ACOUSTICAL CONTROL Engineers & Consultants

GUARANTEED SOLUTIONS TO YOUR NOISE & VIBRATION PROBLEMS

Acoustic Investigation Report:

Complaints regarding noise from plant at the Nisa store in Haverstock Hill, Belsize Park

for: Nisa Local, Haverstock Hill

Report Reference: B5540 2023-11-08 R

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B55540.0		RAC	26/6/2022
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B5540.2	Enclosure drawing modified	RAC	20/12/2023

Contents

1.0 Introduction

1.1 Acoustical Control Consultants (ACC) has been appointed by Nisa Local, Haverstock Hill to undertake an investigation of noise complaints due to external refrigeration plant.

1.2 Some residents of dwellings in the same building above the store are complaining about the noise produced by the fixed plant and equipment in the open passageway to the rear of the store.

1.3 A preliminary site visit indicated that these complaints may be justified so an acoustic complaint investigation has been undertaken.

1.4 A report was originally produced in June 2022 which identified that the plant required 17 dBA attenuation to achieve a demonstrably suitable level of up to 44 dB L_A outside the nearest bedroom windows.

1.5 However, the local authority is insistent that its default acoustic criterion is used. This equates to a plant sound level of 35 dB L_A in this case necessitating that the plant be attenuated by 26 dBA. The original attenuation proposal has therefore been redesigned to achieve this performance.

1.6 ACC is an independent acoustic consultancy company. All our acoustic consultants are qualified and experienced practitioners and are either Associate or Corporate members of the Institute of Acoustics. Acoustical Control Engineers Limited is our associated company specialising in engineered solutions to acoustic problems.

2.0 Scope

2.1 Visit the Nisa store at Haverstock Hill, in Belsize Park to undertake attended sound measurements inside and outside the Complainant's dwelling.

2.2 Measure sound close to the outdoor plant at the store to determine its sound levels emissions.

2.3 Assess the level and character of sound measured inside the dwelling in terms of published standards and guidance for internal ambient sound levels.

2.4 Use the sound power levels determined from manufacturers' data and the on-site measurements to predict plant sound contributions at the receptor locations and compare with the measured sound levels.

2.5 Prepare a complaint investigation report setting out the measurements made, the results of the analysis and giving conclusions and recommendations.

3.0 Site description

3.1 The Nisa store is located at the junction of Haverstock Hill (A502) and Glenloch Road in Belsize Park. It was formerly a bank, that has been converted to a local convenience food store. As part of the conversion, a Daikin ConveniPack (CVP) and associated Booster have been installed in the open passageway to the rear of the premises. The CVP is within a partial enclosure that has been formed adjacent to the brick bin store, with an open side face. The Booster is mounted on wall brackets above the CVP enclosure. Bedroom windows are located in the wall of the same building directly above the plant.

3.2 Figure 1 below shows the outline of the store in red. The nearby noise sensitive dwellings are within the store footprint, with the plant located in the passageway to the rear (southerly corner) of the building.

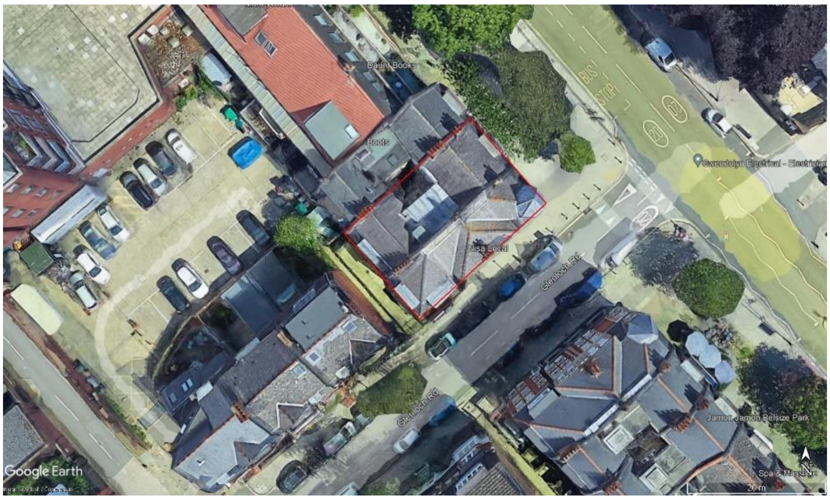


Figure 1 Store with dwellings above (red outline)

3.3 The most significant sources of residual sound in the vicinity of the noise sensitive windows is road traffic on Haverstock Hill and Glenloch Road, together with activity typical of a busy urban area such as this. Vehicles on Haverstock Hill produce an underlying sound level that rises and falls slightly as these vehicles pass Glenloch Road, whereas the sound level from vehicles passing along Glenloch Road rises and falls more quickly and to higher levels as the vehicles pass the end of the passageway to the south of the store.

4.0 Relevant Guidance & Criteria

BS 4142:2014 + A1:2019 Methods for rating industrial and commercial sound[1]

4.1 The BS 4142 methodology compares the rating level (average source noise level with a suitable character correction if applicable), against the existing background level (that exceeded for 90% of the time i.e. the quietest 10% level) and provides an initial estimate of the impact of the sound based solely upon this differential. This initial estimate of impact must then be reviewed to take into account the context in which the sound will be experienced.

Rating level - Background sound level	Initial Estimate
Around 10 dB or more	Likely to be an indication of a significant adverse impact, depending on the context.
Around 5 dB	Likely to be an indication of an adverse impact, depending on the context.
Similar levels	An indication of the specific sound source having a low impact, depending on the context.

4.2 Character corrections should be added for sound that include tones, impulses or other characteristics which might increase the significance of impact for the residents affected by the sound.

4.3 One of the significant differences between BS 4142:2014 and previous editions of the Standard is the explicit requirement to consider context as part of the assessment. It is no longer adequate to simply compare the rating level and the background sound level without due regard to the context of the acoustic environment and the sound source. The context can significantly affect the outcome of the Initial Estimate, which is based solely on the difference between the rating and background sound levels. The background sound level (L_{A90}) specifically excludes acoustic events occurring for less than 90% of the time, such as passing vehicles or activity occurring for much but not all of the time. This means that the difference between rating and background sound levels can be identical for two locations with very different acoustic characteristics and corresponding sensitivities to noise.

4.4 In addition to comparing the level and character of the specific and residual sound, the context also includes careful consideration of other factors such as the character of the locale e.g. quiet rural or predominantly industrial; noise sensitive receptors e.g. outdoor amenity space or indoors; and duration and time of specific sound e.g. 24/7 operation or one event per week.

4.5 Depending upon the context, other guidance may be more appropriate, such as considering the potential impact of sound on residents during the night when the primary concern is to ensure that they are not disturbed whilst sleeping, possibly with open bedroom windows. In this case the difference between background sound level and rating level outdoors is likely to be of little significance to the residents indoors.

BS 8233:2014 Guidance on sound insulation and noise reduction for buildings[2]

4.6 For dwellings the main considerations are to protect sleep in bedrooms and to protect resting, listening and communicating in other rooms. For noise without a specific character it is desirable that the overall average levels during the night or day time periods do not exceed 30 dB $L_{Aeq,8hour}$ or 35 dB $L_{Aeq,16hour}$ respectively.

4.7 For amenity space, such as gardens and patios, it is desirable that the average level does not exceed 50 dB L_{Aeq}, with an upper guideline value of 55 dB L_{Aeq} which would be acceptable in noisier environments. For dwellings with conventional windows, an internal target of 35 dB L_{Aeq} during the day equates to around 50 dB L_{Aeq} (possibly slightly lower) outside noise sensitive rooms with openable windows.

