Green Mountain Data Centre

Stage 3 Acoustic Report

10937.1

29th August 2023

Revision B

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10937.1B

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A	First issue	NC	9th Aug 23
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1 Introduction

1.1 Apex Acoustics have been appointed to provide Stage 3 acoustic design input for the Green Mountain Data Centre consisting of new plant installations proposed at the existing Data Centre building nearby King George Close in Romford; the site location is shown in Figure 1.

1.2 The report follows on from the Stage 2 input which was reported in the Apex report reference 8817.1B

1.3 The report provides the specifications for the plant and building design which are required to meet the existing planning condition requirements and is intended to be included within the tender documentation.

1.4 If a noise impact assessment report is required with any planning submissions that would be issued separately to this report.

1.5 The representative NSR are identified as the residential properties immediately to the north-west and to the east of the proposed site.

- NSR1 82 to 84 Hainault Road
- NSR2 49 Linley Crescent

Figure 1: Data Centre location, measurement positions P1 and P2, and identified NSR

2 Planning policy and noise criteria

2.1 **National Planning Policy Framework (NPPF)**

2.2 The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. It provides a framework within which locally-prepared plans for housing and other development can be produced. In respect of noise, Paragraph 170 and 180 of the NPPF states the following:

2.3 Paragraph 170:

"e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution…"

2.4 Paragraph 180:

"Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

a) mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life;

b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; … "

2.5 **Noise Policy Statement for England (NPSE)**

2.6 The Noise Policy Statement for England , states three policy aims as follows:

"Through the effective management and control of environmental, neighbour and neighbourhood noise within the context of Government policy on sustainable development:

- avoid significant adverse impacts on health and quality of life;
- mitigate and minimise adverse impacts on health and quality of life; and
- where possible, contribute to the improvement of health and quality of life."

2.7 The NPSE defines adverse noise impact as follows:

- No Observed Effect Level (NOEL)
  This is the level below which no effect can be detected. In simple terms, below this level, there is no detectable effect on health and quality of life due to the noise.
- Lowest Observed Adverse Effect Level (LOAEL)
  This is the level above which adverse effects on health and quality of life can be detected.
- Significant Observed Adverse Effect Level (SOAEL)
  This is the level above which significant adverse effects on health and quality of life occur

2.8 The first two aims of the NPSE require that no significant adverse impact should occur and that, where a noise level which falls between a level which represents the lowest observable adverse effect and a level which represents a significant observed adverse effect, then according to the explanatory notes in the statement:

"… all reasonable steps should be taken to mitigate and minimise adverse effects on health and quality of life whilst also taking into consideration the guiding principles of sustainable development. This does not mean that such effects cannot occur."

2.9 **BS 4142 Method for rating and assessing industrial and commercial sound**

2.10 BS 4142:2014 describes methods for rating and assessing sound of an industrial nature in terms of the potential adverse impact on residential properties.

2.11 The specific sound source of an industrial and/or commercial nature is rated and compared against the measured existing background sound environment.

2.12 The rating level is calculated by adding a character correction to the specific sound.

2.13 Character corrections can be applied for the following characteristics depending on their subjective perceptibility:

- Tonality: a penalty of 2 dB may be applied for a tone which is just perceptible at the sound receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.
- Impulsivity: a penalty of 3 dB may be applied for an impulsive sound which is just perceptible at the sound receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.
- Intermittency: where intermittency of a sound source is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

2.14 According to BS4142:

- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context."*
- *A difference of around + 5dB is likely to be an indication of an adverse impact, depending on the context".*
- *Where the rating level does not exceed the background sound level, this is an indication of the specific source having a low impact, depending on the context.*

2.15 In addition to the margin by which the rating level exceeds the background levels, the standard places emphasis upon the context and states:

An effective assessment cannot be conducted without an understanding of the reason(s) for the assessment and the context in which the sound occurs/will occur. When making assessments and arriving at decisions, therefore, it is essential to place the sound in context.

2.16 Following the initial assessment BS4142 gives examples of situations where the context is important, such as:

- *The absolute level of sound. For a given difference between the rating level and the background sound level, the magnitude of the overall impact might be greater for an acoustic environment where the residual sound level is high than for an acoustic environment where the residual sound level is low.*
- *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night.*

2.17 **Local Authority requirements**

2.18 The local authority has included planning conditions for the development of the site which have included noise targets of 5 dB below the background levels for the original application in 2007 to convert the building into a data centre. (Ref P1290.07)

2.19 Application P10151.16 for an external gantry and plant, includes the following condition:

Before any external plant is installed a scheme for any new plant or machinery shall be submitted to the local planning authority to achieve the following standard. Noise levels expressed as the equivalent continuous sound level LAeq (1 hour) when calculated at the boundary with the nearest noise sensitive premises shall not exceed LA90-10 dB and shall be maintained thereafter to the satisfaction of the Local Planning Authority.

2.20 This condition is assumed to apply to the existing plant which is installed at the site, and may also apply to the new proposed plant.

2.21 A noise limit of 10 dB below existing background noise levels would not increase the existing background levels and this assessment has been based on achieving 10 dB below the background levels.

2.22 For emergency plant, the noise limits have previously been set as being no more than the existing background levels and that approach has been followed for this assessment.

3 Existing acoustic environment

3.1 **Previous noise survey**

3.2 The noise level across the site have been determined using noise measurements undertaken by Apex Acoustics for over a 24-hour period from 13:15 hours on the 10th February 2021.

