Memorandum

ARUP

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Subject	Air Quality Assessment Memorandum		
	Revision		

1 Introduction

The proposed Sirius Road datacentre at 1 Sirius Road, Lane Cove West (Lot 1/DP 1151370) is anticipated to incorporate 55 standby generators within the site boundary to support the buildings' power requirement for critical IT systems and other site infrastructure in the event of mains power loss or damage of electrical infrastructure on site.

The generators are located on elevated platforms along western, northern and eastern extents of the building. Appendix A identifies the design drawings that present the distinct locations of the standby generators.

A qualitative based desktop assessment of the potential air quality impacts from the on-site standby generators has been completed to accompany the State Significant Development Application (SSDA) Submission.

2 Standby Generator Use

Data centre components do not easily tolerate power spikes due to switching from a normal to emergency power supply. When these components lose power (if only for a fraction of a second), various IT systems critical to the facility and the service it provides will be interrupted. The proposed site infrastructure includes uninterruptible power supplies (UPS) with battery back-up for power conditioning and short-term interruptions. However, standby generators are needed to ensure ongoing operation if power is interrupted for more than a few minutes. As a result, supplying uninterrupted power to data centres 100% of the time is a critical aspect for their operation. Fundamentally, the function of the standby generators at the site would be to provide power when there is an unexpected interruption of main power.

Given the unlikely event of an interruption of main power, the standby generators would switch on to provide power to each of the buildings. It is likely any loss of main power would be resolved quickly, within a few hours and therefore even when required the generators would only operate for a short time. It is not possible to estimate the likelihood of power outage/damage over a year which would require the standby generators to be in operation, however it is anticipated that the generators would only be required for around 50 hours per year (approximately 0.6% of the time).

The standby generators would be tested on a monthly basis (approximately one hour of operation per month) to ensure they can continue to provide an uninterrupted power supply when required. Each generator would be tested independent of each other (i.e. not be operating concurrently) and be completed during the daytime period when wind conditions are favourable for dispersion.

A photograph of a standby diesel generator similar to the proposed is shown in Figure 1.

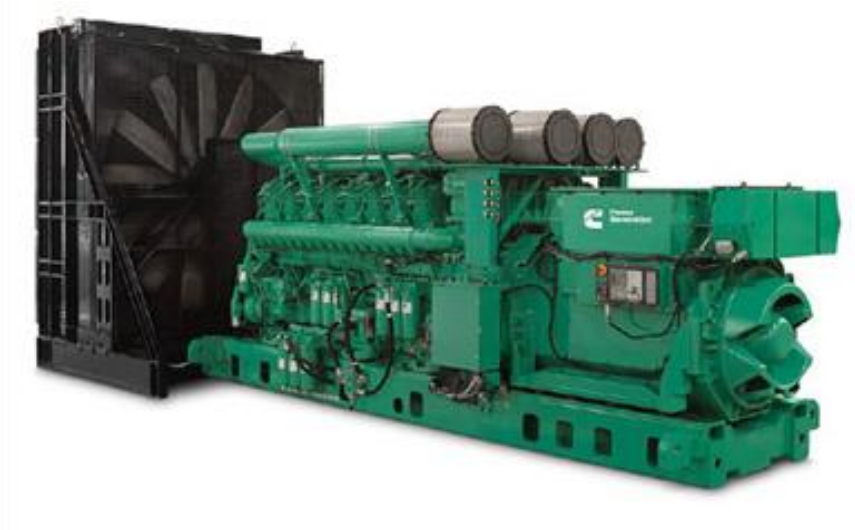

Figure 1: Proposed standby diesel generator

3 Air Quality Assessment

3.1 Generator Emissions

While in use, the standby generators would produce total unburned hydrocarbons (HC), nitrogen oxide (NO_x), carbon monoxide (CO), particulate matter (PM), sulfur dioxide (SO_2) and smoke.

