 1.2 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 |
| R2 | 1.1 | < 0.1 | 1.1 | 0.8 | < 0.1 | 0.8 | 0.7 | < 0.1 | 0.7 |
| R3 | 1.0 | < 0.1 | 1.0 | 0.7 | < 0.1 | 0.7 | 0.6 | < 0.1 | 0.6 |
| R4 | 1.2 | < 0.1 | 1.2 | 0.9 | < 0.1 | 0.9 | 0.9 | < 0.1 | 0.9 |
| R5 | 1.2 | < 0.1 | 1.2 | 0.9 | < 0.1 | 0.9 | 0.9 | < 0.1 | 1.0 |
| R6 | 1.1 | < 0.1 | 1.1 | 0.9 | < 0.1 | 0.9 | 0.8 | < 0.1 | 0.8 |
| R7 | 1.3 | < 0.1 | 1.3 | 1.0 | < 0.1 | 1.0 | 0.7 | < 0.1 | 0.7 |
| R8 | 1.2 | < 0.1 | 1.2 | 0.9 | < 0.1 | 0.9 | 0.6 | < 0.1 | 0.6 |
| R9 | 2.1 | 0.3 | 2.4 | 1.6 | 0.3 | 1.8 | 0.5 | 0.2 | 0.7 |
| R10 | 1.3 | 0.5 | 1.8 | 1.0 | 0.4 | 1.4 | 0.7 | < 0.1 | 0.7 |
| R11 | 0.5 | 0.2 | 0.6 | 0.3 | 0.1 | 0.5 | 0.2 | < 0.1 | 0.2 |
| R12 | 0.9 | < 0.1 | 0.9 | 0.6 | < 0.1 | 0.6 | 0.6 | < 0.1 | 0.6 |
| R13 | 1.1 | < 0.1 | 1.1 | 0.9 | < 0.1 | 0.9 | 0.6 | 0.1 | 0.7 |
| R14 | 1.4 | < 0.1 | 1.4 | 1.1 | < 0.1 | 1.1 | 0.9 | < 0.1 | 0.9 |
| R15 | 1.5 | < 0.1 | 1.5 | 1.1 | < 0.1 | 1.1 | 1.0 | 0.2 | 1.1 |
| R16 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.4 | < 0.1 | 0.4 |
| R17 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.6 |
| R18 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 |
| R19 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.4 | < 0.1 | 0.4 |
| R20 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R21 | 1.3 | 0.5 | 1.8 | 1.0 | 0.4 | 1.4 | 0.8 | 0.1 | 0.9 |
| R22 | 0.8 | < 0.1 | 0.8 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 |
| R23 | 1.5 | 0.5 | 2.0 | 1.1 | 0.4 | 1.5 | 0.3 | < 0.1 | 0.3 |
| R24 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.6 | 0.1 | 0.7 |
| R25 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 | 0.1 | < 0.1 | 0.1 |
| R26 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R27 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R28 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R29 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R30 | 0.5 | 0.2 | 0.7 | 0.4 | 0.1 | 0.5 | 0.2 | 0.1 | 0.3 |
| R31 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.3 | < 0.1 | 0.4 |
| R32 | 0.7 | 0.2 | 0.9 | 0.5 | 0.1 | 0.7 | 0.2 | < 0.1 | 0.2 |
| R33 | 0.7 | 0.2 | 0.9 | 0.5 | 0.1 | 0.7 | 0.3 | < 0.1 | 0.3 |
| R34 | 0.7 | 0.2 | 0.8 | 0.5 | 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 |
| R35 | 0.9 | 0.2 | 1.0 | 0.7 | 0.1 | 0.8 | 0.3 | < 0.1 | 0.3 |
| R36 | 1.0 | 0.2 | 1.2 | 0.8 | 0.1 | 0.9 | 0.2 | 0.4 | 0.6 |

| Receptor | Carbon monoxide (CO) concentration ($mg \cdot m^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R37 | 0.9 | 0.2 | 1.0 | 0.7 | 0.1 | 0.8 | 0.2 | 0.3 | 0.5 |
| R38 | 0.7 | 0.3 | 1.0 | 0.5 | 0.3 | 0.8 | 0.2 | < 0.1 | 0.2 |
| R39 | 0.8 | < 0.1 | 0.8 | 0.6 | < 0.1 | 0.6 | 0.3 | < 0.1 | 0.3 |
| R40 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R41 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.2 | 0.3 | 0.5 |
| R42 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.2 | 0.3 | 0.5 |
| R43 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | 0.4 | 0.6 |
| R44 | 0.5 | 0.2 | 0.7 | 0.4 | 0.1 | 0.5 | 0.2 | 0.4 | 0.5 |
| R45 | 0.6 | 0.2 | 0.7 | 0.4 | 0.1 | 0.6 | 0.3 | < 0.1 | 0.3 |
| R46 | 0.6 | 0.2 | 0.8 | 0.5 | 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 |
| R47 | 1.1 | 0.2 | 1.3 | 0.8 | 0.1 | 1.0 | 0.3 | < 0.1 | 0.3 |
| R48 | 1.4 | 0.2 | 1.6 | 1.1 | 0.1 | 1.2 | 0.2 | 0.3 | 0.5 |
| R49 | 1.1 | 0.5 | 1.6 | 0.8 | 0.4 | 1.2 | 0.3 | < 0.1 | 0.3 |
| R50 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.2 | < 0.1 | 0.2 |
| R51 | 0.4 | 0.3 | 0.8 | 0.3 | 0.3 | 0.6 | 0.2 | 0.3 | 0.4 |
| R52 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R53 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R54 | 0.5 | 0.2 | 0.6 | 0.4 | 0.1 | 0.5 | 0.2 | < 0.1 | 0.2 |
| R55 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R56 | 0.4 | 0.2 | 0.6 | 0.3 | 0.1 | 0.5 | 0.1 | 0.4 | 0.5 |
| R57 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 |
| R58 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R59 | 0.6 | 0.2 | 0.7 | 0.4 | 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R60 | 0.5 | 0.2 | 0.6 | 0.3 | 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R61 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R62 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R63 | 0.4 | 0.3 | 0.7 | 0.3 | 0.3 | 0.6 | 0.2 | 0.3 | 0.4 |
| R64 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R65 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R66 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R67 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.1 | 0.1 | 0.2 |
| R68 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 |
| R69 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 | 0.1 | < 0.1 | 0.1 |
| R70 | 0.2 | 0.7 | 0.9 | 0.2 | 0.5 | 0.7 | 0.1 | < 0.1 | 0.1 |
| R71 | 0.2 | 0.2 | 0.4 | 0.2 | 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R72 | 0.2 | 0.2 | 0.4 | 0.2 | 0.1 | 0.3 | 0.2 | 0.1 | 0.2 |
| R73 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.1 | < 0.1 | 0.1 |
| R74 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 | 0.1 | 0.2 | 0.3 |
| R75 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.1 | 0.1 | 0.3 |

| Receptor | Carbon monoxide (CO) concentration ($mg \cdot m^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R76 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 | 0.1 | 0.1 | 0.2 |
| R77 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 | 0.1 | < 0.1 | 0.1 |
| R78 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.1 | < 0.1 | 0.1 |
| R79 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R80 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | 0.1 | 0.2 |
| R81 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R82 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | 0.1 | 0.3 |
| R83 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R84 | 0.7 | 0.5 | 1.2 | 0.5 | 0.4 | 0.9 | 0.3 | 0.1 | 0.4 |
| R85 | 0.9 | 0.2 | 1.1 | 0.7 | 0.1 | 0.8 | 0.3 | 0.2 | 0.5 |
| R86 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.4 | 0.3 | 0.8 |
| R87 | 0.8 | < 0.1 | 0.8 | 0.6 | < 0.1 | 0.6 | 0.4 | 0.1 | 0.5 |
| R88 | 1.3 | 0.3 | 1.6 | 1.0 | 0.3 | 1.2 | 0.5 | 0.1 | 0.6 |
| R89 | 1.5 | 0.2 | 1.6 | 1.1 | 0.1 | 1.2 | 0.3 | < 0.1 | 0.3 |
| R90 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 |
| R91 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 |
| R92 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 |
| R93 | 0.6 | 0.2 | 0.8 | 0.5 | 0.1 | 0.6 | 0.2 | 0.1 | 0.3 |
| R94 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.4 | 0.1 | 0.5 |
| R95 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R96 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.4 | 0.1 | 0.5 |
| R97 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | 0.2 | 0.4 |
| R98 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.3 | 0.1 | 0.4 |
| R99 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.3 | 0.5 | 0.8 |
| R100 | 0.5 | 0.7 | 1.1 | 0.4 | 0.5 | 0.9 | 0.3 | 0.1 | 0.4 |
| R101 | 0.4 | 0.3 | 0.8 | 0.3 | 0.3 | 0.6 | 0.3 | 0.1 | 0.4 |
| R102 | 0.5 | 0.3 | 0.8 | 0.3 | 0.3 | 0.6 | 0.3 | < 0.1 | 0.3 |
| R103 | 0.5 | 0.3 | 0.8 | 0.4 | 0.3 | 0.6 | 0.3 | < 0.1 | 0.3 |
| R104 | 0.5 | 0.3 | 0.9 | 0.4 | 0.3 | 0.7 | 0.3 | < 0.1 | 0.3 |
| R105 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 |
| R106 | 0.5 | 0.5 | 1.0 | 0.4 | 0.4 | 0.8 | 0.2 | < 0.1 | 0.3 |
| R107 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 |
| R108 | 0.4 | 0.7 | 1.0 | 0.3 | 0.5 | 0.8 | 0.2 | 0.2 | 0.4 |
| R109 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 |
| R110 | 0.5 | 0.5 | 1.0 | 0.4 | 0.4 | 0.8 | 0.2 | < 0.1 | 0.3 |
| R111 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R112 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R113 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R114 | 0.4 | 0.2 | 0.6 | 0.3 | 0.1 | 0.5 | 0.2 | < 0.1 | 0.2 |

| Receptor | Carbon monoxide (CO) concentration ($mg{\cdot}m^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R115 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R116 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.2 | < 0.1 | 0.2 |
| R117 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R118 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 |
| R119 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R120 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 |
| R121 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.5 | < 0.1 | 0.6 |
| R122 | 0.8 | < 0.1 | 0.8 | 0.6 | < 0.1 | 0.6 | 0.6 | < 0.1 | 0.6 |
| R123 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.3 | < 0.1 | 0.3 |
| R124 | 0.9 | < 0.1 | 0.9 | 0.7 | < 0.1 | 0.7 | 0.6 | < 0.1 | 0.6 |
| R125 | 0.8 | < 0.1 | 0.8 | 0.6 | < 0.1 | 0.6 | 0.4 | < 0.1 | 0.4 |
| R126 | 0.6 | < 0.1 | 0.6 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 |
| R127 | 1.1 | < 0.1 | 1.1 | 0.9 | < 0.1 | 0.9 | 0.8 | < 0.1 | 0.8 |
| R128 | 1.4 | < 0.1 | 1.4 | 1.1 | < 0.1 | 1.1 | 0.8 | < 0.1 | 0.8 |
| R129 | 0.5 | < 0.1 | 0.5 | 0.4 | < 0.1 | 0.4 | 0.3 | 0.1 | 0.4 |
| R130 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.2 | < 0.1 | 0.2 |
| R131 | 0.4 | < 0.1 | 0.4 | 0.3 | < 0.1 | 0.3 | 0.1 | < 0.1 | 0.1 |
| R132 | 0.8 | 0.2 | 0.9 | 0.6 | 0.1 | 0.7 | 0.4 | 0.2 | 0.6 |
| R133 | 0.5 | 0.2 | 0.7 | 0.4 | 0.1 | 0.5 | 0.3 | 0.1 | 0.4 |
| R134 | 0.6 | 0.3 | 1.0 | 0.5 | 0.3 | 0.7 | 0.4 | 0.1 | 0.5 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table F4 Predicted 1-hour and 24-hour $SO_2$ concentrations – Scenario 1

| Receptor | Sulphur dioxide ($SO_2$) concentration ($\mu g \cdot m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 215 | | | 57 | | |
| Max. % of criterion | 5.3 | 9.3 | 1< 0.1 | 10.9 | 14.4 | 25.3 |
| R1 | 6.8 | < 0.1 | 6.8 | 3.0 | 0.2 | 3.2 |
| R2 | 6.0 | < 0.1 | 6.0 | 3.4 | < 0.1 | 3.4 |
| R3 | 5.3 | < 0.1 | 5.3 | 2.2 | 0.2 | 2.5 |
| R4 | 6.5 | < 0.1 | 6.5 | 5.2 | < 0.1 | 5.2 |
| R5 | 6.8 | < 0.1 | 6.8 | 4.6 | < 0.1 | 4.6 |
| R6 | 6.3 | 2.9 | 9.2 | 3.7 | 0.4 | 4.0 |
| R7 | 7.1 | < 0.1 | 7.1 | 2.9 | 1.3 | 4.2 |
| R8 | 6.4 | < 0.1 | 6.4 | 2.8 | 0.5 | 3.2 |
| R9 | 11.3 | < 0.1 | 11.3 | 1.6 | 0.7 | 2.3 |
| R10 | 7.4 | 2.9 | 10.3 | 2.6 | 0.4 | 3.0 |
| R11 | 2.5 | 5.7 | 8.2 | 0.6 | 3.1 | 3.7 |
| R12 | 4.6 | < 0.1 | 4.6 | 1.8 | 0.2 | 2.0 |
| R13 | 6.3 | 2.9 | 9.2 | 2.1 | < 0.1 | 2.1 |
| R14 | 7.7 | < 0.1 | 7.7 | 4.4 | 5.8 | 10.2 |
| R15 | 8.0 | 5.7 | 13.8 | 6.2 | 8.2 | 14.4 |
| R16 | 4.8 | < 0.1 | 4.8 | 1.4 | < 0.1 | 1.4 |
| R17 | 5.0 | < 0.1 | 5.0 | 2.9 | 0.2 | 3.1 |
| R18 | 3.8 | < 0.1 | 3.8 | 1.2 | 0.2 | 1.4 |
| R19 | 5.0 | < 0.1 | 5.0 | 1.5 | < 0.1 | 1.5 |
| R20 | 3.4 | < 0.1 | 3.4 | 0.6 | < 0.1 | 0.6 |
| R21 | 7.2 | 2.9 | 10.1 | 3.3 | 0.1 | 3.4 |
| R22 | 4.5 | 2.9 | 7.4 | 1.2 | 0.2 | 1.4 |
| R23 | 8.3 | 2.9 | 11.1 | 0.9 | 1.4 | 2.3 |
| R24 | 4.9 | < 0.1 | 4.9 | 1.9 | 2.5 | 4.4 |
| R25 | 1.7 | 2.9 | 4.6 | 0.4 | 0.4 | 0.7 |
| R26 | 3.6 | 2.9 | 6.4 | 0.7 | 3.7 | 4.4 |
| R27 | 2.4 | < 0.1 | 2.4 | 0.7 | 5.8 | 6.5 |
| R28 | 2.4 | 2.9 | 5.2 | 0.6 | 5.8 | 6.4 |
| R29 | 2.9 | < 0.1 | 2.9 | 0.8 | 5.8 | 6.6 |
| R30 | 2.9 | 5.7 | 8.7 | 0.8 | 5.8 | 6.6 |
| R31 | 5.0 | < 0.1 | 5.0 | 1.5 | < 0.1 | 1.5 |
| R32 | 3.8 | < 0.1 | 3.8 | 0.5 | 1.8 | 2.3 |
| R33 | 3.9 | < 0.1 | 3.9 | 0.6 | 1.8 | 2.4 |
| R34 | 3.5 | 2.9 | 6.4 | 0.7 | 1.8 | 2.5 |
| R35 | 4.8 | < 0.1 | 4.8 | 0.6 | 1.8 | 2.4 |
| R36 | 5.6 | < 0.1 | 5.6 | 0.6 | 1.4 | 2.1 |

| Receptor | Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R37 | 4.8 | < 0.1 | 4.8 | 0.8 | 1.4 | 2.2 |
| R38 | 3.8 | 2.9 | 6.6 | 0.7 | 1.4 | 2.2 |
| R39 | 4.2 | < 0.1 | 4.2 | 0.6 | 0.6 | 1.2 |
| R40 | 3.7 | < 0.1 | 3.7 | 0.6 | 0.6 | 1.2 |
| R41 | 3.4 | < 0.1 | 3.4 | 0.7 | 1.4 | 2.1 |
| R42 | 3.7 | 2.9 | 6.5 | 0.8 | 1.4 | 2.2 |
| R43 | 3.0 | 2.9 | 5.8 | 0.5 | 2.9 | 3.3 |
| R44 | 2.8 | < 0.1 | 2.8 | 0.4 | 1.0 | 1.3 |
| R45 | 3.1 | < 0.1 | 3.1 | 0.6 | 1.8 | 2.4 |
| R46 | 3.4 | 2.9 | 6.2 | 0.7 | 1.8 | 2.4 |
| R47 | 6.1 | < 0.1 | 6.1 | 0.7 | 2.5 | 3.2 |
| R48 | 7.6 | < 0.1 | 7.6 | 0.9 | 1.4 | 2.4 |
| R49 | 5.8 | 2.9 | 8.7 | 0.6 | 1.4 | 2.1 |
| R50 | 3.2 | < 0.1 | 3.2 | 0.4 | 0.6 | 1.0 |
| R51 | 2.3 | 1.4 | 3.7 | 0.5 | 1.4 | 1.9 |
| R52 | 2.5 | < 0.1 | 2.5 | 0.4 | 0.8 | 1.2 |
| R53 | 2.7 | < 0.1 | 2.7 | 0.5 | 0.2 | 0.8 |
| R54 | 2.6 | < 0.1 | 2.6 | 0.5 | 0.4 | 0.8 |
| R55 | 2.1 | < 0.1 | 2.1 | 0.3 | 0.6 | 0.9 |
| R56 | 2.3 | < 0.1 | 2.3 | 0.3 | 1.0 | 1.3 |
| R57 | 2.6 | < 0.1 | 2.6 | 0.5 | 1.8 | 2.3 |
| R58 | 3.4 | 2.9 | 6.3 | 0.8 | 1.1 | 1.9 |
| R59 | 3.0 | < 0.1 | 3.0 | 0.8 | 0.7 | 1.5 |
| R60 | 2.5 | < 0.1 | 2.5 | 1.0 | 0.1 | 1.1 |
| R61 | 2.3 | < 0.1 | 2.3 | 0.6 | 0.7 | 1.3 |
| R62 | 2.3 | 2.9 | 5.2 | 0.5 | 1.1 | 1.5 |
| R63 | 2.2 | 1.4 | 3.6 | 0.4 | 1.4 | 1.9 |
| R64 | 1.9 | < 0.1 | 1.9 | 0.3 | 1.2 | 1.4 |
| R65 | 1.9 | < 0.1 | 1.9 | 0.3 | 0.6 | 0.9 |
| R66 | 2.1 | < 0.1 | 2.1 | 0.3 | 0.6 | 0.9 |
| R67 | 2.2 | 2.9 | 5.1 | 0.3 | 0.1 | 0.4 |
| R68 | 2.3 | < 0.1 | 2.3 | 0.6 | 1.1 | 1.7 |
| R69 | 1.5 | < 0.1 | 1.5 | 0.3 | 0.2 | 0.5 |
| R70 | 1.1 | 2.9 | 4.0 | 0.4 | 0.1 | 0.5 |
| R71 | 1.3 | 2< 0.1 | 21.4 | 0.4 | 4.2 | 4.6 |
| R72 | 1.3 | 11.4 | 12.7 | 0.4 | 8.2 | 8.6 |
| R73 | 1.8 | 2.9 | 4.6 | 0.3 | 4.2 | 4.5 |
| R74 | 1.6 | 2.9 | 4.4 | 0.3 | 2.5 | 2.8 |
| R75 | 2.0 | < 0.1 | 2.0 | 0.4 | 2.5 | 2.9 |
| R76 | 1.8 | < 0.1 | 1.8 | 0.4 | 5.8 | 6.3 |

