ACOUSTIC DESIGN TECHNOLOGY
Noise and Vibration Consultants

ADT 3375

26 August 2022

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BARNSLEY HOSPITAL DECARBONISATION

ENVIRONMENTAL NOISE IMPACT ASSESSMENT

ACOUSTIC CONSULTANCY REPORT ADT 3375/ENIA

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-	26 August 2022	Chris Middleton	-	first issue

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TABLE OF CONTENTS

1.0 SUMMARY 3

2.0 BASIS OF ASSESSMENT 4

2.1 Site Location 4

2.2 Proposed Development 4

2.3 Assessment Criteria 4

2.4 Nearest Noise Sensitive Properties 5

2.5 Strategy for Noise Impact Assessment 5

3.0 ENVIRONMENTAL NOISE SURVEY 6

3.1 Purpose 6

3.2 Scope of Survey 6

3.3 Instrumentation 6

3.4 Procedure 6

3.5 Results 7

3.6 Weather Conditions 7

3.7 Description of Existing Acoustic Environment 7

4.0 NOISE IMPACT ASSESSMENT 8

4.1 Introduction 8

4.2 Specific Sound Levels 8

4.2.1 Computer Model 8

4.2.2 Source Sound Levels 9

4.3 Predicted Sound Levels 9

4.4 Background Sound Level 10

4.5 Rating Level 11

4.5.1 Tonality 11

4.5.2 Impulsivity 11

4.5.3 Other Sound Characteristics 11

4.5.4 Intermittency 11

4.6 Initial Assessment of Impact 12

4.7 Context 13

4.7.1 The Absolute Level of Sound 13

4.7.2 The Character and Level of the Specific and Residual Sound 13

4.7.3 The Sensitivity of the Receptor 13

4.8 Conclusion 14

1.0 SUMMARY

Planning permission is being sought for the installation of external air source heat pump units at various locations around the Barnsley Hospital campus as shown on the planning application drawings.

Acoustic Design Technology Limited have undertaken an environmental noise survey to determine the existing ambient noise levels in the vicinity.

The predicted cumulative rating levels from the proposed installations are at or below the typical background level during the proposed hours of operation. According to BS 4142:2014+A1:2019, this is "... *an indication of the specific sound source having a low impact, depending on the context".*

2.0 BASIS OF ASSESSMENT

2.1 Site Location

Barnsley Hospital is located on Gawber Road, Barnsley. There are a number of buildings around the hospital campus, interspersed with access roads and car parking.

The surrounding area is mostly residential, with houses in all directions. From the point of view of where the new plant will be located, primarily towards the south-western end of the site, the nearest noise sensitive properties are the houses on Oakham Place to the north, Vernon Way to the west, Warner Avenue to the south-west and Pogmoor Road to the south-east.

The closest main road is the A628, just under 500 metres away to the south, and the M1 is about 1.25km away to the south-west.

2.2 Proposed Development

Planning permission is being sought for the installation of air source heat pumps (ASHP) at 5 different locations as shown on the attached site plan 3375/SP1.

Acoustic screening is proposed to the south-west and north-west of the Network 2 and Network 3 roof mounted units, as shown on the attached site plans 3375/SP3 and 3375/SP4.

2.3 Assessment Criteria

The primary guidance on the control of noise emissions from external fixed plant installations is to be found in BS 4142:2014+A1:2019.

2.4 Nearest Noise Sensitive Properties

The noise sensitive properties in the surrounding area have been grouped into 4 noise sensitive areas (NSA), as described below and as indicated on the attached site plan 3375/SP1.

NSA	Location	Direction
1	Houses on Oakham Place	North
2	Houses on Vernon Way	West
3	Houses on Warner Avenue / Warner Place	South-west
4	Houses on Pogmoor Road	South

The above NSA represent the closest noise sensitive properties, with others located further from the site and in some cases screened by the intervening buildings. A satisfactory noise impact at the defined NSA should therefore ensure a satisfactory noise impact at other noise sensitive locations.

