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UCL Howland Street

Noise Emissions Compliance Report

R04

Issue 1 | 11 September 2014

Job number 211374

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1 Introduction

This report sets out the levels of external noise emissions from the building services of UCL Howland Street, to demonstrate that the noise emissions limit established for the project are met. The relevant conditions for planning permission 2011/1444IP are set out below.

Condition 14
Noise levels at a point 1 metre external to sensitive facades shall be at least 5dB(A) less than the existing background measurement (LA90), expressed in dB(A) when all plant/equipment (or any part of it) is in operation unless the plant/equipment hereby permitted will have a noise that has a distinguishable, discrete continuous note (whine, hiss, screech, hum) and/or if there are distinct impulses (bangs, clicks, clatters, thumps), then the noise levels from that piece of plant/equipment at any sensitive façade shall be at least 10dB(A) below the LA90, expressed dB(A).

Condition 15
Prior to the commencement of the relevant part of the development full details of all plant and equipment, including a revised acoustic report, which demonstrates that the plant can comply with condition 14 of this permission, shall be submitted to and approved in writing by the local planning authority. The approved plant shall thereafter be installed and maintained in effective order to the reasonable satisfaction of the Council.

The previous report "Acoustics report for Planning" was issued in February 2011. That report set out the noise criteria at designated receivers, obtained in accordance with the above conditions on the basis of a survey of existing background noise levels, together with related limiting noise levels for plant items.

This report sets out the noise levels of the installed equipment and demonstrates by calculations which take account of source levels, propagation distance, and screening, that noise levels at the receivers will meet these criteria. In this way it is demonstrated that Planning Conditions 14 and 15 are met.

2 Criteria

The noise criteria are set out in the table below in relation to Condition 14 above and on the basis of the noise survey reported in the previous report "Acoustics report for Planning" issued in February 2011.

	Camden, Day-time	Camden, Night-time	Westminster, Day-time	Westminster, Night-time
Normally operating plant	50	45	45	40
Standby Generators	60-65	55-60	65	60

Table 1: Noise Criteria as dB(A) sound pressure levels

Designated receiver locations are as follows:

- Astor College UCL student accommodation on Charlotte Street (Camden)
    - (Receivers A1 and A2)
- Flats along the west side of Cleveland Street (Westminster)
    - (Receiver B)
- A proposal for the new University College Hospitals Trust residential development at 44 Cleveland Street, immediately adjacent to the present Windeyer site (Camden).
    - (Receiver C)

Figure 3: Receiver C section location

Figure 4: Receiver A1 section location

4 Plant Items (Sources)

Figure 5 below shows the location of the sources. A brief discussion of the source levels from each are set out below. A series of calculations of noise levels at the receivers are provided in the appendix.

4.1 Chillers

The installed chillers are low noise, producing a sound pressure level of 64dBA at 1m, in accordance with the planning report. They are fully screened from the receivers.

4.2 Generators

The generators a fully packaged and noise attenuated, producing a sound pressure level of 65dBA at 1m, in accordance with the planning report. They are fully screened from the receivers.

4.3 AHUs

The L6 roof-top AHUs serve the labs, and are fully screened. They have inlet louvre connections to the east (Howland Street) façade, and exhaust connections to the west façade.

Airspeeds through the louvres have been restricted to below 2m/s to avoid airflow noise and all AHUs have atmosphere side attenuation.

Source noise levels used in the calculations are fan sound power level and attenuator dynamic insertion losses confirmed by the supplier.

The plant tower on the west elevation has AHUs at L1-3, and the same principles have been applied. Once more the source noise levels used in the calculations are the fan sound power level and attenuator dynamic insertion losses confirmed by the supplier.

4.4 Fans

4.4.1 Fume extract

Because these fans are externally mounted, two separate source components have been considered: casing radiated noise; and in-duct sound power radiated from the flue discharge. The source levels in each case are figures confirmed by the supplier.

Each pair of fans will either run one at a time at 100% duty, or together at 50% duty. The calculations assume one at a time at 100% duty.

4.4.2 Basement Fans

These have also been considered on the basis of fan sound power and attenuator dynamic insertion losses provided by the supplier.