| Receptor | Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R77 | 1.6 | < 0.1 | 1.6 | 0.3 | 1.3 | 1.6 |
| R78 | 2.1 | < 0.1 | 2.1 | 0.4 | 0.5 | 0.8 |
| R79 | 2.3 | 2.9 | 5.2 | 0.6 | 5.8 | 6.4 |
| R80 | 2.4 | 2.9 | 5.3 | 0.6 | 5.8 | 6.5 |
| R81 | 2.7 | < 0.1 | 2.7 | 0.6 | 5.8 | 6.4 |
| R82 | 2.8 | < 0.1 | 2.8 | 0.8 | 5.8 | 6.6 |
| R83 | 3.3 | < 0.1 | 3.3 | 0.9 | 1.3 | 2.2 |
| R84 | 3.9 | 2.9 | 6.8 | 1.1 | 2.5 | 3.6 |
| R85 | 4.9 | < 0.1 | 4.9 | 1.1 | 2.5 | 3.6 |
| R86 | 3.9 | < 0.1 | 3.9 | 2.0 | 0.2 | 2.3 |
| R87 | 4.6 | < 0.1 | 4.6 | 1.0 | 0.6 | 1.6 |
| R88 | 6.9 | < 0.1 | 6.9 | 1.5 | 0.7 | 2.2 |
| R89 | 8.0 | < 0.1 | 8.0 | 0.9 | 2.0 | 2.9 |
| R90 | 3.1 | < 0.1 | 3.1 | 0.7 | < 0.1 | 0.7 |
| R91 | 2.8 | < 0.1 | 2.8 | 0.8 | 1.1 | 1.8 |
| R92 | 2.4 | < 0.1 | 2.4 | 0.5 | < 0.1 | 0.5 |
| R93 | 3.3 | < 0.1 | 3.3 | 0.7 | < 0.1 | 0.7 |
| R94 | 3.9 | 2.9 | 6.8 | 1.7 | < 0.1 | 1.7 |
| R95 | 2.4 | < 0.1 | 2.4 | 0.6 | 0.1 | 0.7 |
| R96 | 3.4 | 2.9 | 6.3 | 1.1 | 0.5 | 1.6 |
| R97 | 2.4 | < 0.1 | 2.4 | 1.1 | < 0.1 | 1.1 |
| R98 | 2.8 | 2.9 | 5.6 | 1.0 | 3.0 | 4.0 |
| R99 | 2.8 | < 0.1 | 2.8 | 1.0 | 0.5 | 1.5 |
| R100 | 2.5 | 2.9 | 5.4 | 0.9 | 2.1 | 3.0 |
| R101 | 2.3 | 2.9 | 5.2 | 0.8 | 2.1 | 2.9 |
| R102 | 2.5 | 2.9 | 5.3 | 1.0 | 0.5 | 1.5 |
| R103 | 2.6 | 2.9 | 5.5 | 1.2 | 0.1 | 1.4 |
| R104 | 2.9 | 2.9 | 5.7 | 0.7 | 0.8 | 1.6 |
| R105 | 2.4 | < 0.1 | 2.4 | 0.7 | 0.8 | 1.6 |
| R106 | 3.0 | 2.9 | 5.8 | 1.0 | < 0.1 | 1.0 |
| R107 | 3.2 | < 0.1 | 3.2 | 0.6 | 0.1 | 0.7 |
| R108 | 2.0 | 2.9 | 4.9 | 0.4 | 0.7 | 1.1 |
| R109 | 3.1 | < 0.1 | 3.1 | 0.6 | 2.4 | 3.0 |
| R110 | 2.7 | 2.9 | 5.6 | 0.9 | < 0.1 | 0.9 |
| R111 | 2.3 | 2.9 | 5.2 | 0.4 | 0.4 | 0.7 |
| R112 | 2.9 | 2.9 | 5.8 | 0.6 | 0.4 | 1.0 |
| R113 | 2.6 | < 0.1 | 2.6 | 0.6 | < 0.1 | 0.6 |
| R114 | 2.4 | < 0.1 | 2.4 | 0.6 | 0.1 | 0.7 |
| R115 | 3.0 | 2.9 | 5.9 | 0.7 | 0.4 | 1.1 |
| R116 | 2.9 | < 0.1 | 2.9 | 0.7 | < 0.1 | 0.7 |

| Receptor | Sulphur dioxide ($SO_2$) concentration ($\mu g \cdot m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R117 | 3.8 | < 0.1 | 3.8 | 0.9 | < 0.1 | 0.9 |
| R118 | 2.3 | < 0.1 | 2.3 | 0.8 | < 0.1 | 0.8 |
| R119 | 2.4 | < 0.1 | 2.4 | 0.5 | < 0.1 | 0.5 |
| R120 | 3.0 | < 0.1 | 3.0 | 0.8 | < 0.1 | 0.8 |
| R121 | 4.7 | < 0.1 | 4.7 | 2.8 | 0.6 | 3.4 |
| R122 | 4.5 | < 0.1 | 4.5 | 2.4 | 0.2 | 2.6 |
| R123 | 3.5 | < 0.1 | 3.5 | 1.1 | 0.4 | 1.4 |
| R124 | 5.0 | < 0.1 | 5.0 | 3.1 | < 0.1 | 3.1 |
| R125 | 4.1 | < 0.1 | 4.1 | 0.8 | < 0.1 | 0.8 |
| R126 | 3.4 | < 0.1 | 3.4 | 2.1 | < 0.1 | 2.1 |
| R127 | 6.3 | < 0.1 | 6.3 | 4.7 | < 0.1 | 4.7 |
| R128 | 7.7 | < 0.1 | 7.7 | 4.0 | 5.8 | 9.8 |
| R129 | 2.5 | 2.9 | 5.4 | 0.7 | < 0.1 | 0.7 |
| R130 | 2.1 | 2.9 | 5.0 | 0.5 | 0.4 | 0.9 |
| R131 | 2.1 | < 0.1 | 2.1 | 0.4 | 0.5 | 0.9 |
| R132 | 4.2 | < 0.1 | 4.2 | 1.7 | < 0.1 | 1.7 |
| R133 | 2.6 | < 0.1 | 2.6 | 1.2 | < 0.1 | 1.2 |
| R134 | 3.4 | 2.9 | 6.3 | 1.2 | < 0.1 | 1.2 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table F5 Predicted incremental 1-hour (99.9th %ile) PAH and VOC concentrations – Scenario 1

| Receptor | Predicted 1-hour (99.9th %ile) concentration ($mg \cdot m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| Criterion | 0.0004 | 0.029 | 0.36 | 0.19 | 0.02 |
| Max. % of criterion | < 0.1 | 23.1 | 0.7 | 0.9 | 3.4 |
| Max. % at boundary | 0.1 | 89.7 | 2.6 | 3.5 | 13.5 |
| R1 | 7.27E-08 | 4.90E-03 | 1.80E-03 | 1.20E-03 | 4.98E-04 |
| R2 | 6.70E-08 | 4.50E-03 | 1.60E-03 | 1.10E-03 | 4.58E-04 |
| R3 | 6.26E-08 | 4.20E-03 | 1.50E-03 | 1.10E-03 | 4.28E-04 |
| R4 | 8.16E-08 | 5.50E-03 | 2.00E-03 | 1.40E-03 | 5.58E-04 |
| R5 | 8.28E-08 | 5.60E-03 | 2.00E-03 | 1.40E-03 | 5.67E-04 |
| R6 | 7.32E-08 | 4.90E-03 | 1.80E-03 | 1.20E-03 | 5.01E-04 |
| R7 | 7.72E-08 | 5.20E-03 | 1.90E-03 | 1.30E-03 | 5.28E-04 |
| R8 | 6.97E-08 | 4.70E-03 | 1.70E-03 | 1.20E-03 | 4.77E-04 |
| R9 | 5.82E-08 | 3.90E-03 | 1.40E-03 | 9.86E-04 | 3.98E-04 |
| R10 | 7.64E-08 | 5.10E-03 | 1.90E-03 | 1.30E-03 | 5.22E-04 |
| R11 | 2.74E-08 | 1.80E-03 | 6.66E-04 | 4.64E-04 | 1.87E-04 |
| R12 | 4.77E-08 | 3.20E-03 | 1.20E-03 | 8.09E-04 | 3.27E-04 |
| R13 | 5.60E-08 | 3.80E-03 | 1.40E-03 | 9.48E-04 | 3.83E-04 |
| R14 | 9.06E-08 | 6.10E-03 | 2.20E-03 | 1.50E-03 | 6.20E-04 |
| R15 | 9.94E-08 | 6.70E-03 | 2.40E-03 | 1.70E-03 | 6.80E-04 |
| R16 | 3.95E-08 | 2.70E-03 | 9.60E-04 | 6.69E-04 | 2.70E-04 |
| R17 | 5.63E-08 | 3.80E-03 | 1.40E-03 | 9.55E-04 | 3.86E-04 |
| R18 | 4.40E-08 | 3.00E-03 | 1.10E-03 | 7.46E-04 | 3.01E-04 |
| R19 | 4.24E-08 | 2.90E-03 | 1.00E-03 | 7.19E-04 | 2.90E-04 |
| R20 | 3.77E-08 | 2.50E-03 | 9.16E-04 | 6.38E-04 | 2.58E-04 |
| R21 | 7.78E-08 | 5.20E-03 | 1.90E-03 | 1.30E-03 | 5.33E-04 |
| R22 | 4.90E-08 | 3.30E-03 | 1.20E-03 | 8.30E-04 | 3.35E-04 |
| R23 | 4.90E-08 | 3.30E-03 | 1.20E-03 | 8.30E-04 | 3.35E-04 |
| R24 | 5.58E-08 | 3.80E-03 | 1.40E-03 | 9.46E-04 | 3.82E-04 |
| R25 | 1.43E-08 | 9.66E-04 | 3.49E-04 | 2.43E-04 | 9.81E-05 |
| R26 | 3.88E-08 | 2.60E-03 | 9.43E-04 | 6.57E-04 | 2.65E-04 |
| R27 | 2.77E-08 | 1.90E-03 | 6.73E-04 | 4.69E-04 | 1.89E-04 |
| R28 | 2.59E-08 | 1.70E-03 | 6.30E-04 | 4.39E-04 | 1.77E-04 |
| R29 | 3.19E-08 | 2.10E-03 | 7.75E-04 | 5.40E-04 | 2.18E-04 |
| R30 | 3.29E-08 | 2.20E-03 | 8.00E-04 | 5.57E-04 | 2.25E-04 |
| R31 | 3.73E-08 | 2.50E-03 | 9.06E-04 | 6.32E-04 | 2.55E-04 |
| R32 | 3.37E-08 | 2.30E-03 | 8.19E-04 | 5.71E-04 | 2.30E-04 |
| R33 | 3.45E-08 | 2.30E-03 | 8.38E-04 | 5.84E-04 | 2.36E-04 |
| R34 | 3.76E-08 | 2.50E-03 | 9.14E-04 | 6.37E-04 | 2.57E-04 |
| R35 | 3.52E-08 | 2.40E-03 | 8.55E-04 | 5.96E-04 | 2.41E-04 |

| Receptor | Predicted 1-hour (99.9th %ile) concentration ($mg{\cdot}m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| R36 | 3.58E-08 | 2.40E-03 | 8.72E-04 | 6.07E-04 | 2.45E-04 |
| R37 | 3.81E-08 | 2.60E-03 | 9.27E-04 | 6.46E-04 | 2.61E-04 |
| R38 | 3.79E-08 | 2.60E-03 | 9.23E-04 | 6.43E-04 | 2.60E-04 |
| R39 | 4.02E-08 | 2.70E-03 | 9.78E-04 | 6.81E-04 | 2.75E-04 |
| R40 | 3.77E-08 | 2.50E-03 | 9.16E-04 | 6.39E-04 | 2.58E-04 |
| R41 | 3.84E-08 | 2.60E-03 | 9.35E-04 | 6.52E-04 | 2.63E-04 |
| R42 | 3.68E-08 | 2.50E-03 | 8.95E-04 | 6.24E-04 | 2.52E-04 |
| R43 | 2.89E-08 | 1.90E-03 | 7.03E-04 | 4.90E-04 | 1.98E-04 |
| R44 | 2.76E-08 | 1.90E-03 | 6.71E-04 | 4.68E-04 | 1.89E-04 |
| R45 | 3.04E-08 | 2.00E-03 | 7.39E-04 | 5.15E-04 | 2.08E-04 |
| R46 | 3.66E-08 | 2.50E-03 | 8.90E-04 | 6.20E-04 | 2.50E-04 |
| R47 | 4.12E-08 | 2.80E-03 | 1.00E-03 | 6.98E-04 | 2.82E-04 |
| R48 | 4.34E-08 | 2.90E-03 | 1.10E-03 | 7.35E-04 | 2.97E-04 |
| R49 | 4.18E-08 | 2.80E-03 | 1.00E-03 | 7.09E-04 | 2.86E-04 |
| R50 | 3.03E-08 | 2.00E-03 | 7.38E-04 | 5.14E-04 | 2.08E-04 |
| R51 | 2.39E-08 | 1.60E-03 | 5.82E-04 | 4.05E-04 | 1.64E-04 |
| R52 | 2.51E-08 | 1.70E-03 | 6.09E-04 | 4.25E-04 | 1.71E-04 |
| R53 | 2.56E-08 | 1.70E-03 | 6.23E-04 | 4.34E-04 | 1.75E-04 |
| R54 | 2.86E-08 | 1.90E-03 | 6.95E-04 | 4.85E-04 | 1.96E-04 |
| R55 | 2.00E-08 | 1.30E-03 | 4.85E-04 | 3.38E-04 | 1.37E-04 |
| R56 | 2.32E-08 | 1.60E-03 | 5.64E-04 | 3.93E-04 | 1.59E-04 |
| R57 | 2.67E-08 | 1.80E-03 | 6.48E-04 | 4.52E-04 | 1.82E-04 |
| R58 | 3.63E-08 | 2.40E-03 | 8.83E-04 | 6.15E-04 | 2.48E-04 |
| R59 | 3.43E-08 | 2.30E-03 | 8.34E-04 | 5.81E-04 | 2.35E-04 |
| R60 | 2.67E-08 | 1.80E-03 | 6.50E-04 | 4.53E-04 | 1.83E-04 |
| R61 | 2.43E-08 | 1.60E-03 | 5.91E-04 | 4.12E-04 | 1.66E-04 |
| R62 | 2.61E-08 | 1.80E-03 | 6.34E-04 | 4.42E-04 | 1.78E-04 |
| R63 | 2.25E-08 | 1.50E-03 | 5.46E-04 | 3.81E-04 | 1.54E-04 |
| R64 | 1.77E-08 | 1.20E-03 | 4.29E-04 | 2.99E-04 | 1.21E-04 |
| R65 | 1.83E-08 | 1.20E-03 | 4.46E-04 | 3.11E-04 | 1.25E-04 |
| R66 | 1.93E-08 | 1.30E-03 | 4.70E-04 | 3.28E-04 | 1.32E-04 |
| R67 | 2.14E-08 | 1.40E-03 | 5.21E-04 | 3.63E-04 | 1.47E-04 |
| R68 | 2.46E-08 | 1.70E-03 | 5.99E-04 | 4.17E-04 | 1.68E-04 |
| R69 | 1.56E-08 | 1.10E-03 | 3.80E-04 | 2.65E-04 | 1.07E-04 |
| R70 | 1.29E-08 | 8.68E-04 | 3.13E-04 | 2.18E-04 | 8.82E-05 |
| R71 | 1.65E-08 | 1.10E-03 | 4.02E-04 | 2.80E-04 | 1.13E-04 |
| R72 | 1.36E-08 | 9.18E-04 | 3.31E-04 | 2.31E-04 | 9.33E-05 |
| R73 | 1.65E-08 | 1.10E-03 | 4.00E-04 | 2.79E-04 | 1.13E-04 |
| R74 | 1.61E-08 | 1.10E-03 | 3.91E-04 | 2.72E-04 | 1.10E-04 |

| Receptor | Predicted 1-hour (99.9th %ile) concentration (mg·m$^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| R75 | 2.00E-08 | 1.30E-03 | 4.87E-04 | 3.39E-04 | 1.37E-04 |
| R76 | 1.90E-08 | 1.30E-03 | 4.61E-04 | 3.22E-04 | 1.30E-04 |
| R77 | 1.62E-08 | 1.10E-03 | 3.93E-04 | 2.74E-04 | 1.11E-04 |
| R78 | 1.77E-08 | 1.20E-03 | 4.31E-04 | 3.00E-04 | 1.21E-04 |
| R79 | 2.57E-08 | 1.70E-03 | 6.26E-04 | 4.36E-04 | 1.76E-04 |
| R80 | 2.63E-08 | 1.80E-03 | 6.40E-04 | 4.46E-04 | 1.80E-04 |
| R81 | 2.72E-08 | 1.80E-03 | 6.62E-04 | 4.61E-04 | 1.86E-04 |
| R82 | 3.30E-08 | 2.20E-03 | 8.03E-04 | 5.59E-04 | 2.26E-04 |
| R83 | 3.48E-08 | 2.30E-03 | 8.47E-04 | 5.91E-04 | 2.38E-04 |
| R84 | 4.34E-08 | 2.90E-03 | 1.10E-03 | 7.36E-04 | 2.97E-04 |
| R85 | 4.77E-08 | 3.20E-03 | 1.20E-03 | 8.08E-04 | 3.26E-04 |
| R86 | 4.38E-08 | 2.90E-03 | 1.10E-03 | 7.42E-04 | 2.99E-04 |
| R87 | 4.28E-08 | 2.90E-03 | 1.00E-03 | 7.25E-04 | 2.93E-04 |
| R88 | 5.96E-08 | 4.00E-03 | 1.40E-03 | 1.00E-03 | 4.08E-04 |
| R89 | 5.06E-08 | 3.40E-03 | 1.20E-03 | 8.57E-04 | 3.46E-04 |
| R90 | 3.20E-08 | 2.20E-03 | 7.78E-04 | 5.42E-04 | 2.19E-04 |
| R91 | 2.95E-08 | 2.00E-03 | 7.17E-04 | 5.00E-04 | 2.02E-04 |
| R92 | 2.51E-08 | 1.70E-03 | 6.11E-04 | 4.26E-04 | 1.72E-04 |
| R93 | 3.09E-08 | 2.10E-03 | 7.50E-04 | 5.23E-04 | 2.11E-04 |
| R94 | 4.74E-08 | 3.20E-03 | 1.20E-03 | 8.03E-04 | 3.24E-04 |
| R95 | 2.73E-08 | 1.80E-03 | 6.64E-04 | 4.63E-04 | 1.87E-04 |
| R96 | 4.05E-08 | 2.70E-03 | 9.84E-04 | 6.86E-04 | 2.77E-04 |
| R97 | 2.72E-08 | 1.80E-03 | 6.60E-04 | 4.60E-04 | 1.86E-04 |
| R98 | 3.19E-08 | 2.10E-03 | 7.75E-04 | 5.40E-04 | 2.18E-04 |
| R99 | 3.22E-08 | 2.20E-03 | 7.83E-04 | 5.46E-04 | 2.20E-04 |
| R100 | 3.08E-08 | 2.10E-03 | 7.49E-04 | 5.22E-04 | 2.11E-04 |
| R101 | 2.82E-08 | 1.90E-03 | 6.86E-04 | 4.78E-04 | 1.93E-04 |
| R102 | 2.96E-08 | 2.00E-03 | 7.20E-04 | 5.02E-04 | 2.03E-04 |
| R103 | 3.25E-08 | 2.20E-03 | 7.90E-04 | 5.51E-04 | 2.22E-04 |
| R104 | 2.92E-08 | 2.00E-03 | 7.09E-04 | 4.94E-04 | 2.00E-04 |
| R105 | 2.76E-08 | 1.90E-03 | 6.70E-04 | 4.67E-04 | 1.89E-04 |
| R106 | 2.73E-08 | 1.80E-03 | 6.63E-04 | 4.62E-04 | 1.86E-04 |
| R107 | 2.47E-08 | 1.70E-03 | 6.00E-04 | 4.18E-04 | 1.69E-04 |
| R108 | 2.03E-08 | 1.40E-03 | 4.93E-04 | 3.44E-04 | 1.39E-04 |
| R109 | 2.35E-08 | 1.60E-03 | 5.72E-04 | 3.99E-04 | 1.61E-04 |
| R110 | 2.43E-08 | 1.60E-03 | 5.90E-04 | 4.11E-04 | 1.66E-04 |
| R111 | 1.96E-08 | 1.30E-03 | 4.78E-04 | 3.33E-04 | 1.34E-04 |
| R112 | 2.46E-08 | 1.70E-03 | 5.99E-04 | 4.17E-04 | 1.68E-04 |
| R113 | 2.30E-08 | 1.50E-03 | 5.59E-04 | 3.90E-04 | 1.57E-04 |