3.3 The measurement positions P1 and P2 are shown in Figure 1.

3.4 A picture of the measurement in progress is shown in Figure 2.

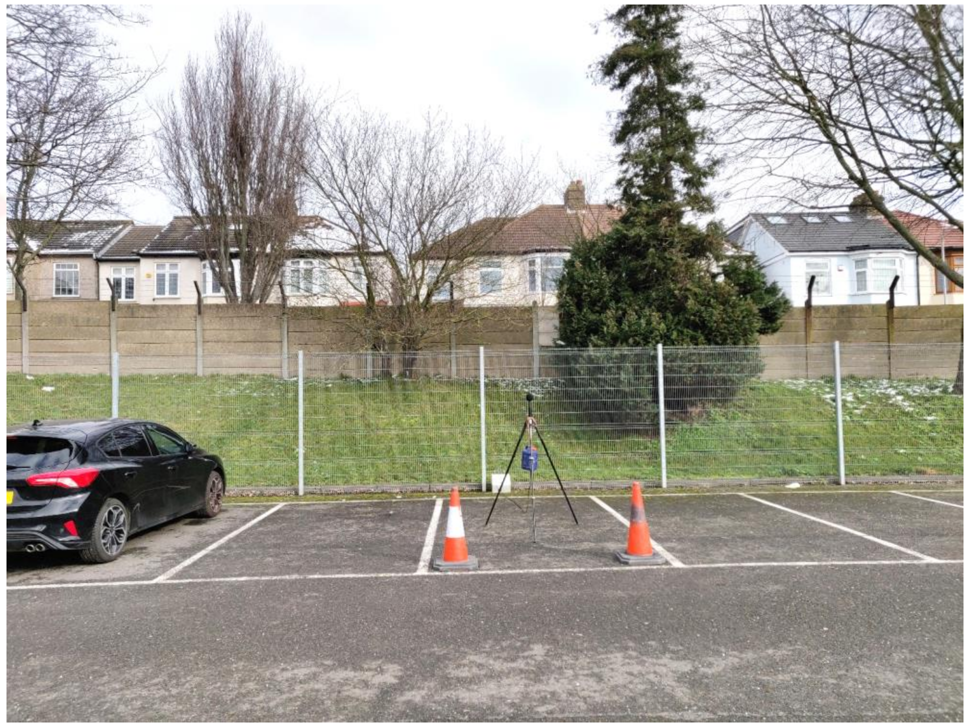

Figure 2: Measurement in progress

3.5 The positions were selected to be representative of the existing acoustic environment at the NSR1 and NSR2.

3.6 The microphones were located 1.5 metres above ground level and away from other reflecting surfaces such that the measurements are considered free-field.

3.7 Data was recorded in single-octave band frequencies at one-second intervals throughout the 24-hour measurement period.

3.8 The most significant noise sources were vehicles passing on local roads and some existing plant associated with the Data Centre.

3.9 **Background sound level**

3.10 Statistical analysis is undertaken of the results of all the $L_{A90,\ 15min}$ data following the guidance of BS 4142, to determine a background sound level considered to be representative of the assessment period.

3.11 Based on the statistical analysis results, the background sound level considered representative of the daytime (07:00 – 23:00 hrs) and night-time (23:00 – 07:00 hrs) assessment periods are shown in Table 1.

Location	Assessment period	L_{A90} (dB)
NSR1	Daytime	43 dB
	Night-time	37 dB
NSR2	Daytime	43 dB
	Night-time	39 dB

Table 1: Background sound levels representative of the assessment periods

3.12 The lowest background noise levels measured in 2010 were 35 dB L_{A90}, so the lowest background levels have slightly increased to 37 dB L_{A90} since 2010, and the change of 2 dB would be a negligible increase over that time period.

4 Noise from existing plant

4.1 It is understood that the existing plant at the site has planning permission and any new planning applications for external plant does not need to include a retrospective assessment of the existing plant.

4.2 The context of the noise from existing plant is however relevant when undertaking a BS4142 assessment.

4.3 The noise levels from the existing plant have been predicted in the Sharps Redmore report – Infinity Romford, Ref 1011296; dated 18th November 2010.

4.4 The report predicts noise levels at the receptors which are shown in Table 2.

Location	Predicted noise levels from existing plant L_{Aeq} (dB)
NSR1 82 to 84 Hainault Road	< 25 dB
NSR2 49 Linley Crescent	< 30 dB

Table 2: Predicted noise levels at receptors from existing plant

4.5 The Sharps Redmore report was based on achieving a noise limit of 30 dB $L_{Aeq,T}$ which was 5dB below the measured background noise levels of 35 dB L_{A90} in 2010.

4.6 The recent noise survey undertaken in February 2021 will have picked up existing plant but the emergency plant was not operational during the survey.

4.7 The predicted levels of the existing plant may not be 10 dB below the current background levels as it was designed to be 5 dB below the background levels in 2010.

5 Proposed new noise sources

5.1 **Proposed plant and associated noise levels**

5.2 The mechanical plant is assessed based on plant details supplied by the mechanical engineers.

5.3 The indicative plant used for the assessment is summarised in Table 3. The number of proposed units in brackets is the number of redundant units which would run as standby units only.

Plant	Manufacturer	Model	No. proposed
MV Switchboard VRFs	Mitsubishi	PUMY-SP140YKM2	1 (+1)
Battery VRFs	Mitsubishi	PUHY-P400YNW-A2	2 (+2)
Northern AHU DX Condensers	Mitsubishi	PKA-M35LA	2
Southern AHU DX Condensers	Toshiba	RAV-GM2801AT8-E	5 (+3)
Ancillary North AHU	Swegon	AD-10001500732	1
Ancillary South AHU	Swegon	AD-10001500726	1
Critical AHU	ENTROPIC	DH unit - 3B:18-07-2023	1 (+1)
Chillers	York	YZ_MA058AN045P102HA	8 (+1)
Adiabatic Coolers	Evapco	EAVWA-9116ZA177F7-621AUCC06	16 (+2)
Generators	AVK	DS3600	8

Table 3: Proposed plant included within the assessment

5.4 Manufacturer supplied noise levels are shown in Table 4.

Plant	Notes	Data type	dB(A)	Single-octave band frequency (Hz) Linear noise levels (dB)					
				125	250	500	1k	2k	4k
Switchboard VRF	-	L_w	74	-	-	-	-	-	-
Battery VRF	-	L_w	82	-	-	-	-	-	-
Mitsubishi DX	-	L_w	65	-	-	-	-	-	-
Toshiba DX	-	L_w	78	-	-	-	-	-	-
Ancillary North AHU	Supply inlet	L_w	68	74	74	63	55	52	48
	Exhaust outlet	L_w	82	80	77	77	78	76	72
	Breakout	L_w	59	67	57	60	47	45	41
	Supply inlet	L_w	70	76	76	65	57	54	50
Ancillary South AHU	Exhaust outlet	L_w	83	76	78	80	77	76	74
	Breakout	L_w	61	65	58	62	47	46	43
Critical AHU	Supply inlet	L_w	85	80	88	83	79	75	68
	Supply casing	L_w	60	65	67	55	49	43	38
Chiller	(at 50% duty)	$L_{p @ 1m}$	72	66	61	56	54	46	69
Adiabatic Cooler	Daytime	L_w	85	72	77	79	81	76	71
	Night-time	L_w	78	81	78	75	74	68	63
Generator	Inlet louvres	$L_{p @ 1 m}$	63	-	-	-	-	-	-
	Discharge louvres	$L_{p @ 1 m}$	63	-	-	-	-	-	-
	Engine Exhaust	$L_{p @ 1 m}$	63	-	-	-	-	-	-

