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Gareth Haslam
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BY Email

Dear Gareth

TECHNICAL NOTE ON AIR SOURCE HEAT PUMP NOISE HARRY DALTON FIELDS, CHORLTON

1. BACKGROUND & OBJECTIVES

E3P have been commissioned to provide a technical note on noise associated with the proposed Air Source Heat Pumps and the noise-based conditions in relation to the planning permission for the residential development at Harry Dalton Fields in Chorlton. Specifically, the following planning conditions are required to be discharged in relation to the proposed Air Source Heat Pumps (ASHPs) and noise resultant from them:

> *25a) Any externally mounted ancillary plant, equipment and servicing to be installed shall be selected and/or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location. Prior to its installation, the scheme shall be submitted to and approved in writing by the City Council as Local Planning Authority in order to secure a reduction in the level of noise emanating from the site.*

This technical document looks to review the information in relation to the proposed ASHPs and looks to determine whether the proposed ASHPs are compliant with part a of the condition and then provides commentary and context in relation to expected noise levels.

It has been undertaken by Lee Faulkner, Associate Director at E3P, who holds the Post Graduate Diploma in Acoustics and Noise Control and is a full member of the Institute of Acoustics (MIOA) and the Institute of Environmental Science (MIEnvSci). I have over 12 years' experience in the measurement and assessment of noise and vibration for various clients, sites, and applications.

2. CONDITION 25 PART A – ASHP NOISE

E3P note that the condition requires the rating level from the ASHPs should be at least 5 dB below the typical background sound level, day and night. This is in relation to a BS 4142:2014+A1:2019 'Methods for rating and assessing industrial and commercial sound' assessment.

In order to assess the extent of any measures which may be necessary in order to comply with suitable conditions relating to the potential noise sources, E3P have reviewed various guidance documents and standards that are considered applicable to this type of noise, these include:

- British Standard 4142:2014+A1:2019.
- British Standard 8233:2014+A1:2019.
- Micro-generation Certification Scheme (MCS 020).
- Manchester City Council Planning & Noise Technical Guidance December 2015.

2.1. BS 4142:2014+A1:2019

The assessment that is usually applied for potential noise from fixed installations (i.e., externally mounted plant) to give rise to community response is contained in BS 4142. This standard assesses the likely effects of such sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident.

BS 4142 describes a method for determining the specific sound level and background sound levels outside residential buildings and for assessing whether the noise is likely to give rise to adverse impact. The specific noise level from the commercial source is rated based on any tonal or intermittent characteristics of the sound.

BS 4142 assessment methodology involves comparing the existing background sound level with the predicted rating level from the new development. The difference between the two levels can be used to indicate the likelihood of adverse impact.

2.2. BS 8233:2014+A1:2019

BS 8233 provides a code of practice for the sound insulation of a variety of building types affected by general environmental noise.

It provides recommendations for control of noise in and around buildings and suggests appropriate criteria / limits for a variety of different situations including within residential properties.

2.3. MICRO-GENERATION CERTIFICATION SCHEME (MCS 020)

UK government has put forward noise limits for maximum noise limit for wind turbines and air source heat pump installed under permitted development as part of the Micro-generation Certification Scheme. The noise limit is 42 dB $L_{Aeq,\ 5\ min}$, at 1 metre from a window or door opening of a habitable room on the façade of a neighbouring residential property.

The 42 dB noise limit would equate to an internal noise level ≤30 dB within rooms i.e., in line with target night-time limits for bedrooms described in BS 8233 and WHO Guidelines.

2.4. MANCHESTER CITY COUNCIL PLANNING & NOISE TECHNICAL GUIDANCE

Manchester City Council Planning & Noise Guidance 2015 details noise limit criteria for industrial and commercial developments along with specific noise limits for externally mounted plant associated with industrial / commercial premises. The following paragraphs are taken from the document:

> *BS 4142 should be used to assess the likely impact of noise from industrial and commercial sources at noise sensitive premises.*
>
> *Many of the noise complaints Environmental Health receive about noise from plant, equipment and machinery specifically concern the character of the noise emitted. Any noise assessment needs to consider not only the overall level of noise emitted but also its particular characteristics. The noise assessment should be based on BS 4142: 2014 and any application for fixed plant, equipment or machinery must demonstrate that:*
>
> *'Externally mounted ancillary plant, equipment and servicing shall be selected and / or acoustically treated in accordance with a scheme designed so as to achieve a rating level of 5dB (L_{Aeq}) below the typical background (L_{A90}) level at the nearest noise sensitive location'.*

E3P would note that the above advice and criteria appears to relate to industrial/commercial premises and the plant or equipment associated with the operation of such. This is considered far removed from the situation here with the resultant sound from an industrial/commercial premises different in nature to a heating system associated with a domestic property.

