Technical Note A2136 TN01a

Date: 11th April 2024 By Email Only
To: Rob Cordier – Life Build
From: Jonathan Croft - Ion Acoustics

Subject **ACS Hillingdon Sports Hall Extension – Plant Noise Assessment**
Planning: 2393/APP/2023/1598 Condition 7

Introduction

Ion Acoustics is appointed by Life Build to carry out an assessment of plant noise emissions for the new Sports Hall extension at ACS Hillingdon and demonstrate compliance with planning Condition 7, and to support the submission to discharge Conditions 3b and 9. These conditions relate to the details of plant equipment.

The assessment relates to new plant serving an extension to the sports facilities at ACS Hillingdon, comprising a multi-use hall, a fitness suite, a climbing wall, and a foyer. For the new extension several new items of building services plant are installed on the roof on 'big foot' systems. The items of plant are; 1no. Heat Recovery Unit (HRU), 1no. Air Source Heat Pump (ASHP), 1no. Heat Pump Condenser. Additionally there will be two extract fans installed internally but ducted to the flat roof on the west side of the building.

The development was granted planning permission via Section 73 (ref: 2393/APP/2023/1598) in September 2023 by LB Hillingdon, including various conditions. Regarding plant noise emissions from the development, Condition 7 states:

"The rating level of the noise emitted for the site by any Air Conditioner or other mechanical plant shall be at least 5dB below the existing background noise level. The noise levels shall be determined at the boundary of the nearest noise sensitive premises. The measurements and assessment shall be made in accordance to the latest British Standard 4142.

REASON

To safeguard the amenity of the surrounding area in accordance with policy D14 of the London Plan (2021)."

To demonstrate compliance with Condition 7, a BS 4142 (2014) assessment has been conducted for new items of plant to be installed on the roof top of ACS Hillingdon. The condition is slightly unusual in that it sets the limit at the boundary of the nearest noise sensitive premises rather than at noise sensitive windows which would be more in line with BS4142. An assessment to the windows and the site boundary for each affected dwelling has been made.

Scheme Details

A site plan is shown in Figure 1. Five assessment positions of varying distances and orientations to the extension are shown as AP1 – AP5 (at the facades of the nearby dwellings) and AP1a – AP5a which is on the boundary of those same dwellings. The noise receptors at AP1 – AP5 are generally at first floor, being the most affected windows, but AP1a – AP5a are only at ground level just inside the boundary line of the property. The new extension is highlighted in purple, and the plant are shown as orange for

the HRU, blue for the ASHP, green for the heat pump condenser, and pink for the extract fans. The monitoring positions from Ion Acoustics' baseline noise survey is also indicatively shown as 'MP1'.

The plant item details are:

- 1no. HRU – Mitsubishi Lossnay LGH-250-RVXTE, to serve the fitness suite ventilation. The intake, exhaust, and the casing breakout has been included in the calculations;
- 1no. ASHP – Mitsubishi Ecodan CAHV-R450YA-HYB, to serve the upper floor heating to the multi-use hall, foyer, and climbing wall;
- 1no. heat pump condenser – Mitsubishi Mr. Slim PUZ-ZM140YKA, to serve heating and cooling in the fitness suite;
- 2no. extract fans – Vent-Axia ACM 150, to serve the plant room and an office.

For this assessment, it is assumed all plant is running simultaneously, and the duty that will give the highest noise emissions associated to each plant item.