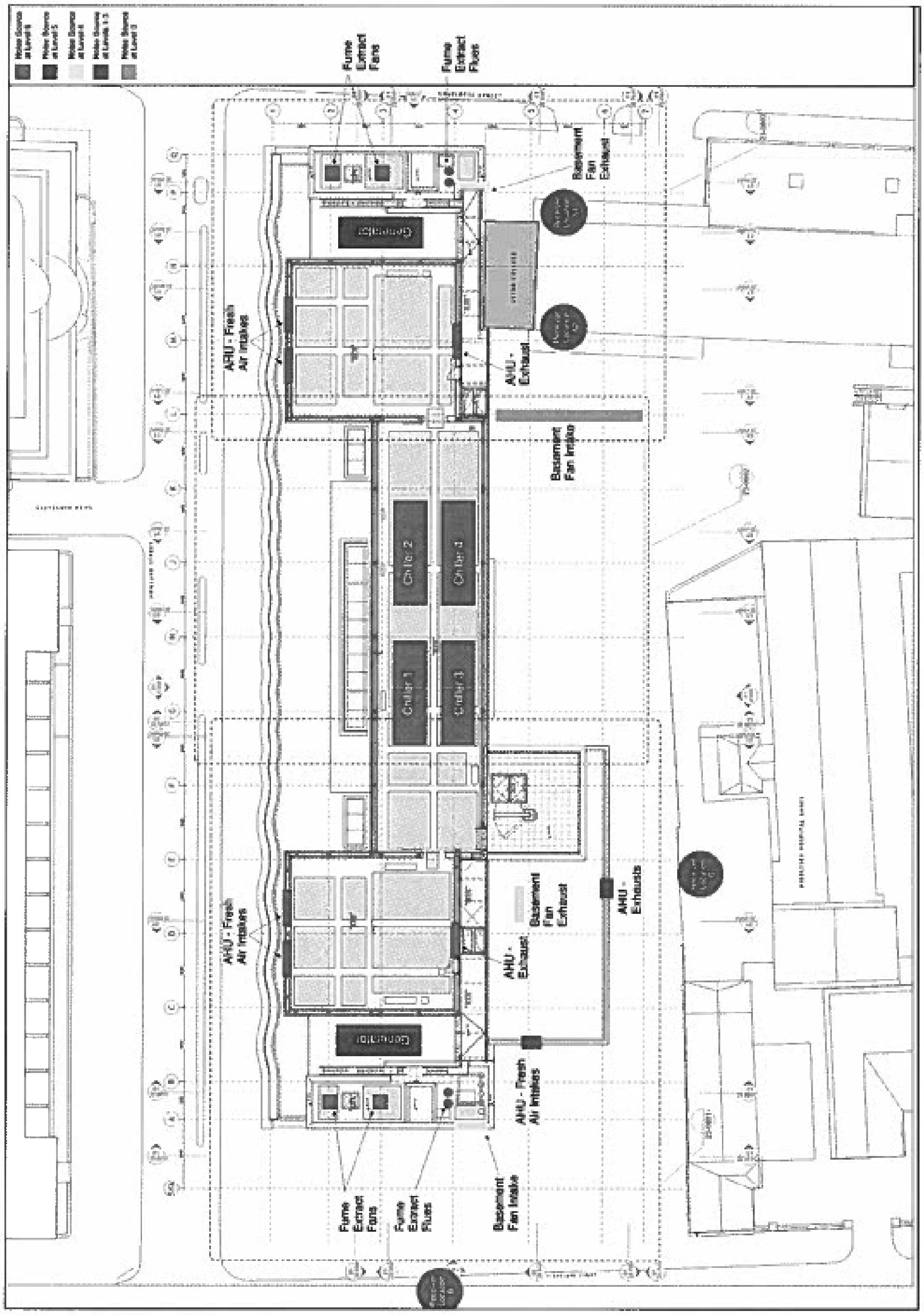

Figure 5: Plant locations

5 Noise at receivers

The table below sets out the sources relevant to each receiver location, and for which a noise level at the receiver has been calculated.

Receiver	Source
A1 Astor College, east	Fume extract fans
	Basement fans
	Generator
A2 Astor College, west	Chillers 2, 4
	Fume extract fans
	Lab AHU exhaust
B Cleveland Street, west	Fume extract fans
	Lab AHUs
	Basement fans
	Generator
C Middlesex Annex	AHUs (plant tower)

Table 2: Sources affecting each receiver

5.1 Calculated Noise Levels

The table below sets out the calculated noise level, in dBA, at each receiver location. The night-time criterion is given in brackets in each case.