| Receptor | Predicted 1-hour (99.9th %ile) concentration ($mg{\cdot}m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| R114 | 2.75E-08 | 1.90E-03 | 6.68E-04 | 4.66E-04 | 1.88E-04 |
| R115 | 2.87E-08 | 1.90E-03 | 6.98E-04 | 4.87E-04 | 1.96E-04 |
| R116 | 2.88E-08 | 1.90E-03 | 7.00E-04 | 4.88E-04 | 1.97E-04 |
| R117 | 2.90E-08 | 2.00E-03 | 7.05E-04 | 4.91E-04 | 1.98E-04 |
| R118 | 2.54E-08 | 1.70E-03 | 6.19E-04 | 4.31E-04 | 1.74E-04 |
| R119 | 1.88E-08 | 1.30E-03 | 4.58E-04 | 3.19E-04 | 1.29E-04 |
| R120 | 3.03E-08 | 2.00E-03 | 7.36E-04 | 5.13E-04 | 2.07E-04 |
| R121 | 5.52E-08 | 3.70E-03 | 1.30E-03 | 9.35E-04 | 3.77E-04 |
| R122 | 5.23E-08 | 3.50E-03 | 1.30E-03 | 8.87E-04 | 3.58E-04 |
| R123 | 3.65E-08 | 2.50E-03 | 8.89E-04 | 6.19E-04 | 2.50E-04 |
| R124 | 6.02E-08 | 4.10E-03 | 1.50E-03 | 1.00E-03 | 4.12E-04 |
| R125 | 4.09E-08 | 2.80E-03 | 9.96E-04 | 6.94E-04 | 2.80E-04 |
| R126 | 3.75E-08 | 2.50E-03 | 9.12E-04 | 6.36E-04 | 2.57E-04 |
| R127 | 7.71E-08 | 5.20E-03 | 1.90E-03 | 1.30E-03 | 5.28E-04 |
| R128 | 9.17E-08 | 6.20E-03 | 2.20E-03 | 1.60E-03 | 6.27E-04 |
| R129 | 2.50E-08 | 1.70E-03 | 6.08E-04 | 4.24E-04 | 1.71E-04 |
| R130 | 1.86E-08 | 1.30E-03 | 4.51E-04 | 3.15E-04 | 1.27E-04 |
| R131 | 1.81E-08 | 1.20E-03 | 4.40E-04 | 3.07E-04 | 1.24E-04 |
| R132 | 4.76E-08 | 3.20E-03 | 1.20E-03 | 8.07E-04 | 3.26E-04 |
| R133 | 3.11E-08 | 2.10E-03 | 7.56E-04 | 5.27E-04 | 2.13E-04 |
| R134 | 3.99E-08 | 2.70E-03 | 9.70E-04 | 6.76E-04 | 2.73E-04 |

Table F6 Predicted annual TSP, $PM_{10}$ and $PM_{2.5}$ concentrations – Scenario 2

| Receptor | Annual particulate matter concentration ($\mu g{\cdot}m^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TSP | | | $PM_{10}$ | | | $PM_{2.5}$ | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 90 | | | 25 | | | 8 | | |
| Max. % of criterion | < 0.1 | 37.2 | 37.2 | < 0.1 | 65.2 | 65.2 | < 0.1 | 72.5 | 72.5 |
| R1 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R2 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R3 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R4 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R5 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R6 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R7 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R8 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R9 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R10 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R11 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R12 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R13 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R14 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R15 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R16 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R17 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R18 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R19 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R20 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R21 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R22 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R23 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R24 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R25 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R26 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R27 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R28 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R29 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R30 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R31 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R32 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R33 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R34 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R35 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |

| Receptor | Annual particulate matter concentration ($\mu g \cdot m^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TSP | | | $PM_{10}$ | | | $PM_{2.5}$ | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R36 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R37 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R38 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R39 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R40 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R41 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R42 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R43 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R44 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R45 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R46 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R47 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R48 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R49 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R50 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R51 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R52 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R53 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R54 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R55 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R56 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R57 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R58 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R59 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R60 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R61 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R62 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R63 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R64 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R65 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R66 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R67 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R68 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R69 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R70 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R71 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R72 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R73 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R74 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R75 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |

| Receptor | Annual particulate matter concentration (µg·m⁻³) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TSP | | | $PM_{10}$ | | | $PM_{2.5}$ | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R76 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R77 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R78 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R79 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R80 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R81 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R82 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R83 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R84 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R85 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R86 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R87 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R88 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R89 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R90 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R91 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R92 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R93 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R94 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R95 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R96 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R97 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R98 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R99 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R100 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R101 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R102 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R103 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R104 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R105 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R106 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R107 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R108 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R109 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R110 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R111 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R112 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R113 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R114 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R115 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |

| Receptor | Annual particulate matter concentration (µg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TSP | | | $PM_{10}$ | | | $PM_{2.5}$ | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R116 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R117 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R118 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R119 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R120 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R121 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R122 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R123 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R124 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R125 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R126 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R127 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R128 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R129 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R130 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R131 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R132 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R133 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |
| R134 | < 0.1 | 33.5 | 33.5 | < 0.1 | 16.3 | 16.3 | < 0.1 | 5.8 | 5.8 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table F7 Predicted incremental 24-hour $PM_{10}$ and $PM_{2.5}$ concentrations – Scenario 2

| Receptor | Predicted incremental 24-hour concentration (µg·m$^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| Criterion | 50 | 25 |
| Max. % of criterion | 2.4 | 4.8 |
| R1 | 1.0 | 1.0 |
| R2 | 0.9 | 0.9 |
| R3 | 0.7 | 0.7 |
| R4 | 1.2 | 1.2 |
| R5 | 1.0 | 1.0 |
| R6 | 1.0 | 1.0 |
| R7 | 0.9 | 0.9 |
| R8 | 0.8 | 0.8 |
| R9 | 0.5 | 0.5 |
| R10 | 0.8 | 0.8 |
| R11 | 0.1 | 0.1 |
| R12 | 0.4 | 0.4 |
| R13 | 0.4 | 0.4 |
| R14 | 1.2 | 1.2 |
| R15 | 1.2 | 1.2 |
| R16 | 0.4 | 0.4 |
| R17 | 0.6 | 0.6 |
| R18 | 0.3 | 0.3 |
| R19 | 0.4 | 0.4 |
| R20 | 0.2 | 0.2 |
| R21 | 0.7 | 0.7 |
| R22 | 0.3 | 0.3 |
| R23 | 0.3 | 0.3 |
| R24 | 0.3 | 0.3 |
| R25 | 0.1 | 0.1 |
| R26 | 0.2 | 0.2 |
| R27 | 0.1 | 0.1 |
| R28 | 0.1 | 0.1 |
| R29 | 0.1 | 0.1 |
| R30 | 0.2 | 0.2 |
| R31 | 0.3 | 0.3 |
| R32 | 0.1 | 0.1 |
| R33 | 0.1 | 0.1 |
| R34 | 0.1 | 0.1 |
| R35 | 0.2 | 0.2 |
| R36 | 0.2 | 0.2 |

| Receptor | Predicted incremental 24-hour concentration (µg·m$^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| R37 | 0.2 | 0.2 |
| R38 | 0.2 | 0.2 |
| R39 | 0.2 | 0.2 |
| R40 | 0.2 | 0.2 |
| R41 | 0.1 | 0.1 |
| R42 | 0.1 | 0.1 |
| R43 | 0.1 | 0.1 |
| R44 | 0.1 | 0.1 |
| R45 | 0.1 | 0.1 |
| R46 | 0.1 | 0.1 |
| R47 | 0.2 | 0.2 |
| R48 | 0.3 | 0.3 |
| R49 | 0.3 | 0.3 |
| R50 | 0.1 | 0.1 |
| R51 | 0.1 | 0.1 |
| R52 | 0.1 | 0.1 |
| R53 | 0.1 | 0.1 |
| R54 | 0.1 | 0.1 |
| R55 | 0.1 | 0.1 |
| R56 | 0.1 | 0.1 |
| R57 | 0.1 | 0.1 |
| R58 | 0.1 | 0.1 |
| R59 | 0.1 | 0.1 |
| R60 | 0.1 | 0.1 |
| R61 | 0.1 | 0.1 |
| R62 | 0.1 | 0.1 |
| R63 | 0.1 | 0.1 |
| R64 | < 0.1 | < 0.1 |
| R65 | < 0.1 | < 0.1 |
| R66 | < 0.1 | < 0.1 |
| R67 | 0.1 | 0.1 |
| R68 | 0.1 | 0.1 |
| R69 | < 0.1 | < 0.1 |
| R70 | 0.1 | 0.1 |
| R71 | 0.1 | 0.1 |
| R72 | < 0.1 | < 0.1 |
| R73 | 0.1 | 0.1 |
| R74 | 0.1 | 0.1 |
| R75 | 0.1 | 0.1 |

| Receptor | Predicted incremental 24-hour concentration (µg·m$^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| R76 | 0.1 | 0.1 |
| R77 | 0.1 | 0.1 |
| R78 | 0.1 | 0.1 |
| R79 | 0.1 | 0.1 |
| R80 | 0.1 | 0.1 |
| R81 | 0.1 | 0.1 |
| R82 | 0.2 | 0.2 |
| R83 | 0.2 | 0.2 |
| R84 | 0.1 | 0.1 |
| R85 | 0.2 | 0.2 |
| R86 | 0.3 | 0.3 |
| R87 | 0.2 | 0.2 |
| R88 | 0.3 | 0.3 |
| R89 | 0.3 | 0.3 |
| R90 | 0.1 | 0.1 |
| R91 | 0.1 | 0.1 |
| R92 | 0.1 | 0.1 |
| R93 | 0.2 | 0.2 |
| R94 | 0.3 | 0.3 |
| R95 | 0.1 | 0.1 |
| R96 | 0.1 | 0.1 |
| R97 | 0.1 | 0.1 |
| R98 | 0.1 | 0.1 |
| R99 | 0.1 | 0.1 |
| R100 | 0.1 | 0.1 |
| R101 | 0.1 | 0.1 |
| R102 | 0.1 | 0.1 |
| R103 | 0.1 | 0.1 |
| R104 | 0.1 | 0.1 |
| R105 | 0.1 | 0.1 |
| R106 | 0.1 | 0.1 |
| R107 | 0.2 | 0.2 |
| R108 | 0.1 | 0.1 |
| R109 | 0.1 | 0.1 |
| R110 | 0.1 | 0.1 |
| R111 | 0.1 | 0.1 |
| R112 | 0.1 | 0.1 |
| R113 | 0.1 | 0.1 |
| R114 | 0.2 | 0.2 |
| R115 | 0.1 | 0.1 |

| Receptor | Predicted incremental 24-hour concentration (µg·m$^{-3}$) | |
|---|---|---|
| | $PM_{10}$ | $PM_{2.5}$ |
| R116 | 0.2 | 0.2 |
| R117 | 0.2 | 0.2 |
| R118 | 0.1 | 0.1 |
| R119 | 0.1 | 0.1 |
| R120 | 0.1 | 0.1 |
| R121 | 0.5 | 0.5 |
| R122 | 0.3 | 0.3 |
| R123 | 0.2 | 0.2 |
| R124 | 0.8 | 0.8 |
| R125 | 0.2 | 0.2 |
| R126 | 0.2 | 0.2 |
| R127 | 1.2 | 1.2 |
| R128 | 0.9 | 0.9 |
| R129 | 0.1 | 0.1 |
| R130 | 0.1 | 0.1 |
| R131 | 2.4 | 4.8 |
| R132 | 1.0 | 1.0 |
| R133 | 0.9 | 0.9 |
| R134 | 0.7 | 0.7 |

Table F8 Predicted 1-hour and annual $NO_2$ concentrations – Scenario 2

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g \cdot m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | Annual | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 164 | | | 31 | | |
| Max % of criterion | 9.8 | 18.8 | 25.0 | < 0.1 | 26.8 | 26.8 |
| R1 | 6.7 | 4.1 | 10.8 | < 0.1 | 8.3 | 8.3 |
| R2 | 11.8 | 2.0 | 13.9 | < 0.1 | 8.3 | 8.3 |
| R3 | 7.6 | 6.1 | 13.7 | < 0.1 | 8.3 | 8.3 |
| R4 | 7.7 | 10.2 | 17.9 | < 0.1 | 8.3 | 8.3 |
| R5 | 11.4 | 4.1 | 15.5 | < 0.1 | 8.3 | 8.3 |
| R6 | 8.7 | 6.1 | 14.9 | < 0.1 | 8.3 | 8.3 |
| R7 | 9.7 | 6.1 | 15.9 | < 0.1 | 8.3 | 8.3 |
| R8 | 7.8 | 4.1 | 11.9 | < 0.1 | 8.3 | 8.3 |
| R9 | 8.6 | < 0.1 | 8.6 | < 0.1 | 8.3 | 8.3 |
| R10 | 5.8 | 4.1 | 9.9 | < 0.1 | 8.3 | 8.3 |
| R11 | 12.7 | 12.3 | 25.0 | < 0.1 | 8.3 | 8.3 |
| R12 | 9.1 | 8.2 | 17.3 | < 0.1 | 8.3 | 8.3 |
| R13 | 15.7 | < 0.1 | 15.7 | < 0.1 | 8.3 | 8.3 |
| R14 | 12.9 | 12.3 | 25.2 | < 0.1 | 8.3 | 8.3 |
| R15 | 14.7 | 12.3 | 27.0 | < 0.1 | 8.3 | 8.3 |
| R16 | 8.3 | 2.0 | 10.3 | < 0.1 | 8.3 | 8.3 |
| R17 | 11.6 | 10.2 | 21.9 | < 0.1 | 8.3 | 8.3 |
| R18 | 8.5 | 6.1 | 14.6 | < 0.1 | 8.3 | 8.3 |
| R19 | 8.5 | 2.0 | 10.5 | < 0.1 | 8.3 | 8.3 |
| R20 | 7.8 | 16.4 | 24.2 | < 0.1 | 8.3 | 8.3 |
| R21 | 8.6 | 4.1 | 12.7 | < 0.1 | 8.3 | 8.3 |
| R22 | 10.7 | 2.0 | 12.7 | < 0.1 | 8.3 | 8.3 |
| R23 | 7.1 | 4.1 | 11.2 | < 0.1 | 8.3 | 8.3 |
| R24 | 13.9 | 12.3 | 26.2 | < 0.1 | 8.3 | 8.3 |
| R25 | 5.5 | 22.6 | 28.0 | < 0.1 | 8.3 | 8.3 |
| R26 | 11.6 | 14.3 | 25.9 | < 0.1 | 8.3 | 8.3 |
| R27 | 10.4 | 12.3 | 22.7 | < 0.1 | 8.3 | 8.3 |
| R28 | 12.6 | 12.3 | 24.9 | < 0.1 | 8.3 | 8.3 |
| R29 | 1< 0.1 | 10.2 | 20.2 | < 0.1 | 8.3 | 8.3 |
| R30 | 12.5 | 12.3 | 24.8 | < 0.1 | 8.3 | 8.3 |
| R31 | 10.2 | 6.1 | 16.3 | < 0.1 | 8.3 | 8.3 |
| R32 | 9.5 | 14.3 | 23.9 | < 0.1 | 8.3 | 8.3 |
| R33 | 8.5 | 14.3 | 22.9 | < 0.1 | 8.3 | 8.3 |
| R34 | 8.4 | 24.6 | 33.0 | < 0.1 | 8.3 | 8.3 |
| R35 | 7.9 | 14.3 | 22.3 | < 0.1 | 8.3 | 8.3 |
| R36 | 6.8 | 2.0 | 8.8 | < 0.1 | 8.3 | 8.3 |

