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BA1250

Assessment of noise from proposed air-conditioning plant at 54 Hatton Garden, London

Summary

It is proposed to install a number of air-conditioning condenser units together with some ventilation plant on the roof of this building to serve the offices. This report estimates the level of the noise generated at the nearest residential property and suggests the noise should be attenuated to achieve reasonable levels at this property.

The ambient noise levels have been measured close to the nearest affected residence over a 24 hour period either side of a weekend and the lowest background noise level was found to be 42dB $L_{A90,15m}$ over the whole period and 49dB over the anticipated operating hours from 8 a.m. to 6 p.m. on weekdays.

The noise levels of the present plant has been estimated at 1m from the nearest affected residential windows to determine the effect and using the proposed mitigation the noise levels will be reduced to 39dB L_{Aeq} which is unlikely to give rise to a disturbance or nuisance to the nearest occupiers.

Prepared by

PETER BIRD

Assessment of noise from proposed air-conditioning plant at 54 Hatton Garden, London

1. Introduction

1.1 As part of the redevelopment of this property it is proposed to install some air-conditioning and ventilation equipment on the roof and the local authority require that any noise from plant is sufficiently quiet as not to cause a nuisance to nearby occupiers.

1.2 Bird acoustics was asked to assess the effect of any noise from the units, recommend any necessary mitigation and report on this.

2. Ambient noise and guidelines levels

2.1 The ambient noise levels were measured over the weekend from Friday 1st to Monday 4th December 2006 at the roof level of the property just below a roof-top conservatory of the next door building. The weather over this period was changeable with some occasional rain and wind and an all weather microphone shield was used. During the relevant periods of Friday afternoon and Monday morning the weather was reasonably dry.

2.2 The equipment used for the measurements was a Norsonic N118 precision integrating sound level meter. More details are shown in Appendix A.

2.3 The microphone was located a some distance from the front of the building to replicate the screening offered by the adjacent building to the roof top conservatory which has been identified as the nearest part of the nearest residential property.

2.4 The results of the measurements are shown in graphical form below and in more detail in Appendix B. Although the whole of this data is presented the relevant parts are the Friday afternoon and Monday morning periods.