Receiver	Normal plant	Generators
A1 Astor College, east	41 (45)	53 (55-60)
A2 Astor College, west	43 (45)	
B Cleveland Street, west	30 (40)	43 (60)
C Middlesex Annex	35 (45)	

Table 3: Calculated noise levels

6 Conclusions

This report, by considering the source levels and attenuation measures installed at UCL Howland Street demonstrates that plant noise emissions from the development will comply with Condition 14 of the planning permission.

7 Appendix: Noise Calculations

7.1 Receiver A1

ARUP Consultants in Acoustics • Vibration • Venues • AudioVisual

Job No.	Made By	Sheet No.	Date Created	Date last revised	Rev	Calc Ref
		10	12-Jun-14	13-Jun-14	6	C1-01

Job Title

Description		Length/Area/Volume		Octave Band Centre Frequency								
Calculation Description		dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Fume Extract Fans												
Casing												
radiated noise 2 fans at 50%			72.7		90.0	80.0	71.0	71.0	67.0	56.0	54.0	45.0
without motor, power estimate												
Distance Correction (Parallelepiped) ; A:1 m, B:0.5 m, C:1 m.		1.0 m			-14.7	-14.7	-14.7	-14.7	-14.7	-14.7	-14.7	-14.7
spl at 1m from fan without motor			58.0		75.3	65.3	56.3	56.3	52.3	41.3	39.3	30.3
Barrier Atten(Mackawa Equation), Path Diff.: 3.21 m ,Ds:7.5 m, H		5.0 m	3.21 m		-13.8	-16.7	-19.7	-22.7	-25.0	-25.0	-25.0	-25.0
Distance Correction (Hemispherical)		10.0 m	3.0 dB		-28.0	-28.0	-28.0	-28.0	-28.0	-28.0	-28.0	-28.0
from one fan			25.5		48.2	35.3	23.3	20.3	14.0	3.0	1.0	-8.0
Flue												
in-duct sound power			96.9		99.8	100.3	96.7	96.0	92.4	84.0	73.6	68.4
allaways selected attenuator					-7.0	-17.0	-28.0	-44.0	-38.0	-36.0	-34.0	-24.0
direct power			70.5		92.8	83.3	68.7	52.0	54.4	48.0	39.6	44.4
Distance Correction (Spherical)		13.0 m	0.0 dB		-33.3	-33.3	-33.3	-33.3	-33.3	-33.3	-33.3	-33.3
direct transmision from top of flue			37.3		59.5	50.0	35.4	18.7	21.1	14.7	6.3	11.1
total	Logarithmic Sum		37.5		59.8	50.2	35.7	22.6	21.9	15.0	7.4	11.2
Basement Fan												
EF-02-02&03	exhaust				77.5	67.5	54.5	45.5	43.5	40.5	36.5	51.5
distance	3.56											
Distance Correction (Plane Source) - Point Source Region		3.56 m			-19.7	-19.7	-19.7	-19.7	-19.7	-19.7	-19.7	-19.7
			37.2		57.8	47.8	34.8	25.8	23.8	20.8	16.8	31.8
TOTAL NORMAL NOISE @ A1	Logarithmic Sum		40.4		62.0	52.2	38.3	27.5	26.0	21.8	17.3	31.9
[illegible]												
dimensions												
length 8m; width 3m; height 3.4m												
SPl at 1m 65dBA					65.0							
Distance Correction (Parallelepiped) ; A:8 m, B:3 m, C:3.4 m.		1.0 m			-22.6							
so sound power					87.6							
distance to receiver		12m										
Distance Correction (Parallelepiped) ; A:8 m, B:3 m, C:3.4 m.		12.0 m			-34.3							
so SPL at receiver					53.3							

7.2 Receiver A2

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Job No.	Made By	Sheet No.
		11

