



MACH
GROUP

THINKING DIFFERENTLY

WOKINGHAM ROAD FIRE STATION

Plant Noise Impact Assessment
Rev00

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1.0 INTRODUCTION

MACH has been appointed by Atkins Realis to undertake a noise impact assessment at the proposed site of Wokingham Road Fire Station in Reading.

The development is an existing fire station which includes the installation of a new air source heat pump. This impact assessment undertaken is required to assist with the following:

- Determine appropriate background noise levels representative of nearby noise sensitive receivers appropriate for a BS4142:2014 plant noise impact assessment.
- Assess the noise impact of the proposed mechanical plant equipment at the nearby noise sensitive receivers.

Details of the noise survey which facilitated this assessment is presented within APPENDIX A -

2.0 SITE DESCRIPTION

The existing Fire Station is located on Wokingham Road, Reading. The surrounding buildings include residential dwellings to the East, South and West.

The site in relation to its surroundings and nearby noise sensitive receivers is presented in Figure 2.1.



Figure 2.1: Worst-affected noise sensitive receivers

2.1 Noise Sensitive Receivers

Locations that are noise sensitive receivers (NSR), which will be assessed within this exercise are listed below.

NSR Reference	Location	Type	Distance from Plant Installation (m)
NSR.1	8 Holmes Road	Residential window	25
NSR.2	3-9 Holmes Road	Residential window	23
NSR.3	Wokingham Road	Residential window	35

Table 2.1: Worst-affected noise sensitive receivers

3.0 ASSESSMENT CRITERIA

3.1 Local Planning Policies

It is understood that the requirements of the Reading Council regarding noise emissions generated by new building services plant are as follows.

“EN17: NOISE GENERATING EQUIPMENT

Where noise generating equipment is proposed, the noise source specific⁶¹ level (plant noise level) should be at least 10dBA below the existing background level as measured at the nearest noise sensitive receptor”

As per above, a plant noise assessment will be undertaken in-accordance with BS 4142:2014 and that the plant noise rating level limit at the worst-affected noise sensitive receptor will be assessed against the existing background noise levels, $L_{A90, T}$.

In line with BS 4142: 2014, should the proposed plant be identified as having intermittent or tonal characteristics, a further penalty will be subtracted from any of the above proposed noise emission limits.

3.2 Summary of Criteria

In summary of the criteria requirements above, if the targeted specific level from noise is 10dB below the existing background noise, then the Local Authority planning criteria will be achieved.

4.0 EXISTING BACKGROUND NOISE LEVELS

To establish the existing background noise levels on site, a noise survey was conducted between 12:40 on the 19/06/2024 and 10:15 on the 20/06/2024 by Chase Bartlett and in accordance with BS 7445-1: 2003.

More information on the methodology of this survey, site information and survey data, is presented in APPENDIX A -

When considering the existing background levels of a site, BS 4142:2014, "Methods for Rating and Assessing Industrial and Commercial Sound" states that the background sound level used for the assessment should be representative of the period being assessed.

BS4142:2014 goes on to state:

"To obtain a representative background sound level a series of either sequential or disaggregated measurements ought to be carried out for the period(s) of interest, possibly on more than one occasion. A representative level ought to account for the range of background sound levels and ought not automatically to be assumed to be either the minimum or modal value."

The table below presents measured noise levels of the $L_{A90,T}$ values measured on site. For the purpose of this assessment, the modal $L_{A90,5\text{minute}}$ was considered representative of the existing background noise level on site.

Measurement Position	$L_{A90,T}$ Method	Background Noise Level $L_{A90,T}$	
		Daytime (07:00 – 23:00)	Night-time (23:00 – 07:00)
F1	Mode	50	42

Table 4.1: $L_{A90,T}$ background noise levels for plant noise break-out assessment

5.0 PLANT NOISE IMPACT ASSESSMENT

Our assessment has been based on the following information.

5.1 Noise Sensitive Receivers

The noise impact generated by the new plant installation has been assessed at the worst-affected NSR's which are described in Section 2.1 of this report.

5.2 Items of Noise Generating Plant

Information on the proposed plant installations have been provided by Atkins Realis. The items of plant within each group, along with their locations and operational hours are as follows:

Reference	Type of Source	Quantity	Manufacturer/ model	Location	Operational Hours
ASHP 1	Air Source Heat Pump/ Breakout noise	1	Mitsubishi/ PURY- EP500YSNW-A2	Shown in image below	24-hours

Table 5.1: Proposed items of noise generating plant

The following site plan shows the proposed plant installation.