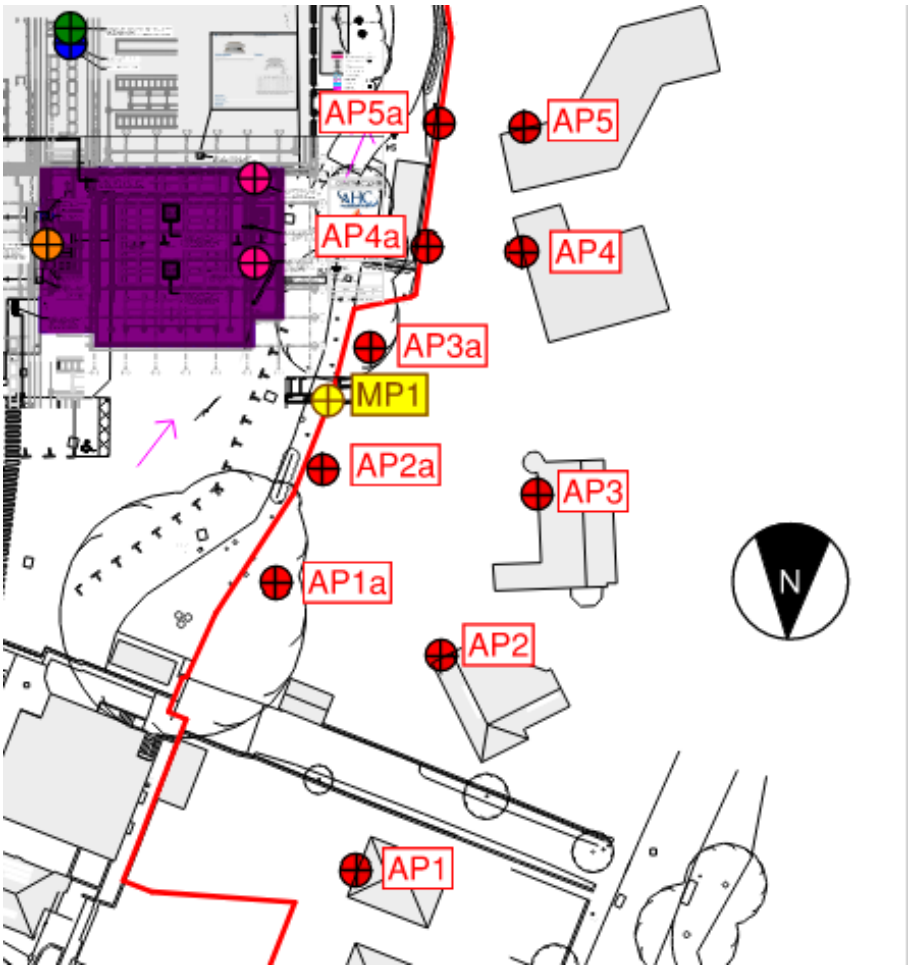

Figure 1 – Site Plan showing location of plant, and monitoring and assessment positions

Noise Survey and Plant Noise Emissions Limits

A baseline noise survey was conducted on site by Ion Acoustics on 15th – 17th May 2023 and is used to represent the baseline background noise levels for deriving the plant limits. One monitoring position to the north west of the school was used to determine typical noise levels affecting the assessment positions. Full details of this survey can be found in Ion Acoustics report A2011 R02a.

A summary of the background sound levels, L_{A90}, and the noise rating level limits (5dB below the background noise level), L_{Ar} are shown below in Table 1.

Table 1: Summary of background sound levels and derived plant noise emission limits

Measurement Position	Assessment Period	Background Sound Level, L_{A90}	Noise Rating Level Limit, L_{Ar}
MP1	Operational Period (08:00 – 18:00)	46dB	41dB
	Overnight (23:00 – 07:00)	41dB	36dB

Plant Noise Emissions Calculations

Calculations have been made to the five closest receptors to the new plant:

- AP1: 102 Vine Lane
- AP2: 100 Vine Lane
- AP3: 98 Vine Lane
- AP4: 96a Vine Lane
- AP5: 96b Vine Lane

For the ASHP, the condenser, and the HRU casing breakout, the calculations were performed using published sound pressure level data by the manufacturer, Mitsubishi. Free-field noise emissions have been calculated at the most affected façade (or window) and on the boundary of the five assessment positions. Simple point source distance loss [$20LOG(r/r_o)$], shielding, and reflections from surfaces around the source have been considered in the calculations to any given receptor.

Sound power levels were given for the HRU supply, and the extract fans. For the HRU, it is likely that the fresh air inlet (with filters, etc.) will emit lower noise levels than the HRU supply side in practice, so this method is considered conservative. Hence, the noise levels would likely be lower than predictions, giving conservative estimates. For these items, induct end reflections, hemispherical radiation, directivity, and simple point distance loss [$20LOG(r/r_o)$] has been included in the calculations to give sound pressure levels at the façade of a given receptor before corrections for shielding and reflections have been applied.

It is assumed that the plant will not contain any tonal, impulsive, intermittent, or other characteristics, therefore a character correction has not been applied.

It is assumed that the items of plant will be operational during extended school hours, 08:00 – 18:00. The noise rating level limits that the emissions are assessed against is L_{Ar} 41dB.

An example calculation to AP1 and AP1a has been added at the end of this note.

The predicted results are shown in Table 2 to the windows (AP1 to AP5) and in Table 3 for the boundary of the properties (AP1a to AP5a). These tables show the specific noise level, the rating level, and the margin of compliance.

