ETHOS URBAN

31 March 2020

2190098

Anthony Witherdin
Director, Key Sites Assessments
Department of Planning, Industry and Environment
320 Pitt Street
Sydney NSW 2000

Attention: Cameron Sargent, Team Leader, Key Sites Assessments

Dear Eliza,

RESPONSE TO SUBMISSIONS – Barangaroo – C1 Commercial Building – Modification 3 – Co-generator plant

This Response to Submissions has been prepared following the public exhibition of a s.4.55(2) modification application for Building C1 at Baragaroo South.

The modification application seeks consent for the installation and operation of a co-generator within the existing plant room across the ground and mezzanine levels of Commercial Building C1. The approved Commercial Building C1 SSD includes a plant room for a used cooking oil co-generator and this modification seeks approval for minor design refinements to accommodate the proposed co-generator.

Two submissions were received in the public exhibition of the modification applications. These were from the Environment Protection Authority (EPA), and City of Sydney Council. In summary, the following issues were raised:

- Air quality impacts; and
- Noise impacts.

A detailed response to the issues raised is provided in **Section 1** and **2** below and is accompanied by the following supplementary information:

- AQIA Summary Memo prepared by Northstar (**Attachment A**).
- Updated Air Quality Impact Assessment prepared by Northstar (**Attachment B**).

The assessment provided in this Response to Submissions demonstrates that all issues can be appropriately mitigated and will not result in any negative environmental impacts associated with proposal. We trust that this information is sufficient to enable assessment of the modification applications to progress.

Yours sincerely,

Frances Mehrtens
Senior Urbanist, Planning
9956 6962
fmehrtens@ethosurban.com

Tim Ward
Director
9956 6962
tward@ethosurban.com

ETHOS URBAN

1.0 City of Sydney Submission

Issue	Response
Potential air quality health impacts on the child care centre and recommend that a site specific risk assessment/air quality impact report be undertaken outlining the impact of emissions from the proposed plant on the surrounding area in accordance with the Guideline – Approved methods for the modelling and assessment of air pollutants – EPA 2005.	On receipt of a development consent a licence will be issued by the EPA. Air quality limits will therefore be set and regulated by the EPA as part of the Resource Recovery Order/Resource Recovery Exemption licencing arrangements. The submitted AQIA assessed the impact on the Child Care Centre and a summary memo has been prepared to specifically summarise the parts of the AQIA that address the Child Care Centre (refer to **Attachment A**).
The proponent should provide the Department the guidance obtained from the NSW EPA Air Quality branch in relation to the relevant localised NO2 emission value to set which should then be referenced in the impact assessment report.	Subsequent to further consultation and correspondence as part of the preparation of this modification application, the EPA acknowledge that 250mg/Nm^3 will be achieved.
Recommendation that a maintenance plan be prepared and submitted for further review that addresses the ongoing maintenance of the emission control equipment, ongoing emission monitoring and reporting to ensure the system is not negatively impacting sensitive receivers.	As part of the preparation of this modification application, the EPA have noted that they will regulate emission under their RRO/RRE licence, with periodic reporting on emissions and ongoing review by the EPA. It is understood that the EPA agree that this regulation will include arrangements to confirm performance of controls under various operating conditions and allowances for equipment condition and maintenance. It is not proposed to include these arrangements as part of the development approval, as they will be covered adequately by the licence issued by the EPA.

2.0 Environmental Protection Authority

Issue	Response
Air Impacts	
Air quality impacts from the burning of waste cooking oil be further assessed in accordance with the following requirements:	