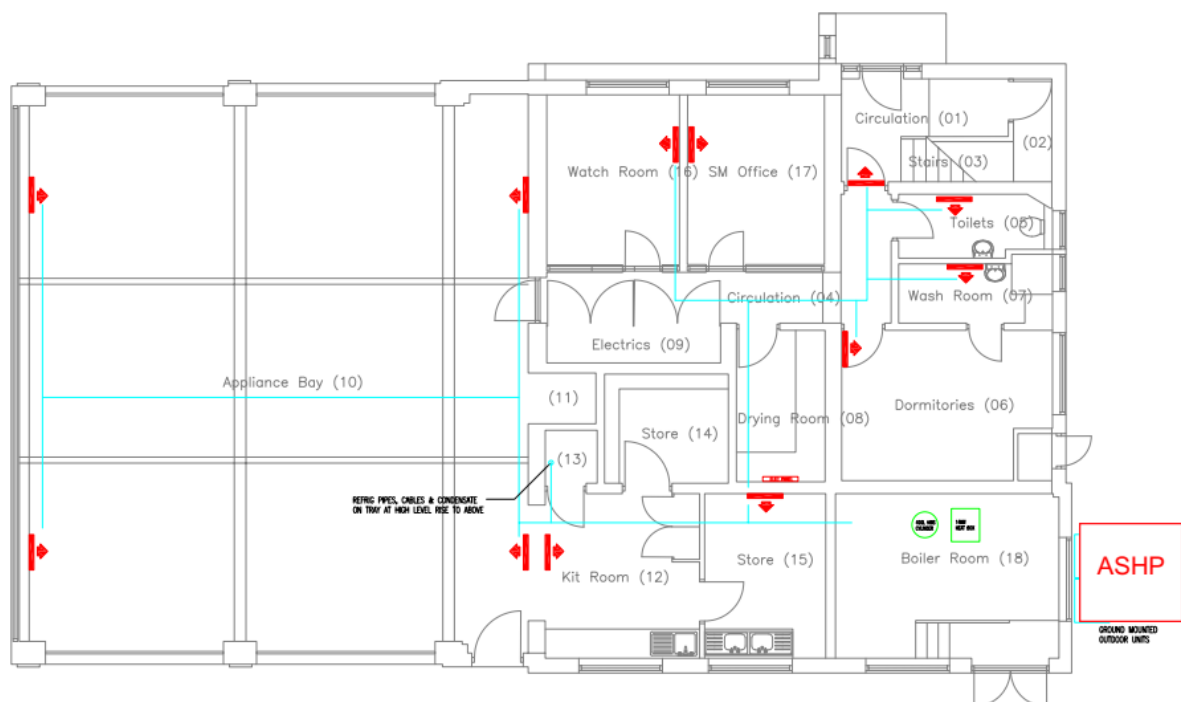


Figure 5.1: Site plan showing proposed plant layout

5.3 Plant Noise Data

The following noise levels for the individual items of plant are presented below. All data is based on manufacturers data. All plant noise data sheets are included within APPENDIX B -

Unit Reference	Noise Data Type	Duty Rate	Sound Levels, dB, at Octave Band Centre Frequencies, Hz						
			63	125	250	500	1000	2000	4000
ASHP 1	Breakout L _p @ 1m	Heating mode	80	66	65	62	56	52	53

Table 5.2: Plant equipment data

5.4 3D Acoustic Model

A 3D acoustic model of the development has been constructed in CadnaA such to accurately predict noise break out from individual items of plant from the development at nearby noise sensitive receivers. CadnaA is an industry standard noise modelling software which calculates how sound travels over distance. The model considers reflections off hard surfaces, ground absorption, acoustic screening, and geometrical spreading. The calculations are performed in accordance with ISO 9613: Attenuation of sound during propagation outdoors.

The following assumptions have been made in the model, based on observation of the site and proposed development has identified the following features. These features will be included within the calculation model including any other additional parameters stated.

- Ground absorption has been set to acoustically hard.
- Topography of the site is assumed to be flat.
- Order of reflections has been set to 3.

A screenshot of the 3D noise model is illustrated below.



Figure 5.2: 3D Acoustic model with noise sources

5.5 Noise Impact Assessment (Proposed Installation)

The resultant noise map which calculated the combined specific noise level at each receiver is presented below. Additionally, the table below provides the calculated rating levels at the worst-affected noise sensitive receptors. The image below represents the relevant operational time of the plant equipment as described in Table 5.3.