Local Authority

4.8 Camden, the local authority for this premises, has a default requirement that the Rating Level ($L_{AR,T}$) of sound from the plant should be at least 5 dB below the background sound level ($L_{A90,T}$) at noise sensitive locations such as the bedroom windows above the plant.

4.9 The previous version of BS 4142 which was superseded in 2014 stated that if sound from the plant was 10 dB below the background sound level then complaints would be unlikely. The author of this report was on the drafting panel for the current version of this standard and is therefore very familiar with changes in the current version and the reasons for these changes.

4.10 In this case, it was concluded that references to sound from the plant being below the background sound level were inappropriately low and had resulted in unreasonable acoustic criteria being imposed for plant. These unnecessarily low plant noise levels provided no additional benefit for residents, but rendered otherwise good schemes unviable, potentially significantly increasing the costs of compliance, and adversely affecting the sustainability of developments by increasing the material requirements, size of plant installations, and the development's carbon footprint.

4.11 These points have been raised with the local authority but it remains insistent that the sound level from the plant should be 5 dB below the background sound level. This has therefore been used as a criterion for the plant installation.

5.0 Survey

5.1 A preliminary site visit was carried out by Richard Collman BSc (Jt. Hons), CEng, MIOA, Tech IOSH during the afternoon of Monday 21st March 2022. This survey indicated a likelihood that the complaints which had initiated the preliminary site visit were justified and that a formal investigation should be undertaken.

5.2 A fully attended site visit and survey was carried out by Richard Collman during the late evening of Tuesday 31st May 2022.

5.3 An engineer was also present to operate the plant so that residual sound levels could be measured without the plant operating and high load conditions could be simulated for a brief period once the plant was restarted.

Measurement Locations

5.4 Measurements were made in the vicinity of the plant to the rear of the store and in the bedrooms of two dwellings with windows open to the plant area.

Instrumentation

RION NA-28 integrating sound level meter (sn 01070575)
RION NC-74 sound level calibrator (sn 34246504)

5.5 The instrumentation calibration was checked before and after use. In addition to the on-site operational check the instrumentation holds valid calibration certificates which are available upon request.

Weather Conditions

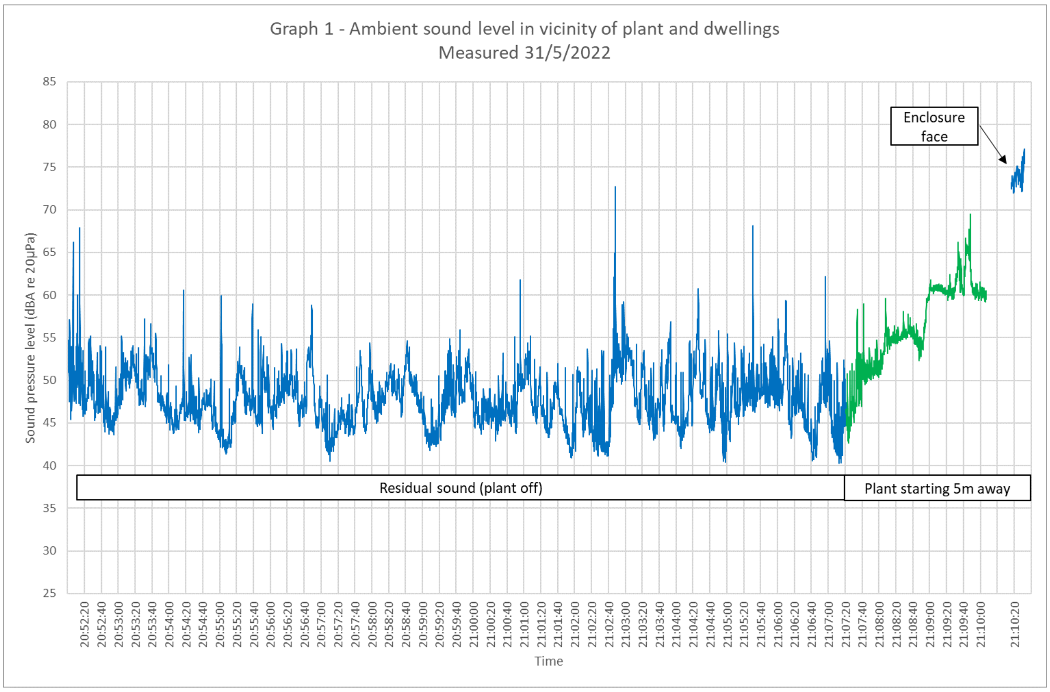
5.6 The temperature throughout the survey was around 10°C. There was a slight breeze, although it was negligible in the relatively sheltered plant area. Ground surfaces were dry and there was no precipitation during the survey.

5.7 The weather conditions during the survey did not significantly affect the measured sound levels.

Measurements

5.8 For each measurement a series of short duration L_{Aeq} third-octave spectra were stored. This allowed temporal variations in the sound to be analysed and sound from transient extraneous sources to be removed in post-processing.

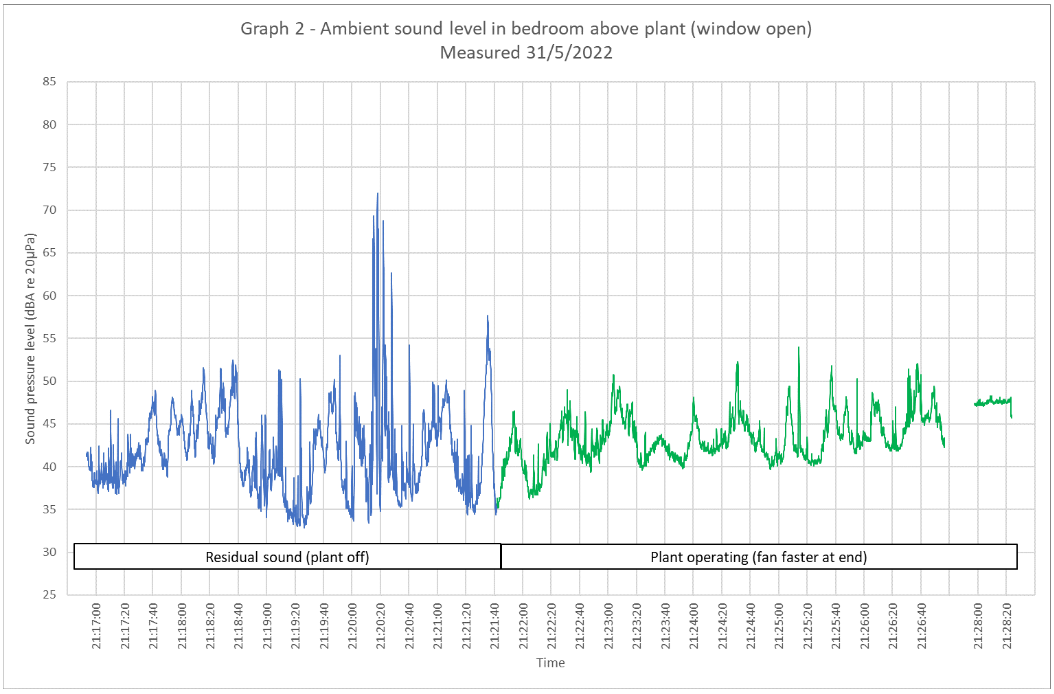
5.9 The residual sound was first measured without the plant operating for about 15 minutes, approximately 5 metres from the CVP, away from Glenloch Road. The sound level typically varied between around 40 – 55 dB L_A during this time. The plant was then restarted whilst the measurements continued as a result of which the sound level rose to around 60 – 61 dB L_A when the CVP fans were operating at full speed. This location was selected to provide an indication of the sound levels outside the nearest noise sensitive windows in the vicinity of the plant, with and without the plant operating. A separate series of measurements was then made scanning the open face of the existing open plant enclosure where the sound level was around 75 dB L_A. These measurements are shown at Graph 1 below, which is also shown to a larger scale in Appendix 1.