Table 4: Manufacturers noise levels

5.5 The noise levels in Table 4 should be used as specifications for the external plant and for the coolers it is recommended that suppliers include for factory testing of the daytime and night-time operational modes.

6 VRF and DX Condensers

6.1 North East Elevation

6.2 Two VRF and five DX condenser units are proposed within the external compound as shown in **Figure 3**.

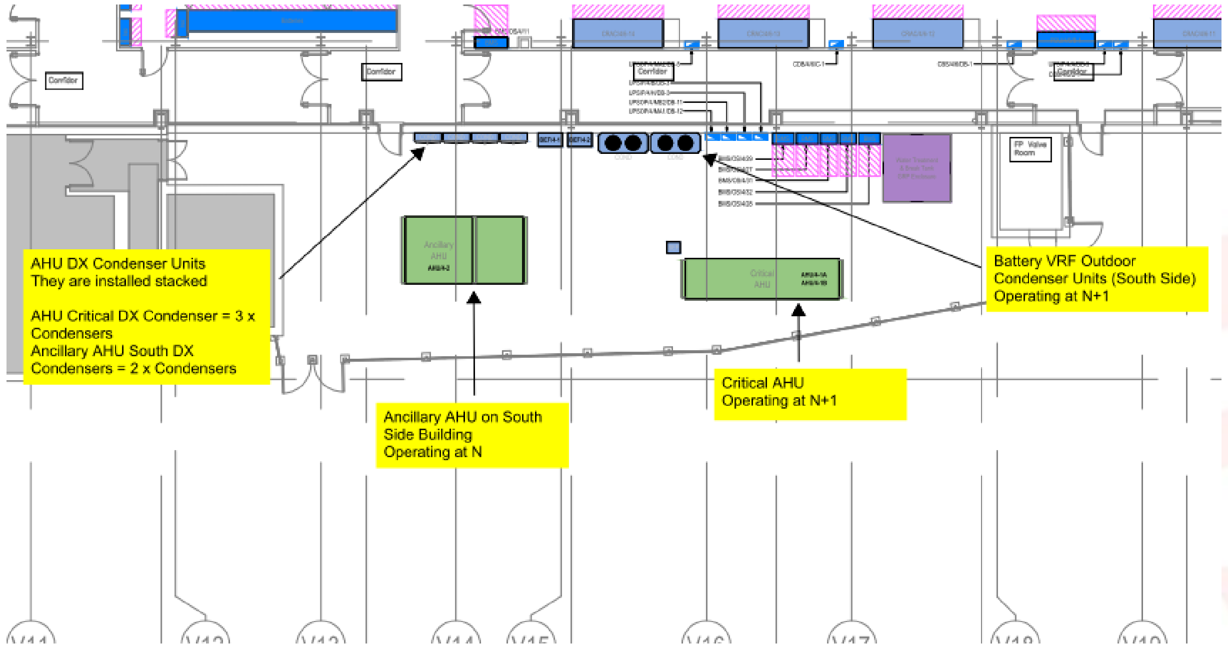

Figure 3: Proposed VRF and DX condenser units locations (NE Elevation)

6.3 To meet the required noise levels at the houses facing the plant, the plant compound will need to be enclosed with a 3.5m high barrier with a surface mass of at least 12kg/m^2.