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g \cdot m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | Annual | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R37 | 9.1 | 2.0 | 11.1 | < 0.1 | 8.3 | 8.3 |
| R38 | 9.3 | 8.2 | 17.5 | < 0.1 | 8.3 | 8.3 |
| R39 | 6.2 | 4.1 | 10.3 | < 0.1 | 8.3 | 8.3 |
| R40 | 6.2 | 8.2 | 14.4 | < 0.1 | 8.3 | 8.3 |
| R41 | 9.4 | 16.4 | 25.8 | < 0.1 | 8.3 | 8.3 |
| R42 | 9.0 | 16.4 | 25.4 | < 0.1 | 8.3 | 8.3 |
| R43 | 7.7 | 14.3 | 22.1 | < 0.1 | 8.3 | 8.3 |
| R44 | 9.1 | 14.3 | 23.4 | < 0.1 | 8.3 | 8.3 |
| R45 | 8.9 | 14.3 | 23.2 | < 0.1 | 8.3 | 8.3 |
| R46 | 8.3 | 24.6 | 32.9 | < 0.1 | 8.3 | 8.3 |
| R47 | 8.0 | 6.1 | 14.2 | < 0.1 | 8.3 | 8.3 |
| R48 | 8.2 | 8.2 | 16.4 | < 0.1 | 8.3 | 8.3 |
| R49 | 7.2 | 4.1 | 11.3 | < 0.1 | 8.3 | 8.3 |
| R50 | 4.7 | 6.1 | 10.8 | < 0.1 | 8.3 | 8.3 |
| R51 | 8.7 | 2.0 | 10.8 | < 0.1 | 8.3 | 8.3 |
| R52 | 5.0 | 4.1 | 9.1 | < 0.1 | 8.3 | 8.3 |
| R53 | 8.3 | < 0.1 | 8.3 | < 0.1 | 8.3 | 8.3 |
| R54 | 7.6 | < 0.1 | 7.6 | < 0.1 | 8.3 | 8.3 |
| R55 | 4.6 | 6.1 | 10.7 | < 0.1 | 8.3 | 8.3 |
| R56 | 8.8 | 14.3 | 23.1 | < 0.1 | 8.3 | 8.3 |
| R57 | 7.7 | 24.6 | 32.3 | < 0.1 | 8.3 | 8.3 |
| R58 | 10.9 | 2.0 | 13.0 | < 0.1 | 8.3 | 8.3 |
| R59 | 9.6 | 2.0 | 11.7 | < 0.1 | 8.3 | 8.3 |
| R60 | 9.3 | 8.2 | 17.5 | < 0.1 | 8.3 | 8.3 |
| R61 | 12.0 | 4.1 | 16.1 | < 0.1 | 8.3 | 8.3 |
| R62 | 8.6 | 10.2 | 18.8 | < 0.1 | 8.3 | 8.3 |
| R63 | 6.6 | 16.4 | 23.0 | < 0.1 | 8.3 | 8.3 |
| R64 | 6.7 | 6.1 | 12.9 | < 0.1 | 8.3 | 8.3 |
| R65 | 6.1 | 6.1 | 12.3 | < 0.1 | 8.3 | 8.3 |
| R66 | 4.9 | 6.1 | 11.0 | < 0.1 | 8.3 | 8.3 |
| R67 | 13.1 | < 0.1 | 13.1 | < 0.1 | 8.3 | 8.3 |
| R68 | 1< 0.1 | < 0.1 | 1< 0.1 | < 0.1 | 8.3 | 8.3 |
| R69 | 7.5 | < 0.1 | 7.5 | < 0.1 | 8.3 | 8.3 |
| R70 | 7.8 | 6.1 | 14.0 | < 0.1 | 8.3 | 8.3 |
| R71 | 5.3 | 10.2 | 15.5 | < 0.1 | 8.3 | 8.3 |
| R72 | 5.2 | 10.2 | 15.5 | < 0.1 | 8.3 | 8.3 |
| R73 | 11.3 | 4.1 | 15.4 | < 0.1 | 8.3 | 8.3 |
| R74 | 9.6 | 6.1 | 15.8 | < 0.1 | 8.3 | 8.3 |
| R75 | 8.2 | 30.8 | 39.0 | < 0.1 | 8.3 | 8.3 |

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g \cdot m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | Annual | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R76 | 8.5 | 12.3 | 20.8 | < 0.1 | 8.3 | 8.3 |
| R77 | 6.3 | 16.4 | 22.7 | < 0.1 | 8.3 | 8.3 |
| R78 | 6.1 | 18.4 | 24.5 | < 0.1 | 8.3 | 8.3 |
| R79 | 12.2 | 12.3 | 24.5 | < 0.1 | 8.3 | 8.3 |
| R80 | 12.0 | 12.3 | 24.3 | < 0.1 | 8.3 | 8.3 |
| R81 | 13.2 | 10.2 | 23.4 | < 0.1 | 8.3 | 8.3 |
| R82 | 8.1 | 10.2 | 18.4 | < 0.1 | 8.3 | 8.3 |
| R83 | 9.3 | 10.2 | 19.6 | < 0.1 | 8.3 | 8.3 |
| R84 | 10.3 | 30.8 | 41.0 | < 0.1 | 8.3 | 8.3 |
| R85 | 13.0 | 6.1 | 19.1 | < 0.1 | 8.3 | 8.3 |
| R86 | 9.4 | 6.1 | 15.6 | < 0.1 | 8.3 | 8.3 |
| R87 | 11.9 | 4.1 | 16.0 | < 0.1 | 8.3 | 8.3 |
| R88 | 10.6 | 2.0 | 12.7 | < 0.1 | 8.3 | 8.3 |
| R89 | 8.8 | 2.0 | 10.9 | < 0.1 | 8.3 | 8.3 |
| R90 | 14.1 | 2.0 | 16.1 | < 0.1 | 8.3 | 8.3 |
| R91 | 10.3 | < 0.1 | 10.3 | < 0.1 | 8.3 | 8.3 |
| R92 | 12.3 | 2.0 | 14.3 | < 0.1 | 8.3 | 8.3 |
| R93 | 13.9 | 4.1 | 18.0 | < 0.1 | 8.3 | 8.3 |
| R94 | 14.1 | 4.1 | 18.2 | < 0.1 | 8.3 | 8.3 |
| R95 | 12.8 | < 0.1 | 12.8 | < 0.1 | 8.3 | 8.3 |
| R96 | 12.2 | < 0.1 | 12.2 | < 0.1 | 8.3 | 8.3 |
| R97 | 16.0 | < 0.1 | 16.0 | < 0.1 | 8.3 | 8.3 |
| R98 | 8.7 | 8.2 | 16.9 | < 0.1 | 8.3 | 8.3 |
| R99 | 11.1 | < 0.1 | 11.1 | < 0.1 | 8.3 | 8.3 |
| R100 | 11.2 | 2.0 | 13.3 | < 0.1 | 8.3 | 8.3 |
| R101 | 10.6 | 2.0 | 12.6 | < 0.1 | 8.3 | 8.3 |
| R102 | 12.5 | < 0.1 | 12.5 | < 0.1 | 8.3 | 8.3 |
| R103 | 14.1 | 6.1 | 20.3 | < 0.1 | 8.3 | 8.3 |
| R104 | 13.7 | < 0.1 | 13.7 | < 0.1 | 8.3 | 8.3 |
| R105 | 14.3 | < 0.1 | 14.3 | < 0.1 | 8.3 | 8.3 |
| R106 | 11.9 | 4.1 | 16.0 | < 0.1 | 8.3 | 8.3 |
| R107 | 10.8 | 8.2 | 19.0 | < 0.1 | 8.3 | 8.3 |
| R108 | 8.5 | 8.2 | 16.7 | < 0.1 | 8.3 | 8.3 |
| R109 | 9.9 | 8.2 | 18.1 | < 0.1 | 8.3 | 8.3 |
| R110 | 12.3 | < 0.1 | 12.3 | < 0.1 | 8.3 | 8.3 |
| R111 | 7.3 | 10.2 | 17.5 | < 0.1 | 8.3 | 8.3 |
| R112 | 4.8 | 10.2 | 15.1 | < 0.1 | 8.3 | 8.3 |
| R113 | 6.1 | 8.2 | 14.3 | < 0.1 | 8.3 | 8.3 |
| R114 | 8.0 | 20.5 | 28.5 | < 0.1 | 8.3 | 8.3 |

| Receptor | Nitrogen dioxide ($NO_2$) concentration ($\mu g{\cdot}m^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | Annual | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R115 | 5.0 | 8.2 | 13.2 | < 0.1 | 8.3 | 8.3 |
| R116 | 8.7 | 12.3 | 21.0 | < 0.1 | 8.3 | 8.3 |
| R117 | 12.4 | 6.1 | 18.5 | < 0.1 | 8.3 | 8.3 |
| R118 | 6.3 | 8.2 | 14.5 | < 0.1 | 8.3 | 8.3 |
| R119 | 5.1 | 6.1 | 11.3 | < 0.1 | 8.3 | 8.3 |
| R120 | 4.3 | 10.2 | 14.6 | < 0.1 | 8.3 | 8.3 |
| R121 | 12.8 | 2.0 | 14.9 | < 0.1 | 8.3 | 8.3 |
| R122 | 9.8 | 10.2 | 2< 0.1 | < 0.1 | 8.3 | 8.3 |
| R123 | 6.5 | < 0.1 | 6.5 | < 0.1 | 8.3 | 8.3 |
| R124 | 9.8 | 2.0 | 11.8 | < 0.1 | 8.3 | 8.3 |
| R125 | 9.6 | 22.6 | 32.2 | < 0.1 | 8.3 | 8.3 |
| R126 | 11.3 | 26.6 | 38.0 | < 0.1 | 8.3 | 8.3 |
| R127 | 8.2 | 10.2 | 18.4 | < 0.1 | 8.3 | 8.3 |
| R128 | 12.8 | 6.1 | 19.0 | < 0.1 | 8.3 | 8.3 |
| R129 | 15.0 | < 0.1 | 15.0 | < 0.1 | 8.3 | 8.3 |
| R130 | 6.6 | 22.6 | 29.2 | < 0.1 | 8.3 | 8.3 |
| R131 | 6.7 | 8.2 | 14.9 | < 0.1 | 8.3 | 8.3 |
| R132 | 15.4 | < 0.1 | 15.4 | < 0.1 | 8.3 | 8.3 |
| R133 | 15.9 | 6.1 | 22.1 | < 0.1 | 8.3 | 8.3 |
| R134 | 10.2 | 2.0 | 12.2 | < 0.1 | 8.3 | 8.3 |

Table F9 Predicted 15-minutes, 1-hour and 8-hour CO concentrations – Scenario 2

| Receptor | Carbon monoxide (CO) concentration (mg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 100 | | | 30 | | | 10 | | |
| Max. % of criterion | < 0.1 | 0.8 | 0.8 | 0.1 | 2.1 | 2.1 | 0.2 | 2.3 | 2.4 |
| R1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R2 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R3 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R4 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R5 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R6 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 |
| R7 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R8 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R9 | < 0.1 | 0.3 | 0.4 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | 0.1 |
| R10 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | < 0.1 | 0.1 |
| R11 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R12 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R13 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R14 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R15 | < 0.1 | 0.3 | 0.4 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R16 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R17 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R18 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R19 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R20 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R21 | < 0.1 | 0.7 | 0.7 | < 0.1 | 0.5 | 0.5 | < 0.1 | < 0.1 | < 0.1 |
| R22 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R23 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | 0.1 | 0.2 |
| R24 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R25 | < 0.1 | 0.7 | 0.7 | < 0.1 | 0.5 | 0.5 | < 0.1 | < 0.1 | < 0.1 |
| R26 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R27 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R28 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R29 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R30 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R31 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R32 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R33 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R34 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R35 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | 0.1 |
| R36 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |

| Receptor | Carbon monoxide (CO) concentration (mg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R37 | < 0.1 | 0.3 | 0.4 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R38 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R39 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | 0.1 | 0.1 |
| R40 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R41 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R42 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R43 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R44 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R45 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R46 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R47 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | 0.1 |
| R48 | < 0.1 | 0.3 | 0.4 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.2 |
| R49 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | 0.1 | 0.2 |
| R50 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R51 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R52 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R53 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R54 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R55 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R56 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R57 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R58 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R59 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | 0.1 | 0.1 |
| R60 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R61 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R62 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R63 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R64 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R65 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R66 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R67 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R68 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R69 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R70 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R71 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R72 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R73 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R74 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R75 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |

| Receptor | Carbon monoxide (CO) concentration (mg·m$^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R76 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R77 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R78 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R79 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R80 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R81 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R82 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R83 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R84 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R85 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R86 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R87 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R88 | < 0.1 | 0.3 | 0.4 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | 0.1 |
| R89 | < 0.1 | 0.3 | 0.4 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | < 0.1 |
| R90 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R91 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R92 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R93 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | < 0.1 | < 0.1 |
| R94 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R95 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.2 | 0.2 |
| R96 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | < 0.1 | < 0.1 |
| R97 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R98 | < 0.1 | 0.8 | 0.8 | < 0.1 | 0.6 | 0.6 | < 0.1 | 0.1 | 0.1 |
| R99 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R100 | < 0.1 | 0.7 | 0.7 | < 0.1 | 0.5 | 0.5 | < 0.1 | < 0.1 | < 0.1 |
| R101 | < 0.1 | 0.7 | 0.7 | < 0.1 | 0.5 | 0.5 | < 0.1 | < 0.1 | < 0.1 |
| R102 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R103 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R104 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | < 0.1 |
| R105 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R106 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | < 0.1 | < 0.1 |
| R107 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R108 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R109 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R110 | < 0.1 | 0.5 | 0.5 | < 0.1 | 0.4 | 0.4 | < 0.1 | < 0.1 | < 0.1 |
| R111 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R112 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | < 0.1 |
| R113 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R114 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |

| Receptor | Carbon monoxide (CO) concentration ($mg \cdot m^{-3}$) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 15-minute | | | 1-hour | | | 8-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R115 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | < 0.1 |
| R116 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R117 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R118 | < 0.1 | 0.7 | 0.7 | < 0.1 | 0.5 | 0.5 | < 0.1 | < 0.1 | < 0.1 |
| R119 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |
| R120 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R121 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R122 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R123 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | < 0.1 |
| R124 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R125 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.1 | 0.1 |
| R126 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 | 0.1 |
| R127 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R128 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R129 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R130 | < 0.1 | 0.7 | 0.7 | < 0.1 | 0.5 | 0.5 | < 0.1 | < 0.1 | < 0.1 |
| R131 | < 0.1 | 0.8 | 0.8 | < 0.1 | 0.6 | 0.6 | < 0.1 | < 0.1 | < 0.1 |
| R132 | < 0.1 | 0.2 | 0.2 | < 0.1 | 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R133 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R134 | < 0.1 | 0.3 | 0.3 | < 0.1 | 0.3 | 0.3 | < 0.1 | < 0.1 | < 0.1 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table F10 Predicted 1-hour and 24-hour $SO_2$ concentrations – Scenario 2

| Receptor | Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| Criterion | 215 | | | 57 | | |
| Max. % of criterion | 0.1 | 6.7 | 6.7 | 0.1 | 14.4 | 14.6 |
| R1 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.2 | 0.3 |
| R2 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R3 | 0.1 | 2.9 | 3.0 | < 0.1 | < 0.1 | < 0.1 |
| R4 | 0.1 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 |
| R5 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R6 | 0.1 | 2.9 | 3.0 | < 0.1 | 0.4 | 0.4 |
| R7 | 0.1 | 5.7 | 5.8 | < 0.1 | 1.3 | 1.4 |
| R8 | 0.1 | 2.9 | 3.0 | < 0.1 | 1.3 | 1.3 |
| R9 | 0.3 | < 0.1 | 0.3 | < 0.1 | 0.6 | 0.6 |
| R10 | 0.2 | 2.9 | 3.0 | < 0.1 | 0.5 | 0.5 |
| R11 | 0.1 | 2.9 | 2.9 | < 0.1 | 1.7 | 1.7 |
| R12 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.4 | 0.4 |
| R13 | 0.1 | 2.9 | 3.0 | < 0.1 | < 0.1 | < 0.1 |
| R14 | 0.2 | < 0.1 | 0.2 | 0.1 | 5.8 | 5.9 |
| R15 | 0.2 | 2.9 | 3.0 | 0.1 | 8.2 | 8.3 |
| R16 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R17 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.2 | 0.3 |
| R18 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R19 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R20 | 0.1 | 2.9 | 2.9 | < 0.1 | 4.5 | 4.5 |
| R21 | 0.2 | 2.9 | 3.0 | < 0.1 | 0.5 | 0.5 |
| R22 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.5 | 0.5 |
| R23 | 0.2 | 2.9 | 3.0 | < 0.1 | 4.5 | 4.5 |
| R24 | 0.1 | 2.9 | 2.9 | < 0.1 | 4.2 | 4.2 |
| R25 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.4 | 0.4 |
| R26 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.5 | 0.5 |
| R27 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.3 | 1.3 |
| R28 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.7 | 1.7 |
| R29 | < 0.1 | 2.9 | 2.9 | < 0.1 | < 0.1 | < 0.1 |
| R30 | 0.1 | 2.9 | 2.9 | < 0.1 | 1.7 | 1.7 |
| R31 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.4 | 0.4 |
| R32 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.6 | 0.6 |
| R33 | 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R34 | 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R35 | 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R36 | 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |

| Receptor | Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R37 | 0.1 | 2.9 | 3.0 | < 0.1 | 4.5 | 4.5 |
| R38 | 0.1 | 2.9 | 2.9 | < 0.1 | 4.5 | 4.5 |
| R39 | 0.1 | 2.9 | 2.9 | < 0.1 | 4.5 | 4.5 |
| R40 | 0.1 | 2.9 | 2.9 | < 0.1 | 4.5 | 4.5 |
| R41 | 0.1 | 1.4 | 1.5 | < 0.1 | 4.5 | 4.5 |
| R42 | 0.1 | 1.4 | 1.5 | < 0.1 | 4.5 | 4.5 |
| R43 | 0.1 | < 0.1 | 0.1 | < 0.1 | 4.5 | 4.5 |
| R44 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.6 | 0.6 |
| R45 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.6 | 0.6 |
| R46 | 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R47 | 0.1 | 2.9 | 3.0 | < 0.1 | 2.5 | 2.5 |
| R48 | 0.1 | 2.9 | 3.0 | < 0.1 | 4.5 | 4.5 |
| R49 | 0.1 | 2.9 | 3.0 | < 0.1 | 4.5 | 4.5 |
| R50 | 0.1 | < 0.1 | 0.1 | < 0.1 | 4.5 | 4.5 |
| R51 | < 0.1 | 14.3 | 14.3 | < 0.1 | 4.5 | 4.5 |
| R52 | < 0.1 | 2.9 | 2.9 | < 0.1 | 4.5 | 4.5 |
| R53 | < 0.1 | 2.9 | 2.9 | < 0.1 | 2.9 | 2.9 |
| R54 | < 0.1 | 2.9 | 2.9 | < 0.1 | 2.9 | 2.9 |
| R55 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 4.5 | 4.5 |
| R56 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.6 | 0.6 |
| R57 | < 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R58 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.7 | 0.7 |
| R59 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.5 | 0.5 |
| R60 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.4 | 1.4 |
| R61 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.6 | 0.6 |
| R62 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.7 | 0.7 |
| R63 | < 0.1 | 1.4 | 1.5 | < 0.1 | 1.4 | 1.4 |
| R64 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.4 | 1.4 |
| R65 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.4 | 1.4 |
| R66 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 2.9 | 2.9 |
| R67 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.8 | 1.8 |
| R68 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.7 | 1.7 |
| R69 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.2 | 0.2 |
| R70 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.4 | 1.4 |
| R71 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 4.2 | 4.2 |
| R72 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.4 | 1.4 |
| R73 | < 0.1 | 2.9 | 2.9 | < 0.1 | 3.7 | 3.7 |
| R74 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.2 | 1.2 |
| R75 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.2 | 1.2 |