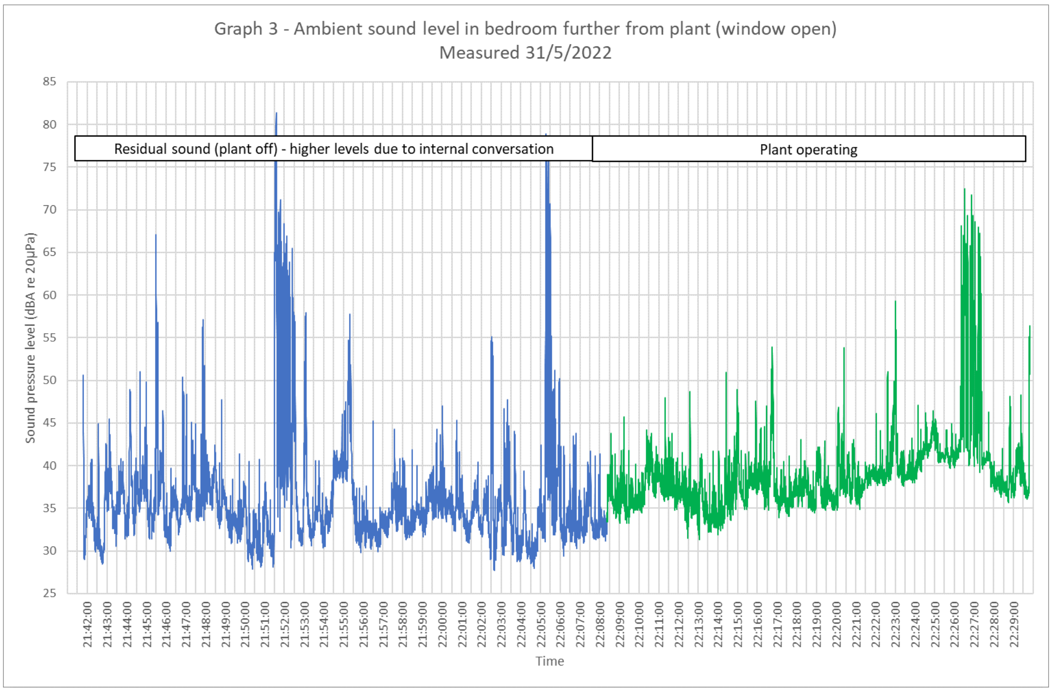
5.10 The L_{A90} for the period before the unit was switched on was around 44 dB $L_{A90,T}$, but the lowest levels are around 40 dB L_A. These measurements were made in the mid-evening. Later in the evening and into the night the road traffic volumes are likely to reduce and the periods for which these lower levels are present will increase. This will result in a lower L_{A90}. Therefore, for the purposes of this assessment a representative background sound level for the late early night time period would be 40 dB L_{A90}.

5.11 Inside the dwellings, measurements were made with the plant switched off initially then switched on when the fans operated at maximum speed for some of the time. The sound level was measured approximately 1 metre away from the open window to represent 'worst case' conditions.

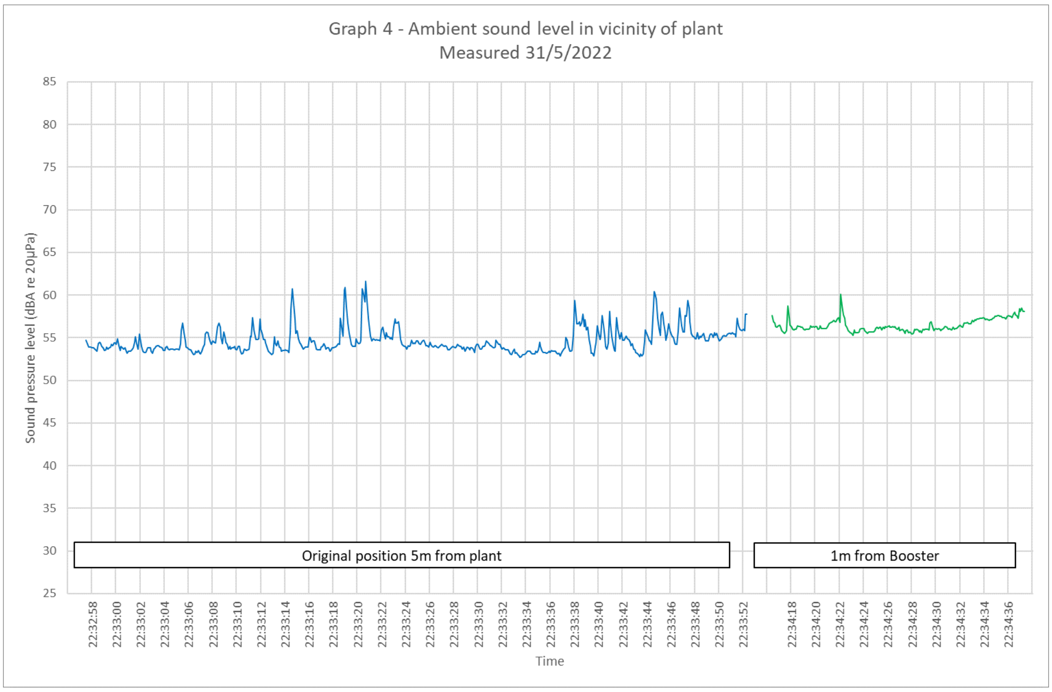
5.12 Graph 2 shows the sound level measured in the bedroom above the plant where the residual sound level typically varied between around 35 – 50 dB L_A, with the higher levels being due to extraneous sources such a passing vehicles. The plant was then switched on, but the fans did not operate at full speed for some time. This briefly occurred at around 21:28 hours when a short series of measurements was made, showing the resultant sound level to be around 47 dB L_A.



5.13 Graph 3 shows the sound level measured in the bedroom further away from the plant and Glenloch Road where the residual sound level typically varied from slightly below 30 to around 40 dB L_A, with the higher levels being due to extraneous sources such a passing vehicles. The plant was then switched on, and with the fans operating at full speed the ambient sound level rose to around 41 dB L_A. The highest levels at around 21:52, 22:06 and 23:27 were due to conversation within the bedroom.



5.14 A further series of measurements was made later in the evening at the original measurement location (as per Graph 1), where the sound level was around 54 dB L_A, i.e. around 6 dBA lower than when the CVP fans were operating at full speed. This is consistent with the change in level towards the end of the measurements shown at Graph 3. The sound level approximately 1 m from the booster was then measured to provide an indication of the relative significance of sound emitted by this unit in comparison to that from the CVP. The corresponding level was around 56 dB L_A. These measurements are shown in Graph 4.



6.0 Results and analysis

6.1 The results below are presented in the most logical order to explain the analysis rather than the order in which they were conducted during the survey. Calculation Sheet 1 (Rev B) at Appendix 2 provides details of the analysis.

Plant sound emissions

6.2 Line 1 uses the manufacturer's stated sound pressure level 1 m from the CVP and corrects this for the corresponding parallelepiped measurement surface area to calculate the unit's sound power level of 78 dB L_{wA}.

6.3 Line 2 uses an estimated surface area 47 m^2 for the area of the propagation surface on site at distance of 5 m from the CVP to calculate a corresponding plant sound pressure level contribution of 61 dB L_A at this distance from the unit on site. Line 3 shows that this is similar to the actual sound level measured, which gives confidence in the data obtained and that the CVP was operating at full speed during the measurements.