At present however, there are no regulations in place in Australia that limit emissions from non-road diesel engines and equipment. Therefore, to determine the likelihood for air quality impacts, a review of the US EPA emission standards (where the generator was developed) and the NSW Protection of the Environment (POEO) Regulation 2010 emission limits against the Cummins QSK95-G4 generator specification sheet (see Appendix B) has been completed. The outcomes of the assessment are summarised in Table 1.

The comparison indicates that for all pollutants (with the exception of NO_x) emission rates will be below the respective US EPA and POEO emission limits. It should be noted that Clause 57A of the POEO (Clean Air) Regulation 2010 states that standby generators are exempt from the air impurity standards for nitrogen dioxide and nitric oxide listed in Schedule 4 of the POEO (Clean Air) regulation 2010 if they are used no more than 200 hours per year, which as detailed previously in section 2 is the case for this proposal.

Table 1: Emission rate assessment

Pollutant	**Cummins QSK95-G4[1]**		**US EPA[3]**	**POEO Regulation 2010**
	g/kWh[2]	**mg/m³**	**g/kWh**	**mg/m³**
HC	0.14	81	0.19	*no limit detailed*
NOx	6.79	3990	0.67	500
CO	0.22	150	3.5	*no limit detailed*
PM	0.04	18	0.03	50
SO_2	0.004	1.8	*no limit detailed*	*no limit detailed*

[1] The worst case ¼ Standby performance data has been applied for the Cummins QSK95-G4.

[2] A conversion from g/BHP-hr to kWh has been applied.

[3] Nonroad Compression-Ignition Engines: Exhaust Emission Standards (2016), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100OA05.pdf

3.2 Sensitive Receptors

The closest sensitive receptors are south-west of the site within the existing commercial precinct at Lane Cove, located approximately 40 metres from the proposed generators. The more sensitive receptors (residential and schools) are located over 400 metres from the site.

Potential air quality impacts from the generators upon staff at the data centre are based on occupational criteria for air quality metrics. These are typically several orders of magnitude greater than those provided for the evaluation of environmental impact, this is since environmental criteria are designed to protect the full spectrum of society, including the frail, very young and very old. Conversely, those who are exposed occupationally are assumed to be fit and healthy individuals. For these reasons, no further assessment of potential occupational air quality impacts has been assessed in this memorandum.

3.3 Potential impacts

Given the distance of sensitive receivers (residential properties or schools), it is unlikely that local air quality at these locations would be significantly affected even when the standby generators are in operation.

However, operation of the generators has the potential to impact local air quality immediately adjacent to the site, particularly concentrations of NOx/NO_2, if in operation over a long period of time. While emissions of NOx are exempt from regulatory standards, these emissions can convert to NO_2 in the atmosphere and impact on human and ecological health. Therefore, operation of the generators during a power outage or damage event should be minimised as far as possible. This is included in the maintenance strategy for the site and therefore it is expected that this would be achieved under typical circumstances.

4 Conclusion

Given that the standby generators will operate within relevant emissions limits, are a considerable distance from sensitive receptors (residential/schools) and are only expected to be used for short, intermittent periods, the air quality impact from them is anticipated to be minor and transient.

Therefore, no further air quality assessment (e.g. dispersion modelling) for the proposal has been recommended.

Appendix A – Drawing Information

Memorandum

Standby generator locations are presented in the following drawings:

L1 - BASEMENT FLOOR PLAN _ RL 9.9_ATSYD2_SSD_DRG_ARC_0100
L2 - FLOOR PLAN _ RL14.4_ATSYD2_SSD_DRG_ARC_0101
L3 - FLOOR PLAN _ RL20.2_ATSYD2_SSD_DRG_ARC_0102
L4 - FLOOR PLAN _ RL26.0_ATSYD2_SSD_DRG_ARC_0103
SECTIONS 1_ATSYD2_SSD_DRG_ARC_0200
SECTIONS 2_ATSYD2_SSD_DRG_ARC_0201
LONG SECTIONS_ATSYD2_SSD_DRG_ARC_0202
18 HEIGHT DIAGRAMS_ATSYD2_SSD_DRG_ARC_0520