6.4 The Battery VRF units will need to be enclosed so that the sound power level per unit does not exceed 70 dB L_{WA}.

6.5 The DX units will need to be attenuated so that the sound power per unit does not exceed 70 dB L_{WA}.

6.6 South West Elevation

6.7 Four VRF and two DX condenser units are proposed, at ground floor levels, as shown in **Figure 4**

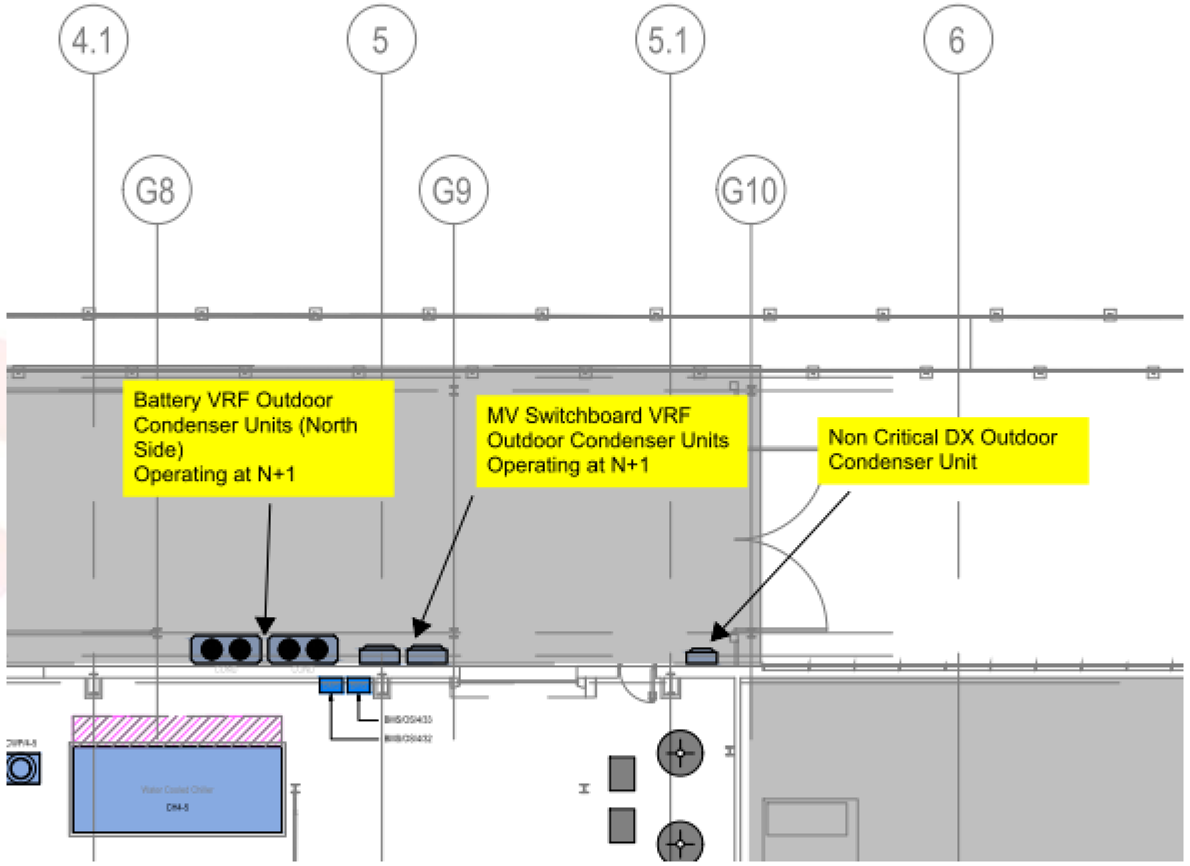

Figure 4: Proposed VRF locations (SW Elevation)

6.8 The predicted noise levels from the Battery VRFs, when located at ground floor, exceed the required noise limits to the receptors on Linley Cresent.

6.9 The Battery VRF units will need to be attenuated so that the sound power level per unit does not exceed 76 dB L_{WA}, which may be achievable with cylindrical silencers to the top of the units.

7 AHUs

7.1 Two AHUs are proposed on the North East elevation as shown in **Figure 5**, and one AHU located on the Gantry as shown in **Figure 6**.