2.5 Strategy for Noise Impact Assessment

Based on the information in Sections 2.1 to 2.4 above, the strategy for the noise impact assessment has been broken down into the following stages:

i. undertake an environmental noise survey to obtain baseline noise data, as described in Section 3.0 below

ii. assess the impact of noise emissions from the proposed mechanical plant as described in Section 4.0 below

3.0 ENVIRONMENTAL NOISE SURVEY

3.1 Purpose

The purpose of the survey was to obtain representative background noise levels for the day time and night time periods.

3.2 Scope of Survey

An attended environmental noise survey was undertaken between 11:15 hours on Thursday 7 July 2022 and 11:00 hours on Tuesday 12 July 2022, thereby covering a sample of week day and weekend periods.

3.3 Instrumentation

The instrumentation used, and the field calibration values before and after the survey are detailed in Appendix A of this report.

3.4 Procedure

Two measurement positions were selected as described below and indicated on the attached site plan 3375/SP1:

i. at the south end of the hospital campus, at 1 metre out of a 2nd floor window of Building B, overlooking Pogmoor Road

ii. at the west end of the site, at 1 metre out of a 1st floor window on the south-west elevation of the Estates Building, facing Vernon Way.

Position 1 was chosen to obtain representative background levels at NSA4 Pogmoor Road, while position 2 was selected to provide background levels for the remaining noise sensitive areas.

The noise levels were logged continuously for the duration of the survey period, using the Svantek 958 sound level meter at position 1 and the 01dB Solo at position 2, both set to store the octave band and 'A' weighted 100ms short-term L_{eq} for subsequent post processing.

3.5 Results

The logged data has been post processed to determine $L_{Aeq,T}$ $L_{A90,T}$ and L_{Amax} levels for each 15 minute period, and these are set out on the attached time history graphs 3375/T1 and 3375/T2.

Please refer to Appendix B for explanation of the noise units and the A-weighting term used in this report.

3.6 Weather Conditions

As the survey was primarily unattended it is not possible to provide a detailed description of the weather conditions throughout the survey, although at the start and end of the survey the weather was dry with no more than a light breeze, with similar conditions forecast and locally observed for the remainder of the period.

3.7 Description of Existing Acoustic Environment

As the survey was primarily unattended it is not possible to provide a detailed description of the noise climate throughout the survey. The following description is therefore based on observations during the set up and collection visits, the pattern of measured results and interrogation of periodic audio samples.

At measurement position 1 the noise levels were controlled by traffic on Pogmoor Road, the recorded time history is in line with typical diurnal traffic flow patterns.

At measurement position 2 the day time noise levels were controlled by a combination of distant road traffic and some plant noise at the hospital. During the night, the background levels levelled off at around 40 dB L_{A90}, and the audio samples indicate low level plant noise. The measurement microphone was located as far from external plant as possible, although on a hospital site of this size, some degree of plant noise at the boundary is inevitable.

4.0 NOISE IMPACT ASSESSMENT

4.1 Introduction

As already mentioned in Section 2.3 above, the appropriate assessment method is BS 4142.

The standard provides a methodology for assessing the likely impact of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident. The assessment involves comparing the *rating* level of the sound source with the typical *background* levels for the period of interest. The standard concludes that if the rating level does not exceed the background levels, the noise impact should be low, depending on the context.

4.2 Specific Sound Levels

4.2.1 Computer Model

As the analysis is relatively complex, a computer model of the proposed installation has been constructed using Datakustik Cadna/A 2022 to predict how the sound will radiate from the proposed plant to the identified noise sensitive areas.

Within the model all buildings and barriers have been assumed to be acoustically reflective, with ground absorption taken into account as appropriate. The receiver height has been assumed to be 4.5 metres - the approximate typical height of the upper floor windows of the surrounding dwellings.

4.2.2 Source Sound Levels

The plant specifications and locations are shown in detail on the separately issued SDA mechanical engineering drawings. The approximate plant locations are marked on the attached plan 3375/SP1, and the plant noise data is set out on the attached plant noise schedule 3375/PNS.

The height and extent of the proposed acoustic screening is shown on the attached plans 3375/SP3 and 3375/SP4 for the Network 2 and Network 3 ASHP respectively. The other units are sufficiently screened from the neighbouring houses by the bulk of the hospital buildings, and increased distances.

The acoustic screens are assumed to be notionally 200mm above the top of the plant, of a material with a minimum sound insulation of R_w 25. This can be fulfilled by a range of materials including 22mm solid timber fencing or a simple insulated metal panel (e.g. Kingspan KS1000 or similar).