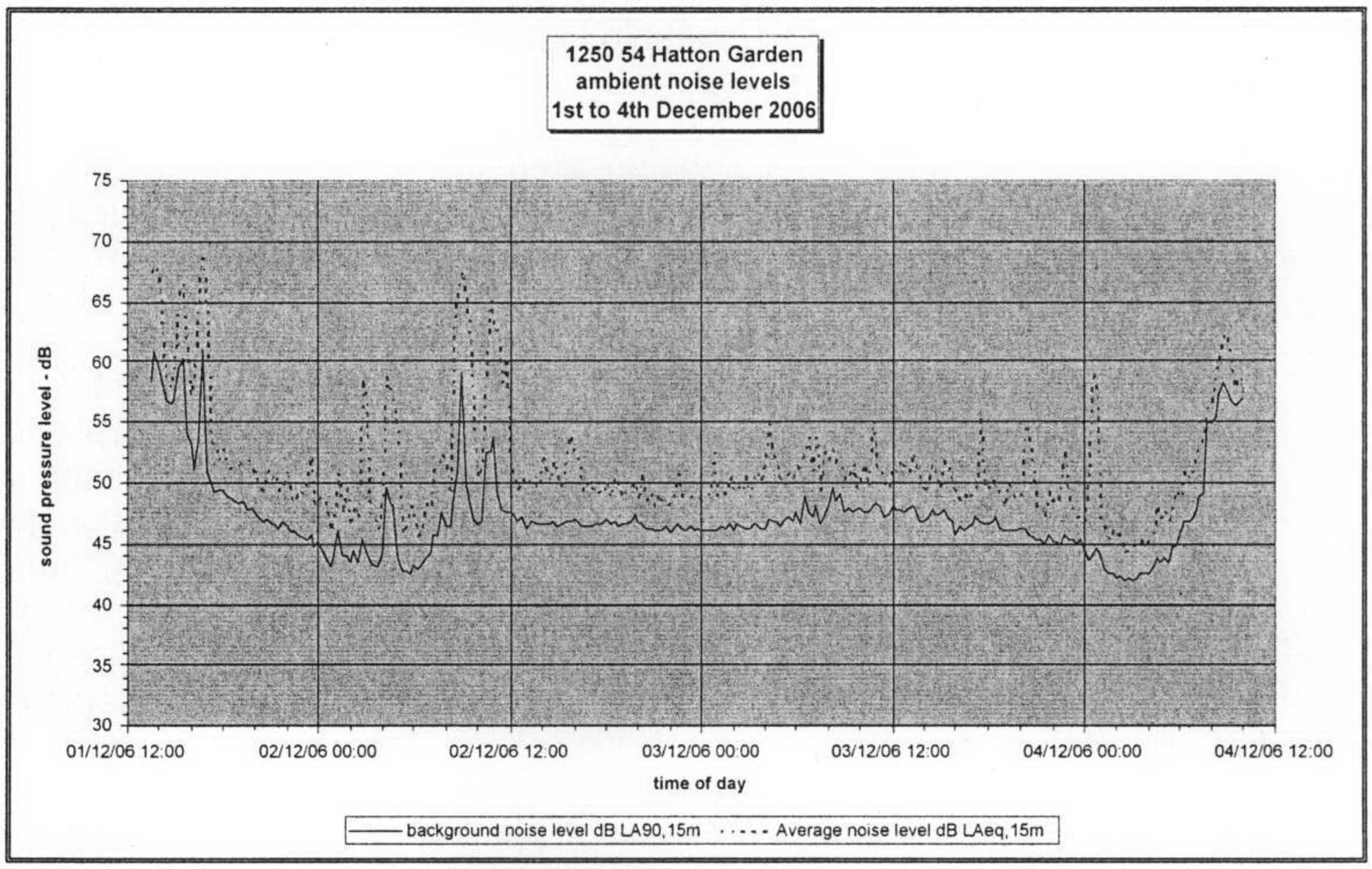

Figure 1. Ambient noise levels at 54 Hatton Garden

2.5 The minimum background noise level over the whole of the measurement period was 42dB $L_{A90,\ 15m}$, and between 8 a.m. and 6 p.m. it was 49dB $L_{A90,\ 15m}$.

2.6 It is understood that the plant for 54 Hatton Garden will operate normal office hours which has been taken to be 8 a.m.,. to 6 p.m.

3. Plant noise assessment

3.1 The local authority requires that any noise from the plant should not cause a nuisance for nearby occupiers and this report has used a noise level of 10dB less than the lowest existing background noise level during the operational time of the plant as a guideline for the maximum noise from the plant. It is felt that this will provide a reasonably robust guideline level.

3.2 The noise from the plant has been estimated using ISO 9613: part 2:1997 "Acoustics – Attenuation of sound during propagation outdoors" implemented using the CadnaA modelling software to determine the noise levels at the locations of the nearest affected windows. Manufacturer's data for the noise of the plant is shown in Appendix C. Two locations have been considered as receiving points both at 1m from the conservatory of the adjacent building, one towards the front at the closest position to the toilet extract fan and the other at the rear of the conservatory at the closest position to the rest of the plant.

3.3 The layout of the plant was based on drawing 2351/M/06P2 from the Environmental Engineering Partnership together with other drawings and information from Marldon.

3.4 Using the estimated level of the un-attenuated plant the degree of attenuation required to achieve the guideline noise level was estimated and a means of achieving this using proprietary attenuation methods and materials has been proposed and accepted by the designers.

3.5 The recommendations are that the condenser plant should be totally enclosed using 300mm deep single bank acoustic louvres for air supply and exhaust, the supply air handling unit should be fitted with a 500mm long, 500mm diameter circular attenuator with a pod on the atmospheric side, the atmospheric side of the extract air handling unit should have 2D long (1000mm) podded 500mm diameter attenuator and the exhaust side of the kitchen extract should be fitted with a 625 long 200mm diameter attenuator. All of these attenuations are based on PAR Noise Control attenuators and the data for this is shown in Appendix C.

3.6 The final calculation of the attenuated plant is summarised in Appendix D which shows that using the proposed attenuation scheme the noise level of the plant will be reduced to 39dB L_{Aeq} at the rearmost part of the conservatory (further from Hatton Garden) and 37dB L_{Aeq} at the more forward part. Provided this plant is only operated between 8 a.m. and 6 p.m. the suggested guideline level of 39dB L_{Aeq} will be satisfied and the neighbours should not be disturbed by the plant noise.

4. Conclusions

4.1 A measurement of the ambient noise levels has been made close to the nearest windows of the nearest affected property over a 24 hour period and the minimum background noise level over the whole of the measurement period was 42dB $L_{A90,\ 15m}$, and between 8 a.m. and 6 p.m. it was 49dB $L_{A90,\ 15m}$.