Table 2: Predicted Noise Rating Levels at the Assessment Positions AP1 to AP5

Assessment Position	Assessment Period	Specific Sound Level, L_s dB	Character Correction, dBA	Noise Rating Level, L_{Ar}	Plant Noise Emissions Limit, L_{Ar} dB	Margin of Compliance (Noise Rating Level – Noise Limit), dBA
AP1	Operational Period, (08:00 – 18:00)	26	+0	26	41	15
AP2		28		28		13
AP3		29		29		12
AP4		32		32		9
AP5		32		32		9

Table 3: Predicted Noise Rating Levels at the Assessment Positions AP1a to AP5a

Assessment Position	Assessment Period	Specific Sound Level, L_s dB	Character Correction, dBA	Noise Rating Level, L_{Ar}	Plant Noise Emissions Limit, L_{Ar} dB	Margin of Compliance (Noise Rating Level – Noise Limit), dBA
AP1a	Operational Period, (08:00 – 18:00)	30	+0	30	41	11
AP2a		32		32		9
AP3a		32		32		9
AP4a		32		32		9
AP5a		32		32		9

These show that the noise limit is met comfortably at all positions with a significant margin of tolerance of no less than 9dBA.

Context and Uncertainty

BS4142 encourages discussion of context and uncertainty within assessments.

The sound climate is mainly dominated by the local road network which contributes to the background noise level, L_{A90}. During the original baseline noise survey, the engineers did not observe any atypical noises. The traffic noise appears to be reasonably steady state with a small difference in the measured L_{Aeq} and L_{A90}. And, although over the survey duration there were periods that appeared to have elevated or reduced noise levels, the fluctuations are deemed to be typical of an urban environment.

Predictions show a good margin of compliance relative to the noise limit. In this instance, the uncertainty of the predictions does not have any significance to the outcome of the assessment.

According to BS4142, this prediction is an indication of the plant noise having better than a low impact.

Summary

A plant noise emissions assessment has been conducted for three items of new rooftop plant at ACS Hillington. Predictions demonstrate that cumulative plant noise emissions are well under The Council of the London Borough of Hillingdon's noise limits in planning Condition 7 and compliance can be achieved. Conditions 3b and 9 can therefore be discharged in respect of noise emissions.

Calculations to AP1

4 April 2024														
Noise Limits														
Operational Day (0800 - 1800)	**LAr**	**41**	**dB**											
Night	**LAr**	**36**	**dB**				Octave Band Centre Frequency, Hz							
							63	125	250	500	1000	2000	4000	dBA
to AP1														
HRU (Casing)														
=sound pressure-distance loss-shielding+reflections														
distance loss = 20LOG(r/ro)														
Sound Pressure Level @	1.5	m from unit				Lp	53.1	46.8	40.4	37.6	32.3	24.0	19.6	39.1
Distance (r)	67.4	m	Reference Distance (ro)	1.5	m	Distance Loss	33.1	33.1	33.1	33.1	33.1	33.1	33.1	
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
HRU Sound Pressure Level at AP1						Lp	13.0	6.7	0.3	-2.5	-7.8	-16.1	-20.5	-1.0
HRU (Exhaust)														
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections														
Sound Power Level						L_W	72.3	72.7	68.0	64.4	58.6	49.0	48.0	65.6
end reflection, 750mm, 250mm							9.0	5.0	1.0	0.0	0.0	0.0	0.0	
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Directivity				directivity : 27.4°,30°, 250mm, 750mm			4.5	5.5	6.0	6.5	7.5	8.0	8.0	
Distance Loss				distance		64.8m	36.2	36.2	36.2	36.2	36.2	36.2	36.2	
Sound Pressure Level at Façade						Lp	23.6	29.0	28.8	26.7	21.9	12.8	11.8	27.3
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
HRU Sound Pressure Level at AP1						Lp	16.6	22.0	21.8	19.7	14.9	5.8	4.8	20.4
HRU (Intake)														
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections														
Sound Power Level						L_W	72.3	72.7	68.0	64.4	58.6	49.0	48.0	65.6
end reflection, 750mm, 250mm							9.0	5.0	1.0	0.0	0.0	0.0	0.0	
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Directivity				directivity : 154.2°,30°, 750mm, 250mm			3.0	3.0	2.5	1.0	-11.5	-11.0	-11.0	
Distance Loss				distance		68.9m	36.8	36.8	36.8	36.8	36.8	36.8	36.8	
Sound Pressure Level at Façade						Lp	21.6	26.0	24.8	20.7	2.4	-6.7	-7.7	20.4
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
HRU Sound Pressure Level at AP1						Lp	14.6	19.0	17.8	13.7	-4.6	-13.7	-14.7	13.4