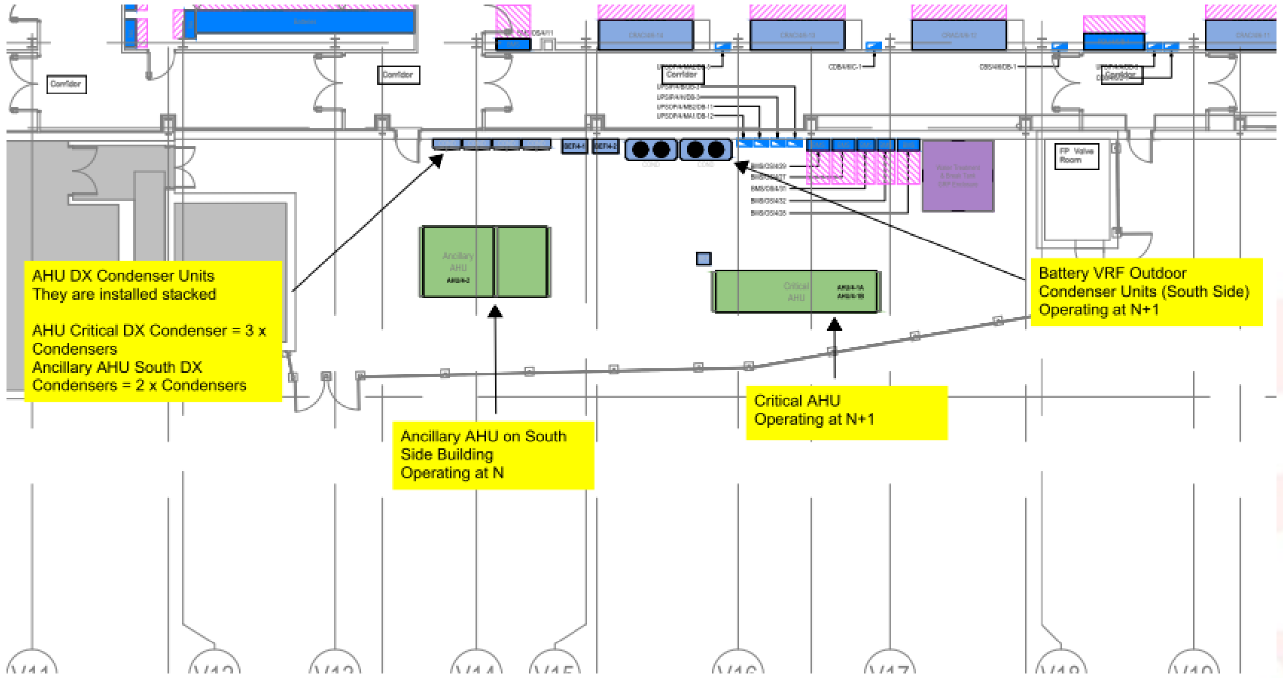

Figure 5: Proposed AHU locations on North East Elevation

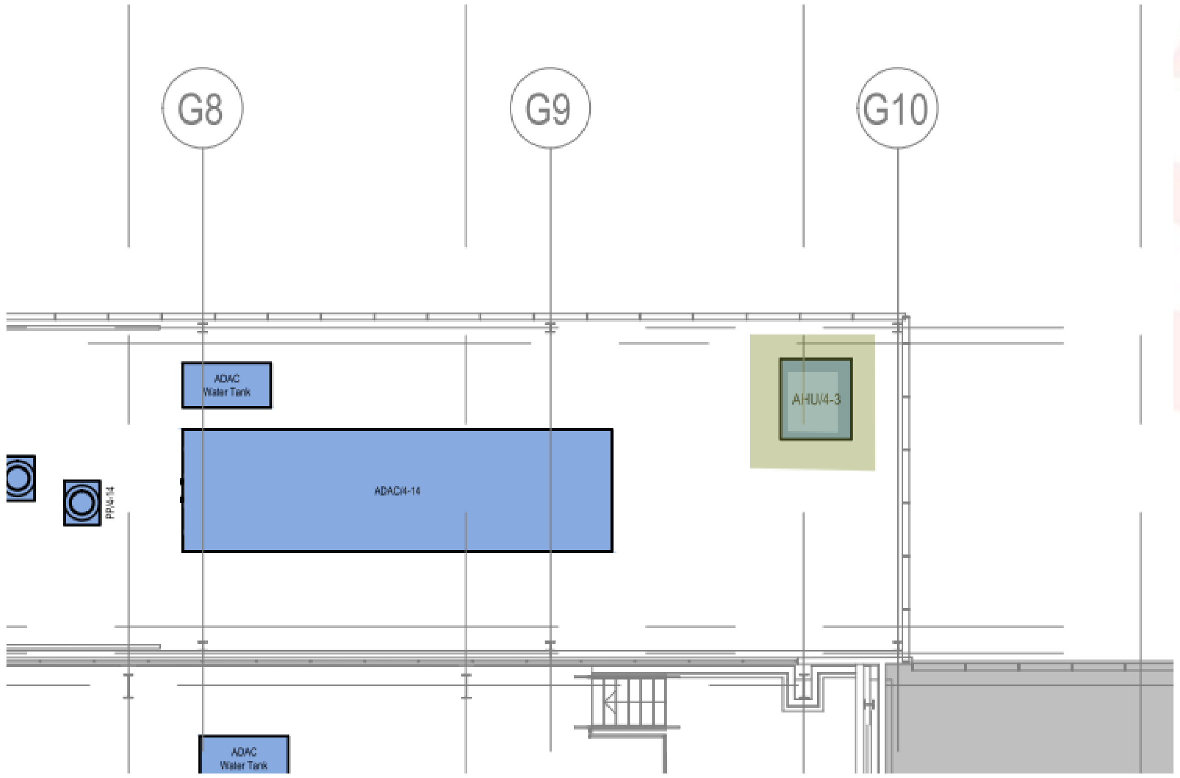

Figure 6: Proposed AHU location on the Gantry

7.2 The proposed units are described as:

- Ancillary AHUs – One on the North East Elevation, One on the Gantry
- Critical AHU – On the North East Elevation

7.3 The Ancillary units have both supply and exhaust systems, whereas the Critical unit is a supply only.

7.4 We have calculated the attenuation required for the proposed AHUs, as shown in Table 5, assuming that the compound has a 3.5m barrier as described in section 6.3.

AHU	Notes	Attenuator insertion loss dB					
		125	250	500	1k	2k	4k
Ancillary	Supply inlet	-	-	-	-	-	-
	Exhaust outlet	2	9	12	16	14	12
Critical	Supply inlet	2	9	12	16	14	12

Table 5: Attenuation requirements for proposed AHUs

7.5 Should alternative units be proposed, the total sound power of the atmosphere side terminations and the casing breakout should not exceed 76 dB per AHU, based on the approximate location shown, relative to the barriers

8 Chiller noise levels

8.1 Nine chillers are proposed, to be located within the mechanical plant room as shown in **Figure 7**.

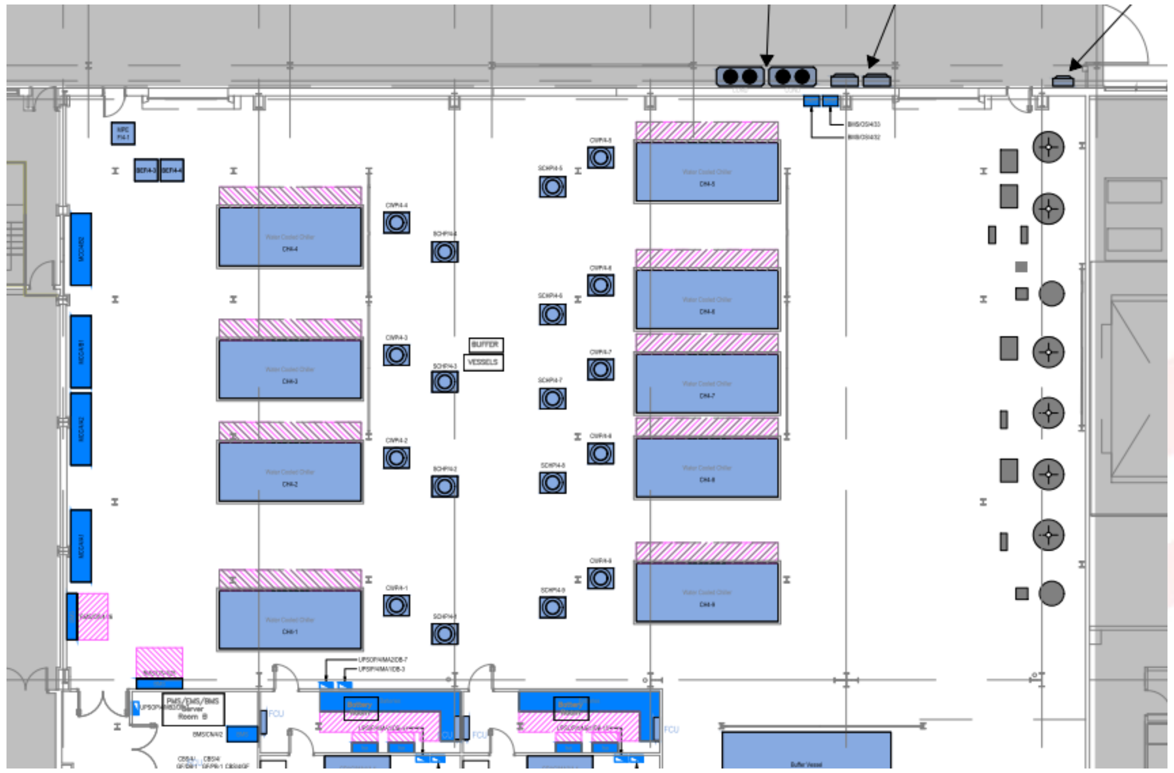

Figure 7: Proposed Chiller locations

8.2 The plant room will be reverberant, and the levels in the plant room could be up to 85 dB $L_{Aeq,T}$.

8.3 To suitably control the noise egress from the plant room, the façade should be constructed from a build-up which provides 40 dB reduction, which could be a blockwork wall or an insulated composite panel with an internal lining.