4.2 Based on these ambient noise measurements it is suggested that the plant noise levels should not exceed 39dB L_{Aeq} when operated between 8 a.m. and 6 p.m. at the nearest adjacent property.

4.3 Using the suggested attenuation scheme summarised in Appendix D the suggested guideline noise levels will be achieved and consequently there should be no disturbance or nuisance from noise from the plant caused to the neighbours.

APPENDIX A

Equipment used during measurements:

Instrument	**Serial no.**	**Date of last calibration (T – Traceable) A – ANC kit)**
Norsonic 118 Integrating SLM and type 1206 preamp.	31617 30597	Dec 2005 (T)
Gras Microphone type 40AF	25652	Feb 2005 (T)
Norsonic sound calibrator type 1251	20804	Feb. 2005 (T)

APPENDIX B

Ambient noise levels 1st to 4th December 2006

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
01/12/06 13:31	58.4	67.5
01/12/06 13:45	60.9	68.1
01/12/06 14:00	59.7	67.2
01/12/06 14:15	58.0	61.0
01/12/06 14:30	56.8	58.4
01/12/06 14:45	56.6	57.9
01/12/06 15:00	56.9	60.6
01/12/06 15:15	59.5	66.3
01/12/06 15:30	60.2	66.5
01/12/06 15:45	54.1	60.8
01/12/06 16:00	53.1	57.3
01/12/06 16:15	51.1	60.1
01/12/06 16:30	53.8	67.3
01/12/06 16:45	61.0	69.1
01/12/06 17:00	51.0	64.1
01/12/06 17:15	49.8	53.4
01/12/06 17:30	49.2	53.1
01/12/06 17:45	49.5	51.9
01/12/06 18:00	49.5	52.9
01/12/06 18:15	48.8	51.4
01/12/06 18:30	48.7	51.3
01/12/06 18:45	48.5	51.3
01/12/06	48.3	51.6

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
19:00		
01/12/06 19:15	48.6	51.7
01/12/06 19:30	47.8	52.0
01/12/06 19:45	48.0	51.3
01/12/06 20:00	47.6	50.8
01/12/06 20:15	47.2	49.8
01/12/06 20:30	46.8	49.4
01/12/06 20:45	47.1	51.1
01/12/06 21:00	46.7	50.4
01/12/06 21:15	46.6	50.8
01/12/06 21:29	46.2	49.4
01/12/06 21:45	46.9	49.7
01/12/06 22:00	46.4	51.2
01/12/06 22:15	45.9	48.8
01/12/06 22:30	46.0	48.5
01/12/06 22:45	45.7	49.5
01/12/06 23:00	45.6	49.2
01/12/06 23:15	45.3	50.9
01/12/06 23:29	45.7	52.3
01/12/06 23:45	44.8	48.2
02/12/06 00:00	45.2	48.8
02/12/06 00:15	44.5	48.9
02/12/06 00:30	43.7	47.9

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
02/12/06 00:45	43.1	46.1
02/12/06 01:00	43.8	47.8
02/12/06 01:15	46.0	50.9
02/12/06 01:30	44.1	47.5
02/12/06 01:45	44.0	50.0
02/12/06 02:00	43.5	46.5
02/12/06 02:15	44.5	48.3
02/12/06 02:30	43.5	47.2
02/12/06 02:45	45.3	58.7
02/12/06 03:00	44.2	56.7
02/12/06 03:15	43.5	47.1
02/12/06 03:30	43.3	47.1
02/12/06 03:45	43.1	46.3
02/12/06 04:00	44.3	49.3
02/12/06 04:15	49.7	58.8
02/12/06 04:30	48.4	57.8
02/12/06 04:45	48.2	56.2
02/12/06 05:00	43.9	53.7
02/12/06 05:15	42.8	45.9
02/12/06 05:30	42.7	46.6
02/12/06 05:45	42.5	48.2
02/12/06 06:00	43.3	47.2
02/12/06 06:15	43.0	45.7
02/12/06 06:30	43.2	46.3
02/12/06 06:45	43.9	48.4