| Receptor | Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R76 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.3 | 1.3 |
| R77 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.7 | 1.7 |
| R78 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.3 | 1.3 |
| R79 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.7 | 1.7 |
| R80 | < 0.1 | 2.9 | 2.9 | < 0.1 | 1.7 | 1.7 |
| R81 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R82 | 0.1 | 2.9 | 2.9 | < 0.1 | < 0.1 | < 0.1 |
| R83 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.3 | 1.3 |
| R84 | 0.1 | 2.9 | 2.9 | < 0.1 | 1.2 | 1.2 |
| R85 | 0.1 | 2.9 | 2.9 | < 0.1 | 1.2 | 1.2 |
| R86 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.2 | 0.3 |
| R87 | 0.1 | 2.9 | 2.9 | < 0.1 | 0.6 | 0.6 |
| R88 | 0.2 | < 0.1 | 0.2 | < 0.1 | 0.6 | 0.6 |
| R89 | 0.2 | 2.9 | 3.0 | < 0.1 | 3.5 | 3.5 |
| R90 | 0.1 | < 0.1 | 0.1 | < 0.1 | 1.5 | 1.6 |
| R91 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 1.7 | 1.7 |
| R92 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.4 | 0.4 |
| R93 | 0.1 | < 0.1 | 0.1 | < 0.1 | 1.8 | 1.8 |
| R94 | 0.1 | < 0.1 | 0.1 | < 0.1 | 1.3 | 1.3 |
| R95 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.5 | 0.5 |
| R96 | 0.1 | 2.9 | 2.9 | < 0.1 | < 0.1 | < 0.1 |
| R97 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R98 | < 0.1 | 2.9 | 2.9 | < 0.1 | 2.1 | 2.1 |
| R99 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R100 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.5 | 0.5 |
| R101 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.5 | 0.5 |
| R102 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.5 | 0.5 |
| R103 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.8 | 0.8 |
| R104 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.1 | 0.1 |
| R105 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.8 | 0.8 |
| R106 | 0.1 | 2.9 | 2.9 | < 0.1 | 0.6 | 0.6 |
| R107 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R108 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R109 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R110 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.6 | 0.6 |
| R111 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R112 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.2 | 0.2 |
| R113 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.4 | 0.4 |
| R114 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | 0.1 | 0.1 |

| Receptor | Sulphur dioxide ($SO_2$) concentration (µg·m$^{-3}$) | | | | | |
|---|---|---|---|---|---|---|
| | 1-hour | | | 24-hour | | |
| | Incr. | Bkg. | Cumul. | Incr. | Bkg. | Cumul. |
| R115 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.2 | 0.2 |
| R116 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R117 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.4 | 0.4 |
| R118 | < 0.1 | 5.7 | 5.7 | < 0.1 | < 0.1 | < 0.1 |
| R119 | < 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R120 | < 0.1 | 1.4 | 1.4 | < 0.1 | 0.1 | 0.1 |
| R121 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.2 | 0.3 |
| R122 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.4 | 0.4 |
| R123 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.4 | 0.4 |
| R124 | 0.1 | < 0.1 | 0.1 | < 0.1 | 0.4 | 0.4 |
| R125 | 0.1 | 2.9 | 2.9 | < 0.1 | 2.5 | 2.5 |
| R126 | 0.1 | < 0.1 | 0.1 | < 0.1 | < 0.1 | < 0.1 |
| R127 | 0.1 | < 0.1 | 0.1 | 0.1 | < 0.1 | 0.1 |
| R128 | 0.2 | < 0.1 | 0.2 | < 0.1 | 5.8 | 5.9 |
| R129 | 0.1 | 2.9 | 2.9 | < 0.1 | < 0.1 | < 0.1 |
| R130 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.4 | 0.4 |
| R131 | < 0.1 | 2.9 | 2.9 | < 0.1 | 0.5 | 0.5 |
| R132 | 0.1 | < 0.1 | 0.1 | < 0.1 | 1.1 | 1.1 |
| R133 | 0.1 | 2.9 | 2.9 | < 0.1 | 0.8 | 0.8 |
| R134 | 0.1 | 2.9 | 2.9 | < 0.1 | 0.2 | 0.3 |

**Notes**: Incr. – Incremental, Bkg. – Background, - Cumul. – Cumulative.

Table F11 Predicted 1-hour (99.9th %ile) PAH and VOC concentrations – Scenario 2

| Receptor | Predicted 1-hour (99.9th %ile) concentration ($mg \cdot m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| Criterion | 0.0004 | 0.029 | 0.36 | 0.19 | 0.02 |
| Max. % of criterion | 0.0 | 0.4 | < 0.1 | < 0.1 | 0.1 |
| Max. % at boundary | 0.0 | 1.6 | < 0.1 | 0.1 | 0.2 |
| R1 | 1.40E-09 | 9.42E-05 | 3.40E-05 | 2.37E-05 | 9.57E-06 |
| R2 | 1.36E-09 | 9.14E-05 | 3.30E-05 | 2.30E-05 | 9.28E-06 |
| R3 | 1.22E-09 | 8.21E-05 | 2.96E-05 | 2.07E-05 | 8.34E-06 |
| R4 | 1.59E-09 | 1.07E-04 | 3.88E-05 | 2.70E-05 | 1.09E-05 |
| R5 | 1.37E-09 | 9.25E-05 | 3.34E-05 | 2.33E-05 | 9.39E-06 |
| R6 | 1.43E-09 | 9.63E-05 | 3.48E-05 | 2.42E-05 | 9.78E-06 |
| R7 | 1.33E-09 | 8.98E-05 | 3.24E-05 | 2.26E-05 | 9.12E-06 |
| R8 | 1.35E-09 | 9.11E-05 | 3.29E-05 | 2.29E-05 | 9.25E-06 |
| R9 | 1.01E-09 | 6.83E-05 | 2.47E-05 | 1.72E-05 | 6.94E-06 |
| R10 | 1.51E-09 | 1.01E-04 | 3.66E-05 | 2.55E-05 | 1.03E-05 |
| R11 | 2.82E-10 | 1.90E-05 | 6.86E-06 | 4.78E-06 | 1.93E-06 |
| R12 | 5.85E-10 | 3.94E-05 | 1.42E-05 | 9.92E-06 | 4.00E-06 |
| R13 | 8.48E-10 | 5.71E-05 | 2.06E-05 | 1.44E-05 | 5.80E-06 |
| R14 | 1.70E-09 | 1.14E-04 | 4.13E-05 | 2.88E-05 | 1.16E-05 |
| R15 | 1.72E-09 | 1.16E-04 | 4.18E-05 | 2.91E-05 | 1.17E-05 |
| R16 | 5.67E-10 | 3.82E-05 | 1.38E-05 | 9.60E-06 | 3.88E-06 |
| R17 | 8.22E-10 | 5.54E-05 | 2.00E-05 | 1.39E-05 | 5.62E-06 |
| R18 | 7.15E-10 | 4.81E-05 | 1.74E-05 | 1.21E-05 | 4.89E-06 |
| R19 | 6.26E-10 | 4.22E-05 | 1.52E-05 | 1.06E-05 | 4.28E-06 |
| R20 | 4.74E-10 | 3.20E-05 | 1.15E-05 | 8.04E-06 | 3.25E-06 |
| R21 | 1.42E-09 | 9.59E-05 | 3.46E-05 | 2.41E-05 | 9.74E-06 |
| R22 | 7.67E-10 | 5.17E-05 | 1.87E-05 | 1.30E-05 | 5.25E-06 |
| R23 | 7.13E-10 | 4.80E-05 | 1.73E-05 | 1.21E-05 | 4.88E-06 |
| R24 | 7.88E-10 | 5.31E-05 | 1.92E-05 | 1.33E-05 | 5.39E-06 |
| R25 | 1.49E-10 | 1.00E-05 | 3.62E-06 | 2.53E-06 | 1.02E-06 |
| R26 | 4.75E-10 | 3.20E-05 | 1.15E-05 | 8.05E-06 | 3.25E-06 |
| R27 | 2.19E-10 | 1.48E-05 | 5.34E-06 | 3.72E-06 | 1.50E-06 |
| R28 | 2.62E-10 | 1.76E-05 | 6.37E-06 | 4.44E-06 | 1.79E-06 |
| R29 | 2.88E-10 | 1.94E-05 | 7.00E-06 | 4.88E-06 | 1.97E-06 |
| R30 | 3.75E-10 | 2.53E-05 | 9.12E-06 | 6.36E-06 | 2.57E-06 |
| R31 | 6.08E-10 | 4.10E-05 | 1.48E-05 | 1.03E-05 | 4.16E-06 |
| R32 | 4.39E-10 | 2.96E-05 | 1.07E-05 | 7.44E-06 | 3.00E-06 |
| R33 | 4.18E-10 | 2.81E-05 | 1.02E-05 | 7.08E-06 | 2.86E-06 |
| R34 | 4.38E-10 | 2.95E-05 | 1.07E-05 | 7.43E-06 | 3.00E-06 |
| R35 | 4.98E-10 | 3.36E-05 | 1.21E-05 | 8.45E-06 | 3.41E-06 |

| Receptor | Predicted 1-hour (99.9th %ile) concentration ($mg \cdot m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| R36 | 5.87E-10 | 3.95E-05 | 1.43E-05 | 9.94E-06 | 4.01E-06 |
| R37 | 6.76E-10 | 4.55E-05 | 1.64E-05 | 1.15E-05 | 4.62E-06 |
| R38 | 6.46E-10 | 4.35E-05 | 1.57E-05 | 1.10E-05 | 4.42E-06 |
| R39 | 4.28E-10 | 2.88E-05 | 1.04E-05 | 7.25E-06 | 2.93E-06 |
| R40 | 4.80E-10 | 3.23E-05 | 1.17E-05 | 8.13E-06 | 3.28E-06 |
| R41 | 4.73E-10 | 3.18E-05 | 1.15E-05 | 8.01E-06 | 3.23E-06 |
| R42 | 4.57E-10 | 3.08E-05 | 1.11E-05 | 7.75E-06 | 3.13E-06 |
| R43 | 2.91E-10 | 1.96E-05 | 7.08E-06 | 4.94E-06 | 1.99E-06 |
| R44 | 2.72E-10 | 1.83E-05 | 6.62E-06 | 4.61E-06 | 1.86E-06 |
| R45 | 2.76E-10 | 1.86E-05 | 6.70E-06 | 4.67E-06 | 1.89E-06 |
| R46 | 4.00E-10 | 2.69E-05 | 9.72E-06 | 6.78E-06 | 2.74E-06 |
| R47 | 6.55E-10 | 4.41E-05 | 1.59E-05 | 1.11E-05 | 4.48E-06 |
| R48 | 8.03E-10 | 5.41E-05 | 1.95E-05 | 1.36E-05 | 5.50E-06 |
| R49 | 6.66E-10 | 4.48E-05 | 1.62E-05 | 1.13E-05 | 4.55E-06 |
| R50 | 3.12E-10 | 2.10E-05 | 7.58E-06 | 5.29E-06 | 2.13E-06 |
| R51 | 2.60E-10 | 1.75E-05 | 6.33E-06 | 4.41E-06 | 1.78E-06 |
| R52 | 2.53E-10 | 1.70E-05 | 6.14E-06 | 4.28E-06 | 1.73E-06 |
| R53 | 3.38E-10 | 2.28E-05 | 8.21E-06 | 5.72E-06 | 2.31E-06 |
| R54 | 3.32E-10 | 2.24E-05 | 8.08E-06 | 5.63E-06 | 2.27E-06 |
| R55 | 1.83E-10 | 1.23E-05 | 4.45E-06 | 3.10E-06 | 1.25E-06 |
| R56 | 1.97E-10 | 1.33E-05 | 4.80E-06 | 3.35E-06 | 1.35E-06 |
| R57 | 2.24E-10 | 1.51E-05 | 5.45E-06 | 3.80E-06 | 1.53E-06 |
| R58 | 2.83E-10 | 1.91E-05 | 6.89E-06 | 4.80E-06 | 1.94E-06 |
| R59 | 2.48E-10 | 1.67E-05 | 6.03E-06 | 4.20E-06 | 1.70E-06 |
| R60 | 2.32E-10 | 1.56E-05 | 5.64E-06 | 3.93E-06 | 1.59E-06 |
| R61 | 1.76E-10 | 1.19E-05 | 4.29E-06 | 2.99E-06 | 1.21E-06 |
| R62 | 1.57E-10 | 1.06E-05 | 3.83E-06 | 2.67E-06 | 1.08E-06 |
| R63 | 1.21E-10 | 8.17E-06 | 2.95E-06 | 2.06E-06 | 8.30E-07 |
| R64 | 1.27E-10 | 8.56E-06 | 3.09E-06 | 2.15E-06 | 8.69E-07 |
| R65 | 1.03E-10 | 6.93E-06 | 2.50E-06 | 1.74E-06 | 7.04E-07 |
| R66 | 1.05E-10 | 7.11E-06 | 2.56E-06 | 1.79E-06 | 7.22E-07 |
| R67 | 2.25E-10 | 1.52E-05 | 5.48E-06 | 3.82E-06 | 1.54E-06 |
| R68 | 2.91E-10 | 1.96E-05 | 7.08E-06 | 4.93E-06 | 1.99E-06 |
| R69 | 1.50E-10 | 1.01E-05 | 3.65E-06 | 2.55E-06 | 1.03E-06 |
| R70 | 1.05E-10 | 7.09E-06 | 2.56E-06 | 1.78E-06 | 7.21E-07 |
| R71 | 1.54E-10 | 1.04E-05 | 3.74E-06 | 2.61E-06 | 1.05E-06 |
| R72 | 1.36E-10 | 9.17E-06 | 3.31E-06 | 2.31E-06 | 9.31E-07 |
| R73 | 2.23E-10 | 1.50E-05 | 5.41E-06 | 3.77E-06 | 1.52E-06 |
| R74 | 1.35E-10 | 9.12E-06 | 3.29E-06 | 2.30E-06 | 9.27E-07 |

| Receptor | Predicted 1-hour (99.9th %ile) concentration (mg·m$^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| R75 | 1.98E-10 | 1.33E-05 | 4.81E-06 | 3.35E-06 | 1.35E-06 |
| R76 | 1.52E-10 | 1.03E-05 | 3.70E-06 | 2.58E-06 | 1.04E-06 |
| R77 | 1.39E-10 | 9.33E-06 | 3.37E-06 | 2.35E-06 | 9.48E-07 |
| R78 | 1.89E-10 | 1.27E-05 | 4.60E-06 | 3.21E-06 | 1.29E-06 |
| R79 | 2.30E-10 | 1.55E-05 | 5.58E-06 | 3.89E-06 | 1.57E-06 |
| R80 | 2.57E-10 | 1.73E-05 | 6.25E-06 | 4.36E-06 | 1.76E-06 |
| R81 | 2.95E-10 | 1.99E-05 | 7.18E-06 | 5.01E-06 | 2.02E-06 |
| R82 | 3.06E-10 | 2.06E-05 | 7.43E-06 | 5.18E-06 | 2.09E-06 |
| R83 | 3.93E-10 | 2.64E-05 | 9.55E-06 | 6.65E-06 | 2.69E-06 |
| R84 | 3.86E-10 | 2.60E-05 | 9.38E-06 | 6.53E-06 | 2.64E-06 |
| R85 | 5.49E-10 | 3.70E-05 | 1.33E-05 | 9.30E-06 | 3.75E-06 |
| R86 | 6.46E-10 | 4.35E-05 | 1.57E-05 | 1.09E-05 | 4.42E-06 |
| R87 | 5.48E-10 | 3.69E-05 | 1.33E-05 | 9.28E-06 | 3.75E-06 |
| R88 | 7.65E-10 | 5.15E-05 | 1.86E-05 | 1.30E-05 | 5.23E-06 |
| R89 | 8.77E-10 | 5.91E-05 | 2.13E-05 | 1.49E-05 | 6.00E-06 |
| R90 | 2.78E-10 | 1.87E-05 | 6.75E-06 | 4.70E-06 | 1.90E-06 |
| R91 | 3.95E-10 | 2.66E-05 | 9.60E-06 | 6.69E-06 | 2.70E-06 |
| R92 | 2.35E-10 | 1.58E-05 | 5.71E-06 | 3.98E-06 | 1.61E-06 |
| R93 | 4.04E-10 | 2.72E-05 | 9.83E-06 | 6.85E-06 | 2.76E-06 |
| R94 | 8.21E-10 | 5.53E-05 | 2.00E-05 | 1.39E-05 | 5.62E-06 |
| R95 | 4.13E-10 | 2.78E-05 | 1.00E-05 | 6.99E-06 | 2.82E-06 |
| R96 | 4.84E-10 | 3.26E-05 | 1.18E-05 | 8.20E-06 | 3.31E-06 |
| R97 | 4.33E-10 | 2.92E-05 | 1.05E-05 | 7.34E-06 | 2.96E-06 |
| R98 | 3.09E-10 | 2.08E-05 | 7.50E-06 | 5.23E-06 | 2.11E-06 |
| R99 | 3.99E-10 | 2.68E-05 | 9.69E-06 | 6.75E-06 | 2.73E-06 |
| R100 | 3.75E-10 | 2.53E-05 | 9.11E-06 | 6.35E-06 | 2.56E-06 |
| R101 | 3.80E-10 | 2.56E-05 | 9.23E-06 | 6.43E-06 | 2.60E-06 |
| R102 | 3.40E-10 | 2.29E-05 | 8.27E-06 | 5.77E-06 | 2.33E-06 |
| R103 | 4.16E-10 | 2.80E-05 | 1.01E-05 | 7.04E-06 | 2.84E-06 |
| R104 | 3.46E-10 | 2.33E-05 | 8.41E-06 | 5.86E-06 | 2.37E-06 |
| R105 | 2.87E-10 | 1.93E-05 | 6.98E-06 | 4.86E-06 | 1.96E-06 |
| R106 | 2.97E-10 | 2.00E-05 | 7.21E-06 | 5.03E-06 | 2.03E-06 |
| R107 | 2.75E-10 | 1.85E-05 | 6.69E-06 | 4.66E-06 | 1.88E-06 |
| R108 | 2.03E-10 | 1.37E-05 | 4.94E-06 | 3.44E-06 | 1.39E-06 |
| R109 | 2.26E-10 | 1.52E-05 | 5.49E-06 | 3.83E-06 | 1.55E-06 |
| R110 | 2.66E-10 | 1.79E-05 | 6.47E-06 | 4.51E-06 | 1.82E-06 |
| R111 | 1.73E-10 | 1.17E-05 | 4.21E-06 | 2.94E-06 | 1.19E-06 |
| R112 | 2.19E-10 | 1.47E-05 | 5.32E-06 | 3.71E-06 | 1.50E-06 |
| R113 | 1.57E-10 | 1.06E-05 | 3.81E-06 | 2.66E-06 | 1.07E-06 |

| Receptor | Predicted 1-hour (99.9th %ile) concentration ($mg \cdot m^{-3}$) | | | | |
|---|---|---|---|---|---|
| | PAHs | Benzene ($C_6H_6$) | Toluene ($C_7H_8$) (odour) | Xylene ($C_8H_{10}$) (odour) | Formaldehyde ($CH_2O$) |
| R114 | 3.52E-10 | 2.37E-05 | 8.55E-06 | 5.96E-06 | 2.41E-06 |
| R115 | 2.68E-10 | 1.81E-05 | 6.53E-06 | 4.55E-06 | 1.84E-06 |
| R116 | 2.37E-10 | 1.59E-05 | 5.75E-06 | 4.01E-06 | 1.62E-06 |
| R117 | 2.91E-10 | 1.96E-05 | 7.06E-06 | 4.92E-06 | 1.99E-06 |
| R118 | 2.11E-10 | 1.42E-05 | 5.14E-06 | 3.58E-06 | 1.45E-06 |
| R119 | 1.73E-10 | 1.16E-05 | 4.20E-06 | 2.93E-06 | 1.18E-06 |
| R120 | 1.73E-10 | 1.16E-05 | 4.20E-06 | 2.93E-06 | 1.18E-06 |
| R121 | 7.12E-10 | 4.80E-05 | 1.73E-05 | 1.21E-05 | 4.87E-06 |
| R122 | 5.73E-10 | 3.86E-05 | 1.39E-05 | 9.71E-06 | 3.92E-06 |
| R123 | 4.67E-10 | 3.15E-05 | 1.14E-05 | 7.91E-06 | 3.20E-06 |
| R124 | 1.22E-09 | 8.24E-05 | 2.97E-05 | 2.07E-05 | 8.37E-06 |
| R125 | 4.73E-10 | 3.18E-05 | 1.15E-05 | 8.01E-06 | 3.23E-06 |
| R126 | 4.03E-10 | 2.72E-05 | 9.81E-06 | 6.84E-06 | 2.76E-06 |
| R127 | 1.56E-09 | 1.05E-04 | 3.78E-05 | 2.64E-05 | 1.06E-05 |
| R128 | 1.49E-09 | 1.01E-04 | 3.63E-05 | 2.53E-05 | 1.02E-05 |
| R129 | 2.24E-10 | 1.51E-05 | 5.45E-06 | 3.80E-06 | 1.53E-06 |
| R130 | 2.25E-10 | 1.52E-05 | 5.48E-06 | 3.82E-06 | 1.54E-06 |
| R131 | 1.87E-10 | 1.26E-05 | 4.55E-06 | 3.17E-06 | 1.28E-06 |
| R132 | 6.96E-10 | 4.69E-05 | 1.69E-05 | 1.18E-05 | 4.76E-06 |
| R133 | 5.26E-10 | 3.54E-05 | 1.28E-05 | 8.91E-06 | 3.60E-06 |
| R134 | 5.15E-10 | 3.47E-05 | 1.25E-05 | 8.74E-06 | 3.53E-06 |

# APPENDIX G

## Review of Best Available Technologies (BAT)

The following additional controls demonstrate how air quality impacts could be further reduced through the application of Best Available Technologies (BAT), consistent with the operational and site-specific conditions of the Proposal. To prevent or minimise emissions during operation, BAT ensures through proper design, operation and maintenance, that emission control techniques are utilised at their optimal capacity and availability.