6.4 Line 4 uses the level measured at the open face of the existing partial enclosure and corrects this for the estimated surface area of 2 m^2 to calculate the corresponding sound power level of 78 dB L_{wA} which is the same as that calculated from the manufacturer's stated sound pressure level, giving further confidence in the measurements made on site.

6.5 Line 5 gives a representative background sound level of around 40 dB $L_{A90,T}$ determined from the measurements shown in Graph 1 made during the most noise sensitive night time period around 11pm.

6.6 Line 6 subtracts 5 dB from this background sound level to derive the local authority's default criterion for this plant installation of 35 dB L_{Ar} at the noise sensitive receptor locations.

6.7 Line 7 subtracts this 35 dB criterion from the 61 dB measured 5 m from the plant, which is equivalent to the level that will be incident on the nearest bedroom window. This gives the amount of attenuation required in order to comply with the local authority's default criterion, 26 dB.

6.8 Line 8 compares the level of 47 dB L_A measured inside the nearest bedroom with the 61 dB L_A indicative of the sound level incident on the window. The difference of 14 dBA, is of the order of magnitude expected for a partially open bedroom window, giving confidence that the sound level measured in the bedroom is representative of the CVP operating at full speed (as the engineer confirmed was the case at the time). It is likely that the actual level difference outside and inside the bedroom window is slightly lower than this, indicating that the actual sound level incident on the window is probably slightly lower than that measured at 5 m from the unit.

6.9 Line 9 derives the expected indoor plant sound contribution when the sound level incident on the window meets the local authority's default criterion of 35 dB L_A. The measured outside/inside difference of 14 dB gives a corresponding plant sound level contribution of 21 dB L_A inside the bedroom if the window is open. This is significantly lower than the level measured inside the bedroom when the plant was not operating at all.

Background and Residual Sound

6.10 Graph 1 shows that, at around 9pm, the residual sound level in the vicinity of the CVP and outside the nearest bedroom windows typically varied between around 41 – 55 dB L_A, briefly rising to around 60 – 70 dB L_A on occasion due to sources such as road traffic and other activity. This shows that, although the residual sound level will be slightly lower later at night, as would be expected of a busy urban environment such as this, it is not a quiet area.

6.11 This also shows that there is a relatively large difference between the background sound level, which is defined as the level exceeded for 90% of the time, i.e. the quietest 10% level; and the average residual sound level which is indicative of the higher residual sound levels occurring for the majority of the time.

6.12 The previous version of BS 4142 simply compared the plant sound level, plus a character correction if appropriate, with the background sound level, to conclude whether there was a likelihood of complaints. This approach has been shown to be flawed which is why it has been removed from the current version of the standard, which now requires both the background and residual sound levels to be considered, together with the character of both the residual acoustic environment and sound from the plant, as part of the review of the context in which the sound will be experienced by a listener.

6.13 The need for this can easily be understood by considering two very different scenarios which would have produced the same outcome using the previous version of the standard, but which give very different outcomes using the current version instead.

6.14 In both cases the plant produces a level of 44 dB L_{A} outside the nearest bedroom windows when operating at maximum capacity, which will happen primarily during hot summer days, with the level being somewhat lower when the ambient temperature drops and the plant can operate more efficiently.

6.15 In one case this plant is in a rural environment where distant road traffic produces a steady level of around 40 – 43 dB L_{A}, giving a background sound level of 40 dB $L_{A90,T}$ and an average residual level of 42 dB $L_{Aeq,T}$.

6.16 In the other case the plant is in a busy urban environment, where nearby road traffic, plant and other activity produce a sound level that varies between around 40 – 60 dB L_{A}, giving a background sound level of 40 dB $L_{A90,T}$ and an average residual level of 58 dB $L_{Aeq,T}$ and maximum levels of around 70 – 75 dB $L_{Amax,F}$.

6.17 In the first case, sound from the plant will be readily identifiable at the dwelling, raising the ambient average sound level from 42 to 45 dB $L_{Aeq,T}$ and significantly changing the character of the acoustic environment at the dwelling. Clearly sound from the plant may have a significant acoustic impact on the residents.

6.18 In the second case, sound from the plant will be masked by the residual sound. There will be no difference to the existing ambient average sound level of 58 dB $L_{Aeq,T}$ and even in the brief periods when the residual sound level falls to around 40 dB L_{A}, sound from the plant will be relatively insignificant, because of the varying level and character of residual sound and the fact that the plant does not always operate at maximum capacity, and produces lower sound levels at other times. This means that the background sound level may remain the same, but could increase by perhaps 2 – 3 dB $L_{A90,T}$ depending primarily on the timing when the plant operates at higher and lower capacity. In this case sound from the plant will have no significant impact on the residents.

6.19 The previous version of the standard ignored the level and characteristics of the residual acoustic environment whereas the current version of the standard requires that this is considered as part of the acoustic assessment. Unfortunately, the local authority's approach of setting a criterion that is solely related to the background sound level, makes the same mistake as the previous version of the standard, which has now been obsolete for 9 years.

7.0 Mitigation

7.1 In order to comply with the local authority's default criterion, the plant requires 26 dBA attenuation. This can only be achieved by installing a complete acoustic enclosure around the plant, which will inevitably adversely affect the plant's operation, energy consumption and capacity.

7.2 It is therefore necessary to ensure that the acoustic enclosure is designed so that these effects do not compromise the plant's capacity to the extent that it cannot continue to keep food refrigerated to the temperatures required for safe storage and the expected shelf life.

7.3 The acoustic enclosure will need to allow the plant to draw in cooling air into and expel the ejected warm air. However, this air path requires a similar amount of attenuation as the overall insertion loss that the acoustic enclosure needs to achieve of 26 dBA. This attenuation will impose significant aerodynamic resistance to the cooling airflow, which must not exceed the capacity of the CVP's fans otherwise the plant will no longer be able to achieve adequate airflow and will fail to provide the required cooling capacity.

7.4 Fans could be installed within the acoustic enclosure to overcome the enclosure attenuation's aerodynamic resistance, but these will inevitably produce additional sound which may increase the overall sound level emitted the plant. There is also insufficient space to incorporate fans within the enclosure design.

7.5 The remainder of the acoustic enclosure needs to comprise panelling which provides sufficient sound insulation and appropriate access to the plant for routine maintenance etc.

Attenuation Proposal

7.6 The acoustic enclosure shown at Appendix 3 has therefore been designed to provide an insertion loss of 26 dBA to comply with the local authority's default criterion.