Hence, whilst the Manchester City Council guidance is considered in this report it is not deemed wholly applicable to the current proposals. However, due to the planning condition, this will be the main consideration in any assessment of noise impact, but context and consideration of the above discussions is warranted.

3. NOISE ASSESSMENT

3.1. BS 4142 ASSESSMENT

The following Daikin ASHP models are proposed based on house types:

- AF2-1 (2B4P), AF3-1 (3B4P), AF3-4 (3B5P) AND Birkdale – Daikin EDLA04EV3 – Sound Power of 58 dB L_w.
- Euxton, Evesham and Huxley – Daikin EDLA06EV3 – Sound Power of 60 dB L_w.
- Cheltenham and Cartmel – Daikin EDLA08EV3 – Sound Power of 62 dB L_w.

The above sound power levels relate to normal typical operations.

For the purposes of this assessment, E3P has used noise modelling software, CadnaA 2023 MR1, to determine the impact of noise from the ASHPs.

The following inputs have been included in the model:

- Air Source Heat Pump Layout (ASHPL01) dated April 2022.
- Each ASHP is input as a point source with the unit drawn in to resemble the directional output of the ASHP from the fan only.
- Site elevations have been taken as existing by way of a 2 m grid Digital Terrain Model (DTM) which contains public sector information licensed under the Open Government License v3.0.
- Existing buildings are included.
- A reflection order of 1 has been used in all calculations.
- Noise levels generated using ISO 9613-1 and ISO 9613-2 "*Acoustics – Attenuation of sound during propagation outdoors*" as incorporated into CadnaA software.

Figure 1 shows noise levels at 1.5 m height across the Site to show garden noise levels. Numbers noted in the circle on the buildings are façade noise levels, left being daytime and right being night-time.

The background sound levels to be applied here are 45 dB during the day and 41 dB at night as measured at NMP4 (noted in the submitted Noise Impact Assessment for the development (50-585-R1-4). These are derived from the long-term measurement position and are considered the lowest typical background sound levels. The daytime background is taken as the modal value between 07:00-23:00 over the full weekday and weekend period. The night-time is the median measured value between the hours of 23:00-00:00 and 05:00-07:00 when the heating systems at the majority of plots are likely to be in use.

This results in a criteria of 40 dB during the day in rear gardens and 36 dB at 1st floor bedrooms windows.

Table 3.1 below details the expected noise levels in gardens during the day and at 1st floor windows at night. For garden noise levels, the noise level in the centre of the garden is used for an average assessment. Furthermore, it is considered reasonable to assume that were residents outside to experience the noise, its unlikely heating would be required inside and that residents would sit or socialise within close proximity of the unit.

The grid noise map is appended to the rear and shows 1st floor façade levels and coloured grid at 1.5 m height.

Bold values are in exceedance of the -5 dB criterion.

TABLE 3.1 BS4142 ASSESSMENT

PLOT	PREDICTED RATING LEVEL IN GARDEN (DAYTIME), $L_{A,r}$ (dB)	DAYTIME CRITERION (dB)	PREDICTED RATING LEVEL AT FAÇADE (NIGHT-TIME), $L_{A,r}$ (dB)	NIGHT-TIME CRITERION (dB)
1 and 2	39	40	36	36
3 and 4	35	40	34	36
5	35	40	33	36
6	36	40	35	36
7 and 8	38	40	35	36
9	38	40	35	36
10	35	40	35	36
11 and 12	35	40	34	36
13 and 14	34	40	35	36
15 and 16	35	40	34	36
17 and 18	34	40	35	36
19 and 20	36	40	36	36
21 and 22	35	40	34	36
23 and 24	35	40	**38**	36
25 and 26	37	40	34	36
27 and 28	36	40	**37**	36
29	36	40	33	36
30	35	40	35	36
31	38	40	36	36
32 and 33	40	40	35	36
34	39	40	**37**	36
35 to 37	37	40	**37**	36
38 and 39	37	40	35	36
40	35	40	33	36
41	35	40	36	36
42	39	40	32	36
43 and 44	38	40	34	36
45 and 46	36	40	**37**	36
47and 48	35	40	**38**	36
49 and 50	38	40	**37**	36
51 and 52	36	40	35	36