Figure 5.3: Noise map

NSR Reference	Time Period	Background Noise Level (dB L _{A90,T})	Criteria (dB)	Specific Noise Level (dB L _{Aeq,T})	Feature Correction	Rating Level (dB L _{A,r,Tr})	Assessment Outcome
NSR1	07:00–23:00	50	10dB Below Background	31	N/A	31	-19
	23:00–07:00	42		31		31	-11
NSR2	07:00–23:00	50		31		31	-19
	23:00–07:00	42		31		31	-11
NSR3	07:00–23:00	50		30		30	-20
	23:00–07:00	42		30		30	-12

Table 5.3: BS4142 assessment outcome

5.5.1 Acoustic Feature Correction

The following acoustic feature corrections have been considered in regards to the rating level, L_{A,r,Tr} at the affected NSR's.

5.5.1.1 Intermittency

The proposed ASHP unit is seen to be intermittently operating; however, as the predicted specific noise level of these units are 10dB or greater, below the measured background noise level, the intermittency is seen to be inaudible. Therefore, the acoustic feature correction for intermittency has not been applied.

5.5.1.2 Tonality

The tonality of the proposed M&E items could not be assessed as third octave noise data is required for the assessment and only octave band noise data was available at the time of writing. However, the proposed M&E items are typically broadband in character. Based on previous projects, in our experience extract fans, air source heat pumps and condenser units are broadband in nature.

APPENDIX D - presents measurements we have conducted of a typical condenser unit, the noise levels show no tones are present. Further guidelines can be found in Annex C of BS 4142: 2014 which presents the objective method of assessing tones.

5.6 Vibration Control

Although not necessarily related to planning matters, It is also important to consider the potential transfer of structure borne noise to the development itself, in the form of vibration.

It is typically recommended that condenser units and fans or anything generating vibration are isolated from the supporting structure by either steel spring isolators or rubber footings. Where there are particularly sensitive locations nearby, or when equipment is mounted on lightweight structures, consideration to use caged restrained type anti-vibration mounts should be made.

In addition, it is critical that the isolation is not "short-circuited" by associated ductwork or pipework. As such, flexible connectors should be introduced between the plant and any associated pipework or ductwork. Associated pipework and ductwork should be resiliently mounted, as appropriate.

5.7 Uncertainty

Consideration of the potential uncertainties involved in the sound level measurements and the assessment methodology have been made to ensure a high level of confidence in the outcome of the assessment. Annex B of BS4142:2014 presents a range of factors and good practice methods which should be made, and these have been considered in this assessment.

6.0 CONCLUSION

In summary the following points set out the conclusions of this report;

- A noise survey has been conducted at the proposed site in order to establish representative background noise levels (L_{A90}) at the nearby noise sensitive receivers. These background noise levels are presented in Section 0 of this report and the details of the noise survey itself are included in Appendix A.
- The assessment criteria to be used for the purpose of planning submission has been established and is provided Section 3.2.
- Details of the plant equipment have been provided to us, including location, hours of operation and noise data has been presented in Section 5.0 of this report.
- Calculations have shown that the criteria for the purpose of planning submission have been achieved where this report demonstrates compliance.

APPENDIX A - ENVIRONMENTAL NOISE SURVEY

To establish the existing environmental noise levels on site, a noise survey was conducted between 12:40 on the 19/06/2024 and 10:15 on the 20/06/2024.

This site assessment was undertaken by Jos Melliush of MACH Group.

A.1 Site Description

The site is located at Wokingham Road and is situated in an urban area of East Reading.

A.1.1 Subjective Noise Climate (On-site)

Noise Type	Noise Characteristics	Sources
Dominant	A primary contributor of noise levels on the site.	Road traffic from Wokingham Road and Holmes Road.
Other Noise Contributions	Contributors to the remainder of the noise climate on site.	Existing operational noise from the fire station.

Table A.1.1 Subjective Summary of the Noise Sources

A.1.2 Non-Representative Noise Sources

During the survey from 19:30 to 20:10, levels increased, likely due to a fire engine being deployed. This has been taken into account and highlighted on the graph as it is unrepresentative.

A.2 All Measurement Locations

To help with the understanding of the site and measurement locations all the measurement positions are presented on the map below. Photos of the locations in situ are in the following sections.