4.3 Predicted Sound Levels

The scheduled plant noise levels and acoustic screening have been input into the Cadna/A computer model, and the predicted noise levels at the identified noise sensitive areas are as follows:-

Location	Predicted $L_{eq,T}$ (dB) at octave band centre frequency (Hz)								$L_{Aeq,T}$ dB
	63	125	250	500	1k	2k	4k	8k	
NSA1 Oakham Place	36	27	28	30	33	31	23	14	36
NSA2 Vernon Way	38	28	28	31	33	32	23	23	37
NSA3 Warner Avenue	40	32	32	35	36	34	27	27	40
NSA4 Pogmoor Road	35	27	30	31	34	32	23	5	37

The above levels are for all plant running simultaneously with no 'on time' corrections, and can therefore be used as specific sound levels for the day time or night time periods.

4.4 Background Sound Level

The plant will need to operate 24 hours a day. Typical background sound levels for the day time (07:00 – 23:00) and night time (23:00 – 07:00) periods have been calculated using the modal method suggested in Section 8.1.4 of BS 41242, analysed across all of the surveyed day time and night time periods. The results are as follows:

Location	Day	Night
Position 1 Pogmoor	53	41
Position 2 West	41	40

These are fairly typical of the background sound levels at the boundary of a major hospital.

4.5 Rating Level

To convert the specific sound level into a rating level, corrections have to be applied for impulsivity, intermittency, tonality and other sound characteristics where such features are present.

4.5.1 Tonality

Using commonly accepted definitions of tonality, the predicted specific sound levels at the assessment locations are not tonal. Therefore, a tonal correction is not required.

4.5.2 Impulsivity

The noise emissions from the air source heat pumps should not be impulsive in character, so no correction is required.

4.5.3 Other Sound Characteristics

There are no additional sound characteristics which would warrant the addition of an extra correction.

4.5.4 Intermittency

The plant will switch off when buildings reach the desired temperature, although this would be compensated for by the reduced 'on time' over the assessment period which has not been accounted for in the specific sound level. It is also likely that while one of the five units is switched off, others will still be running, and of course the rest of the hospital plant would be running.

On that basis it is considered unlikely that the intermittency would be perceptible at the assessment locations.

The rating levels are therefore the same as the specific sound levels.

4.6 Initial Assessment of Impact

The initial assessment of impact for the most sensitive night time period is set out in the following table:

Initial assessment of impact – night time period				
	NSA1 Oakham Place	NSA2 Vernon Way	NSA3 Warner Avenue	NSA4 Pogmoor Road
Specific Sound Level $L_{Aeq,\ 15\ mins}$ (dB)	36	37	40	37
Character correction (dB)	-	-	-	-
Predicted Rating Level $L_{Ar,1\ hour}$ (dB)	36	37	40	37
Background level $L_{A90,1\ hour}$ (dB)	40	40	40	41
Excess of rating level over background sound level (dB)	-4	-3	0	-4
Initial assessment of impact	low	low	low	low

The initial assessment of impact is therefore 'low' at all noise sensitive areas.

4.7 Context

4.7.1 The Absolute Level of Sound

The rating levels and background levels are relatively low, and the absolute sound levels are therefore potentially relevant. Specific sound levels of up to 40 dB $L_{Aeq, T}$ incident on a residential building would translate to around 25 dB inside, assuming 15 dB reduction for open windows, which is within the BS 8233 recommended range of 30 dB $L_{Aeq, 8\ hour}$ for bedrooms at night.

That is of course defined for anonymous traffic type noise, although there is a reasonable margin of compliance to account for the fact that the plant could potentially be identified from some locations.

4.7.2 The Character and Level of the Specific and Residual Sound

Plant noise is already an established part of the local noise climate, so the introduction of additional sources would not be incongruous.

4.7.3 The Sensitivity of the Receptor

The surrounding houses are not known to be more or less sensitive than typical residential properties, nor do they have specific sound insulation measures.

Taking the above contextual factors into account, it should not be necessary to adjust the initial assessment of impact.