PLOT	PREDICTED RATING LEVEL IN GARDEN (DAYTIME), $L_{A,r}$ (dB)	DAYTIME CRITERION (dB)	PREDICTED RATING LEVEL AT FAÇADE (NIGHT-TIME), $L_{A,r}$ (dB)	NIGHT-TIME CRITERION (dB)
53	36	40	33	36
54	36	40	33	36
55 and 56	36	40	33	36
57	34	40	34	36
58	39	40	35	36
59 and 60	39	40	**37**	36
61	38	40	35	36
62	35	40	36	36
63 and 64	39	40	**37**	36
65	37	40	34	36

In accordance with the guidance in BS4142, the assessment in Table 3.1 above indicates that all plots would not experience an exceedance of the MCC criterion during the day, i.e., the ASHP noise levels are equal to, or more than, 5 dB below the existing background noise levels.

During the night, most plots achieve the MCC criterion except for plots 23, 24, 27, 28,34, 35 to 37, 45 to 50, 59, 60, 63 and 64 that would experience a rating level of between 1 and 4 dB below the background sound level. NO plots are subject to an exceedance of the background sound level.

It is worth noting, that all criteria are achieved at existing plots that surround the site.

3.2. INTERNAL NOISE LEVELS

The predicted noise levels from the ASHPs have been assessed against the guidance provided in BS8233:2014+A1:2019 which provide acceptable internal noise levels. The highest predicted façade noise level from ASHPs is noted to be 38 dB at night. When considering an open window provides attenuation of approximately 13 dB, internal noise levels in bedrooms should not exceed 25 dB, 5 dB below the 30 dB criterion for sleeping conditions.

The above assessment demonstrates that noise from the ASHP would be suitably controlled to achieve appropriate internal noise levels in the worst affected proposed properties. Based on the assessment findings in BS 4142 and BS 8233, the predicted ASHP noise levels can be considered acceptable and suitable to discharge Condition 25a, subject to approval from MCC.

In accordance with national planning policy, noise shouldn't be considered in isolation. It is understood that ASHPs are low carbon technology (compared to traditional heating systems) and are a part of the solution for the government meeting its carbon neutral goals.

3.3. MCS 020 ASSESSMENT

The MCS 020 assessment sets an absolute criterion of 42 dB for noise from ASHPs. As shown in Table 3.1, predicted noise levels fall below this noise level and, as such, the ASHP noise output would satisfy permitted development as described in MCS 020.

4. DISCUSSION AND OTHER APPLICATIONS

In order to discharge and comply with Condition 25a, MCC requires compliance with the -5 dB criterion for daytime and night-time periods. However, the assessment has shown, although mostly in compliance, plots that would exceed this criteria.

E3P, as discussed, consider the criteria to be more applicable to commercial/industrial installations rather than individual heating systems at residential properties. As such, the assessment aimed to consider this within the context of the assessment and found that although marginal exceedances are noted, the overall noise levels would be acceptable.

Indeed, there is precedent for this as noted in approved applications, as follows:

4.1. CDN/22/0790 - DISCHARGE OF CONDITIONS 5 (SECURED BY DESIGN), 9 (LANDSCAPING), 16 (AIR SOURCE HEAT PUMP - ACOUSTIC INSULATION) AND 17 (AIR SOURCE HEAT PUMP - VERIFICATION) FROM PLANNING APPROVAL REFERENCE 128754/FO/2020 – 25 & 25A CHANDOS ROAD SOUTH, MANCHESTER M21 0TH.

This condition discharge assessment was accompanied by a Noise Impact Assessment, produced by AEC and dated 1st November 2022. The condition in relation to ASHP noise (16 and 17) were discharged by MCC.