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
02/12/06 07:00	44.3	48.0
02/12/06 07:15	45.7	51.3
02/12/06 07:30	45.8	51.4
02/12/06 07:45	47.5	52.4
02/12/06 08:00	46.5	51.7
02/12/06 08:15	46.5	49.1
02/12/06 08:30	48.6	63.7
02/12/06 08:45	51.2	66.1
02/12/06 09:00	59.1	67.6
02/12/06 09:15	49.9	65.2
02/12/06 09:30	48.0	61.3
02/12/06 09:45	47.0	53.6
02/12/06 10:00	46.7	50.5
02/12/06 10:15	46.9	51.3
02/12/06 10:30	52.5	59.7
02/12/06 10:45	52.6	65.2
02/12/06 11:00	53.7	62.7
02/12/06 11:15	49.0	62.8
02/12/06 11:30	47.7	58.3
02/12/06 11:45	47.5	60.4
02/12/06 12:00	47.5	51.3
02/12/06 12:15	47.4	50.8
02/12/06 12:30	46.8	49.5
02/12/06 12:45	47.2	50.4
02/12/06 13:00	46.3	49.8

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
02/12/06 13:15	46.9	50.4
02/12/06 13:30	46.9	50.1
02/12/06 13:45	46.6	49.6
02/12/06 14:00	46.7	52.4
02/12/06 14:15	46.6	50.9
02/12/06 14:30	46.7	50.1
02/12/06 14:45	46.9	51.9
02/12/06 15:00	46.5	49.8
02/12/06 15:15	46.6	50.1
02/12/06 15:30	46.9	52.4
02/12/06 15:45	46.8	54.0
02/12/06 16:00	47.1	52.1
02/12/06 16:15	46.9	52.1
02/12/06 16:30	46.5	49.3
02/12/06 16:45	46.4	49.9
02/12/06 17:00	46.4	50.1
02/12/06 17:15	46.6	49.1
02/12/06 17:30	46.6	49.3
02/12/06 17:45	46.6	49.1
02/12/06 18:00	47.1	50.2
02/12/06 18:15	46.6	48.8
02/12/06 18:30	46.8	50.6
02/12/06 18:45	46.5	49.7
02/12/06 19:00	46.7	48.8
02/12/06 19:15	46.6	49.6

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
02/12/06 19:30	46.9	49.7
02/12/06 19:45	47.4	50.1
02/12/06 20:00	46.8	48.8
02/12/06 20:15	46.7	50.6
02/12/06 20:30	46.2	48.5
02/12/06 20:45	46.2	49.1
02/12/06 21:00	46.1	48.1
02/12/06 21:15	46.0	49.2
02/12/06 21:30	46.0	48.3
02/12/06 21:45	46.4	48.2
02/12/06 22:00	45.9	48.4
02/12/06 22:15	46.5	49.1
02/12/06 22:30	46.7	51.2
02/12/06 22:45	46.2	48.9
02/12/06 23:00	46.0	49.1
02/12/06 23:15	46.5	48.9
02/12/06 23:30	46.0	49.0
02/12/06 23:45	46.2	48.9
03/12/06 00:00	46.0	48.6
03/12/06 00:15	46.0	49.0
03/12/06 00:30	46.0	49.2
03/12/06 00:45	46.1	52.6
03/12/06 01:00	46.0	48.9
03/12/06 01:15	46.4	49.3
03/12/06 01:30	46.2	49.1

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
03/12/06 01:45	46.6	50.6
03/12/06 02:00	46.0	49.5
03/12/06 02:15	46.6	50.0
03/12/06 02:30	46.4	49.3
03/12/06 02:45	46.3	50.6
03/12/06 03:00	46.2	48.8
03/12/06 03:15	46.6	50.3
03/12/06 03:30	46.7	51.0
03/12/06 03:45	46.2	50.2
03/12/06 04:00	46.2	51.9
03/12/06 04:15	47.1	54.9
03/12/06 04:30	46.9	52.4
03/12/06 04:45	46.8	51.6
03/12/06 05:00	46.5	49.9
03/12/06 05:15	47.1	49.9
03/12/06 05:30	47.3	50.9
03/12/06 05:44	46.8	50.4
03/12/06 06:00	47.6	51.0
03/12/06 06:15	46.6	52.0
03/12/06 06:30	48.8	52.3
03/12/06 06:45	47.6	53.8
03/12/06 07:00	47.3	51.1
03/12/06 07:15	48.1	53.9
03/12/06 07:30	46.7	49.3
03/12/06 07:45	47.2	52.6