1. Volumetric exhaust flowrate not corrected to the reference concentration.

- The proponent must revise the AQIA to use the correct mass emission rates in all scenarios. The volumetric flowrate of the exhaust gas was calculated using the exhaust gas flow rate
- The volumetric flowrate of the exhaust gas was calculated using the exhaust gas flow rate listed in the engine technical data (53.5 m3/min) and corrected to 273 K from the exhaust gas temperature of 395 K. This resulted in an exhaust gas flow of 0.366 m3/s. It was not corrected for oxygen concentration, and therefore the flowrate of 0.366 m3/s is at the operating oxygen concentration of the engine (12.3%). When calculating the mass flowrates of pollutants, the volumetric flowrate and the concentration should be at the same oxygen concentration.
- The mass flowrate for Scenario 1 was calculated correctly based on a volumetric flow rate referenced to 15% oxygen and a mass concentration referenced to 15% oxygen. Thus the mass flow rate in scenario 1 is correctly calculated. The mass rates modelled for Scenarios 2 and 3 were calculated using a volumetric flowrate referenced to 12.3% oxygen and a discharge concentration referenced to 3% oxygen (the oxygen concentration for the regulatory limit). Thus, the emission rates used in Scenarios 2 and 3 are over-estimated.

The assumed volumetric discharge rate of 0.366 Nm3·s-1 at STP (12.3% O2) should have been adjusted to 3 % O2 and dry gas for multiplication with the emission concentration limits of 100 mg·Nm-3 (TSP) and 450 / 250 mg·Nm-3(NOX as NO2). Using this data, the volumetric discharge rate is 0.366 Nm3·s-1(STP, 12.3%, wet) equates to 0.169 Nm3·s-1(STP, 3%, dry). Substituting this reference gas volume into the following emission rates calculation in Table 6 of the AQIA provides for the following update:

Parameter	Emission Concentration	Volumetric Discharge Rate	Emission Rate
	$mg \cdot Nm^{-3}$	$Nm^3 \cdot s^{-1}$	$g \cdot s^{-1}$
Solid particles	100	~~0.366~~ 0.169	~~0.0366~~ 0.0169
Oxides of nitrogen	450	0.366 0.169	0.1649 0.0759
	250	~~0.366~~ 0.169	~~0.0916~~ 0.0422

The above recalculation reduces the assumed emission rates by approximately 54 % of that assumed in the AQIA first submitted with the modification application (i.e. they are approximately half of that assumed).

The models for TSP and NOX have been re-run and the results of the revised modelling (increment only) is reproduced below. The results for all other pollutants are presented for completeness, although it is noted that results associated with expected emission profiles have not changed. Of most relevance, the predicted maximum incremental 1 hour NO2 concentration reduces by the following:

- At an assumed Policy NOX concentration of 450 mg·m-3, the maximum predicted incremental 1-hour NO2 concentration of 129.0 µg·m-3 is reduced to 95.1 µg·m-3 (representing 38.7 % of the criterion).
- At an assumed Policy NOX concentration of 250 mg·m-3, the maximum predicted incremental 1-hour NO2 concentration of 115.0 µg·m-3 is reduced to 61.7 µg·m-3 (representing 25.1 % of the criterion).

It is noted that the change in NOX emission rates are not proportional to the change in NO2 impacts. This is due to the application of the OLM to assess NOX to NO2 reactions.

Summary of results – incremental predictions (SO2 and NO2):