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Condenser															
=sound pressure-distance loss-shielding+reflections															
distance loss = 20LOG(r/ro)															
Sound Pressure Level @	1	m from unit				Lp	62.7	55.1	52.9	50.0	46.7	42.0	37.4	52.1	
Distance (r)	85.7	m	Reference Distance (ro)	1	m	Distance Loss	38.7	38.7	38.7	38.7	38.7	38.7	38.7		
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0		
Reflecitons	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Condenser Sound Pressure Level at AP1						Lp	17.0	9.4	7.2	4.3	1.0	-3.7	-8.3	6.4	
ASHP															
=sound pressure-distance loss-shielding+reflections															
distance loss = 20LOG(r/ro)															
Sound Pressure Level @	1	m from unit				Lp	65.8	72.9	69.2	67.3	61.1	59.4	61.1	69.2	
Distance (r)	84.2	m	Reference Distance (ro)	1	m	Distance Loss	38.5	38.5	38.5	38.5	38.5	38.5	38.5		
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0		
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0		
ASHP Sound Pressure Level at AP1						Lp	20.3	27.4	23.7	21.8	15.6	13.9	15.6	23.7	
Extract Fan 1															
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections															
Sound Power Level						L_w	62.2	64.1	62.6	63.2	58.0	59.8	53.0	65.4	
end reflection, 150mm, 150mm							16.0	11.0	6.0	2.0	0.0	0.0	0.0		
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0		
Directivity				directivity : 90°,0°, 150mm, 150mm			3.0	3.5	3.5	3.0	2.0	-10.5	-10.5		
Distance Loss				distance		59.0m	35.4	35.4	35.4	35.4	35.4	35.4	35.4		
Sound Pressure Level at Façade						Lp	5.8	13.2	16.7	20.8	16.6	5.9	-0.9	20.6	
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0		
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0		
HRU Sound Pressure Level at AP1						Lp	-1.2	6.2	9.7	13.8	9.6	-1.1	-7.9	13.7	
Extract Fan 2															
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections															
Sound Power Level						L_w	62.2	64.1	62.6	63.2	58.0	59.8	53.0	65.4	
end reflection, 150mm, 150mm							16.0	11.0	6.0	2.0	0.0	0.0	0.0		
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0		
Directivity				directivity : 90°,0°, 150mm, 150mm			3.0	3.5	3.5	3.0	2.0	-10.5	-10.5		
Distance Loss				distance		68.2m	36.7	36.7	36.7	36.7	36.7	36.7	36.7		
Sound Pressure Level at Façade						Lp	4.5	11.9	15.4	19.5	15.3	4.6	-2.2	19.4	
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0		
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0		
HRU Sound Pressure Level at AP1						Lp	-2.5	4.9	8.4	12.5	8.3	-2.4	-9.2	12.4	
Cumulative Plant Noise Levels at AP1 (dB add)						**Lp**	**24.0**	**29.1**	**26.7**	**25.0**	**19.3**	**14.8**	**16.0**	**26.1**	
										Operational Noise Limit			**41**	**dB(A)**	
										Margin of Compliance			**15**	**dB(A)**	

Calculations to AP1a

8th April 2024															
Noise Limits															
Operational Day (0800 - 1800)	**LAr**	**41**	**dB**												
Night	**LAr**	**36**	**dB**					Octave Band Centre Frequency, Hz							
							63	125	250	500	1000	2000	4000	dBA
to AP1															
HRU (Casing)															
=sound pressure-distance loss-shielding+reflections															
distance loss = 20LOG(r/ro)															
Sound Pressure Level @	1.5	m from unit				Lp	53.1	46.8	40.4	37.6	32.3	24.0	19.6	39.1
Distance (r)	42.7	m	Reference Distance (ro)	1.5	m	Distance Loss	29.1	29.1	29.1	29.1	29.1	29.1	29.1	
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
HRU Sound Pressure Level at AP1						Lp	17.0	10.7	4.3	1.5	-3.8	-12.1	-16.5	3.0
HRU (Exhaust)															
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections															
Sound Power Level						L_W	72.3	72.7	68.0	64.4	58.6	49.0	48.0	65.6
end reflection, 750mm, 250mm							9.0	5.0	1.0	0.0	0.0	0.0	0.0	
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Directivity				directivity : 27.4°,30°, 250mm, 750mm			4.5	5.5	6.0	6.5	7.5	8.0	8.0	
Distance Loss				distance		39.6m	32.0	32.0	32.0	32.0	32.0	32.0	32.0	
Sound Pressure Level at Façade						Lp	27.9	33.3	33.1	31.0	26.2	17.1	16.1	31.6
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
HRU Sound Pressure Level at AP1						Lp	20.9	26.3	26.1	24.0	19.2	10.1	9.1	24.6
HRU (Intake)															
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections															
Sound Power Level						L_W	72.3	72.7	68.0	64.4	58.6	49.0	48.0	65.6
end reflection, 750mm, 250mm							9.0	5.0	1.0	0.0	0.0	0.0	0.0	
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Directivity				directivity : 154.2°,30°, 750mm, 250mm			3.0	3.0	2.5	1.0	-11.5	-11.0	-11.0	
Distance Loss				distance		44.8m	33.0	33.0	33.0	33.0	33.0	33.0	33.0	
Sound Pressure Level at Façade						Lp	25.3	29.7	28.5	24.4	6.1	-3.0	-4.0	24.1
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0	
HRU Sound Pressure Level at AP1						Lp	18.3	22.7	21.5	17.4	-0.9	-10.0	-11.0	17.1