Within this approved noise report, they state within 3.7:

> *Baseline noise levels between 0500-0700h would typically be the same or slightly nosier than those presented above. Although background noise levels may drop slightly further in the middle of the night, between say 0030h and 0500h, the ASHPs would typically not be operating during these periods when most people are asleep. Furthermore, the middle of the night, when people are asleep, is considered to be not as sensitive as around 2200- 0000h, when people are more likely to be awake and trying to get to sleep.*

This supports E3Ps use of the above hours in relation to night-time periods. Furthermore, the consultant notes MCCs criteria of -5 dB but conclude the following:

> *As stated in the introduction above, MCC has placed a condition on the ASHP noise to achieve a rating level of -5dB below the background noise levels at the nearest noise sensitive premises. This is based on an assessment in general accordance with BS4142, discussed above, and should be subject to contextual factors and consideration of absolute noise levels where appropriate.*

The assessment found an exceedance of the MCC criteria at an existing property but concluded that:

> *The predicted internal noise level of 20dB$L_{Aeq,T}$ is significantly below the recommended noise level of 30dB$L_{Aeq,8hrs}$ for bedrooms during the night-time period.*
>
> *The above assessment demonstrates that noise from the ASHP would be suitably controlled to achieve appropriate internal noise levels in the worst affected neighbouring property. Based on the assessment findings in Table 5.2 and 5.4, the measured ASHP noise levels could be considered acceptable and suitable to discharge Conditions 16 & 17, subject to approval from MCC*

4.2. 129071/FO/2021 – INSTALLATION OF AIR SOURCE HEAT PUMPS (ASHP) TO EACH DWELLINGHOUSE – 9 AND 11 CARNABY STREET, MANCHESTER M9 4DF

A noise assessment was submitted as part of the application and produced by Azymuth Acoustics UK and dated 28th October 2020. The application was approved in March 2021.

This assessment followed the following criteria:

> *1. Microgeneration Certification Scheme plant noise limit of 42dB $L_{Aeq, 5min}$ externally at the nearest noise sensitive receptor (window to living or bedroom).*
> *2. It is understood that Manchester City Council typically requires plant noise to be limited to 5dBA below the typical Background Sound Level (BSL, L_{A90}) at the nearest receptor. However, it would be asserted that this limit would only apply to noise from industrial / commercial sources.*
> *3. Based on the domestic nature of the proposal it would be recommended that worst case cumulative ASHP noise levels should not exceed the typical night-time background sound level at the nearest noise sensitive receptor.*
> *4. An absolute cumulative receptor rating noise limit of 32dB would be recommended for the site (as suggested in BS 4142), which experiences unusually low background sound levels at night for an urban area. An absolute external receptor limit of 32dBA would equate to internal levels approx. 20dBA inside bedrooms i.e., comfortably compliant with the BS 8233 recommended noise limit of 30dBA in bedrooms at night.*

The BS 4142 assessment found that the rating level would fall below the background sound level by 3 dB, not achieving the MCC criterion. A similar outcome that is expected here with a difference of between -1 and -4 dB at some plots.

The report concluded:

> *Predicted noise levels at the nearest noise sensitive receptors would be up to 3 dB below level of the measured night-time background sound level during periods where all units are working under Night Mode 3 operation. However, it should be noted that background levels are low as relates an urban area. BS 4142 would suggest this level would be below that where an adverse impact would be indicated.*
>
> *A night-time absolute receptor rating level noise limit of 32dB $L_{Aeq, 5min}$ (ie 10dB below the MCS target level) would be recommended with the aim of compliance with all suggested assessment criteria in Section 3.6 above. As such, all installations in the proposed scheme would meet requirements assuming permanent adoption of 'night mode' operation and installation of sound reduction kits.*
>
> *It can be seen that the proposed installation would comply with MCS 020 and WHO / BS 8233 night-time noise limit criteria assuming a habitable room receptor with window open. Compliance with MCS criteria would suggest that the units are eligible for installation under permitted development rights.*

Accordingly, there is precedent to exceed the MCC criterion as long as it can be shown that acceptable external and internal noise levels, in relation to BS 8233 and the criteria stipulated in MCS 020 is achieved. As such, no adverse impact is predicted at existing and proposed receptors and the MCC criteria is achieved at most plots. Where a plot is not compliant, internal noise levels, with windows open, are well below the 30 dB criterion stipulated for sleeping conditions.

I trust the report is clear and concise but please do not hesitate to contact me should you require further information.