Pollutant	SO_2	SO_2	SO_2	NO_2	NO_2	NO_2	NO_2
Ave period	1-hr	24-hr	ann	1-hr	ann	1-hr	ann
Reported[A]	inc	inc	inc	inc	inc	inc	inc
Emission[B]	meas	meas	meas	reg(450)	reg(450)	reg(250)	reg(250)
Units	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$
117	1.68E-01	4.19E-02	1.91E-02	9.56E+00	1.21E+00	5.99E+00	6.77E-01
118	1.65E-01	4.60E-02	1.91E-02	9.26E+00	1.21E+00	5.88E+00	6.73E-01
119	1.54E-01	5.12E-02	1.85E-02	9.32E+00	1.16E+00	5.52E+00	6.48E-01
120	1.58E-01	5.40E-02	1.82E-02	9.99E+00	1.14E+00	5.56E+00	6.38E-01
121	1.66E-01	5.60E-02	1.78E-02	1.07E+01	1.12E+00	5.94E+00	6.23E-01
122	2.01E-01	5.91E-02	1.73E-02	1.29E+01	1.08E+00	7.18E+00	6.02E-01
123	2.28E-01	6.25E-02	1.68E-02	1.44E+01	1.04E+00	7.99E+00	5.82E-01
124	2.36E-01	6.29E-02	1.57E-02	1.46E+01	9.66E-01	8.13E+00	5.43E-01
125	2.91E-01	7.47E-02	1.64E-02	1.81E+01	1.00E+00	1.01E+01	5.64E-01
126	3.28E-01	8.32E-02	1.71E-02	2.05E+01	1.05E+00	1.14E+01	5.90E-01
127	3.60E-01	9.10E-02	1.80E-02	2.10E+01	1.09E+00	1.26E+01	6.19E-01
128	4.00E-01	1.01E-01	1.89E-02	2.33E+01	1.15E+00	1.41E+01	6.50E-01
max(all)[C]	2.51E+00	3.49E-01	2.30E-02	9.51E+01	1.45E+00	6.17E+01	8.14E-01
max(ccc)[D]	4.00E-01	1.01E-01	1.91E-02	2.33E+01	1.21E+00	1.41E+01	6.77E-01
crit[E]	570	228	60	246	62	246	62
max(all)/crit	0.44%	0.15%	0.04%	38.66%	2.34%	25.09%	1.31%
max(ccc)/crit	0.07%	0.04%	0.03%	9.49%	1.96%	5.74%	1.09%

Note: (A): inc = increment, bg = background, con = concurrent
(B): meas = measured, reg = regulatory emission limit value (with the emission limit in parenthesis)
(C): max(all) maximum predicted concentration at all receptor locations
(D): max(ccc) maximum predicted concentration at the childcare centre
(E): crit: criterion

Summary of results – incremental predictions (CO, PM2.5, C6H6, NH3):

Issue	Response

Pollutant	CO	CO	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	$PM_{2.5}$	C_6H_6 (F)	NH_3
Ave period	1-hr	8-hr	24-hr	ann	24-hr	ann	1-hr	1-hr
Reported(A)	inc	inc	inc	inc	inc	inc	inc	inc
Emission(B)	meas	meas	meas	meas	reg(100)	reg(100)	meas	US EPA
Units	$mg.m^{-3}$	$mg.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$	$\mu g.m^{-3}$
117	2.47E-03	1.12E-03	7.68E-02	3.51E-02	5.99E-01	2.74E-01	3.44E-01	3.95E-01
118	2.42E-03	1.01E-03	8.45E-02	3.50E-02	6.59E-01	2.73E-01	3.37E-01	3.88E-01
119	2.27E-03	1.13E-03	9.40E-02	3.39E-02	7.33E-01	2.64E-01	3.17E-01	3.64E-01
120	2.33E-03	1.34E-03	9.92E-02	3.35E-02	7.74E-01	2.61E-01	3.25E-01	3.74E-01
121	2.44E-03	1.49E-03	1.03E-01	3.27E-02	8.01E-01	2.55E-01	3.41E-01	3.92E-01
122	2.95E-03	1.70E-03	1.08E-01	3.17E-02	8.46E-01	2.48E-01	4.12E-01	4.73E-01
123	3.36E-03	1.83E-03	1.15E-01	3.08E-02	8.94E-01	2.40E-01	4.68E-01	5.38E-01
124	3.48E-03	1.86E-03	1.16E-01	2.88E-02	9.01E-01	2.25E-01	4.84E-01	5.57E-01
125	4.28E-03	2.23E-03	1.37E-01	3.00E-02	1.07E+00	2.34E-01	5.97E-01	6.87E-01
126	4.83E-03	2.49E-03	1.53E-01	3.14E-02	1.19E+00	2.45E-01	6.73E-01	7.74E-01
127	5.29E-03	2.72E-03	1.67E-01	3.30E-02	1.30E+00	2.57E-01	7.38E-01	8.48E-01
128	5.88E-03	3.03E-03	1.86E-01	3.47E-02	1.45E+00	2.71E-01	8.19E-01	9.42E-01
max(all)(C)	3.70E-02	1.61E-02	6.41E-01	4.21E-02	5.00E+00	3.29E-01	5.15E+00	5.93E+00
max(ccc)(D)	5.88E-03	3.03E-03	1.86E-01	3.51E-02	1.45E+00	2.74E-01	8.19E-01	9.42E-01
crit(E)	30	10	25	8	25	8	29	330
max(all)/crit	0.12%	0.16%	2.56%	0.53%	20.00%	4.11%	17.77%	1.80%
max(ccc)/crit	0.02%	0.03%	0.74%	0.44%	5.80%	3.43%	2.82%	0.29%