### Source – Pathway – Receptor Model

The source-pathway-receptor (SPR) model is useful for understanding the hypothetical relationships between contributing factors to create exposure linkages and also how controls may be applied to manage the risk of exposure from those linkages. Each component of the SPR model is defined below, as relates to the context of this AQIA:

- **Source** – the origin of air emissions, which in this case is the discharge points from the standby generators.
- **Pathway** – the route through which pollutants disperse from source to receptor. In this case the pathway assessed in through atmospheric dispersion which can be influenced by various parameters such as meteorological conditions, terrain, and characteristics of the emission source(s).
- **Receptor** – the presence of receptors that could be adversely affected by a contaminant. In this case receptors considered as the receptor locations identified in Section 4.2.

For air emissions to have an impact on the receiving environment, there needs to be a connection through the SPR model. This means that the source of pollution, the way it travels (pathway), and the affected area (receptor) must all be linked for there to be a potential risk.

Identification of the SPR model allows for targeted management interventions to manage the environmental risks and prevent pollution from reaching sensitive areas.

### Hierarchy of Controls

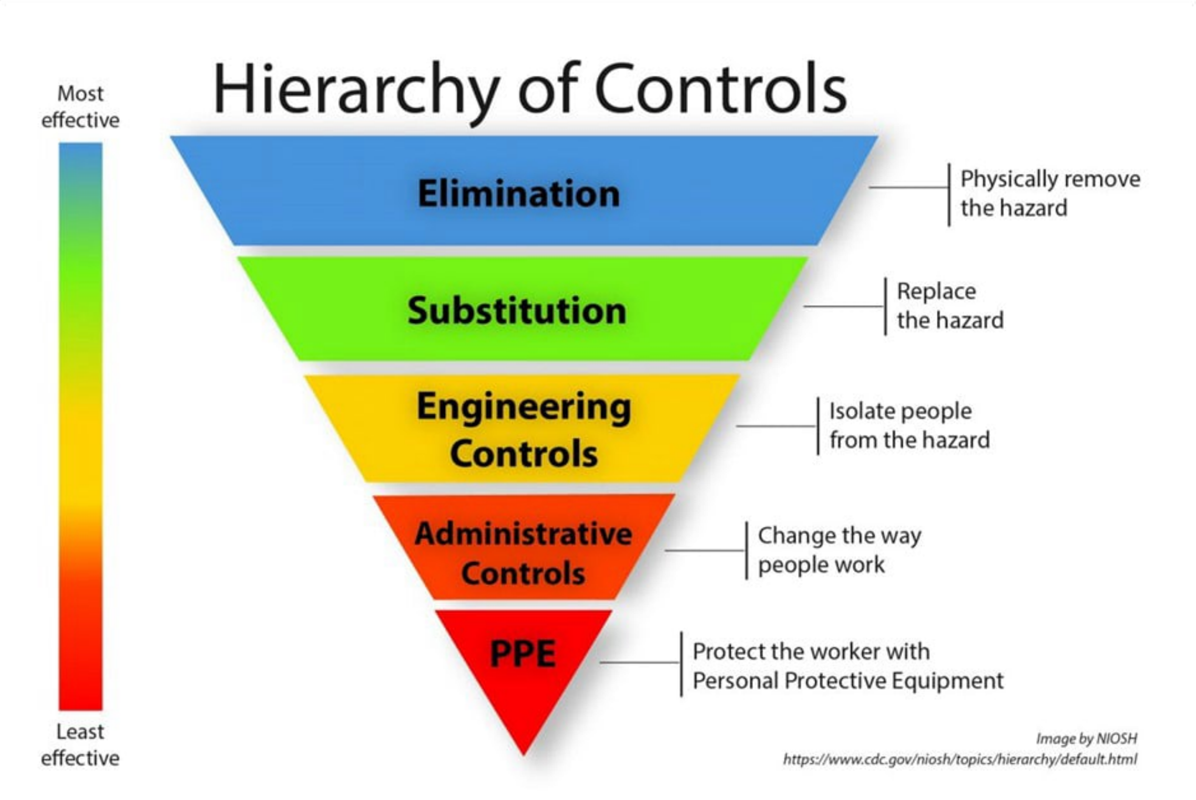
The hierarchy of controls are a well-documented and utilised tool for evaluating the efficacy and reliability for the control of hazards. An example of the hierarchy is presented in Figure F1.

The hierarchy of controls shows 'elimination' of the hazard as the most desirable control, through 'substitution ', 'engineering' and 'administrative controls' to 'PPE' (i.e. protection from the hazard at the point of exposure) being the least effective.

For each identified potential control that is subsequently evaluated below, each control has been given a unique identifier that is **[S*x*]**, **[P*x*]** or **[R*x*]** relating to how they fit into the SPR model and ***x*** being a sequential number (e.g. **[S1]**, **[S2]**, **[S3]**... for identified controls at source).

It is noted that these references may occur in multiple places in the following sections.

Figure F1 Hierarchy of controls




**Source**: Centres for Disease Control and Prevention (CDC) / National Institute for Occupational Safety & Health (NIOSH)

## Controls at Source

Air pollution controls at the source may involve the installation of emission control devices and adoption of efficient power generation techniques to minimise pollutant releases from the Proposal site.

### Selection of Generators

The capacity, number and configuration of the standby generators at the Proposal site will have been dependant on the requirements sought by the Applicant during the design phase of the development.

Key factors which may have influenced the selection of generators at the Proposal site include (in no order) fuel efficiency, reliability, capabilities to retrofit air pollution control (APC) techniques, start-up times and compliance with appropriate emissions limit values as specified in legislative and regulatory requirements.

The UK Environment Agency's working draft guide on the approach to the permitting and regulatory aspects for Data Centres (UK Environment Agency, 2018) notes that:

> *"It is generally accepted that the BAT for data centre back-up generation is presently a set of diesel generators – this allows for an on-site store of fuel for reliability and a scalable provision of MWelec."*

Other technologies identified for standby power generation purposes include the Diesel Rotary Uninterruptible Power Supply engine (DRUPS) and natural gas-fuelled standby generators utilising either combined-cycle or open-cycle gas turbine technologies or employing spark ignition.

In terms of generator selection for the Proposal site:

- Diesel engines can offer a faster response speed relative to the demanded load; making them a crucial component for data centre operations which require fast response times. Rapid start-up of standby generators is essential where a near instantaneous supply of electricity is imperative in the event of a power outage.
- Diesel engines typically have lower maintenance cost compared to gas-fired generators; and,
- Ensuring a reliable fuel supply, particularly diesel, is essential for maintaining dependability. Use of a natural gas generator for example would necessitate reliance on an off-site supply network.

In terms of pollutants, $NO_X$ is a predominant byproduct obtained from the combustion process. The adoption of low $NO_X$ engine technology would aide in reducing emissions at source. It is acknowledged that gas engines are known to emit lower amounts of $NO_X$, $SO_X$, and particulate matter (PM) in comparison to diesel fired engines.

As each generator has a unique specification for operating conditions (such as fuel consumption rate, operating temperature, and resultant emission specifications), the selection of generators to account for the different emission specification is a consideration for control **[S1]**.

In Chapter 3 of the BAT Reference Document (BREF) for Large Combustion Plants (LCP BREF) (Lecomte, et al., 2017) low $NO_x$ burners are described as employing a combination of air staging, fuel staging and internal flue-gas recirculation techniques to achieve low $NO_X$ emission from combustion. The control efficiency can vary depending on the specific design of the burner, the combustion technology applied and fuel type, with low $NO_x$ burners generally achieving between 20 % and 70 % of a reduction of $NO_x$ emissions (Lecomte, et al., 2017) **[S2]**.

### Emissions Standards

In NSW, standby generators are not required to comply with emissions standards as long as their operation does not exceed a specific annual hour limit or if maintenance and testing activities are conducted for less than a designated number of hours per year (refer Section 3.2).

Schedule 2 of the POEO CAR sets out emission limits relevant to standby electricity generators as both scheduled and non-scheduled activities. Table G1 outlines the respective standards of concentrations with regard to schedule 2 of the POEO CAR pertaining to this Proposal and AQIA.

Table G1 POEO CAR – Schedule 2 - General standards of concentrations for premises

| Air impurity | Activity or plant | Group | Concentration |
|---|---|---|---|
| **Schedule 2, Part 2, Division 2 – Electricity Generation** | | | |
| Solid particles (Total) | An activity or plant using a liquid or solid standard fuel or a non-standard fuel | Group 1 | 400 $mg{\cdot}m^{-3}$ |
| | | Group 2-4 | 250 $mg{\cdot}m^{-3}$ |
| | | Group 5 | 100 $mg{\cdot}m^{-3}$ |
| | | Group 6 | 50 $mg{\cdot}m^{-3}$ |
| Nitrogen dioxide ($NO_2$) or nitric oxide (NO) or both, as $NO_2$ equivalent | A turbine operating on a fuel other than gas, being a turbine used in connection with an electricity generating system with a capacity of 30 MW or more | Group 1-4 | 2 500 $mg{\cdot}m^{-3}$ |
| | | Group 5 | 150 $mg{\cdot}m^{-3}$ |
| | | Group 6 | 90 $mg{\cdot}m^{-3}$ |
| **Schedule 2, Part 3, Division 3 – General Activities and Plant** | | | |
| Solid particles (Total) | An activity or plant | Group 1 | 400 $mg{\cdot}m^{-3}$ |
| | | Group 2-4 | 250 $mg{\cdot}m^{-3}$ |
| | | Group 5 | 100 $mg{\cdot}m^{-3}$ |
| | | Group 6 | 50 $mg{\cdot}m^{-3}$ |
| Nitrogen dioxide ($NO_2$) or nitric oxide (NO) or both, as $NO_2$ equivalent | Stationary reciprocating internal combustion engines | Group 1-5 | - |
| | | Group 6 | 450 $mg{\cdot}m^{-3}$ |
| Volatile organic compounds (VOCs), as *n-propane* | A stationary reciprocating internal combustion engine using a liquid fuel | Group 1-5 | - |
| | | Group 6 | 1 140 $mg{\cdot}m^{-3}$ (as VOCs) |
| | | | 5 880 $mg{\cdot}m^{-3}$ (as CO) |
| Smoke | An activity or plant in connection with which liquid or gaseous fuel is burnt | Group 1-6 | 20 % opacity |
| **Schedule 2, Part 3 – Non-scheduled Premises** | | | |
| Solid particles (Total) | Any activity or plant (except as listed below) | Group A | 400 $mg{\cdot}m^{-3}$ |
| | | Group B | 250 $mg{\cdot}m^{-3}$ |
| | | Group C | 100 $mg{\cdot}m^{-3}$ |
| Smoke | Any activity or plant in connection with which liquid or gaseous fuel is burnt | Group A-C | 20 % opacity |

Standby generators in Australia commonly adhere to either United States (US) emissions standards (Tier 1 to Tier 4) or European Union (EU) emissions standards (Stage I to Stage V) due to the prevalent manufacturing of diesel engines in these regions.

The US non-road emissions standards are categorised by engine horsepower and model year as regulated by the United States Environmental Protection Agency (US EPA). Tier 1 standards were phased in from 1996 to 2000, followed by more stringent Tier 2 from 2001 to 2006 and Tier 3 from 2006 to 2008 (applicable to engines from 37 kW to 560 kW).

Current Tier 4 standards, implemented from 2008 to 2015 require around a 90 % reduction in $NO_x$ and PM emissions, achieved through exhaust gas aftertreatment technologies like SCR catalysts. The California Air Resources Board (CARB) is developing Tier 5 standards to be in place between 2028 and 2030, aiming to further reduce $NO_x$ and PM emissions by between 50 % - 90 %, which currently under consideration by the US EPA for adoption into their respective non-road engine regulations.

An air information report published by NSW EPA on the reduction of emissions from non-road diesel engines (NSW EPA, 2014) notes that tier 4 emission standards make provision for the following reductions compared to Tier 1 emission standards:

- *95 % reduction in NOx for engines less than 560 kW and 60% reduction for larger engines*
- *85 % reduction in HC for engines less than 560 kW and 70% reduction for larger engines, and*
- *50–60% reduction in PM during first phase (2008), and 80–95% reduction in second phase (2013–2015).*

Table G2 provides details of the corresponding US EPA Tier 1 to Tier 3 emissions standards for engines rated above 560 kW and Table G3 outlines the respective requirements under US EPA Tier 4 emissions standards.

**Table G2 US EPA Tier 1 to Tier 3 emissions standards – engines above 560 kW**

| Rated power | Tier | Model year | Emissions standards | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Units | CO | HC | NMHC + $NO_X$ | $NO_X$ | PM |
| ≥ 560 kW ( ≥ 750 hp) | Tier 1 | 2000 | g·kWh$^{-1}$ | 11.4 | 1.3 | - | 9.2 | 0.54 |
| | | | g·bhp-hr$^{-1}$ | 8.5 | 1.0 | - | 6.9 | 0.4 |
| | Tier 2 | 2006 | g·kWh$^{-1}$ | 3.5 | - | 6.4 | - | 0.2 |
| | | | g·bhp-hr$^{-1}$ | 2.6 | - | 4.8 | - | 0.15 |

**Note**: NMHC – non-methane hydrocarbon

**Table G3 US EPA Tier 4 emissions standards – engines above 560 kW**

| Model year | Category | Emissions standards | | | | |
|---|---|---|---|---|---|---|
| | | Units | CO | NMHC | $NO_x$ | PM |
| 2011 - 2014 | Generator sets > 900 kW | g·kWh$^{-1}$ | 3.5 | 0.40 | 0.67 | 0.10 |
| | | g·bhp-hr$^{-1}$ | 2.6 | 0.30 | 0.50 | 0.075 |
| | All engines except gensets > 900 kw | g·kWh$^{-1}$ | 3.5 | 0.40 | 3.5 | 0.10 |
| | | g·bhp-hr$^{-1}$ | 2.6 | 0.30 | 2.6 | 0.075 |
| 2015 | Generator sets | g·kWh$^{-1}$ | 3.5 | 0.19 | 0.67 | 0.03 |
| | | g·bhp-hr$^{-1}$ | 2.6 | 0.14 | 0.5 | 0.022 |
| | All engines except gensets | g·kWh$^{-1}$ | 3.5 | 0.19 | 3.5 | 0.04 |
| | | g·bhp-hr$^{-1}$ | 2.6 | 0.14 | 2.6 | 0.03 |

**Note**: NMHC – non-methane hydrocarbon

European emissions standards follow a tiered approach akin to the US and are driven by EU parliamentary directives. EU Stages I–IV were established under Directive 97/68/EC and subsequent amendments which apply to non-road mobile machinery and stationary engines including generators.

An overview of the key EU Stage emissions standards for diesel generators is provided below:

- **EU Stage I and II** – Early standards setting limits on $NO_X$, CO, HC, and PM emissions, phased in during the late 1990s and early 2000s.
- **EU Stage IIIA and IIIB** – Introduced tighter emissions limits with Stage IIIB requiring particulate filters to reduce PM emissions significantly. These stages correspond broadly to US EPA Tier 2 and Tier 3 standards.
- **EU Stage IV** – Requires advanced aftertreatment such as Selective Catalytic Reduction (SCR) and Diesel Particulate Filters (DPF) to meet lower $NO_X$ and PM limits, similar to US EPA Tier 4.
- **EU Stage V** – The latest regulations effective from 2019 to 2021, tightening limits further and setting particle number limits for some engine sizes. EU Stage V covers power ranges above 56 kW, including large generator engines. It drives adoption of the latest aftertreatment technologies and cleaner engine designs.

EU Directive 2015/2193 on Medium Combustion Plant (MCPD) establishes requirements for stationary combustion plants with a thermal rating of equal to or more than 1 MW and less than 50 MW with limits for $SO_2$, $NO_X$, and PM.

According to MCPD Article 6, emergency plants operating less than 500 hours per year, as a five-year rolling average, are exempt from emission limit values. Each generator with its own discharge stack under MCPD provisions can operate for testing or emergencies for up to 500 hours per calendar year without emission limit values (ELVs) under the MCPD. If generators share a common discharge stack the set can be tested and maintained without ELVs for up to 500 hours per year.

Further, the UK Environment Agency has issued BAT guidance[2] for emergency standby diesel generators where these form part of an Industrial Emissions Directive (IED) installation and are classed as MCPD plant operating up to 500 hours per year and exempt from ELVs. The guidance is applicable to emergency standby diesel engines that are located on combustion installations greater than 50 MWth, Part of an IED installation as a directly associated activity and classed as either static or mobile plant (excluding temporary mobile plant). The guidance focuses on minimising emissions of oxides of nitrogen ($NO_X$) through appropriate engine design ('build standards') and operational controls.

The UK Environment Agency note[2] that BAT requires that diesel engines are emissions optimised rather than fuel optimised. Engines optimised primarily for fuel efficiency are considered to have higher emissions and would not meet BAT unless fitted with secondary abatement. Compliance with one or more of the following

[2] https://www.gov.uk/guidance/emergency-backup-diesel-engines-on-installations-best-available-techniques-bat

standards is considered acceptable evidence of BAT-compliant plant and would not require on site exhaust emission monitoring:

- Former 2g TA Luft standard; or
- US EPA Tier 2 (or equivalent).

Where engine performance data are provided, the achievement of the following guidance levels (not an ELV) would be considered indicative of an emissions optimised engine:

- Approximately 750 mg·m$^{-3}$ $NO_X$ (as $NO_2$) at 15 % $O_2$, standard temperature and pressure and dry (273 K, 101.3 kPa) - equivalent to 2 000 mg·m$^{-3}$ $NO_X$ at 5 % $O_2$ (commonly referred to as '2g') as measured at a typical emergency load (usually more than 67 % of standby power rating).