8.0 Conclusions

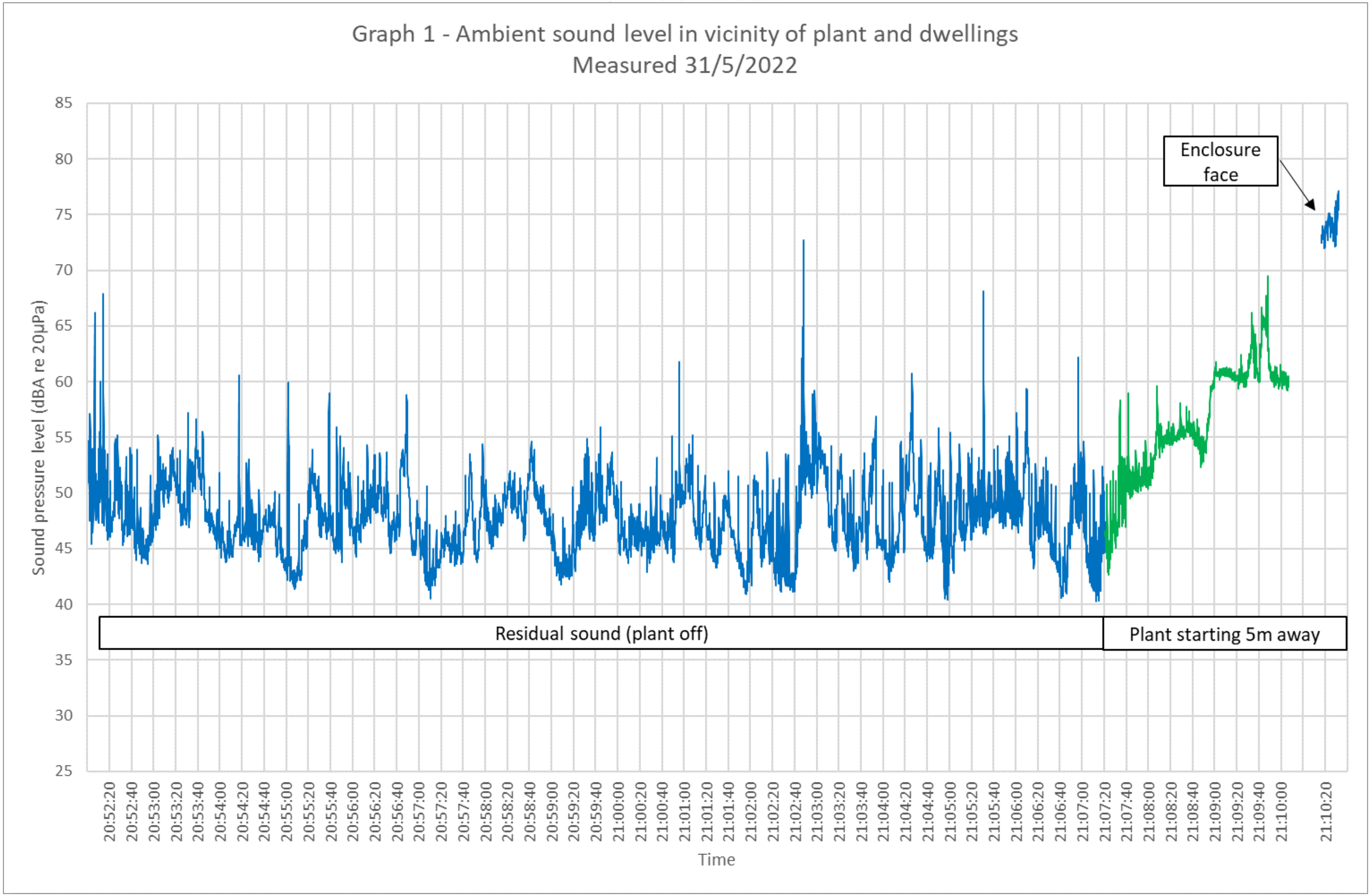
8.1 Acoustical Control Consultants has undertaken an investigation of noise complaints related to plant at the Nisa food store in Haverstock Hill, Belsize Park. The complainants live in dwellings with bedroom windows above the plant area.

8.2 Measurements were made inside and outside the affected bedrooms and close to the operating equipment at the store. The measurements close to the plant were used to compare with the manufacturer's stated sound levels and those measured indoors.

8.3 The residual sound level measurements were also used to estimate the likely background sound level as part of a BS 4142 assessment, which then refers to BS 8233 for specific guidance regarding suitable internal sound levels.

8.4 Although BS 8233 indicates that a suitable sound level from the plant may be up to around 44 dB L_{A}, the local authority's default criterion equates to 35 dB $L_{Aeq,T}$ so, despite the adverse impacts on sustainability, the acoustic enclosure has been designed to achieve this.

Appendix 1 Sound Level Measurements


Graph 1 - Ambient sound level in vicinity of plant and dwellings
Measured 31/5/2022
Sound pressure level (dBA re 20µPa)
85
80
75
70
65
60
55
50
45
40
35
30
25
Enclosure face
Residual sound (plant off)
Plant starting 5m away
20:52:20
20:52:40
20:53:00
20:53:20
20:53:40
20:54:00
20:54:20
20:54:40
20:55:00
20:55:20
20:55:40
20:56:00
20:56:20
20:56:40
20:57:00
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20:59:40
21:00:00
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21:01:00
21:01:20
21:01:40
21:02:00
21:02:20
21:02:40
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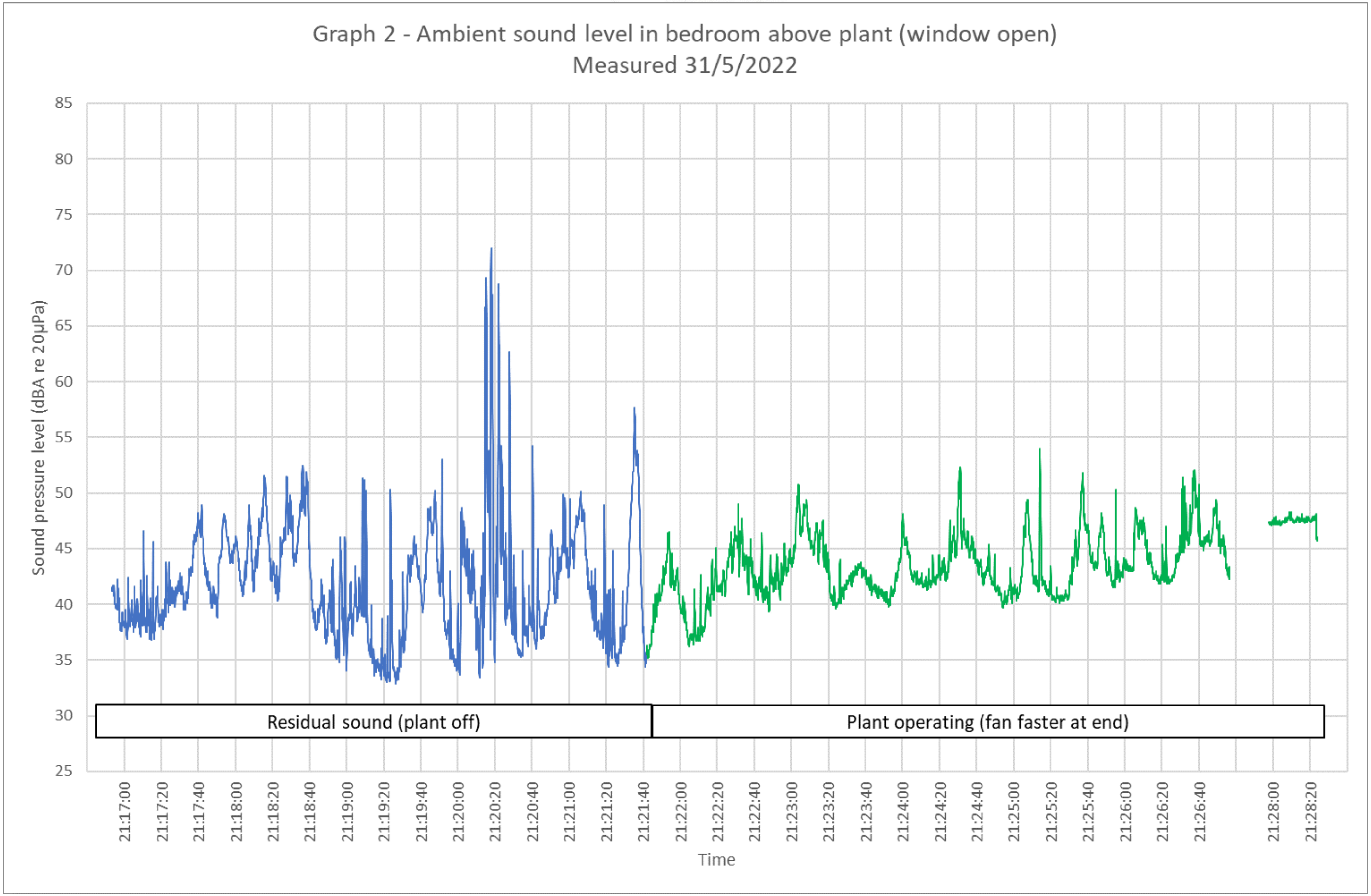
21:03:40
21:04:00
21:04:20
21:04:40
21:05:00
21:05:20
21:05:40
21:06:00
21:06:20
21:06:40
21:07:00
21:07:20
21:07:40
21:08:00
21:08:20
21:08:40
21:09:00
21:09:20
21:09:40
21:10:00
21:10:20
Time