Note: (A): inc = increment, bg = background, con = concurrent

(B): meas = measured, reg = regulatory emission limit value (with the emission limit in parenthesis)

(C): max(all) maximum predicted concentration at all receptor locations

(D): max(ccc) maximum predicted concentration at the childcare centre

(E): crit: criterion

(F): C_6H_6 (benzene) assumed to be 11% of TVOC impacts

The updated AQIA submitted with this modification incorporates these changes.

Issue	Response
2. The proponent must provide additional evidence that NOx emissions of 250 mg/Nm3 at 3%oxygen can be achieved.	Further consultation with the EPA has been undertaken as part of the preparation of this modification application, resulting in the EPA being satisfied that the proposed selective catalytic reduction (SCR) technology represents best available technology and is likely to be able meet the discharge limits. To achieve 250 mg·Nm-3(STP,3%,dry) the NOX control system would need an abatement efficiency of 92 %. Given that achieving 250 mg·Nm-3 (92 % abatement) is at the upper range of SCR technology performance, and that SCR efficiency depends on several factors and is limited by wearing out of some of its components from routine use, the EPA has indicated that Lendlease should implement a trial emissions sampling and monitoring period as part of the early operation phase. The plan should include: • Trial period of 12 months • Quantity of biofuel to be used as a fuel • Rate of biofuel to be used as a fuel ▪ Detailed air emission testing regime ▪ Trial evaluation procedure, including: evaluation of air emissions due to the use of biofuel, quantification of absolute emission levels and sampling carried out during process activities that represent potential for worst case emissions such as before maintenance of the SCR system.
3. The proponent should clarify the statement in Section 7.1 of the AQIA regarding incremental impacts, and provide further justification for why the incremental NOx impacts are not considered to be significant.	The text at Section 7.1 has been included erroneously and it relates to a marginal change in emission configuration (stack height) that is no longer part of the application. The results in Section 6.1 and Appendix E relate to the predicted incremental impacts. The text at Section 7.1 has been amended accordingly in the updated AQIA submitted with this modification application.

Issue	Response
4. Inadequate justification for not assessing odour • The proponent must provide a more robust justification for not assessing odour, including data from reference facilities, if available. If reference facility data is not available, details should be provided of contingency measures to mitigate potential odour impacts. • The AQIA states "Due to the thermal oxidation process, the routine operational emissions are anticipated to result in an insignificant emission of odour". The EPA does not consider that this is adequate justification for not assessing potential odour impacts from the proposal	There is limited published information available relating to used cooking oil generator emission profiles, particularly in relation to odour. It is considered unlikely that there would be a significant odour emission. The UK reference sites have received no odour complaints in many years of operation but does not operate to a quantifiable odour regime that we can source data from. Given the low odour potential and the high capacity for air pollution abatement control, it is considered that odour can be effectively managed . However to provide a suitable control to manage any potential odour emissions, the air extraction system will have the capacity to include a Particulate Catalyst, capable of reducing VOCs by 85%. The system will be constructed to enable a this to be installed without retrofit should an odour problem eventuate. . Lendlease will also operate an odour nuisance complaint procedure to record any complaints and provide documentation of root cause investigations and response. Further consultation with the EPA indicates that the above approaches are acceptable, and that the EPA will require Lendlease to assess odour impact discharging from the facility and set threshold values (or circumstances) that will trigger requirement for the installation of the Particulate Catalyst, if and where required.
5. Ammonia emissions were not assessed • The proposal includes the use of SCR, which utilises ammonia, to reduce NOx emissions. The ammonia slip (ammonia left over from the reaction with NOx) could lead to adverse ammonia impacts. However, ammonia emissions were not assessed in the AQIA. • The proponent must assess ammonia impacts against the ammonia impact assessment criterion at the boundary of the site, or provide robust justification for why they should not be assessed.	The US EPA Air Pollution Control Technology Fact Sheet (EPA-452/F-03-032) (copy attached) provides that ammonia slip levels are typically 2 to 10 ppm, which do not result in plume formation or human health hazards. Process optimization after installation can lower slip levels. Measured emission concentration data due to ammonia slip provided from technology providers shows achieving an NH3 emission limit of 10 ppm at the required NO2 abatement efficiency is achievable, and this value has been used in the updated AQIA submitted with this modification application . An emission concentration of 10 ppm (7.6 mg·Nm-3) has been incorporated into the revised assessment report, equating to an emission rate of 0.002783 g·s-1. The results of the modelling of NH3 are shown in the revised incremental result tables reproduced above (item 1) and may be compared to the criterion of 0.46 ppm (0.33 mg·m-3) (as a 1-hour average). Predicted maximum NH3 impacts are 0.29 % of the criterion. 10 ppm equates to 7.6 mg·Nm-3(STP), and, (assuming 4.2 % water vapour and 12.3 % O2 consistent with the assumptions used in the AQIA and discussed in Section (1) of this memo), equates to 16.5 mg.Nm-3(STP, dry, 3% O2).