Engine specification sheets are typically provided as evidence of compliance with applicable design and emissions standards, noting that the UK Environment Agency may accept engines exceeding the 2g benchmark only in specific technical or safety circumstances (e.g. critical standby diesel applications), where such units nevertheless represent the best available option for the intended use.

Appendix E provides standby generator emissions data for $NO_X$ as derived from manufacturer specification sheets for the representative generator unit adopted within the AQIA. For context, the previously assessed Baudouin 16M55G3750/5 generator (Northstar, 2025; Northstar, 2026) reported $NO_x$ emissions of 3 813.5 mg·Nm$^{-3}$.

Subsequent to NSW EPA feedback regarding emissions performance justification (refer Table 3), the AQIA has been updated to be based on representative standby generator units compliant with United States Environmental Protection Agency (US EPA) Tier 2 emissions standards, including the Baudouin 16M55G6D2/5 as a nominated example **[S1]**. The manufacturer's technical datasheets for this unit (refer Appendix E) indicate measured $NO_x$ emissions of 2 603.3 mg·Nm$^{-3}$. While this remains above the UK Environment Agency 2g benchmark, it represents an improvement in emissions performance relative to the previously assessed generator technology.

Other non-road engine emissions in Europe adhere to EU Directive 2016/1628, known as the NRMM Regulation. This regulation sets emission limits for various power ranges and applications, outlining procedures for engine manufacturers to obtain type-approval. European Stage V standards, derived from Directive 2016/1628, mandates stringent limits on PM emissions, necessitating diesel particulate filters (DPFs) for non-road engines rated between 19 kW and 560 kW. Stage V emissions limits are also established for engines above 560 kW and examination of advanced aftertreatment technologies.

It is noted that no specific EU emissions standards explicitly covering diesel generators above 560 kW before the introduction of EU Stage V regulations as previous regulations such as EU Stages I through IV mainly targeted engines below 560 kW.

Table G4 provides the EU Stage V emissions limits for generators set engines rated above 560 kW.

**Table G4 EU Stage V emissions limits by engine category**

| Engine category | Ignition type | Net power (kW) | Date | Emission limit (g·kWh) | | | |
|---|---|---|---|---|---|---|---|
| | | | | CO | HC | $NO_x$ | PM |
| NRG-v-1<br>NRG-c-1 | All | P > 560 | 2019 | 3.5 | 0.19 | 0.67 | 0.035 |

Table G5 benchmarks emissions from the representative standby generator unit adopted within the AQIA against applicable international emissions standards, based on 100 % load operating conditions.

**Table G5 Benchmarking of emissions from representative standby generator against international standards**

| Pollutant | Baudouin 16M55G6D2/5 emissions ($g \cdot kWh^{-1}$) | Emission standard ($g \cdot kWh^{-1}$) | | |
|---|---|---|---|---|
| | | US EPA Tier 2 | US EPA Tier 4 | EU Stage V |
| $NO_X$ | 5.34 | 6.4 | 0.67 | 0.67 |
| CO | 0.56 | 3.5 | 3.5 | 3.5 |
| HC | 0.37 | - | 0.19 | 0.19 |
| PM | 0.09 | 0.2 | 0.03 | 0.035 |

**Note:** Compliance of the quoted international emissions standards.
Non-compliance of the quoted international emissions standards.

The results indicate that the Baudouin 16M55G6D2/5 generator **[S1]** demonstrates compliance with US EPA Tier 2 emissions standards (refer Appendix E). In comparison against more stringent international standards, the unit meets the listed carbon monoxide (CO) limits under US EPA Tier 4 and EU Stage V benchmark values, while exceeding the corresponding hydrocarbon (HC), particulate matter (PM) and nitrogen oxides ($NO_X$) benchmark limits without the use of additional exhaust after-treatment technologies such as selective catalytic reduction (SCR) and / or particulate filtration technologies.

At this time of assessment, NSW EPA has not prescribed specific 'best practice' advice pertaining to standby generator engine standards for data storage centre applications however have noted that that practical measures to minimise emissions include selection of diesel generators meeting US EPA Tier 2 $NO_X$ emission performance, reflecting the potential for reduced emissions and associated air quality impacts. In broader Australian and international contexts US EPA Tier 4 and EU Stage V engines equipped with after treatment systems such as Diesel Particulate Filters (DPF), Diesel Oxidation Catalysts (DOC) and SCR systems are generally regarded as representing best practice emission performance for continuously operated diesel plant.

While SCR is widely applied to achieve best practice $NO_X$ performance for continuously operated plant, its suitability for intermittent standby generators is considered more constrained. The feasibility and proportionality of advanced after-treatment technologies are discussed further below.

Under Scenario 1 (emergency power generation) the dispersion modelling indicates that short term $NO_2$ concentrations could exceed criteria in the vicinity of the Proposal site if all generators operate concurrently at 100 % (full) load. Considering the available electricity network reliability metrics (Endeavour Energy, 2025) (refer Figure 16 and Section 8.2.1) and the short duration of operation that all generators would be required for under an emergency power generation scenario, any potential impacts would be spatially limited.

Under Scenario 2 (maintenance testing) dispersion modelling indicates that $NO_2$ concentrations remain below short term criteria (refer Table 28) even when multiple generators are tested concurrently. The limited duration of operation controlled operating conditions and other management measures such as scheduling tests under favourable meteorological conditions would likely reduce potential impacts. Operational controls and best practice measures such as avoiding testing during periods of poor ambient air quality and managing generator operations would ensure that residual impacts on human health and the environment are minimised as far as reasonably practicable in alignment with BAT principles.

**Selection of Fuel**

The Proposal site utilises diesel for the purposes of standby power generation. Diesel is typically the fuel used for standby generators and reciprocating engines fuelled by low-sulphur diesel are the most common choice for other developments of this nature. Diesel fuel in Australia is subject to specified parameters governing environmental factors like sulphur and HC as well as operational considerations such as carbon residue and sediments which can impact engine performance.

Part 9 of the POEO CAR specifies limits on sulphur content within liquid fuel whereby clause 159(2) states:

> *"A person must not operate fuel burning equipment powered by a reciprocating internal combustion engine using diesel, if the fuel has a sulphur content of more than the sulphur content specified for diesel—*
>
> *(a) in a fuel standard determined under the Fuel Quality Standards Act 2000 of the Commonwealth, section 21, or*
>
> *(b) in an approval granted under the Fuel Quality Standards Act 2000 of the Commonwealth, section 13."*

The Fuel Standard (Automotive Diesel) Determination 2001, as authorised by the Fuel Quality Standard Act 2000 denotes that diesel fuels must not contain more than 10 $mg \cdot kg^{-1}$ (ppm) from 1 January 2009.

In the US, Tier 1 to Tier 3 non-road engine regulations permitted higher sulphur content (up to 0.5 %). To enable sulphur-sensitive after-treatment systems used in Tier 4 engines, such as catalytic particulate filters, the US EPA reduced allowable sulphur content in non-road diesel fuel to 15 ppm.

Hydrotreated Vegetable Oil (HVO) is an emerging renewable fuel source that is considered for standby power generation **[S3]**. HVO is a biofuel produced from waste fats and oils through hydrocracking or hydrogenation and has properties similar to diesel but burns cleaner and thus significantly lowers $CO_2$, $NO_X$ and particulate emissions. It provides a cost-effective alternative as it can be blended with diesel in any ratio and integrated into existing generator systems. When used alongside Selective Catalytic Reduction (SCR) technology, HVO further enhances $NO_x$ and particulate emissions reduction

Key properties of HVO include:

- Reliable performance in colder temperature;
- Low tendency for deposit formation in fuel systems;
- Compatibility with engine oil, without dilution issues;
- Potential for more efficient, low-emission diesel engines; and,
- Greenhouse gas emissions reduction between 50 % - 90 % depending on feedstock and blend.

Compared to diesel, HVO can reduce[3]:

- Fine particles (PM) by up to 33 %;
- Nitrogen oxides ($NO_X$) by up to 9 %;
- Hydrocarbons (HC) by up to 30 %;
- Carbon monoxide (CO) by up to 24 %;

HVO meets EN 15940 standards for paraffinic fuels and can blend with EN 590 diesel. The adoption of HVO is growing due to compatibility with existing generators and reduced initial costs. However, its current adoption is limited by supply chain constraints and higher costs. Supply chains are expanding to meet increasing demand which is essential for broader uptake in carbon reduction efforts. The Applicant has confirmed that the diesel generators selected are HVO compatible, allowing for migration to HVO fuels in the future once more robust supply chains are established in the region.

Other alternative fuel types identified through the desktop review include natural gas, propane, gasoline and liquefied natural gas (LNG). These fuels may provide gas engines with higher thermal efficiencies when compared to use over diesel generators. However, it is important to note that gas engines may come with relatively higher levels of investment, operating and maintenance costs. Additionally, whilst the use of gas engines may have the potential for lower $NO_x$ emissions compared to diesel engines there would be a reliance on the national gas grid for an uninterruptable supply which may not provide the Applicant with fuel security **[S4]**.

### On site Power and Energy Storage Solutions for Data Centres

Recent research on data centre sustainability and resilience highlights the increasing importance of on-site power and energy storage solutions to address grid constraints. A briefing released by the UK House of

[3] https://www.neste.be/sites/neste.com/files/neste_my_renewable_diesel_a4-factsheet_be-english.pdf

Commons Library (UK House Of Commons Library, 2025) notes that limited grid capacity can result in delays of several years to obtain permission to connect to the national electricity grid. To address this, the UK government has indicated it intends to explore on-site low-carbon generation, including small modular reactors (SMRs) and battery storage.

Building clean energy capacity on or near a data centre can supply power directly and reduce demands on the national grid even if it does not fully meet the data centre's energy requirements. EnergyUK has recommended that data centre operators be encouraged to install on-site generation capacity without delay. In the Republic of Ireland, the utilities regulator has proposed that new data centres connecting to the Dublin grid must have sufficient on-site or nearby generation to meet their energy demand in full.

On-site energy storage such as battery energy storage systems (BESS) and hydrogen fuel cells (HFCs) is identified as a key mechanism to manage the variability of renewable generation. Batteries store energy when supply is plentiful and discharge it when supply is low thus assisting to balance supply and demand. This approach is becoming increasingly attractive to data centre operators, particularly in markets with grid capacity constraints. A 2025 survey by Bloom Energy found that 27 % of US data centres are expected to be fully powered by on site generation by 2030, compared with only 1 % in previous years. While this generation may not always be renewable, it demonstrates a growing trend toward on-site energy solutions.

Given these challenges with grid access and the increasing focus on decarbonisation, alternative on-site low-carbon power solutions like BESS and HFCs may be considered.

Hydrogen ($H_2$) fuel cells (HFCs) **[S5]** present a promising pathway towards decarbonising data centre standby and auxiliary power[4]. When powered by green $H_2$, fuel cells can deliver near-zero carbon emissions with only water and heat as byproducts, making them attractive for hyperscale operators aiming to match sustainability targets. Major pilot and commercial demonstration projects, such as those by Microsoft and Caterpillar[5] have shown that HFC systems are technically capable of delivering reliable standby power to data centre operations by successfully supporting power loads for extended periods and performing well under challenging conditions (e.g., at high elevation and sub-zero temperatures). Modular scalability and integration with battery and grid systems can add resilience and operational flexibility.

However, several critical constraints remain for the widespread selection of HFCs as a primary backup solution:

- **Implementation Costs** – High initial capital expenditure on HFCs and associated storage / compression infrastructure; green $H_2$ supply is currently much more expensive than grid electricity or conventional fuels.
- **Regulatory Requirements** – On site $H_2$ use is governed by stringent safety and environmental regulations, and permitting remains a challenge within urban or densely built environments.

4 https://www.fastechus.com/blog/ai-evolution-hydrogen-sustainable-data-centers

5 https://www.powermag.com/hydrogen-fuel-cell-provides-backup-power-for-microsoft-data-center/

- **Environmental Impacts** – The carbon abatement potential directly depends on the source of $H_2$. Green $H_2$ provides full benefits, but 'grey' or 'blue' hydrogen still involve some fossil fuel use or lifecycle emissions. 'Pink' $H_2$ which is produced using nuclear energy offers significant carbon reduction potential however involves other environmental considerations.
- **Safety Implications** – $H_2$'s flammability, low ignition energy, and high storage pressure present greater fire / explosion risks than diesel, necessitating advanced monitoring, containment, and emergency management.
- **System Compatibility** – Adoption typically requires conversion from DC to AC, changes to site electrical architecture, adaptation of generator control logic, and significant re-engineering of mechanical systems for safe, on-demand hydrogen storage and fuel delivery.

Given these factors, HFCs are best viewed as an emerging and potentially transformative solution for decarbonising data centre power particularly where commercial-scale green $H_2$ and the necessary Proposal site infrastructure are available. In the current market, they are most feasible in demonstration or hybrid setups and are often paired with batteries and conventional generators to ensure both technical reliability and regulatory compliance.

Battery energy storage systems (BESS) [**S6**] are essentially large-scale rechargeable battery banks and have evolved from niche pilots to essential components in modern data centres which are driven by increasing power demand, the need for uninterrupted uptime, rising energy costs and sustainability goals. BESS provide near-instantaneous power standby which may eliminate reliance on diesel fuel, reduce operational maintenance and enable integration with renewable energy sources[6]. They offer key benefits including rapid response times, high reliability with built-in redundancy, lower operational costs through peak shaving and load management and significant reductions in carbon emissions. Additionally, BESS support grid stability and can participate in demand response programs which enhances overall energy efficiency and cost savings.

However, BESS adoption faces challenges such as high upfront capital costs, space and scalability limitations[7] especially for long-duration backup, complex integration with existing infrastructure and ongoing safety and lifecycle management requirements. Long-duration outages still pose difficulties as large battery banks to cover extended events can be prohibitively expensive, making diesel generators a necessary complement in many cases. Regulatory hurdles and dependence on grid-sourced electricity for charging may also constrain the full environmental benefits of BESS. While BESS offer transformative advantages and can align with Best Available Techniques (BAT) principles, current limitations mean they are most effective in hybrid strategies alongside diesel backup to provide comprehensive, resilient power solutions in large-scale data centres.

### Discharge Design

6 https://www.delfos.energy/blog-posts/data-centers-battery-storage-ensuring-reliable-sustainable-power

7 https://www.pv-magazine-australia.com/2025/10/15/dealing-with-demands-of-power-hungry-data-centres/

According to (UK Environment Agency, 2018) data centres can have short, below roof level emissions stacks, which can impact on the efficiency of dispersion of emissions. With reference to BAT, the following techniques are noted for the adequate dispersion of exhaust emissions:

1. Increased stack height;
2. Vertical discharge points;
3. Increased distances from buildings to be above roof line; and / or,
4. 'Common windshield' combining several individual flues.

The UK Environment Agency further note[2] that BAT requires that stack design promotes effective dispersion of exhaust emissions. Specifically, that stacks should be vertical and emissions should not be obstructed by caps, cowls or other impediments.

**Stack Height**

By raising the stack height, this can facilitate a higher level of dispersion of exhaust gases as they mix with the surrounding air beyond the stack plume. Although this does not decrease the pollutant concentration at source, this does aide in reducing pollutant concentrations at ground level. Elevating the stack height serves to mitigate the impact of building wake and the entrainment of emissions in the locality of the emission source.

When wind interacts with buildings or structures, turbulent eddies form on the downwind side, potentially forcing a stack plume down to the ground if it's located within approximately five times the height of the nearby structure. This turbulence is known as building downwash and can lead to increased ground-level pollutant concentrations downstream of the building or structure.

Elevating the stack height above the highest point of the building in which it is located (or nearby buildings) will help mitigate building downwash effects and reduce air quality impacts beyond the Proposal site, where feasible **[S7]**.

**Discharge Velocity**

Decreases in ground-level pollutant concentrations can be accomplished through improved mixing with the surrounding air once the exhaust gas plume terminates from the stack. A higher emission velocity generates increased momentum, increasing the height of the plume in the atmosphere beyond the stack exit point. This increased vertical mixing contributes to lower pollutant concentrations at surrounding receptors.

Any increase in discharge velocity should be considered alongside any improvements to the stack height to optimise plume dispersion conditions.

Increasing discharge velocities associated with the standby generators may be achieved by:

- Increasing the air extraction rate from the discharge point; and / or,
- Decreasing the physical dimensions of the discharge point; and / or,

- Addition of diluted air into the exhaust stream prior to discharge.

Exhaust stack restriction devices can regulate the corresponding exhaust flow through adjustment of the cross-sectional area of the stack at point of discharge **[S8]**

Enhanced discharge velocity may also be gained through the use of dilution fans (for example[8]). They operate by drawing in additional air below the point of discharge to increase volumetric flow and increasing discharge velocity. The effect of this is to significantly increase vertical momentum, which can increase the effective discharge height to conditions that are less affected by turbulent air flows over buildings and enhance dispersion.

They can be configured by multiple inlet manifold and variable speed drive fans to serve multiple discharge points, and as such may offer a practical solution for data centres that are designed with nested discharge points and have highly variable discharge flows **[S9]**.

**Discharge Temperature**

High stack exhaust temperatures **[S10]** can increase both buoyancy and plume rise dispersion conditions. Plumes tend to rise more rapidly when the associated gases are warmer compared to the atmospheric temperature, which in turn contributes to a higher plume rise which can affect the dispersion pattern.

Combustion modification such as changes to the flame temperature and $O_2$ content of the air-fuel (stoichiometric) mixture aim to reduce $NO_x$ pollution by ensuring that the fuel is burned completely or reducing the amount of nitrogen from the air that is burnt in the combustion process. Such approaches include lean burn, water injection, exhaust gas recirculation or low-$NO_x$ boiler designs that reduce the flame temperature.

Secondary abatement technologies such as SCR operate within a narrow temperature range. Operating at lighter loads typically results in emissions at lower temperature can result in poorer performance of SCR after treatment.

**Multi-Stack Configuration**

By physically bringing together the exhaust streams for multiple engines, it is possible to improve the mixing of flue gases with the surrounding air. This plume aggregation does not decrease the absolute quantities of pollutants being emitted however it can lead to enhanced plume dispersion which results in lower concentration at ground level.

A multi-flue stack configuration pertains to a chimney or exhaust system that contains several flues, where each generator can discharge independently through its own flue but is constrained within that stack. Multi-

[8] https://www.criticalairflow.com/site/assets/files/1080/critical_airflow_tristactech.pdf

flue stacks are common in facilities with multiple combustion processes. Each flue may lead to a specific emission control system or stack gas treatment unit.

A combined flue stack configuration involves the use of a single exhaust stack system for the collective discharge of combustion byproducts from various power generation sources. This serves as the termination point with each flue feeding into the shared exhaust system **[S11]**.

### Air Pollution Control

Air pollution control (APC) encompasses a range of technologies and strategies aimed at eliminating or minimising the release of pollutants into the atmosphere. With regard to standby power generation from diesel combustion, the application of exhaust aftertreatment technologies is common.