Figure A.2.1 All Measurement Locations on a Map

A.3 Fixed Measurement

A fixed microphone position was used to record noise levels between 12:40 on the 19/06/2024 and 10:15 on the 20/06/2024, where the fixed long-term meter was set to measure consecutive 'A' weighted 5-minute time samples. Measurements have been taken in have been taken within 2 meters from a solid façade and will be corrected before used in the calculation.

To help with the understanding of the site and the measurement locations, the figures below present the location of the microphone position(s) in situ.

A.3.1 Fixed Measurement Location – F1



Figure A.3.2 Fixed measurement F1 location in situ

A.3.2 Fixed Measurement Results – F1

The following graph presents the noise levels recorded over the measurement period at the fixed location (F1). During times 19:30 to 20:10 levels peaked.

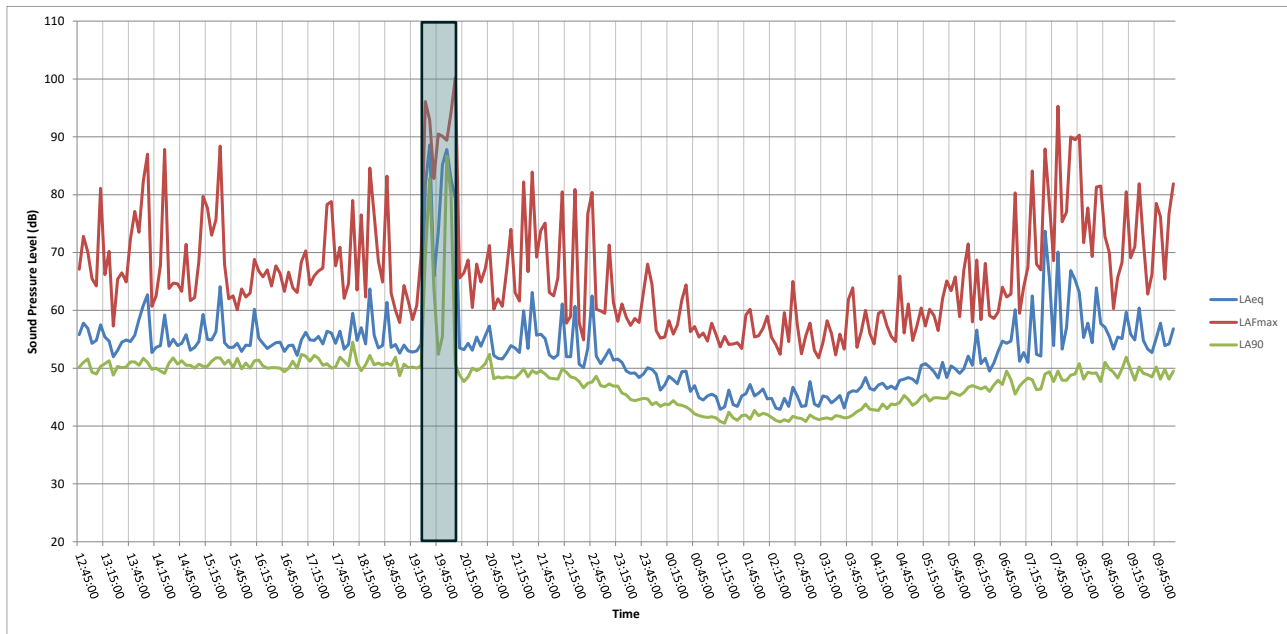


Figure A.3.3 Sound Pressure Level at fixed location, F1

A.4 Measurement Equipment

Item	Serial No.	Last Calibration	Certificate No.	Calibration Due
NTI Precision Sound Analyser XL2 TA	A2A-15207-E0	02/02/2023	186910	02/02/2025
NTI Pre-amplifier MA220	7856	02/02/2023	186910	02/02/2025
Cirrus Microphone Capsule MK:224	215285E	02/02/2023	186889	02/02/2025
Svantek Acoustic Calibrator SV31	32527	13/12/2023	204756	13/12/2024