Issue	Response
6. No discussion as to why Building 4A contributes significantly to TPM and NOx emissions • The proponent must discuss why Building 4A is such a significant contributor to NOx and TPM emissions. • Results of the AQIA indicate that emissions from Building 4A at Barangaroo contribute significantly to ambient PM2.5 and NO2 concentrations. The AQIA indicates that building 4A has a cogeneration plant, and that cumulative impacts from both cogeneration plants have been assessed. However, no information is provided about the size or type of the cogeneration plant in Building 4A. • Considering that the cogeneration plant in Building 4A is a significant contributor to NOx and TPM emissions, and to the surrounding airshed, more details about the size and nature of the emissions from this plant are required.	Please note there is no co-generation plant associated with Building R4A. Building R4A is not assessed under this DA. With reference to AECOM (2016) that AQIA includes an assessment of the following: *(Section 1.1) The Residential Building R4A DA seeks approval for the construction and use of a 72 storey residential flat building comprising 327 apartments, ground floor retail, the allocation of car parking, services, plant and storage within the Stage 1B Basement (subject of a separate concurrent DA), and the construction of ancillary landscaping and temporary public domain.* *Approval for the construction of Residential Building R4A's core and associated plant and services within the basement is being sought as part of the concurrent Stage 1B Basement DA and do not form part of this process.* *(Section 1.2) The construction of the residential buildings of the Stage 1B development will overlap. Based on staging information provided by Lendlease, the following concurrent activities are expected to represent the worst-case emissions during the residential building construction works:* - *Construction of the Stage 1B basement (note main remediation & civil works are complete);* - *Construction of the R4A building;* *This will occur between December 2019 and March 2021. As such, this report presents the findings of the worst-case emissions assessment for the residential building construction for the Stage 1B development as a whole.*
Noise Impacts	
The proponent must review the operation of the equipment for the proposal to determine whether the frequency spectrum contains any major components in the low-frequency range (10 - 160 Hz), or provide justification for why these frequency ranges do not require assessment. The acoustic assessment for the proposal, titled Barangaroo South Building C1 Co-Generation Plant Noise Assessment (Wilkinson Murray, 22.02.2019), concludes that noise impacts from the proposal, including night time impacts, comply with noise policy guidelines. However, the acoustic assessment does not analyse potential low frequency noise impacts associated with use of the generators.	The Diesel Generators of the size proposed in the development do not exhibit "low frequency" noise as defined by the EPA. However, even if a low frequency modifying factor of 5 dB were applied to predicted noise levels at Hickson Road residences (the residences where highest generator noise levels are predicted) the corrected resultant noise level would be 29 dBA. If you compare this to the night time criterion of 50 dBA there is a 21 dBA difference and compliance is easily achieved, even in this "worst case" operating scenario.