8.4 Doors into the plant room should be solid door sets, with perimeter door seals.

8.5 The ventilation openings into the plant room will need to attenuated with the insertion loss as shown in Table 6.

Louvre / Attenuator insertion loss dB					
125	250	500	1k	2k	4k
8	14	18	16	14	8

Table 6: Attenuation requirements for ventilation openings to the mechanical plant room

9 Coolers noise levels

9.1 The coolers are located on the upper floor and gantry areas as shown in **Figure 8**.

Figure 8: Proposed Cooler locations highlighted in green

9.2 Directivity information has also been provided for the coolers and this demonstrates that approximately half of the noise is directed upwards from the fans, and half is directed downwards. This is important for establishing the effect of the local horizontal baffles.

9.3 The coolers should be specified to meet the sound power levels shown in Table 4, and these need to be based on daytime and night-time duties required during the time periods 07:00 to 23:00 and 23:00 to 07:00 respectively.

9.4 Each of the three identified locations are reviewed separately.

9.5 **Grids C to E and 1 to 2**

9.6 Six coolers are located in this area, and they are to be located at first floor level with the existing roof to be removed. A section through the area, with mitigation requirements is shown in **Figure 9**.

9.7 The mitigation requirements consist of:

- Solid barrier following the profiles of the existing façade and roof
- Attenuated louvres on the façade
- Horizontal 'baffles' which have an absorptive lining to the underside

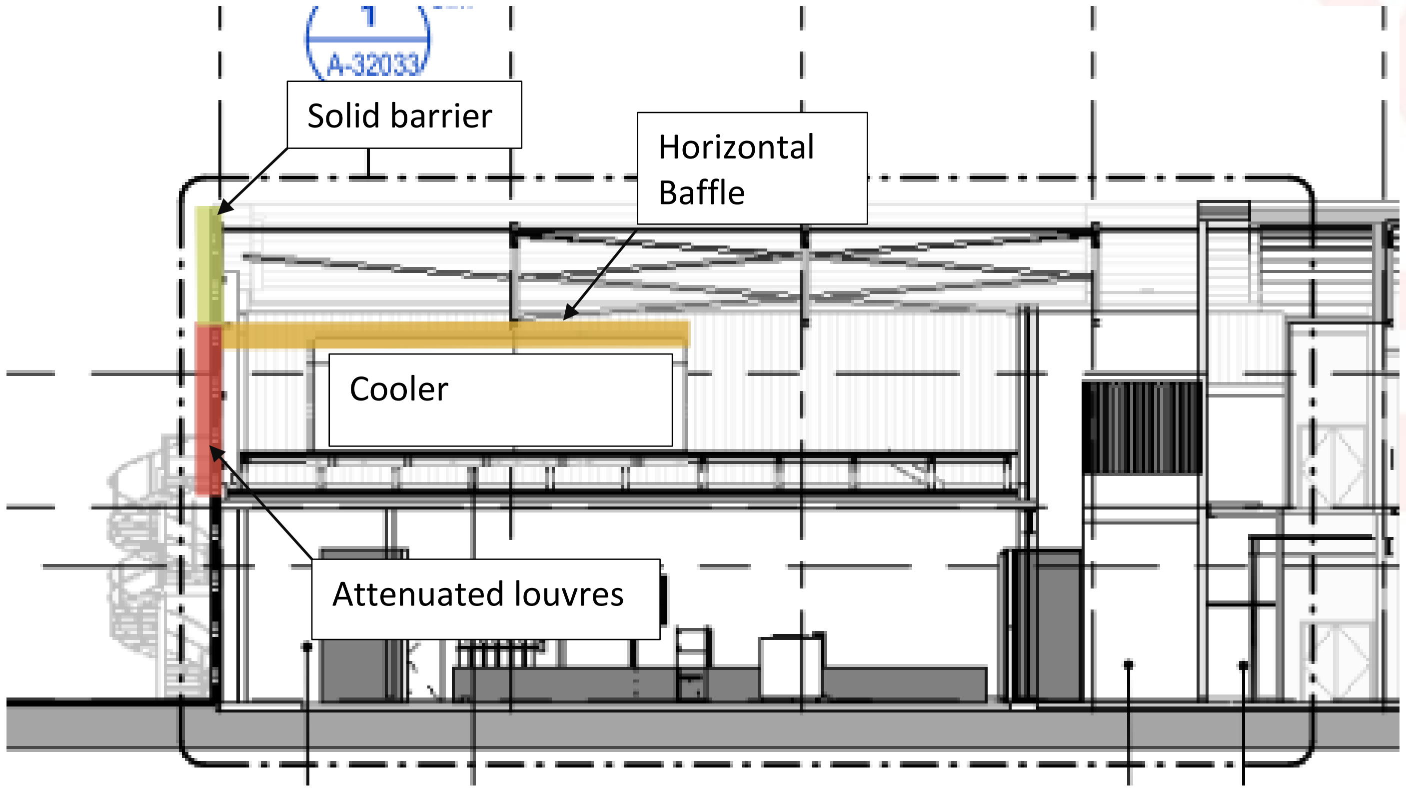

Figure 9: Section showing cooler location and mitigation requirements

9.8 The solid barrier could be either a composite cladding panel, or an architectural louvre with a blanking plate behind. The surface mass should be a minimum of 12 kg/m^2.

9.9 The attenuated louvres will need to achieve the insertion loss figures shown in Table 7.

Louvre / Attenuator insertion loss dB					
125	**250**	**500**	**1k**	**2k**	**4k**
5	10	13	16	14	8

Table 7: Attenuation requirements for louvres / attenuators

9.10 The horizontal baffles should have a minimum surface mass of 12 kg/m^2 and require the underside to be lined with an absorptive finish which provides absorption coefficient of 0.7 or better at 500Hz.

9.11 That can be achieved with a 100mm thick mineral wool material and a perforated metal lining to the underside.

9.12 **Grids A to B and 3 to 5.1**

9.13 Seven coolers which are located in this area, at level 1, and the existing roof is to be removed.

9.14 To achieve the required noise levels at the receptors relies on the perimeter of this area being screened with the proposed new walls between the external plant area and the rest of the buildings. Typically, as shown in **Figure 10**.