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
03/12/06 08:00	48.2	51.9
03/12/06 08:15	49.6	52.8
03/12/06 08:30	48.6	51.6
03/12/06 08:45	49.0	51.6
03/12/06 09:00	47.6	50.4
03/12/06 09:15	48.0	50.3
03/12/06 09:30	47.5	51.6
03/12/06 09:45	47.7	49.6
03/12/06 10:00	47.9	50.4
03/12/06 10:15	47.6	51.6
03/12/06 10:30	47.5	49.7
03/12/06 10:45	48.1	55.2
03/12/06 11:00	48.4	51.2
03/12/06 11:15	48.1	51.2
03/12/06 11:30	47.3	49.7
03/12/06 11:45	47.4	49.7
03/12/06 12:00	48.1	51.3
03/12/06 12:15	47.7	50.9
03/12/06 12:30	47.7	52.0
03/12/06 12:45	47.5	51.2
03/12/06 13:00	47.9	50.9
03/12/06 13:15	48.1	52.5
03/12/06 13:30	47.8	51.3
03/12/06 13:45	46.9	50.6
03/12/06 14:00	46.8	49.2

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
03/12/06 14:15	47.2	50.2
03/12/06 14:30	47.7	51.6
03/12/06 14:45	47.4	50.5
03/12/06 15:00	47.4	49.6
03/12/06 15:15	47.7	51.9
03/12/06 15:30	47.1	51.4
03/12/06 15:45	46.9	50.1
03/12/06 16:00	45.8	49.0
03/12/06 16:15	46.4	48.6
03/12/06 16:30	46.1	49.1
03/12/06 16:45	46.5	48.6
03/12/06 17:00	46.7	49.2
03/12/06 17:15	47.3	49.9
03/12/06 17:30	46.8	55.3
03/12/06 17:45	46.7	49.6
03/12/06 18:00	46.6	49.6
03/12/06 18:15	46.9	50.3
03/12/06 18:30	47.3	49.8
03/12/06 18:45	46.3	48.7
03/12/06 19:00	46.1	48.1
03/12/06 19:15	46.0	50.1
03/12/06 19:30	46.1	49.1
03/12/06 19:45	46.1	48.7
03/12/06 20:00	46.3	49.1
03/12/06 20:15	46.3	54.9

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
03/12/06 20:30	45.8	54.0
03/12/06 20:45	45.5	51.5
03/12/06 21:00	45.3	47.9
03/12/06 21:15	45.3	48.0
03/12/06 21:30	45.0	47.2
03/12/06 21:45	45.7	49.3
03/12/06 22:00	45.2	48.5
03/12/06 22:15	45.2	48.3
03/12/06 22:30	45.0	50.0
03/12/06 22:45	45.7	52.8
03/12/06 23:00	45.4	48.6
03/12/06 23:15	45.4	47.6
03/12/06 23:30	44.9	47.2
03/12/06 23:45	45.4	47.4
04/12/06 00:00	44.4	47.0
04/12/06 00:15	43.7	51.0
04/12/06 00:30	44.3	59.2
04/12/06 00:45	44.6	57.3
04/12/06 01:00	44.2	47.2
04/12/06 01:15	43.0	46.4
04/12/06 01:30	42.6	45.3
04/12/06 01:45	42.6	46.2
04/12/06 02:00	42.2	46.0
04/12/06 02:14	42.3	45.6
04/12/06 02:30	41.9	44.3

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
04/12/06 02:45	42.2	44.7
04/12/06 03:00	41.9	45.0
04/12/06 03:15	42.2	44.8
04/12/06 03:30	42.5	45.1
04/12/06 03:45	42.6	45.6
04/12/06 04:00	42.6	44.7
04/12/06 04:15	43.1	45.2
04/12/06 04:30	43.9	48.2
04/12/06 04:45	43.4	47.1
04/12/06 05:00	43.9	47.8
04/12/06 05:15	43.4	46.9
04/12/06 05:30	44.8	48.2
04/12/06 05:45	45.0	49.4
04/12/06 06:00	45.7	48.7
04/12/06 06:15	46.8	51.1
04/12/06 06:30	46.8	50.5
04/12/06 06:45	47.0	50.4
04/12/06 07:00	47.7	52.5
04/12/06 07:15	48.8	53.0
04/12/06 07:30	49.1	54.1
04/12/06 07:45	55.0	56.5
04/12/06 08:00	54.9	56.6
04/12/06 08:15	55.5	58.7
04/12/06 08:29	57.2	60.9
04/12/06 08:45	58.3	62.4

time of day	background noise level dB $L_{A90,15m}$	Average noise level dB $L_{Aeq,15m}$
04/12/06 09:00	57.6	62.0
04/12/06 09:15	56.7	60.0
04/12/06 09:30	56.3	57.9
04/12/06 09:45	56.5	58.9
04/12/06 10:00	57.0	57.4