4.8 Conclusion

This assessment has demonstrated that when assessed following the methodology of BS 4142:2014, the initial estimate of impact of the proposed plant installations should be low, depending on the context.

Furthermore, consideration of the context has shown that this need not affect the initial estimate of impact.

The conclusion of this report is therefore that noise emissions from the proposed plant installations should be acceptable with the proposed noise control measures.

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Notes

P1 – Network 1 unit, ground level
P2 – Network 2 unit, roof of Education Centre
P3 – Network 3 unit, roof of Estates building
P4 – Network 4 unit, ground level
P5 – Network 5 unit, roof of Block Z

Description

Site plan showing plant locations (P) and noise sensitive areas (NSA)

Project

Barnsley Hospital Decarbonisation

Date

26 August 2022

Drawing No.

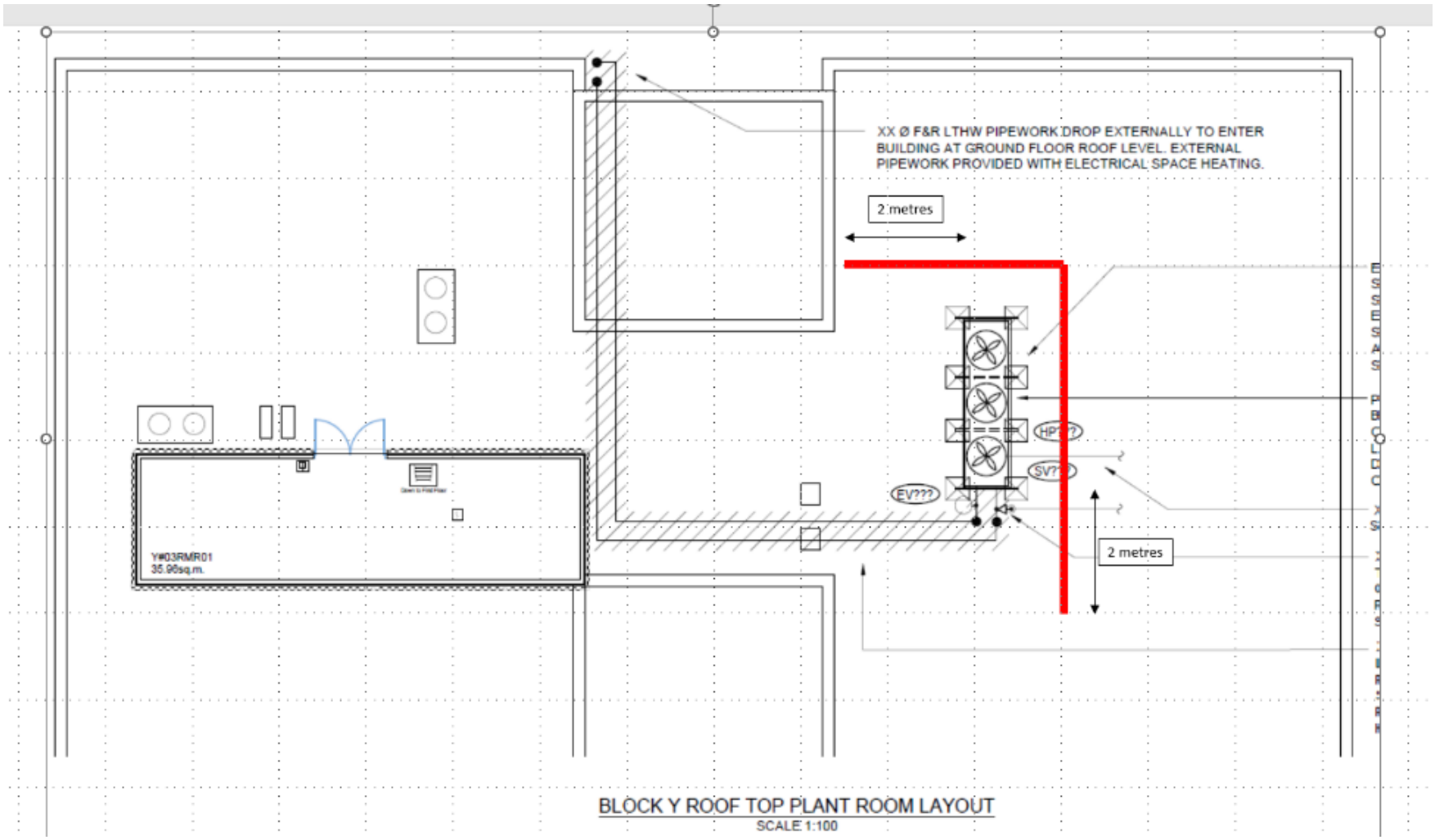
3375/SP1

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Notes	**Description** Site plan showing survey measurement positions	
	Project Barnsley Hospital Decarbonisation	
	Survey Date 7 to 12 July 2022	**Drawing No.** 3375/SP2

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Notes

Acoustic screen extent marked in red
200mm above top of plant

Description

Indicative acoustic screening to Network 2 plant

Project

Barnsley Hospital Decarbonisation

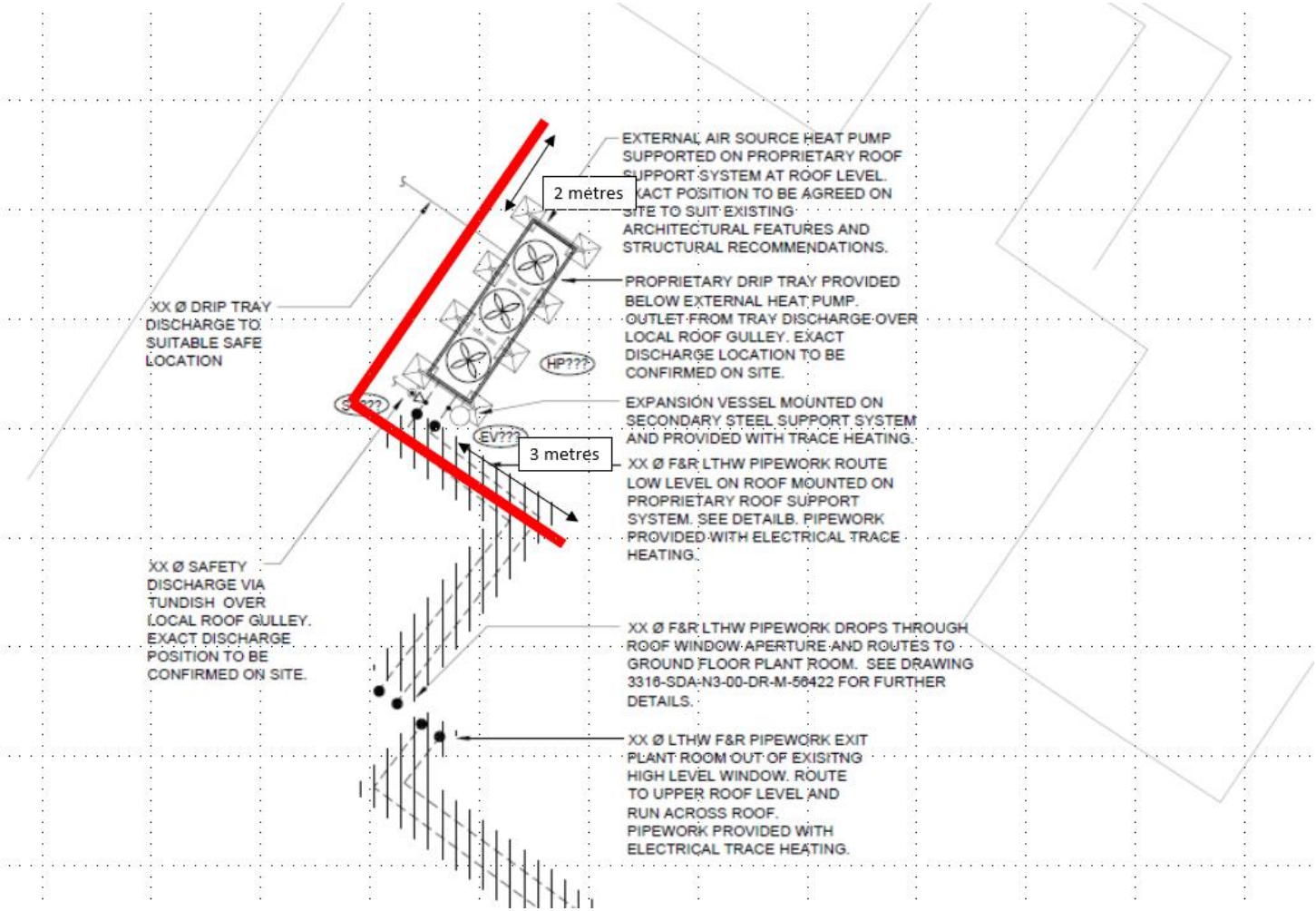
Date

26 August 2022

Drawing No.