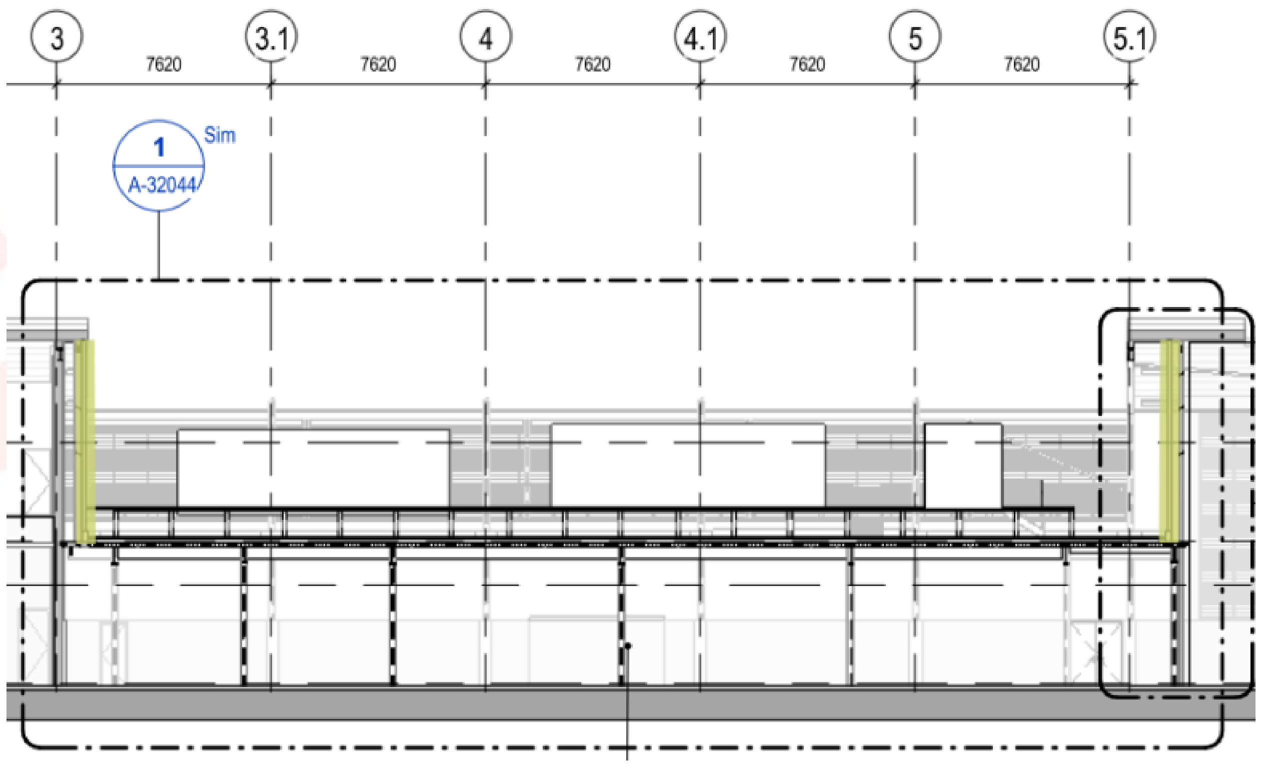

Figure 10: Location of barriers / walls to the plant deck area

9.15 **Gantry**

9.16 The five coolers located on the proposed gantry contribute to the overall noise levels at the north and south and the units will require attenuation from barriers on the gantry.

9.17 Some of these are required to be open, to allow for airflow.

9.18 The attenuated louvres will need to provide the insertion loss figures shown in Table 7 and the solid barriers should have a surface mass of 12 kg/m^2 or greater.

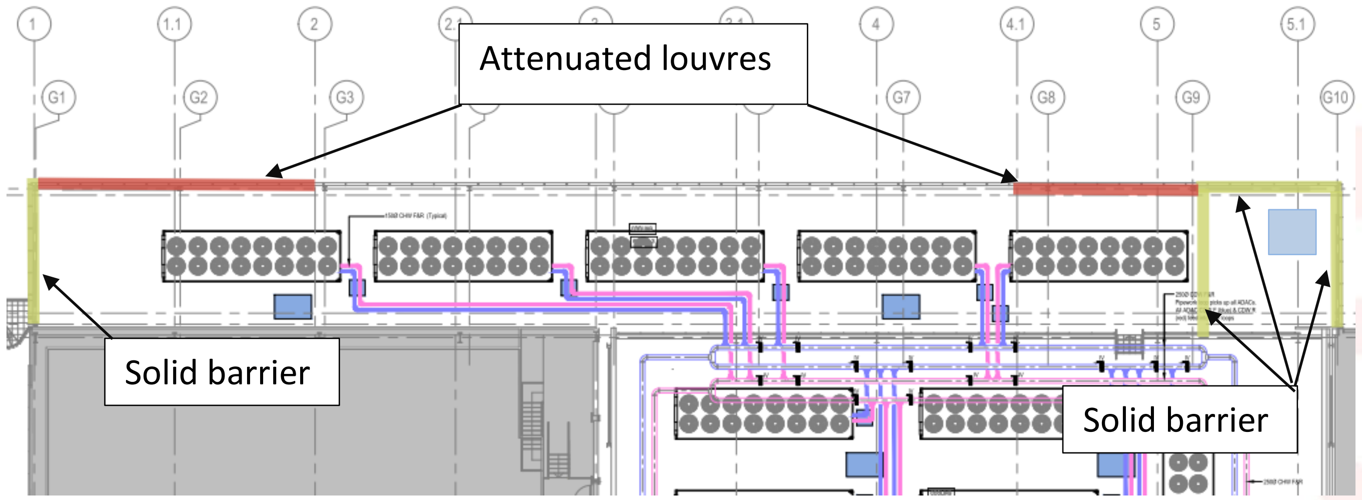

Figure 11: Location of barriers to the gantry

10 Review of generator noise control measures

10.1 The generators have been specified to achieve 63 dB at 1m from the generator housing, inlet louvres, discharge louvres and engine exhaust.

10.2 The specification is a high level of sound reduction for a large generator set, but it is achievable with suitable attenuation and housing design.

10.3 The proposed supplier has provided noise level calculations for the generators, and these are predicting a performance of less than 59 dBA at 1m from the attenuator terminations, which allows for some tolerance.