APPENDIX C

Manufacturers' data for plant

		Sound power levels							
plant manufacturer, type and description		**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
RXYSQ4		63	64	65	65	56	50	45	42
RXYQ10			84	80	77	73	66	59	53
RXYQ5			75	75	72	68	62	55	56
RXYSQ6			64	65	68	57	54	51	46
Nu-Aire Ecosmart Boxer ESBHS2H-E	Supply	84	79	74	69	69	65	60	54
	room side	86	81	81	78	76	72	69	63
Nu-Aire Ecosmart Boxer ESBHEX2H	extract	86	81	81	78	76	72	69	63
	room side	84	79	74	69	69	65	60	54
Nu-Aire EST3-X	Kitchen extract	79	74	61	54	57	54	51	45
	room side	77	72	55	47	43	40	36	32
Nu-Aire EST3-X	toilet extract	79	74	61	54	57	54	51	45
	room side	77	72	55	47	43	40	36	32

Manufacturers data for attenuations

		63	125	250	500	1000	2000	4000	8000
PAR 500dia 1D L podded	ATTC04	2	7	9	17	24	24	20	16
PAR 500dia 2D L podded	ATTC06	4	10	16	26	29	29	29	20
PAR 200 dia 625 L circular attenuator	ATTC03	2	2	4	15	26	19	19	13
PAR 75mm metal screen	RBR02	15	22	26	34	39	47	49	48
PAR 300mm deep acoustic louvres	ATTL01	4	5	10	12	15	23	21	24

APPENDIX D

Calculation of attenuated plant noise levels

Attenuated to required standard:

Attenuation required	code	description
Condensers	ATTL01	Complete enclosure formed by 300mm deep acoustic louvres from PAR
AHU supply - atmospheric side	ATTC04	PAR 500dia 1D L podded
AHU extract - atmospheric side	ATTC06	PAR 500dia 2D L podded
Kitchen extract - atmospheric side	ATTC03	PAR 200 dia 625 L circular attenuator
AHU supply & extract ducts from PAR	RBR02	enclosed using 75mm thick acoustic panels

Receiver points

Name	ID	Level Lr	Limit. Value	Height			Coordinates	
		Day	Day			X	Y	Z
		(dBA)	(dBA)	(m)		(m)	(m)	(m)
Rear of conservatory of no 55	R01	39	39	1	g	4.87	18.76	19.4
Front of conservatory of no 55	R02	37	39	1	g	4.9	16.46	19.4

Daytime immission spectrum

Name	ID	Level Spectrum Day dB(A)								
		Overall dB L_{Aeq}	63	125	250	500	1000	2000	4000	8000
Rear of conservatory of no 55	R01	38.5		34.4	32.6	31.1	26.1	19.6	15.3	6.9
Front of conservatory of no 55	R02	37		32.8	30.5	30.3	25.6	19.1	14.3	5.4

Daytime partial levels at immission points

Source Partial Level Day

Name	ID	Rear of conservatory of no 55	Front of conservatory of no 55
Condenser unit 1	CU01	20.7	20.2
Condenser unit 2	CU02	35	33.2
Condenser unit 3	CU03	26	25.9
Condenser unit 4	CU04	25.1	24
Condenser unit 5	CU05	24.6	23.6
Condenser unit 6	CU06	21.5	17.4
Condenser unit 7	CU07	22.4	22
Toilet extract fan	EF02	24.1	24.2
Kitchen extract	EF1	23	18.8
Extract AHU	AHU02	25.5	23.6
Supply AHU	AHU01	23.7	21.7
Toilet extract duct	D04	22.7	25.1

Main extract duct	D03	22.6	19.9
Main supply duct	D02	25.9	23.2
Kitchen extract duct	D01	28.6	25.8

Spectra of daytime partial levels:

Source Partial Level Day

Name	ID	Rear of conservatory of no 55								
		overall	63	125	250	500	1000	2000	4000	8000
Condenser unit 1	CU01	20.7	3	11.4	15.6	17.7	7.6	-6.6	-11.3	-21.7
Condenser unit 2	CU02	35		31.5	29.3	28.6	22.9	6.7	-1.2	-15.8
Condenser unit 3	CU03	26		21	21.4	20.4	14.3	-1.6	-9.2	-16.5
Condenser unit 4	CU04	25.1		20	20.5	19.5	13.5	-2.3	-10	-17
Condenser unit 5	CU05	24.6		19.4	20	19.2	13.3	-2.5	-10	-17.1
Condenser unit 6	CU06	21.5		17.1	16.9	15.2	8.7	-7.4	-14.6	-20.1
Condenser unit 7	CU07	22.4		12.3	15.3	20.6	8.9	-2.7	-4.9	-17.7
Toilet extract fan	EF02	24.1	2.4	12.7	10.8	12.4	20	18.7	14.7	4.8
Kitchen extract	EF1	23	13	20.6	17.3	5.9	1.2	5.4	0	-3.7
Extract AHU	AHU02	25.5	17.8	18.9	22.1	14.9	12.3	7.7	2.5	0.8
Supply AHU	AHU01	23.7	15.4	18.4	20.3	12.3	7	1.5	-2.4	-8.2
Toilet extract duct	D04	22.7	15.9	21.1	10.3	6.7	-0.8	-9.2	-20.2	-30.2
Main extract duct	D03	22.6	20.4	17.1	12.7	-1.5	-10.5	-28.4	-42.8	-53.4
Main supply duct	D02	25.9	22.8	19.5	20.1	7.7	-3.3	-21.3	-33.6	-44.2
Kitchen extract duct	D01	28.6	24.7	26	14.1	-6.9	-25.1	-28.1	-37.3	-39.8

Name	ID	Front of conservatory of no 55								
		overall	63	125	250	500	1000	2000	4000	8000
Condenser unit 1	CU01	20.2	1.7	10.2	14.5	17.7	7.8	-6.2	-11	-22.1
Condenser unit 2	CU02	33.2		29.9	26.6	27.3	21.7	5.6	-2.3	-17.1
Condenser unit 3	CU03	25.9		19.7	20.2	21.7	16.2	0.7	-6.6	-14.5
Condenser unit 4	CU04	24		18.8	19.4	18.5	12.5	-3.3	-11	-18.4
Condenser unit 5	CU05	23.6		18.3	19	18.2	12.4	-3.4	-10.9	-18.3

Condenser unit 6	CU06	17.4		14.1	12.6	9.6	2.4	-13.2	-18.9	-24.8
Condenser unit 7	CU07	22		11	14.2	20.4	8.9	-2.5	-4.6	-17.6
Toilet extract fan	EF02	24.2	3.7	14.3	12.7	13	20.2	18.2	13.6	3.1
Kitchen extract	EF1	18.8	7.7	16.1	13.5	3.3	-0.9	3.8	-1.3	-5.9
Extract AHU	AHU02	23.6	15.5	16.7	20.2	13.3	11	6.5	1.5	-0.2
Supply AHU	AHU01	21.7	13.4	16.3	18.4	10.5	5.3	-0.1	-4	-10.6
Toilet extract duct	D04	25.1	18.8	23.4	13.1	8.7	1	-8	-19.7	-30.3
Main extract duct	D03	19.9	17.7	14.4	10.2	-3	-11.7	-29.4	-43.7	-54.7
Main supply duct	D02	23.2	20.1	16.8	17.5	6.4	-4.4	-22	-34.4	-45.4
Kitchen extract duct	D01	25.8	21.8	23.3	11.7	-8.2	-26	-28.8	-38	-40.7

Point sources:

Name	ID	Result. PWL		Lw / Li		Attenuation	Height		Coordinates		
		Day	Night	Type	Value				X	Y	Z
		(dBA)	(dBA)				(m)		(m)	(m)	(m
Condenser unit 1	CU01	52.4	52.4	Lw	CU01	ATTL01	0.6	g	8.78	21.8	2
Condenser unit 2	CU02	67.3	67.3	Lw	CU02	ATTL01	1.4	g	8.13	24.04	2
Condenser unit 3	CU03	61.2	61.2	Lw	CU03	ATTL01	1.4	g	9.12	24.02	2
Condenser unit 4	CU04	61.2	61.2	Lw	CU03	ATTL01	1.4	g	10.12	24.02	2
Condenser unit 5	CU05	61.2	61.2	Lw	CU03	ATTL01	1.4	g	11.18	24	2
Condenser unit 6	CU06	61.2	61.2	Lw	CU03	ATTL01	1.4	g	12.19	24.02	2
Condenser unit 7	CU07	54.3	54.3	Lw	CU04	ATTL01	0.6	g	9.82	21.8	2
Toilet extract fan	EF02	60.3	60.3	Lw	EF01	ER02	0.35	g	12.53	16.4	2
Kitchen extract	EF1	47.9	47.9	Lw	EF01	ER02+ATT C03	0.35	g	6.14	20.25	2
Extract AHU	AHU02	57.7	57.7	Lw	AHU02	ER01+ATT C06	0.7	g	6.65	24.44	2
Supply AHU	AHU01	57.6	57.6	Lw	AHU01	ER01+ATT C04	0	g	6.65	24.42	1