3375/SP3

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Notes

Acoustic screen extent marked in red
200mm above top of plant

Description

Indicative acoustic screening to Network 3 plant

Project

Barnsley Hospital Decarbonisation

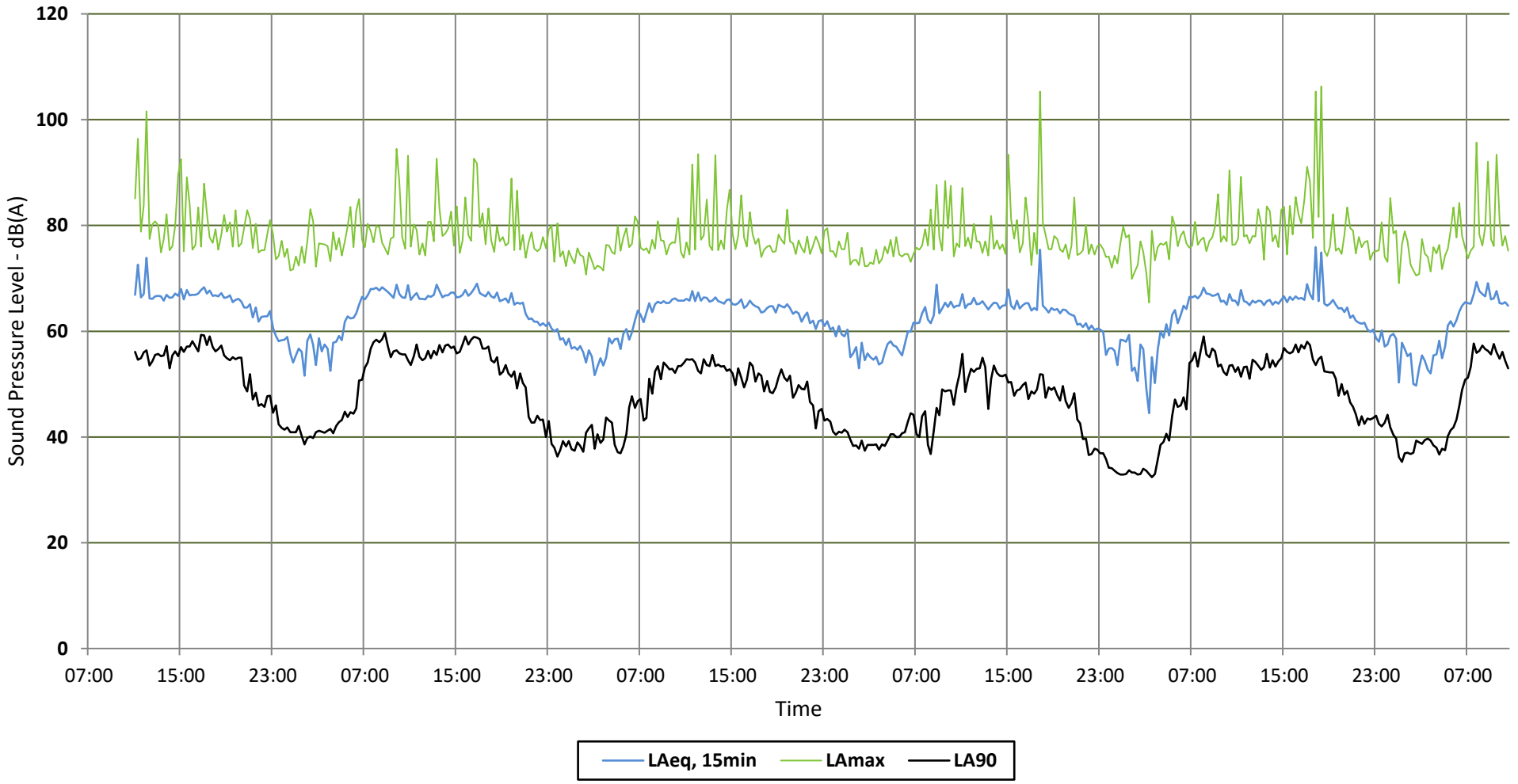
Date

26 August 2022

Drawing No.