Graph 2 - Ambient sound level in bedroom above plant (window open)
Measured 31/5/2022
Sound pressure level (dBA re 20µPa)
85
80
75
70
65
60
55
50
45
40
35
30
25
Residual sound (plant off)
Plant operating (fan faster at end)
21:17:00
21:17:20
21:17:40
21:18:00
21:18:20
21:18:40
21:19:00
21:19:20
21:19:40
21:20:00
21:20:20
21:20:40
21:21:00
21:21:20
21:21:40
21:22:00
21:22:20
21:22:40
21:23:00
21:23:20
21:23:40
21:24:00
21:24:20
21:24:40
21:25:00
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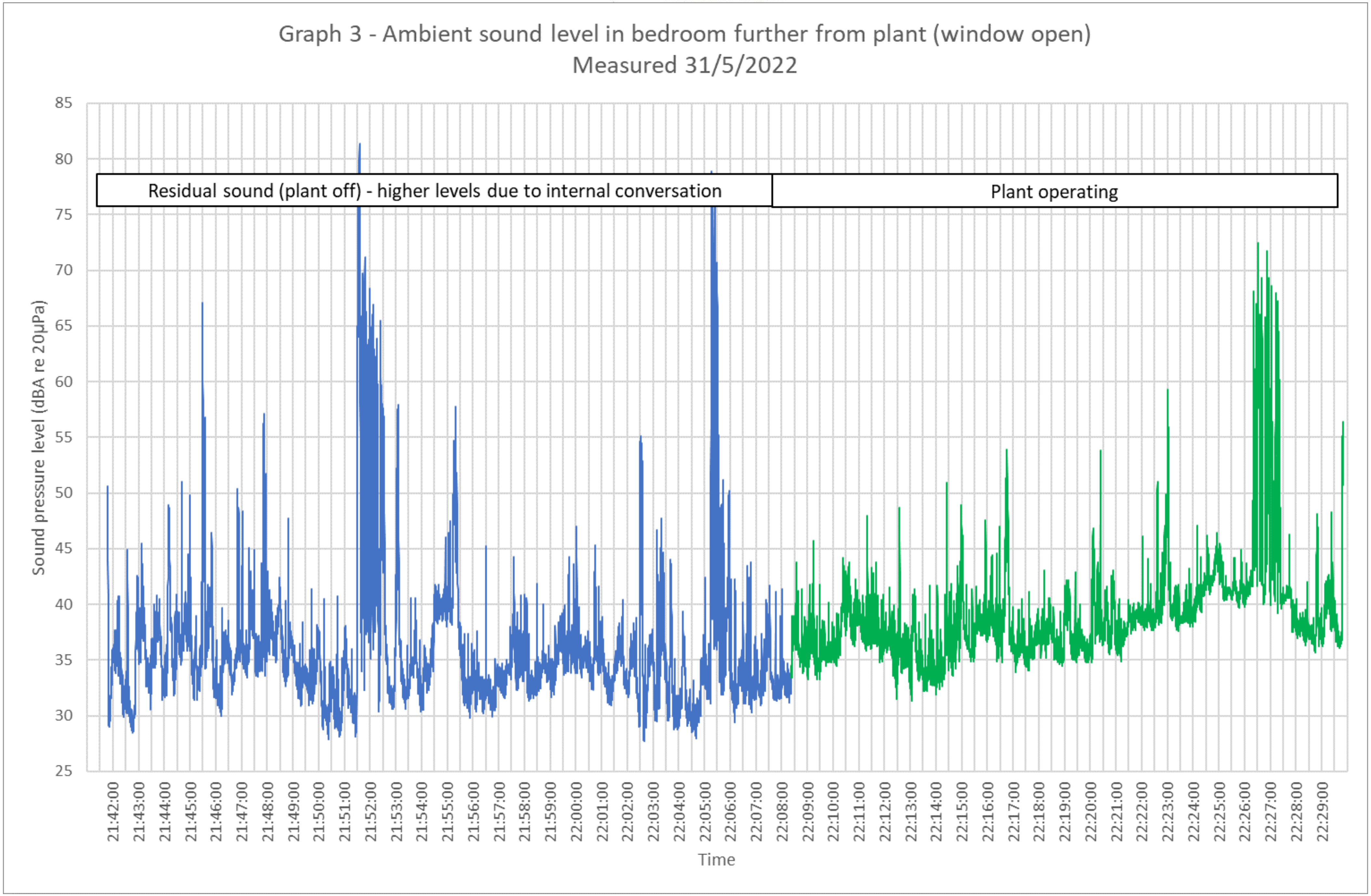
21:25:40
21:26:00
21:26:20
21:26:40
21:28:00
21:28:20
Time



Graph 3 - Ambient sound level in bedroom further from plant (window open)
Measured 31/5/2022
Residual sound (plant off) - higher levels due to internal conversation
Plant operating
Sound pressure level (dBA re 20µPa)
85
80
75
70
65
60
55
50
45
40
35
30
25
21:42:00
21:43:00
21:44:00
21:45:00
21:46:00
21:47:00
21:48:00
21:49:00
21:50:00
21:51:00
21:52:00
21:53:00
21:54:00
21:55:00
21:56:00
21:57:00
21:58:00
21:59:00
22:00:00
22:01:00
22:02:00
22:03:00
22:04:00
22:05:00
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22:07:00
22:08:00
22:09:00
22:10:00
22:11:00
22:12:00
22:13:00
22:14:00
22:15:00
22:16:00
22:17:00
22:18:00
22:19:00
22:20:00
22:21:00
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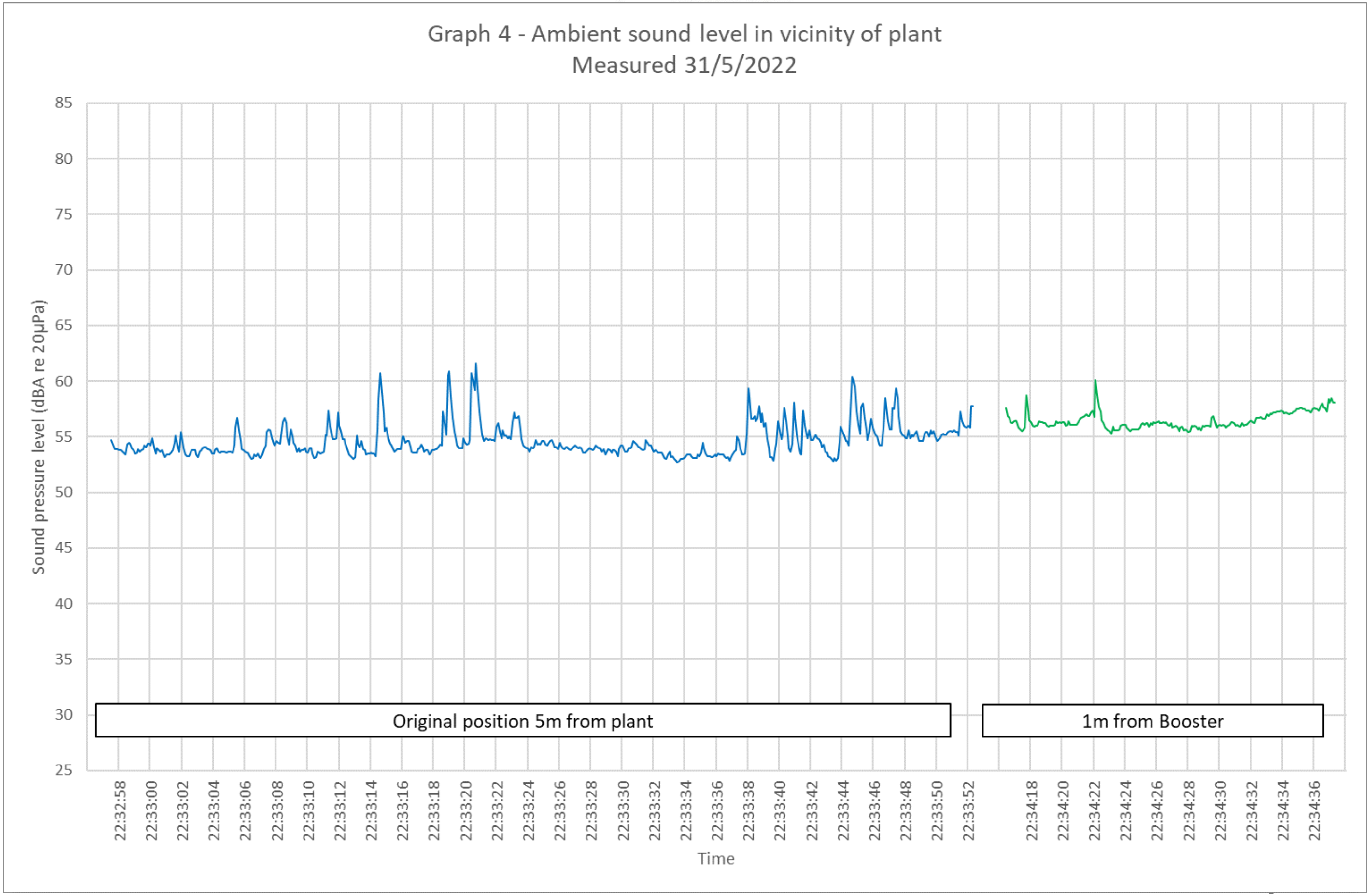
22:25:00
22:26:00
22:27:00
22:28:00
22:29:00
Time