Known air pollution control technologies that are available to reduce diesel combustion pollutant emissions include:

- **Diesel Oxidisation Catalyst (DOC) –** use of a catalyst to promote the oxidation of CO and hydrocarbons (HC) contained in the diesel exhaust gas to produce $CO_2$ and water as byproducts.
- **Diesel Particulate Filters (DPF) –** filters particulate matter (PM) from the exhaust gas and is ' burned off' through either active of passive filter regeneration.
- **Selective Catalytic Reduction (SCR) –** emissions control method that reduces $NO_x$ emissions within exhaust gases by injecting a reducing agent which initiates a chemical reaction that converts $NO_x$ into $N_2$, water, and small amounts of $CO_2$.
- **Non-selective Catalytic Reduction (NSCR) –** use of a catalyst reaction to simultaneously reduce NOx, CO, and hydrocarbon (HC) to water, $CO_2$, and $N_2$.

A diesel oxidisation catalyst (DOC) is an aftertreatment component that is designed specifically for modern diesel engines to convert CO and HC and are commonly used alongside other emission control devices such as DPF and SCR systems. DOCs can achieve a higher level of performance with the use of low sulphur diesel. General information provided by the US Environmental Protection Agency[9] (US EPA) indicates that DOCs are typically effective at reducing emissions of particulate matter (PM) between 20 % to 40 %, HC emissions can be reduced between 40 % and 75 % and CO emissions between 10 % and 60 % **[S12]**.

A Diesel Particulate Filter (DPF) **[S13]** serves as an APC device aimed at minimising particulate matter (PM) emissions linked to diesel engine exhaust. Positioned downstream of the engine, the DPF employs a filtration medium, typically a porous ceramic filter, to capture PM. Subsequently, the accumulated PM undergoes combustion at elevated temperatures to ensure effective removal. This technology can be combined with other emissions controls including SCR and DOC as DPF has a limited effect on other pollutants such as $NO_X$.

[9] https://www.epa.gov/sites/default/files/2016-03/documents/420f10031.pdf

Passive regeneration takes place when the exhaust gas temperatures reach a level that initiates the combustion of collected PM within the DPF without the need for additional fuel, heat, or driver intervention. Conversely, Active regeneration may necessitate external sources of fuel or heat to elevate the DPF temperature to a point where the accumulated PM can be effectively combusted. The associated control efficiencies for DPF technology, as verified by US EPA[10] ranges between 85 % and 90 % for PM emissions **[S13]**.

Selective catalytic reduction (SCR) control devices **[S14]** is widely regarded as one of the most effective technologies for reducing $NO_X$ emissions from combustion sources. SCR systems inject a reducing agent, typically aqueous urea, into the exhaust stream where in the presence of a catalyst $NO_X$ is chemically reduced to nitrogen ($N_2$) and water vapour. In mobile source applications, an aqueous urea solution is typically preferred as the reductant.

The LCP BREF (Lecomte, et al., 2017) notes that, *"A higher $NO_X$ reduction is achieved with the use of several layers of catalyst. The technique design can be modular; a special catalyst and / or preheating can be used to cope with low loads or with a wide flue-gas temperature window."* It is performance dependent on catalyst type, configuration and operating temperature. Multiple catalyst layers and modular system designs can enhance performance and supplementary measures such as exhaust preheating may be required to extend operation across lower temperature ranges.

Effective $NO_X$ conversion occurs within a defined exhaust temperature window which is typically optimised between approximately 300 °C and 450 °C with reduced efficiency outside this range depending on catalyst formulation. Under optimal conditions, SCR systems can achieve $NO_X$ reductions in a range between approximately 70 % - 90 %.

For standby generators operating on an intermittent basis, the use of SCR presents practical constraints as effective operation requires sustained exhaust temperatures within the catalyst activation range. In a data centre context these generators are generally operated for short-duration maintenance testing carried out up to one (1) hour or during unplanned outages. Under these operating conditions, exhaust temperatures may not consistently reach or remain within the optimal range which reduces the $NO_X$ conversion efficiency. Low-load operation may also increase the risk of urea crystallisation and deposit formation which then leads to additional maintenance requirements.

To maintain catalyst temperature during short or low-load operation supplementary systems such as exhaust pre-heaters may be required which increases capital cost system complexity and operational oversight. For intermittently operated standby plant the capital and operational expenditure associated with SCR may therefore be disproportionate to the incremental emissions benefit when considered in the context of limited annual operating hours. In this context $NO_X$ emissions can be more effectively managed through operational

[10] https://www.epa.gov/sites/default/files/2016-03/documents/420f10029.pdf

controls and good combustion practices. These include optimised engine tuning minimising routine test durations, managing concurrent unit operation during testing where operationally feasible and scheduling testing during periods of favourable atmospheric dispersion.

Selective Non-Catalytic Reduction (SNCR) **[S15]** involves reducing $NO_X$ to $N_2$ through the reaction with ammonia ($NH_3$) or urea ($CH_4N_2O$) at a temperature between 800 °C and 1 100 °C for optimal reaction. The LCP BREF (Lecomte, et al., 2017) provides a technical description for SNCR, whereby, "*Using ammonia as a reagent, the following chemical reactions take place more or less at the same time. At the lower temperature, both reactions are too slow; at the higher temperature, the unwanted by-reaction dominates with an increase in $NO_X$ emissions.*"

In contrast to SCR technology, a catalyst is not required, which lowers investment and maintenance costs, and less space is required to house the SNCR technology at the generator location. The LCP BREF (Lecomte, et al., 2017) notes that SNCR cannot be applied to gas engines or turbines due to the residence time and temperature window required for operation. SNCR processes can typically achieve a $NO_X$ reduction level of between 30 % and 50 % (Lecomte, et al., 2017).

In NSCR technology, the engine exhaust flows through a catalyst bed where $NO_x$ is converted to $N_2$. Simultaneously, VOCs and CO undergo oxidation, resulting in the formation of water and $CO_2$ under optimal conditions.

A technical progress report on reciprocating engine emissions control (Chapman, 2004) notes that, *"For an NSCR system to operate optimally (i.e., to minimise $NO_x$ emissions), the inlet exhaust stream must have very low oxygen content, as well as proper concentrations of $NO_X$, hydrocarbons, and carbon monoxide. This requires initial engine adjustments, followed by careful monitoring of oxygen content in the exhaust."*

The catalyst demands exhaust with less than 0.5 % $O_2$ content. Although employing a fuel-rich mixture increases engine fuel consumption due to back pressure, it enables effective $NO_X$ control, typically achieving levels between 90 % and 98 %[11] **[S15]**.

Various standby generator manufacturers have developed retrofit emission control device (RECD) systems[12] based on electrostatic precipitation (ESP) fundamentals for use with diesel generator sets. The RECD is installed after the standby generator exhaust and no modifications to the exhaust are required. However, the RECD would have additional spacing requirements which may be constrained at the Proposal site **[S16]**.

Each air pollution control device identified in this section requires retrofitting to each standby generator (or each discharge point in the event of co-vented discharges), incurring associated costs. Retrofitting involves integrating or adding these devices to existing plant to enhance their emission control capabilities. The costs

11 https://www3.epa.gov/ttncatc1/dir1/fnoxdoc.pdf

12 http://www.jnmachineries.com/cummins_retrofit_emission_control_device.php

associated with this process include expenses for purchasing the control devices, installation, and potentially ongoing maintenance **[S13-S16]**.

### Controls in the Pathway

Enhancing the dilution and dispersion of a pollutant plume during its journey from the source to the receptor will lower the concentration at the receptor, subsequently minimising exposure. For instance, extending the pathway, such as by emitting emissions from a tall stack, will generally, under constant conditions, increase both dilution and dispersion conditions.

#### Green Infrastructure

The integration of Green Infrastructure (GI) in the environment has the potential to reduce the effectiveness of the pathway from the emission source to the receptor. Introducing natural elements, like vegetation or green spaces as contiguous barriers can disrupt the usual flow of pollutants by creating obstacles that impede the direct transmission of emissions. This interference promotes dispersion, dilution and absorption of pollutants by greenery which can aide in lowering the concentration of pollutants reaching the receptor.

Strategically placed Vegetative Environment Buffers (VEB) along the perimeter of industrial areas, abutting sensitive areas such as residential, child-care and educational facilities can aide in mitigation human exposure to air pollution.

According to recent research (Barwise & Kumar, 2020), the optimal configuration and plant composition of GI are unclear. Furthermore, the effectiveness of GI depends on factors such as the condition of the built environment, as well as the type, location and configuration of GI (Kumar, et al., 2019) **[P1]**.

#### Structural Barriers

Structural barriers such as sound walls or shelterbelts can influence the exposure pathway by obstructing the pollutant plume. These barriers can induce turbulence in the airflow thus leading to enhanced dispersion and are used in industrial settings to reduce direct exposure to emissions at receptors. These methods may be more feasible in comparison to GI which would also require additional considerations with regard to establishment and maintenance activities.

The Proposal site is located within a predominately industrial zone (refer Section 4.1) with residential land use, areas located adjacent to the north.

While the discharges are released at a height, the implementation of structural barriers may be limited to the immediate vicinity of the Proposal site due to the distance to sensitive land uses and the magnitude of the discharge and structural constraints due to the increased loads of such structures **[P2]**.

**Stack Height Optimisation**

Increasing the stack height can influence the dispersion pattern of pollutants emitted from a stack. A taller stack emits the discharge at greater height and into atmospheric conditions which can enhance more effective dispersion.

Stack heights may be increased through retrofitting, noting that the increased height may have an effect of duct pressure which may affect performance of APC devices.

Often, planning restrictions may also impose limitations on stack heights to limit other environmental effects such as visual impact and design aesthetics **[S4, P3]**.

### Controls at Receptors

**Air Filtration Systems**

Air filtration systems reduce indoor pollutant levels in buildings by extracting contaminants from airflow and commonly feature filters like activated carbon and HEPA filters, which capture airborne pollutants and particulates.

Research conducted by the Public Health Research & Practice[13] assessed the effectiveness of air filtration, particularly those utilising HEPA filtration, in residential settings, focusing on their potential to increase infiltration rates. The research focused on the quantification of HEPA filters in residential settings during smoke events and notes that:

> *"The percentage reduction of $PM_{2.5}$ attributable to using the HEPA cleaner, which ranged between 30 % and 75 %. Other international studies suggest that HEPA cleaners can provide approximately 52 % – 67% reductions in PM….*
>
> *The effectiveness of HEPA cleaners depends on several factors, including outdoor smoke concentrations, room size, housing characteristics and building ventilation"*

Commercial and industrial buildings in the surrounding environment likely incorporate air handling units (AHU) within their respective building design whilst residential dwellings may also have some uses.

This control is by definition only of value inside engineered airtight buildings and of limited value in non-airtight buildings (such as residential properties) and of no value in outdoor locations **[R1]**.

[13] https://www.phrp.com.au/issues/online-early/residential-indoor-air-quality-and-hepa-cleaner-use/

### Alerts and Alarms

Implementation of air quality monitoring networks and early warning systems can assist in safeguarding sensitive receptors in proximity to the Proposal site. These systems can detect pollutant levels in real-time and can issue timely alerts which can alert the local community to any potential pollution episodes. Alarm and alert systems that could be potentially implemented include:

- Real-time air quality monitoring stations that detect elevated levels of pollutants.
- Automated warning systems that send alerts via SMS, email, or mobile apps to the local community when pollution levels exceed any impact assessment criterion or predetermined thresholds.
- Integration of meteorological forecasting into air quality management.
- Online platforms or dashboards providing up-to-date information on air quality advisories for the community.

Increased community engagement, through mediums such as public forums, community advisory boards and meetings can help educate the local community to understand the Proposal site's procedures for standby power generation and the potential implications on air quality. The associated costs of implementing real time air quality monitoring and automated warning systems may not be viable given the likelihood of the Proposal site suffering a catastrophic power outage.

If implemented, each standby generator will feature operational alarms to alert in case of faults and will adhere to maintenance schedules and compliance monitoring programs to ensure emission control equipment functions correctly and complies with regulations. Regular testing and monitoring of the standby generators would incur costs **[R2]**.

### Summary

The feasibility of implementing the identified control options in the SPR model have been evaluated by considering the following factors:

- Implementations cost;
- Regulatory requirements;
- Environmental impacts;
- Safety implications; and,
- Compatibility with current processes.

This summary assesses the measures that may constrain the implementation of the control measures outlined above. Each measure is provided a risk rating (**low**, **medium**, or **high**) which identifies the constraints which may result in the implementation of the measure not being practical at the Proposal site. Where any of the measures of practicability are rated as high, these measures are not considered further.

It is noted that for the assessment of implementation costs, this review has adopted a relative and qualitative approach as follows:

- Low = $
- Medium = $$
- High = $$$

Table G6 provides a summary of the additional controls that could be employed at the Proposal site to minimise and reduce air pollution impacts from the standby generator operations.

Table G6 Practicality of implementing control measures at the Proposal site

| Control measure(s) | Potential Constraints | | | | | Conclusion of evaluation |
|---|---|---|---|---|---|---|
| | Implementation costs | Regulatory requirements | Environmental impacts | Safety implications | System compatibility | |
| **Controls at Source** | | | | | | |
| S1 generator specification | $$$ | Low | Low | Low | High | Selecting alternative generator sets would represent a high-cost option and would be difficult to implement once the facility is operational NSW EPA has indicated that practical measures include the selection of diesel generators meeting US EPA Tier 2 $NO_X$ emission performance, reflecting that improved emissions performance generators are available and may be reasonably and feasibly adopted to minimise emissions and associated impacts. |
| S2 low $NO_X$ burners | $$$ | Low | Low | Medium | Low | Change in designed operational conditions (combustion stability, heat exchange) represents some safety issues that would require due consideration.<br>May offer additional air pollution control however would require extensive retrofitting to each standby generator. |
| S3 use of HVO-100 as alternative to diesel fuel | $$ | Low | Low | Low | Low | HVO-compatible, drop-in renewable diesel (no engine modification required). Reduces lifecycle GHG emissions due to lower carbon intensity vs fossil diesel. Compatibility confirmed by Applicant. Practical option subject to regional fuel availability and supply chain maturity. |
| S4 other alternative fuels (LNG, natural gas, propane, gasoline) | $$ | Low | Low | High | High | Compatibility, storage and handling capabilities and combustion characteristics. Standby generators would require compatibility for renewable fuels which may require significant modification, and/or re-specification. |

| Control measure(s) | Potential Constraints | | | | | Conclusion of evaluation |
|---|---|---|---|---|---|---|
| | Implementation costs | Regulatory requirements | Environmental impacts | Safety implications | System compatibility | |
| S5 hydrogen fuel cells (HFCs) | $$$ | High | Medium | High | Medium | High upfront capital costs for HFC and storage infrastructure; green H2 fuel remains expensive currently. Dependent on source, green and pink H2 offer near-zero emissions, while grey / blue H2 emits some lifecycle carbon. H2's flammability, high pressure storage, and risk profiles require rigorous safety systems and emergency preparedness. Requires significant electrical and mechanical system modification from diesel or conventional backup systems, including DC-AC conversion and storage integration. |
| S6 battery energy storage system (BESS) | $$$ | Medium | Low | Medium | Medium | High upfront capital costs ($400-$600 per kWh or more), plus installation and integration expenses. Evolving safety and permitting standards can delay deployment, but guidance and experience exist. Generally positive, with zero local emissions and enabling renewables, though lifecycle impacts exist. Battery fire risk and thermal runaway require robust safety systems and maintenance. Complex integration with existing power infrastructure and controls needed for seamless operation. |
| S7 stack height | $ | Low | Low | Medium | Low | Requires compatibility with clearance requirements to negate building downwash effects, stability, and structural integrity considerations. May be considered feasible for implementation. |
| S8 increased stack velocities | $ | Low | Low | Medium | Low | Change in designed operational conditions which may then require structural integrity considerations to stack configuration. May be considered feasible for implementation. |

| Control measure(s) | Potential Constraints | | | | | Conclusion of evaluation |
|---|---|---|---|---|---|---|
| | Implementation costs | Regulatory requirements | Environmental impacts | Safety implications | System compatibility | |
| S9 dilution fans | $$ | Low | Low | Low | Medium | Higher capital cost but reduced operating cost due to inlet manifolds serving multiple discharges and variable drives. Retrofitting may require load considerations. |
| S10 stack temperature | $$ | Low | Low | Low | Low | Maintaining optimal stack temperature is critical to avoid wet stacking (incomplete combustion) which causes buildup of unburned fuel / carbon in the exhaust, affecting performance and emissions. Load management and periodic load banking are necessary to sustain temperature and ensure combustion efficiency. |
| S11 multi-stack configuration | $$ | Low | Low | Medium | Medium | Structural and maintenance considerations required from a design perspective. Additional works required to combine flues into a multi-stack configuration. Separating exhaust into multiple stacks may aide in optimises airflow, reducing backpressure, and enhancing generator performance. |
| S12 diesel oxidisation catalyst (DOC) | $$ | Low | Low | Medium | Low | Require additional design considerations and may offer additional air pollution control, requires retrofitting to each standby generator. |
| S13 diesel particulate filters (DPF) | $$ | Low | Low | Medium | Low | Require additional design considerations and may offer additional air pollution control, requires retrofitting to each standby generator. |
| S14 selective catalytic reduction (SCR) | $$ | Low | Low | Medium | Medium | Require additional design considerations and may offer additional air pollution control, requires retrofitting to each standby generator. |
| S15 non-selective catalytic reduction (NSCR) | $$ | Low | Low | Medium | Medium | Require additional design considerations and may offer additional air pollution control, would require retrofitting to each standby generator. |

| Control measure(s) | Potential Constraints | | | | | Conclusion of evaluation |
|---|---|---|---|---|---|---|
| | Implementation costs | Regulatory requirements | Environmental impacts | Safety implications | System compatibility | |
| S16 electrostatic precipitation (ESP) | $$ | Low | Low | Medium | Medium | Require additional design considerations and may offer additional air pollution control, would require retrofitting to each standby generator. |
| **Controls at Pathway** | | | | | | |
| P1 green infrastructure | $ | Low | Low | Low | Medium | Green infrastructure often supports compliance with local planning and environmental regulations, particularly for visual screening and noise abatement. Positive benefits include improved local air quality through pollutant filtration, enhanced aesthetics, biodiversity support, and microclimate cooling reducing local heat impacts from exhaust stacks. |
| P2 structural barriers | $$ | Medium | Low | Medium | Low | Require compliance with building codes and planning policies. Choice, design, and stability capabilities for type of barrier used. Strategic use of barriers may provide airflow restriction from source to receptor. |
| P3 optimised stack height | $$ | Low | Low | Medium | Low | Compatibility with clearance requirements to negate building downwash effects, stability, and structural integrity considerations. |
| **Controls at Receptors** | | | | | | |
| R1 air filtration systems | $$ | Low | Low | Low | Low | High-quality filtration systems such as HEPA or multi-stage filters involve upfront equipment and installation costs. Regular filter replacement and maintenance add to ongoing operating expenses. |
| R2 alerts and alarms | $ | Medium | Low | Medium | Low | Promotes timely maintenance and prevention of excessive emissions or malfunctions, indirectly supporting environmental compliance. Critical for early detection of hazardous conditions (e.g., exhaust temperature anomalies, fuel leaks), enabling prompt response to prevent accidents or equipment damage. |

air quality | environment | sustainability

| | |
|---|---|
| **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. |
| **sustainability** | We look beyond compliance to add value and identify opportunities. Our services range from sustainability strategies, ecologically sustainable development reporting and assessment, to bespoke greenhouse gas and energy estimation and reporting. |

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