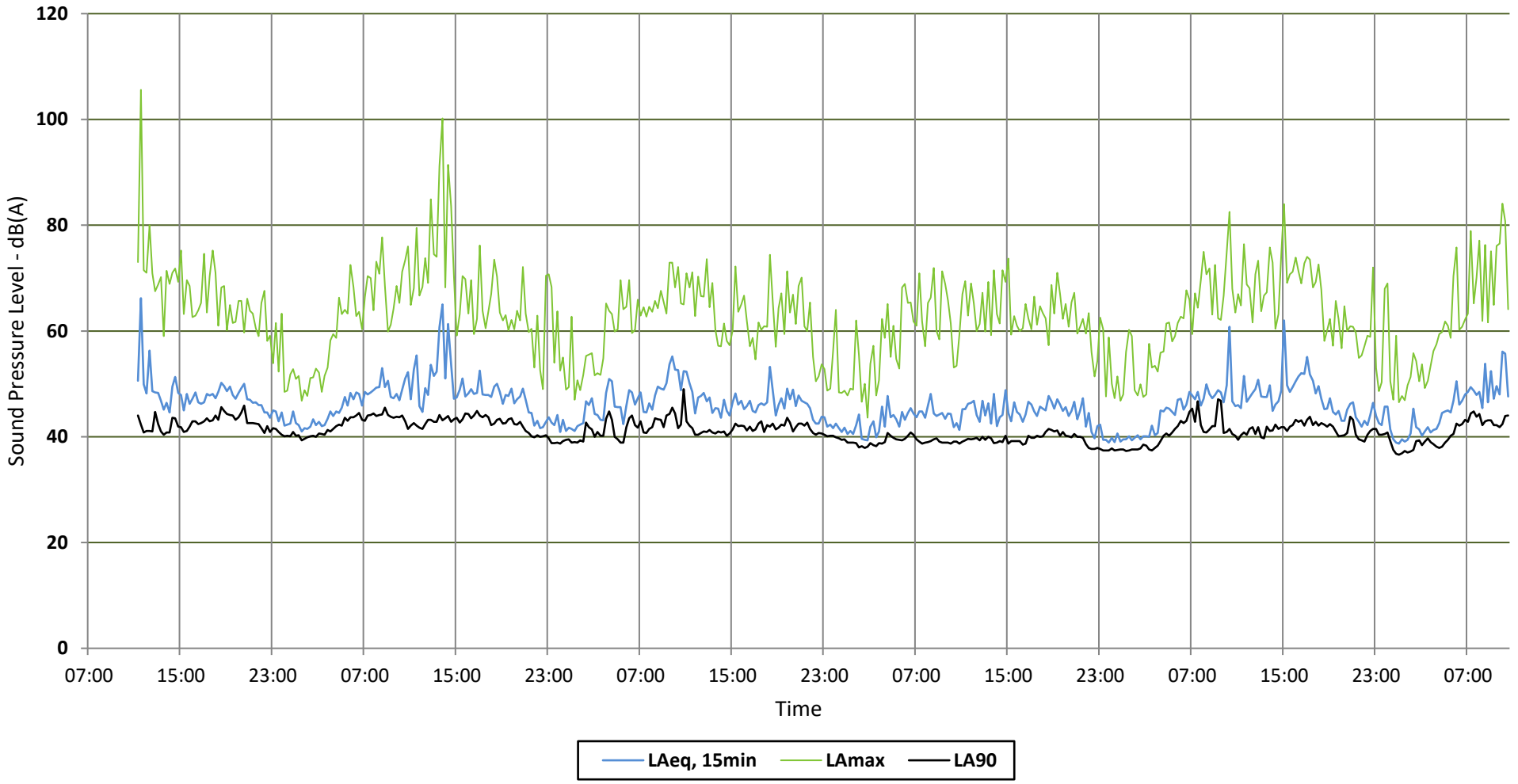
3375/SP4

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Notes	Description	
	Time History Graph - Measurement Position 1	
	Project	
	Barnsley Hospital Decarbonisation	
	Survey Date	**Drawing No.**
	7 to 12 July 2022	3375/TH1