Graph 4 - Ambient sound level in vicinity of plant
Measured 31/5/2022
Sound pressure level (dBA re 20µPa)
85
80
75
70
65
60
55
50
45
40
35
30
25
Original position 5m from plant
1m from Booster
22:32:58
22:33:00
22:33:02
22:33:04
22:33:06
22:33:08
22:33:10
22:33:12
22:33:14
22:33:16
22:33:18
22:33:20
22:33:22
22:33:24
22:33:26
22:33:28
22:33:30
22:33:32
22:33:34
22:33:36
22:33:38
22:33:40
22:33:42
22:33:44
22:33:46
22:33:48
22:33:50
22:33:52
22:34:18
22:34:20
22:34:22
22:34:24
22:34:26
22:34:28
22:34:30
22:34:32
22:34:34
22:34:36
Time

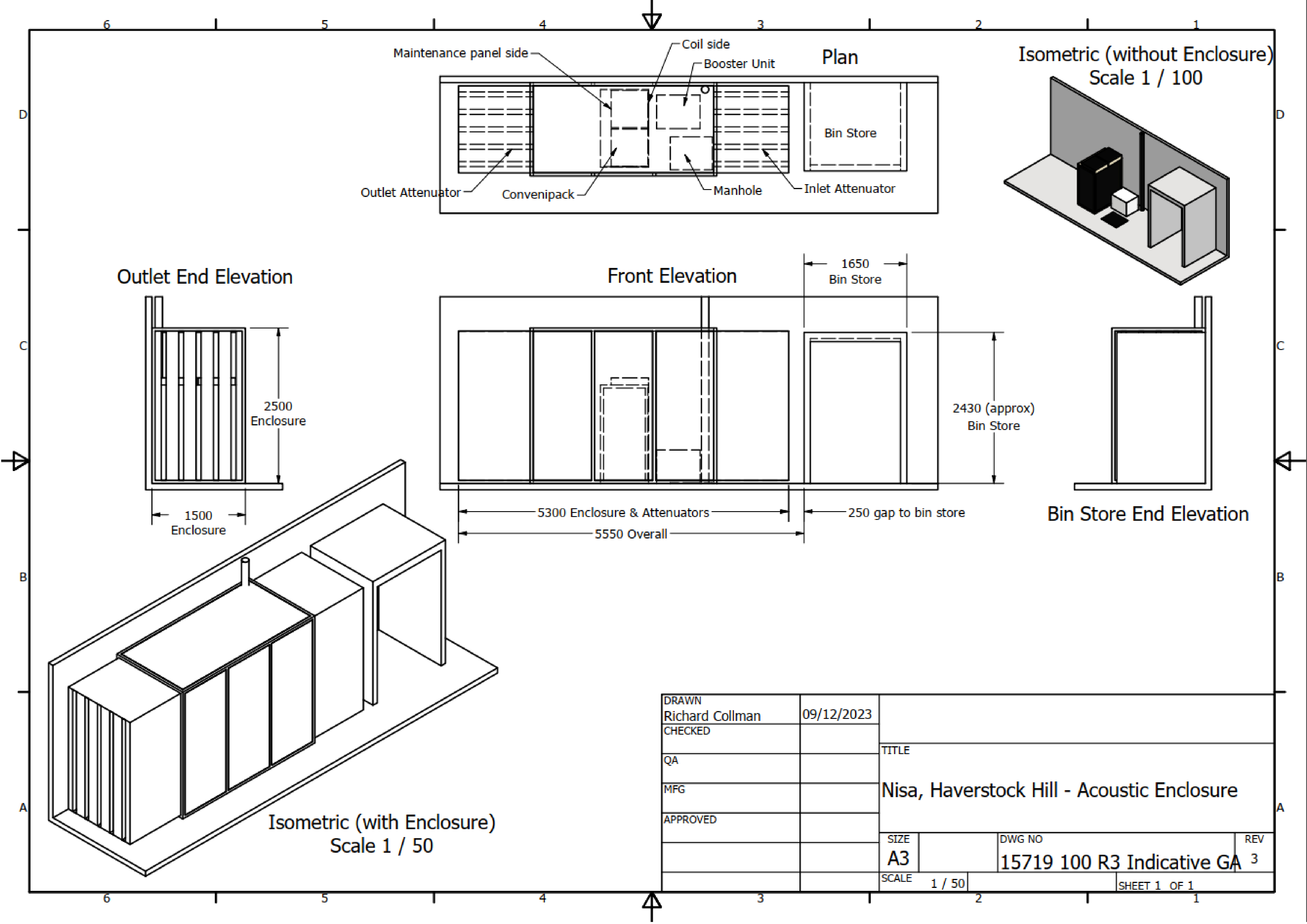
Appendix 2 Analysis

Calculation Sheet 1 (Rev B) - Plant sound levels

Line	Details					dBA	Notes
1	Sound pressure level (Lp) 1m from CVP					62	Manufacturer's data
	Unit dimensions & area correction	1240	785	1680	41.3	16	Correction = 10 Log_{10} (Area)
	CVP sound power level (Lw)					78	Lp + Area Correction
2	Approx. area 5m from CVP	47				-17	-10 Log_{10} (Area)
	Calculated Lp 5m from CVP					61	Lines 1 + 2
3	Measured level 5m from CVP (equivalent to bedroom window)					61	From Graph 1
4	Measured level at enclosure face					75	From Graph 1
	Enclosure open area & correction	2				3	Correction = 10 Log_{10} (Area)
	Calculated CVP Lw					78	Sum of above
5	Background level ($L_{A90,T}$)					40	
6	Local authority default criterion					35	Background ($L_{A90,T}$) - 5 dB
7	Unattenuated excess (attenuation required)					26	Lines 3 - 6
8	Difference between 5m level and in nearest bedroom					-14	Assuming open window
9	Corresponding level in nearest bedroom					21	Lines 6 + 8

Appendix 3 Attenuation Proposal

The attenuation proposal in this version of the report has been changed in response to the Council's comments. It is still intended to achieve the same sound level at the noise sensitive receptors so, from an acoustic perspective, this proposal is identical to the previous one.