Yours sincerely,
For and on behalf of E3P Ltd

Lee Faulkner
Associate Director

LEE FAULKNER

Curriculum Vitae

POSITION
Associate Director

QUALIFICATIONS
BSc (Hons), PGDip

PROFESSIONAL MEMBERSHIPS

Member of the Institute of Acoustics (MIOA)

AREAS OF EXPERTISE

Environmental Noise Surveys and Assessment

Noise and Vibration Assessments in accordance with British Standards

3D Noise Modelling

Noise and Vibration Environmental Impact Assessments

Construction Noise and Vibration

Sound Verification Testing

PROFILE

Mr Lee Faulkner is an Associate Director at E3P. His current role involves management of the Acoustic Division at E3P including Noise and Vibration Assessments and Reporting for multiple projects. Lee has over 12 years' experience in the industry and has worked on a multitude of differing projects and sites.

Lee has extensive experience of complex environmental noise assessments, providing detailed and tailored advice on a site-by-site basis that is not only in accordance with the relevant standards but also a cost-effective solution for the client.

Lee has extensive experience in the calculation of complex noise levels across various sites such as those constrained by transportation sources, commercial, industrial and entertainment noise. Noise Modelling of various projects, including residential developments and the Esso Refinery, using SoundPLAN and CadnaA.

SELECTED PROJECT EXPERIENCE

Residential Development, Kinross
Noise and Vibration Chapter for the wider EIA. Construction and Operational Noise and Vibration Impacts were assessed for existing and proposed receptors. Key noise sources consisted of existing road traffic and commercial premises and proposed skate park and sports fields. The proximity of the M8 was particularly constraining. The Chapter addressed construction noise and vibration impacts upon existing receptors and existing noise upon the proposed receptors. Mitigation measures included for acoustic barriers, higher spec glazing and alternative ventilation.

Residential Development, Longsight
Noise Impact Assessment in support of the planning application for a residential development on a parcel of land in a residential location near to a speedway track and sports centre. Included specification of acoustic glazing and also acoustic barrier height to protect future residents from road traffic noise and leisure noise.

Noise Modelling of Noise at Work Levels for Esso Refinery, Fawley
Esso, Fawley required noise measurements to be taken at a total of 11 blocks for the operations at their Fawley Refinery. This meant a high number of noise measurements were taken due to the scale of the area. The results of the noise survey were used to create contour noise graphics using 3D Noise Modelling in order to determine the noise levels across each block.

NOISE AND VIBRATION ES CHAPTER FOR LEISURE DEVELOPMENT

Noise and Vibration monitoring was required in order to provide baseline conditions across the Site. A Noise and Vibration ES Chapter was provided which addressed construction noise and vibration, construction generated traffic, rail noise and vibration and proposed impacts such as new leisure facilities and fixed plant items. The assessment overcame issues with rail noise for very closely situated receptor by way of an earth bund.

SOUND VERIFICATION TESTING, SHEFFIELD

Sound Testing in order to verify the effectiveness of the installed glazing and alternative ventilation applied to a residential scheme, following the recommendations of a Noise Impact Assessment. Noise Surveys were undertaken over an entire 48-hour period in a dwelling for each phase and showed compliance with the necessary criteria given in the British Standard

NEW SUPERMARKET, SHIPLEY

Noise Impact Assessment in support of a planning application for a new supermarket in Shipley including a Café Retail Unit. Assessed for noise associated with the delivery yard, fan units and the petrol filling station associated with the development. Lee advised on the acoustic fence locations and heights and to ensure no exceedance of the applicable criterion.

NOISE AT WORK ASSESSMENT, YORKSHIRE

Atlas Steel Structures required a Noise at Work Assessment for their daytime and night-time shifts to accompany their annual risk assessment. The Noise at Work Survey comprised the use of personal dose badges and spot measurements to quantify the noise levels across the factory floor. The Noise at Work Assessment advised that existing hearing protection was overprotecting, and so alternative protection was recommended.

Figure 1 - ASHP Grid Noise Map - Calculation at 1.5m above ground level



Project:
Land off Wilbraham Road, Chorlton

Project-No:
50-585

Client:
Anwyl Homes

Specific Noise Level, LAeq,1hr (dB)

... <= 40.5
40.5 < ...

Noise Map Objects

Point Source
Area Source
Road
Building
Building Evaluati
Calculation Area

e3p

Project Engineer: Lee Faulkner
Date: 23/08/2023