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Notes	**Description** Time History Graph - Measurement Position 2	
	Project Barnsley Hospital Decarbonisation	
	Survey Date 7 to 12 July 2022	**Drawing No.** 3375/TH2

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APPENDIX A

Instrumentation

Manufacturer	Type and / or Model	Serial Number	Last Laboratory Calibration	Calibrator Output (dB)	Free Field Correction (dB)	Initial Reading (dB)	Final Reading (dB)
Svantek	Svan 958 4 Channel Sound and Vibration Analyser	23430	February 2021				
Microtech Gefell	MK 255 Microphone (Mic 4)	12328			0.0	113.99	114.0
Svantek	SV12L Preamplifier	47684					
01dB	(Black) Solo Class 1 Sound Level Meter	65201	November 2021		-0.10	113.9	113.9
01dB	PRE 21 S Pre-Amplifier	15619					
01dB	MCE 212 ½ inch Microphone	101204					
Norsonic	Nor1251 Calibrator (Cal 4)	33453	February 2022	113.99			

APPENDIX B

Acoustic Terminology

The annoyance produced by noise is dependent upon many complex interrelated factors such as 'loudness', its frequency (or pitch) and any variations in its level. In order to have some objective measure of the annoyance, scales have been derived to allow for these subjective factors.

A-weighting The human ear is more susceptible to mid-frequency noise than the high and low frequencies. To take account of this when measuring noise, the A-weighting scale is used so that the measured noise corresponds roughly to the overall level of noise that is discerned by the average person. It is also possible to calculate the A-weighted noise level by applying certain corrections to an un-weighted spectrum.

When the noise being measured has variable amplitude, such as traffic noise, it is necessary to qualify the basic dB unit. This may be done using a statistical index L_n dB, where n is any value between 0 and 100, and is the percentage of the sample time for which the stated level is exceeded. In defining the use of the index, both the value of n and the length of the sample period must be stated.

L_{10} L_{10}, being the level exceeded for 10% of the time, has been shown to be a good indicator for traffic noise intrusion, and is used in assessing the effect of traffic noise on residential or commercial premises.

L_{90} L_{90} is the level exceeded for 90% of the time, and is used as a measure of background noise level, as it excludes the effects of occasional transient levels, such as individual passing cars or aircraft.

In addition to the statistical noise indices defined above, the following noise units are also used to define variable amplitude noise sources:

$L_{eq,T}$ $L_{eq,T}$ is defined as the notional steady sound pressure level which, over a stated period of time, would contain the same amount of acoustical energy as the actual fluctuating sound measured over the same period. In other words, it is a measure of the "average" noise level

L_{max} L_{max} is the maximum time-weighted sound pressure level recorded over the stated time period

BARNSLEY HOSPITAL DECARBONISATION

PLANT NOISE SCHEDULE ADT 3375/PNS

PRELIMINARY ISSUE

26 August 2022

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Ref.	Plant Description	Location	Data L_w / L_p	Octave Band Centre Frequency - Hz							
				63	125	250	500	1k	2k	4k	8k
Network 1 ASHP	Swegon Zeta Sky HP SLN 10.2 / EC	Rear of Block 14, ground level	L_w	77Rob	68	73	74	73	77	69	61
Network 2 ASHP	Swegon Zeta Sky HP SLN 17.2 / EC	Roof of Block 12	L_w	78	69	73	75	79	78	73	66
Network 3 ASHP	Swegon Zeta Sky HP SLN 18.4 / EC	Roof of Block D	L_w	82	73	72	76	78	78	74	69
Network 4 ASHP	Swegon Zeta Sky HP SLN 10.2 / EC	Rear of Block A, ground level	L_w	77	68	73	74	73	77	69	61
Block Z ASHP	Swegon Zeta Sky HP SLN 17.2 / EC	Roof of Block Z	L_w	78	69	73	75	79	78	73	66

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