Date Created	Date last revised	Rev
12-Jun-14	13-Jun-14	3

Job Title

Calc Ref: C1-01

Description		Length/Area/Volume		Octave Band Centre Frequency								
Calculation Description		dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Lab AHUs												
AHU-06-03	exhaust				72.0	55.0	51.0	36.0	32.0	28.0	32.0	42.0
Distance Correction (Plane Source) - Point Source Region		15.00 m			-31.7	-31.7	-31.7	-31.7	-31.7	-31.7	-31.7	-31.7
			17.5		40.3	23.3	19.3	4.3	0.3	-3.7	0.3	10.3
AHU-06-04	exhaust				72.0	55.0	51.0	36.0	32.0	28.0	32.0	42.0
Distance Correction (Plane Source) - Point Source Region		15.00 m			-31.7	-31.7	-31.7	-31.7	-31.7	-31.7	-31.7	-31.7
			17.5		40.3	23.3	19.3	4.3	0.3	-3.7	0.3	10.3
chillers												
Chiller 2												
dimensions												
length 9m; width 2.2m; height 2.6m												
SPl at 1m 64dBA					64.0							
Distance Correction (Parallelepiped) ; A:9 m, B:2.2 m, C:2.6 m.		1.0 m			-21.9							
so sound power					85.9							
Distance Correction (Parallelepiped) ; A:9 m, B:2.2 m, C:2.6 m.		22.0 m			-38.7							
so SPL at receiver					47.2							
screening	no line of sight				-5.0							
					42.2							
Chiller 4												
dimensions												
length 9m; width 2.2m; height 2.6m												
SPl at 1m 64dBA					64.0							
Distance Correction (Parallelepiped) ; A:9 m, B:2.2 m, C:2.6 m.		1.0 m			-21.9							
so sound power					85.9							
Distance Correction (Parallelepiped) ; A:9 m, B:2.2 m, C:2.6 m.		20.0 m			-37.9							
so SPL at receiver					48.0							
screening	no line of sight				-5.0							
			43.0		43.0							
TOTAL NORMAL NOISE @ A2	Logarithmic Sum		43.0									

7.3 Receiver B

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Job No.	Made By	Sheet No.
		12
Date Created	Date last revised	Rev
12-Jun-14	13-Jun-14	3
	Calc Ref	
	C1-01	

Job Title

Description Calculation Description		Length/Area/Volume dB	dB(A)	31.5	Octave Band Centre Frequency 63	125	250	500	1k	2k	4k	8k
Fume Extract Fans												
Casing												
radiated noise 2 fans at 50%			72.7		90.0	80.0	71.0	71.0	67.0	56.0	54.0	45.0
without motor, power estimate												
Distance Correction (Parallelepiped) : A:1 m, B:0.5 m, C:1 m.		1.0 m			-14.7	-14.7	-14.7	-14.7	-14.7	-14.7	-14.7	-14.7
spl at 1m from fan without motor			58.0		75.3	65.3	56.3	56.3	52.3	41.3	39.3	30.3
Barrier Atten(Maekawa Equation), Path Diff.: 3.21 m .Dx7.5 m. Hs3.5 m. Dr1.5 m .Hr0 m		5.0 m	3.21 m		-13.8	-16.7	-19.7	-22.7	-25.0	-25.0	-25.0	-25.0
Distance Correction (Hemispherical)		30.0 m	3.0 dB		-37.5	-37.5	-37.5	-37.5	-37.5	-37.5	-37.5	-37.5
from one fan			15.9		38.7	25.8	13.8	10.8	4.5	-6.5	-8.5	-17.5
Flue												
in-duct sound power			96.9		99.8	100.3	96.7	96.0	92.4	84.0	73.6	68.4
allways selected attenuator					-7.0	-17.0	-28.0	-44.0	-38.0	-36.0	-34.0	-24.0
direct power			70.5		92.8	83.3	68.7	52.0	54.4	48.0	39.6	44.4
Distance Correction (Spherical)		33.0 m	0.0 dB		-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4	-41.4
direct transmission from top of flue			29.2		51.4	41.9	27.3	10.6	13.0	6.6	-1.8	3.0
total	Logarithmic Sum		29.4		51.7	42.0	27.5	13.7	13.6	6.8	-0.9	3.1
Tower AHUs												
AHU-03-01	Fresh Air Intake				72.0	58.0	53.0	30.0	19.0	20.0	29.0	39.0
Distance Correction (Plane Source) - Point Source Region		27.98 m			-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9
			12.6		35.1	21.1	16.1	-6.9	-17.9	-16.9	-7.9	2.1
AHU-02-01	Fresh Air Intake				73.0	59.0	47.0	36.0	21.0	18.0	26.0	37.0
Distance Correction (Plane Source) - Point Source Region		27.98 m			-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9
			12.1		36.1	22.1	10.1	-0.9	-15.9	-18.9	-10.9	0.1
AHU-01-01	Fresh Air Intake				69.0	58.0	52.0	33.0	17.0	25.0	33.0	40.0
Distance Correction (Plane Source) - Point Source Region		27.98 m			-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9
			11.4		32.1	21.1	15.1	-3.9	-19.9	-11.9	-3.9	3.1
AHU-01-02	Fresh Air Intake				69.0	58.0	52.0	33.0	17.0	25.0	33.0	40.0
Distance Correction (Plane Source) - Point Source Region		27.98 m			-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9	-36.9
			11.4		32.1	21.1	15.1	-3.9	-19.9	-11.9	-3.9	3.1
Basement Fan												
SF-01-02&03	fresh air output				75.5	65.5	52.5	43.5	41.5	38.5	34.5	49.5
Distance Correction (Plane Source) - Point Source Region		20.70 m			-34.3	-34.3	-34.3	-34.3	-34.3	-34.3	-34.3	-34.3
			20.5		41.2	31.2	18.2	9.2	7.2	4.2	0.2	15.2
TOTAL NORMAL NOISE @ B	Logarithmic Sum		30.2		52.3	43.5	28.7	15.3	14.3	8.8	4.6	16.2
Generator												
dimensions												
length 8m, width 3m, height 3.4m												
SPL at 1m 65dBA					65.0							
Distance Correction (Parallelepiped) : A:8 m, B:3 m, C:3.4 m.		1.0 m			-22.6							
so sound power					87.6							
Distance Correction (Parallelepiped) ; A:8 m, B:3 m, C:3.4 m.		25.0 m			-39.7							
screening	no line of sight, minimum 5dB				-5.0							
					42.9							