Appendix B– Generator Specification Sheet

Exhaust emission data sheet
C3750 D5
50 Hz Diesel generator set

Engine Information:

Model:	Cummins Inc. QSK95-G4	Bore:	7.48 in. (190 mm)
Type:	4 Cycle, VEE, 16 cylinder diesel	Stroke:	8.27 in. (210 mm)
Aspiration:	Turbocharged and Aftercooled	Displacement:	5816 cu. in. (95.3 liters)
Compression Ratio:	15.5:1		
Emission Control Device:	Turbocharged and Aftercooled		
Emission Level:	Stationary emergency		

Performance Data	1/4 Standby	1/2 Standby	3/4 Standby	Full Standby	Full Prime	Full Continuous
Engine BHP @ 1500 RPM (50 Hz)	1145	2185	3225	4308	3822	3433
Fuel Consumption L/Hr (US Gal/Hr)	216 (57)	371 (98)	537 (142)	723 (191)	636 (168)	575 (152)
Exhaust Gas Flow m^3/min (CFM)	205 (7251)	317 (11195)	443 (15664)	560 (19765)	510 (18022)	473 (16705)
Exhaust Gas Temperature °C (°F)	331 (627)	378 (713)	383 (722)	413 (776)	391 (763)	384 (723)
Exhaust Emission Data						
HC (Total Unburned Hydrocarbons)	0.19 (81)	0.09 (46)	0.08 (40)	0.06 (31)	0.06 (33)	0.08 (41)
NOx (Oxides of Nitrogen as NO_2)	9.1 (3990)	9.3 (4540)	7.6 (3800)	7.4 (3700)	7.3 (3670)	7 (3500)
CO (Carbon Monoxide)	0.3 (150)	0.2 (110)	0.1 (30)	0.1 (40)	0.1 (30)	0.1 (30)
PM (Particulate Matter)	0.05 (18)	0.01 (6)	0.01 (3)	0.01 (4)	0.01 (3)	0.01 (3)
SO_2 (Sulfur Dioxide)	0.005 (1.8)	0.004 (1.8)	0.004 (1.8)	0.004 (1.7)	0.004 (1.7)	0.004 (1.8)
Smoke (FSN)	0.35	0.16	0.08	0.11	0.08	0.08

All values (except smoke) are cited: g/BHP-hr (mg/Nm^3 @ 5% O_2)

Test Conditions

Steady-state 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.

Fuel Specification:	40-48 Cetane Number, 0.0015 Wt.% Sulfur; Reference ISO8178-5, 40 CFR 86, 1313—98 Type 2-D and ASTM D975 No. 2-D. Fuel Density at 0.85 Kg/L (7.1 lbs/US Gal)
Air Inlet Temperature	25 °C (77 °F)
Fuel Inlet Temperature:	40 °C (104 °F)
Barometric Pressure:	100 kPa (29.53 in Hg)
Humidity:	NOx measurement corrected to 10.7 g/kg (75 grains H_2O/lb) of dry air
Intake Restriction:	Set to 18 in of H_2O as measured from compressor inlet
Exhaust Back Pressure:	Set to 1.5 in Hg
Note:	mg/m^3 values are measured dry, corrected to 5% O_2 and normalized to standard temperature and pressure (0°C, 101.325 kPa)

The NOx, HC, CO and PM emission data tabulated here are representative of test data taken from a single engine under the test conditions shown above. Data for the other components are estimated. These data are subjected to instrumentation and engine-to-engine variability. Field emission test data are not guaranteed to these levels. Actual field test results may vary due to test site conditions, installation, fuel specification, test procedures and instrumentation. Engine operation with excessive air intake or exhaust restriction beyond published maximum limits, or with improper maintenance, may results in elevated emission levels.