Table A.4.2 Measurement Equipment

A.5 Meteorological Conditions

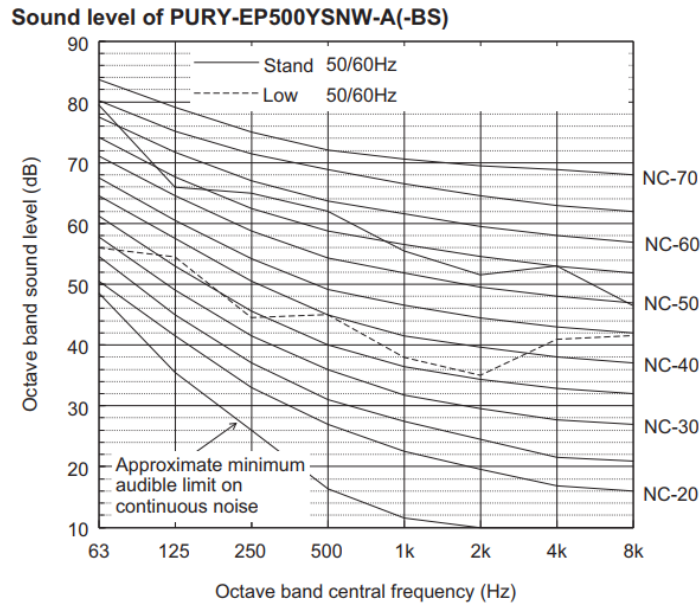
Data Taken from: <https://www.timeanddate.com/weather/>

Date	Time (hh:mm)	Temperature (High / Low) (°C)	Humidity (%)	Pressure (hPa)	Wind Speed (m/s)	Wind Direction	Conditions
19/06/2024	12:00	20/18	50	1021	4.7	NE	Passing clouds
	18:00	20/12	63	1022	4.2	E	Clear
20/06/2024	00:00	12/6	87	1022	1.4	N	Clear
	06:00	20/9	63	1021	2.8	ENE	Clear
	12:00	23/20	35	1019	2.8	N	Clear

Table A.5.3 Meteorological Conditions

APPENDIX B - PLANT NOISE DATA

PURY500



		63	125	250	500	1k	2k	4k	8k	dB(A)
Standard Cooling	50/60Hz	79.5	66.0	65.0	62.0	55.5	51.5	53.0	46.5	63.5
Low noise mode	50/60Hz	56.0	54.5	44.5	45.0	38.0	35.0	41.0	41.5	48.0

APPENDIX C - BS 4142:2014

BS 4142:2014 “Methods for rating and assessing industrial and commercial sound” describes a method of determining the level of noise of an industrial nature, together with the procedures for assessing whether the noise in question is likely to give rise to complaints from persons living in the vicinity. As such, an assessment to BS 4142 is typically called for within planning conditions. The likelihood of complaints in response to a noise depends on various factors. BS 4142 assesses the likelihood of complaints by considering the margin by which the noise in question exceeds the background noise level.

BS 4142 states that one should ‘obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level from the rating level and consider the following:

- a) Typically, the greater this difference, the greater the magnitude of the impact.
- b) A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.
- c) A difference of around + 5 dB is likely to be an indication of an adverse impact, depending on the context.
- d) The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context.

The aforementioned rating level is based upon the specific noise level of the noise source in question. A correction should be applied to the specific noise level to obtain an increased rating level if ‘a tone, impulse or other characteristic occurs, or is expected to be present, for new or modified sound sources. To summarise, BS4142 Section 9.2 advises the following with regards to corrections for acoustic characteristics:

- **Tonality** – for sound ranging from not tonal to prominently tonal the Joint Nordic Method gives a correction of between 0 dB and +6 dB for tonality. Subjectively, this can be converted to a penalty of 2 dB for a tone which is just perceptible at the noise receptor, 4 dB where it is clearly perceptible, and 6 dB where it is highly perceptible.
- **Impulsivity** – A correction of up to +9 dB can be applied for sound that is highly impulsive, considering both the rapidity of the change in sound level and the overall change in sound level., Subjectively, this can be converted to a penalty of 3 dB for impulsivity which is just perceptible at the noise receptor, 6 dB where it is clearly perceptible, and 9 dB where it is highly perceptible.
- **Other sound characteristics** – Where the specific sound features characteristics that are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied
- **Intermittency** – When the specific sound has identifiable on/off conditions, if the intermittency is readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

APPENDIX D - THIRD OCTAVE BAND NOISE LEVELS

Measured noise levels, dB at Third Octave-band Frequency, Hz											
63	80	100	125	160	200	250	315	400	500	630	800
20	20	36	31	26	31	32	32	33	37	37	40
1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	
41	40	40	37	34	31	28	23	21	19	18	

Table 6.4 Third octave band measured noise levels. SPL @1m. Typical condenser unit