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Condenser																
=sound pressure-distance loss-shielding+reflections																
distance loss = 20LOG(r/ro)																
Sound Pressure Level @	1	m from unit				Lp	62.7	55.1	52.9	50.0	46.7	42.0	37.4	52.1		
Distance (r)	59.4	m	Reference Distance (ro)	1	m	Distance Loss	35.5	35.5	35.5	35.5	35.5	35.5	35.5			
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0			
Reflecitons	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0			
Condenser Sound Pressure Level at AP1						Lp	20.2	12.6	10.4	7.5	4.2	-0.5	-5.1	9.6		
ASHP																
=sound pressure-distance loss-shielding+reflections																
distance loss = 20LOG(r/ro)																
Sound Pressure Level @	1	m from unit				Lp	65.8	72.9	69.2	67.3	61.1	59.4	61.1	69.2		
Distance (r)	57.1	m	Reference Distance (ro)	1	m	Distance Loss	35.1	35.1	35.1	35.1	35.1	35.1	35.1			
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0			
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0			
ASHP Sound Pressure Level at AP1						Lp	23.7	30.8	27.1	25.2	19.0	17.3	19.0	27.0		
Extract Fan 1																
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections																
Sound Power Level						L_w	62.2	64.1	62.6	63.2	58.0	59.8	53.0	65.4		
end reflection, 150mm, 150mm							16.0	11.0	6.0	2.0	0.0	0.0	0.0			
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0			
Directivity				directivity : 90°,0°, 150mm, 150mm			3.0	3.5	3.5	3.0	2.0	-10.5	-10.5			
Distance Loss				distance	25.3m		28.1	28.1	28.1	28.1	28.1	28.1	28.1			
Sound Pressure Level at Façade						Lp	13.2	20.6	24.1	28.2	24.0	13.3	6.5	28.0		
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0			
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0			
HRU Sound Pressure Level at AP1						Lp	6.2	13.6	17.1	21.2	17.0	6.3	-0.5	21.0		
Extract Fan 2																
Sound Power Level-end reflection-hemispherical radiation+directivity-distance loss-shielding+reflections																
Sound Power Level						L_w	62.2	64.1	62.6	63.2	58.0	59.8	53.0	65.4		
end reflection, 150mm, 150mm							16.0	11.0	6.0	2.0	0.0	0.0	0.0			
Hemisperical Radiation							8.0	8.0	8.0	8.0	8.0	8.0	8.0			
Directivity				directivity : 90°,0°, 150mm, 150mm			3.0	3.5	3.5	3.0	2.0	-10.5	-10.5			
Distance Loss				distance	33.5m		30.5	30.5	30.5	30.5	30.5	30.5	30.5			
Sound Pressure Level at Façade						Lp	10.7	18.1	21.6	25.7	21.5	10.8	4.0	25.6		
Shielding	10	dB(A)					10.0	10.0	10.0	10.0	10.0	10.0	10.0			
Reflections	3	dB(A)					3.0	3.0	3.0	3.0	3.0	3.0	3.0			
HRU Sound Pressure Level at AP1						Lp	3.7	11.1	14.6	18.7	14.5	3.8	-3.0	18.6		
Cumulative Plant Noise Levels at AP1 (dB add)						**Lp**	**27.7**	**32.7**	**30.6**	**29.3**	**23.9**	**18.5**	**19.5**	**30.3**		
										Operational Noise Limit				**41**	**dB(A)**	
										Margin of Compliance				**11**	**dB(A)**	