7.4 Receiver C

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Job No		Made By	Sheet No
			13
Date Created		Date last revised	Rev
12-Jun-14		13-Jun-14	1
Job Title		Calc Ref	
		C1-01	

Description		Length/Area/Volume		Octave Band Centre Frequency								
Calculation Description		dB	dB(A)	31.5	63	125	250	500	1k	2k	4k	8k
Lab AHUs												
AHU-06-01	exhaust				69.0	53.0	50.0	33.0	28.0	21.0	29.0	43.0
Distance Correction (Plane Source) - Point Source Region		30.00 m			-37.6	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6
			9.9		31.4	15.4	12.4	-4.6	-9.6	-16.6	-8.6	5.4
AHU-06-02	exhaust				69.0	53.0	50.0	33.0	28.0	21.0	29.0	43.0
Distance Correction (Plane Source) - Point Source Region		30.00 m			-37.6	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6	-37.6
			9.9		31.4	15.4	12.4	-4.6	-9.6	-16.6	-8.6	5.4
Tower AHUs												
AHU-03-01	Exhaust Air				69.0	56.0	54.0	35.0	25.0	22.0	30.0	43.0
Distance Correction (Plane Source) - Point Source Region		6.23 m			-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9
			25.3		45.1	32.1	30.1	11.1	1.1	-1.9	6.1	19.1
AHU-02-01	Exhaust Air				67.0	58.0	51.0	32.0	24.0	22.0	33.0	44.0
Distance Correction (Plane Source) - Point Source Region		6.23 m			-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9
			24.4		43.1	34.1	27.1	8.1	0.1	-1.9	9.1	20.1
AHU-01-01	Exhaust Air				59.0	59.0	62.0	50.0	38.0	38.0	39.0	45.0
Distance Correction (Plane Source) - Point Source Region		6.23 m			-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9
			31.4		35.1	35.1	38.1	26.1	14.1	14.1	15.1	21.1
AHU-01-02	Exhaust Air				59.0	59.0	62.0	50.0	38.0	38.0	39.0	45.0
Distance Correction (Plane Source) - Point Source Region		6.23 m			-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9	-23.9
			31.4		35.1	35.1	38.1	26.1	14.1	14.1	15.1	21.1
Basement Fan												
FF-01-02&03	exhaust air				69.9	55.9	31.9	6.9	-9.1	21.9	30.9	46.9
distance	16.8, path diff 4m											
Barrier Atten(Maekawa Equation), Path Diff.: 1.26 m ,Ds:8 m, Hs:		10.0 m	1.26 m		-10.2	-12.8	-15.6	-18.6	-21.6	-24.7	-25.0	-25.0
Distance Correction (Plane Source) - Point Source Region		16.80 m			-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6	-32.6
			2.0		27.1	10.5	-16.3	-44.3	-63.3	-35.4	-26.7	-10.7
TOTAL NORMAL NOISE @ C	Logarithmic Sum		35.3		48.0	40.3	41.6	29.2	17.3	17.2	18.9	26.5