10.4 A section through the generator plant room is shown in **Figure 12** with the air inlet located on the external façade and the outlet discharging vertically through the roof of the building.

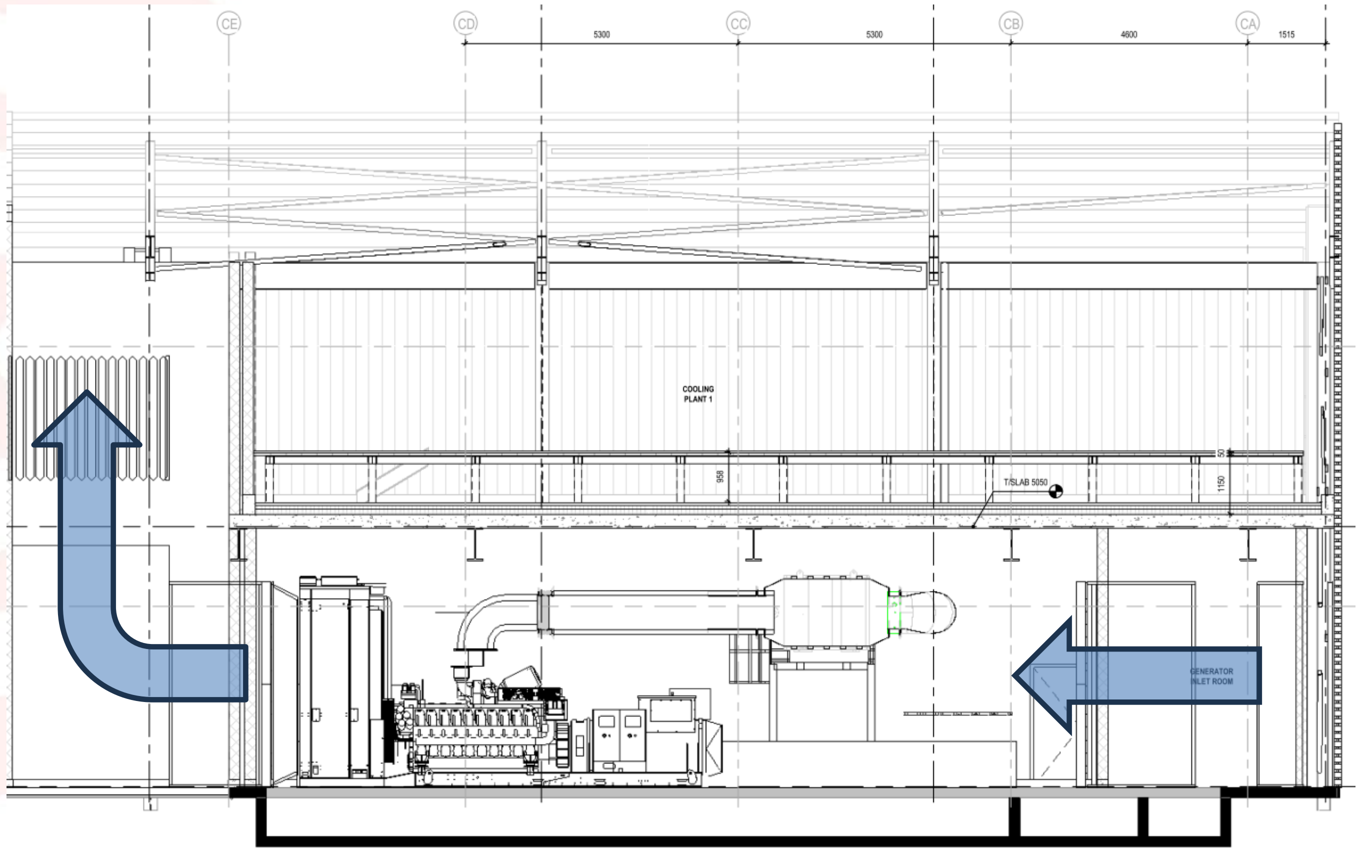

Figure 12: Section through generator housing

10.5 **Housing details**

10.6 The generator plantrooms house two generators within a single plantroom.

10.7 The plant rooms are to be lined to the walls and soffit with a 100mm thick acoustically absorbent panel and the predicted noise level in the generator room is 101 dB A

10.8 The plant room to atmosphere on the inlet side is proposed as two separate blockwork walls. It is assumed that all blockwork is medium density concrete block of 1500 kg/m^3 or greater.

10.9 The roof to the plant room is understood to be 250 mm thick concrete.

10.10 The proposed build ups are suitable for controlling the noise breakout from the plant room, but it will require careful detailing at Stage 4 to ensure that the performance of the walls and roof are maintained at the junctions and any apertures.

10.11 **Inlet attenuation**

10.12 The inlet attenuation is shown as two separate 'attenuators' described as primary and secondary attenuators. The calculations provided indicate the same arrangement, with two separate attenuator performances shown.

10.13 The combined length of the attenuation is around 3000mm which should be sufficient to meet the required noise limits.

10.14 **Discharge attenuation**

10.15 The arrangement for the discharge attenuation indicates longer attenuation than for the inlet, which is usual as the direct sound from the radiator will also be included in the discharge calculations.

10.16 The calculation for the discharge attenuation indicates the dominant frequencies as 63Hz and 8kHz, which could potentially be improved by lining the plenum or turning vanes where the airflow is turned through 90 degrees.

10.17 At Stage 3, the space allowed for the attenuation seems sufficient to meet the specified levels.

10.18 **Exhaust silencers**

10.19 Calculations haven't been provided for the exhaust silencers, but the drawings do show a route for the exhaust pipework and there would be sufficient length of pipework to incorporate the required silencers.

10.20 An large reactive / primary silencer is shown within the plant room and a secondary silencer could be located within the vertical stack if required.

10.21 It isn't clear where the termination for the exhaust is located, but there can be some benefit from directing the termination away from the residential receptors.

11 Conclusion

11.1 The proposed plant and building design are predicted to produce noise levels of 10 dB below the existing background noise levels at the nearby receptors, during normal operation, with the proposed mitigation.

11.2 During emergency operation, when the generators operate, the noise levels are predicted to be no more than the existing background levels.