Plan
Maintenance panel side
Coil side
Booster Unit
Bin Store
Outlet Attenuator
Convenipack
Manhole
Inlet Attenuator
Isometric (without Enclosure)
Scale 1 / 100
Outlet End Elevation
2500
Enclosure
1500
Enclosure
Front Elevation
1650
Bin Store
2430 (approx)
Bin Store
5300 Enclosure & Attenuators
250 gap to bin store
5550 Overall
Bin Store End Elevation
Isometric (with Enclosure)
Scale 1 / 50
DRAWN
Richard Collman
09/12/2023
CHECKED
QA
MFG
APPROVED
TITLE
Nisa, Haverstock Hill - Acoustic Enclosure
SIZE
A3
DWG NO
15719 100 R3 Indicative GA
REV
3
SCALE
1 / 50
SHEET 1 OF 1

Annex A Competence & Experience

A.1 Acoustical Control Consultants Limited has the advantage of personnel that were directly involved in the drafting of BS 4142, who have specialised in the measurement, assessment and control of noise from industrial and commercial sources throughout their careers. This type of work forms a major part of our activity and has done so for several decades. Our culture, systems and working practices are geared towards ensuring that this type of work is consistently undertaken to the high and robust level of quality for which we are known.

A.2 **Richard A Collman** has overall responsibility for ACC's activities including BS 4142 assessments. He graduated with a BSc (Class I) in Acoustics and Computer Science from Salford University in 1984, being awarded the course prize in both the second and final years. He is a Chartered Engineer and has specialised in the measurement and assessment of sound from industrial and commercial plant for over 30 years, writing articles and papers on this subject for Acoustics Bulletin and IOA conferences. He pioneered the use of digital instrumentation for short duration consecutive logging rather than longer term statistical averaging measurement techniques. As an expert on sound from refrigeration and air conditioning plant he represented the Institute of Refrigeration on the BSI committee and the Drafting Panel responsible for the 2014 edition of BS 4142, presented the section on Uncertainty at the BS 4142Launch Meeting in November 2014, and authored an associated Technical Article in Acoustics Bulletin. He has been closely involved in the development of BRL's BS 4142 measurement, assessment and reporting system to ensure that it is fully compliant with all aspects of BS 4142.

A.3 **Mike Hewett,** Principal Acoustician, joined the company in February 2021 bringing with him more than 30 years' experience of Acoustic consultancy. Mike's particular expertise is in the assessment, prediction and control of noise and vibration from structures, plant and equipment. Other skills include acoustic design, environmental acoustics and the assessment and control of vibration. He has managed several large-scale acoustic design projects and is highly experienced in diagnostic techniques including sound mapping, sound intensity and vibration measurements. He is an active member of the Institute of Acoustics has been chair and secretary of the Noise and Vibration Engineering specialist group and chair of the North West Regional Branch. In 1994 Mike was awarded the prize for the best overall performance in the IOA Diploma and has since presented papers at numerous conferences and seminars.

Annex B Acoustics Terms and Glossary

This Annex provides a layperson's explanation of the acoustics terms that commonly appear in reports.
This Annex provides a layperson's explanation of the acoustics terms that commonly appear in reports.
It is not intended to give full scientific definitions and explanations or go into detail on how and why things are as they are. Some obsolete terms and abbreviations have been included as they still appear in documents from time to time.

Jargon Buster

Many words have more specific meanings when used in acoustics than in every-day language.	
sound	is used to describe the physical phenomenon of the transmission of energy through gaseous or liquid media via rapid fluctuations in pressure.
vibration	is used to describe the transmission of energy through solid media by oscillation
structure borne sound	The sound radiated from a structure as a result of vibration passing through it from a source in another location
level	used solely to describe values measured in decibels
axis	The direction of measurement of vibration (the transducers used to measure vibration are only able to measure in a single direction, therefore in order to completely describe the vibration of an object it is necessary to measure in three directions at right angles ton each other [three orthogonal axes])
loudness	is the human perception of the level of sound
noise	can have several definitions and is often used interchangeably with sound however it is usually taken to mean 'unwanted' sound
index	a value based on the mathematical processing of raw data
indicator	a value used to indicate the likelihood of a particular response of effect eg. VDV is an index based on processing of vibration acceleration data that is used as an indicator for human response to vibration.
weighted	values modified to reflect sensitivities at particular frequencies.
apparent	measured in situ
insulation	resistance to the passage of airborne sound
isolation	resistance to the passage of vibration
attenuation	amount by which sound or vibration is reduced when passing through a structure or system

decibels dB	The decibel is not a true measurement unit nor is it exclusive to acoustics. The decibel is a logarithmic ratio of two values of a variable. Decibels are used because they can represent very wide ranges of ratios (from trillionths and billionths to billions and trillions) with a small range of decibel values. Decibels can be used to represent measured values by using a known reference value in the ratio. When using decibels to measure something it is therefore important to specify what variable is actually being measured and what reference level has been used. This is done by adding a reference value statement in the form "dB re x units", where the units indicate the variable being measured and x is the reference value. Decibels are used in acoustics because the human ear responds to sound in a logarithmic way and the quantities measured in acoustics vary over wide ranges. However, decibels are used in acoustics to measure several different things, which it is important not to confuse with each other. To avoid confusion there is a notation system that identifies what a decibel value is for. The notations take the form of an italic capital letter and some subscript characters. The capital identifies the general type of value and the subscripts give specific details of what is being represented. L_{xxx} denotes a level (ie a value measured in dB by comparison with a reference value); D_{xxx} denotes a difference between two levels; R_{xxx} denotes a rating (or index), which is measure of the generalised acoustic performance of a material or construction based on a difference between two levels; C_{xxx} denotes a correction (or constant) Of these only those with *L* notations require a reference value statement. Those with *D* or *R* notations are effectively ratios of two measured values not one measured value and a reference value and those with *C* notations are not based on reference values at all. A reference value statement therefore has no meaning when describing *D*, *R* and *C* decibels. Because decibels are logarithmic they have to be added, subtracted, multiplied, divided and averaged using different techniques from normal numbers.

Pitch, frequency	The sound and vibration we perceive can have different characteristics such as low-pitched hums, high-pitched squeals and impulsive sounds. In engineering acoustics the word frequency rather than pitch tends to be used when describing the characteristics of a sound. The unit of frequency is the Hertz (Hz), which is the number of pressure fluctuations per second.	
tonal sound broadband sound impulsive sound	Any sound or vibration can be defined by its frequency content. Some comprise just one discrete frequency (tonal). Others are distributed over wide frequency ranges (broad band). Impulsive sound or vibration is made up short pulses of high frequency components. Sources often produce all of these types of sound at the same time.	
frequency analysis	There are different ways of analysing and displaying the frequency content of a sound or vibration:	
	Octave Band Analysis	is the simplest method. The audible range of frequencies is divided into 10 bands.
	Third-Octave Band Analysis	more detailed with 30 bands
	Narrow Band Analysis	12th Octave (120 bands), 24th Octave (240),
	Fast Fourier (FFT) Analysis	a high resolution technique that can give extremely detailed information on frequency content