Line sources:

Name	ID	Result. PWL		Result. PWL'		Lw / Li		Attenuation
		Day	Night	Day	Night	Type	Value	
		(dBA)	(dBA)	(dBA)	(dBA)			
Toilet extract duct	D04	56.5	56.5	54.6	54.6	Lw'	BR04	
Main extract duct	D03	51.8	51.8	42.7	42.7	Lw'	BR03	RBR02
Main supply duct	D02	55.1	55.1	46	46	Lw'	BR02	RBR02
Kitchen extract duct	D01	56.3	56.3	50.8	50.8	Lw'	BR01	ATTC07

Name	Height				Coordinates			
	Begin		End		x	y	z	Ground
	(m)		(m)		(m)	(m)	(m)	(m)
Toilet extract duct	0.35	g			12.47	16.39	20.32	0
					10.91	16.39	20.32	0
Main extract duct	0.5	g			6.75	24.41	20.47	0
					6.75	21.42	20.47	0
					10.2	21.42	20.47	0

					10.2	19.78	20.47	0
Main supply duct	0.5	g			6.52	24.43	20.47	0
					6.52	21.33	20.47	0
					9.93	21.33	20.47	0
					9.93	19.78	20.47	0
Kitchen extract duct	0.35	g			6.18	20.26	20.32	0
					9.19	20.26	20.32	0
					9.19	19.79	20.32	0

Buildings:

Name	ID	RB	Residents	Absorption	Height					
					Begin					
					(m)					
54 Front of building	B02		0	0.21	16.55	r				
54 main body of building to roof	B01		0	0.21	19.97	r				
51 to 53 Hatton Garden	B03		0	0.21	27.17	r				
55 Hatton Garden to 4th floor	B04	x	4	0.21	16.3	r				
55 Hatton Garden part 5th floor	B05	x	4	0.21	18.4	r				
55 Hatton Garden 5th floor conservatory	B06	x	4	0.21	19.4	r				
54 stair case	B06	x	4	0.21	2.85	g				
Name	ID	RB	Residents	Absorption	Height		Coordinates			
					Begin		x	y	z	Ground
					(m)		(m)	(m)	(m)	(m)
54 Front of building	B02		0	0.21	16.55	r	5.65	9.99	16.55	0
							5.65	9.09	16.55	0
							12.91	9.09	16.55	0
							12.92	9.99	16.55	0
54 main body of building to roof	B01		0	0.21	19.97	r	12.91	9.99	19.97	0
							12.9	26.29	19.97	0
							13.04	26.29	19.97	0
							13.04	27.31	19.97	0
							5.71	27.29	19.97	0
							5.72	25.85	19.97	0
							5.63	25.85	19.97	0
							5.63	25.85	19.97	0
							5.65	10	19.97	0
51 to 53 Hatton Garden	B03		0	0.21	27.17	r	12.91	26.29	27.17	0
							12.94	9.15	27.17	0
							15.63	9.13	27.17	0
							15.66	26.3	27.17	0
55 Hatton Garden to 4th floor	B04	x	4	0.21	16.3	r	5.61	9.18	16.3	0
							5.61	25.88	16.3	0
							0.02	25.88	16.3	0

							0.02	9.2	16.3	0
							0.06	9.14	16.3	0
55 Hatton Garden part 5th floor	B05	x	4	0.21	18.4	r	3.96	10.87	18.4	0
							3.96	25.71	18.4	0
							5.65	25.73	18.4	0
							5.63	10.87	18.4	0
55 Hatton Garden 5th floor conservatory	B06	x	4	0.21	19.4	r	3.92	10.9	19.4	0
							0	10.88	19.4	0
							0.02	18.82	19.4	0
							3.93	18.79	19.4	0
54 stair case	B06	x	4	0.21	2.85	g	12.87	22.67	22.82	0
							12.89	17.11	22.82	0
							8.75	17.11	22.82	0
							8.75	19.78	22.82	0
							10.39	19.77	22.82	0
							10.37	22.68	22.82	0