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Spectrum
ACOUSTIC CONSULTANTS

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Dear Paul

**BOURNE ESTATE, BUILDING 1, PORTPOOL LANE, CAMDEN-**
**PLANNING CONDITION 9 - PLANT NOISE**

Higgins Construction plc are constructing two new buildings to provide 75 residences, new community facilities, an energy centre, substation, and other facilities at Bourne Estate (South), Portpool Lane, EC1N.

Condition 9 of the planning permission for this development requires a noise impact assessment of the Combined Heat and Power plant to be installed within Block 1 together with any noise mitigation required be submitted to and approved by the local planning authority, Camden Council.

The purpose of this technical letter is to analyse the noise emission from the proposed plant and to determine whether suitable noise levels are achieved for nearby noise-sensitive premises in accordance with the requirements of the Council's Development Policy 28, Table E.

## 1. PLANNING CONDITION AND CRITERION FOR ACCEPTABILITY

Planning permission 2012/6372/P for the development was granted by Camden Council including the following condition:

9. *Prior to the commencement of Block 1, other than site clearance & preparation, relocation of services, utilities and public infrastructure and demolition, a noise impact assessment of the Combined Heat and Power plant to be installed within that block together with a report of any noise mitigation required shall be submitted to and approved by the local planning authority and thereafter no occupation of Block 1 shall be permitted until completed fully in accordance with the mitigation measures as recommended by such report as has been approved..*

Camden's DP 28 states, *inter alia*,

> *Noise and vibration can have a major effect on amenity and health and therefore quality of life.*
>
> *The Council will seek to ensure that noise and vibration is controlled and managed.*
>
> *The Council will only grant permission for plant or machinery if it can be operated without cause harm to amenity and does not exceed our noise thresholds.*
>
> *In assessing applications, we will have regard to the Noise and Vibration thresholds, set out below:*

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**Table E: Noise levels from plant and machinery at which planning permission will not be granted**

| Noise description and location of measurement | Period | Time | Noise level |
|---|---|---|---|
| Noise at 1 metre external to a sensitive façade | Day, evening and night | 0000-2400 | 5dB(A) <LA90 |
| Noise that has a distinguishable discrete continuous note (whine, hiss, screech, hum) at 1 metre external to a sensitive façade. | Day, evening and night | 0000-2400 | 10dB(A) <LA90 |
| Noise that has distinct impulses (bangs, clicks, clatters, thumps) at 1 metre external to a sensitive façade. | Day, evening and night | 0000-2400 | 10dB(A) <LA90 |
| Noise at 1 metre external to sensitive façade where LA90>60dB | Day, evening and night | 0000-2400 | 55dB$_{LAeq}$ |

**Figure 1:** Excerpt from DP28

## 2. SITE DESCRIPTION

Block 1 of the subject development will comprise a 6 storey building plus basement attached to the existing Nigel Buildings on Portpool Lane, Camden.

The basement will house boiler, combined heat and power as well as pumping equipment. This space will be ventilated via an inlet and discharge louvre on the southern (blank) elevation of the building. The flues to this equipment will discharge above roof level. Personnel access will be via an internal stair and emergency / maintenance access is via double doors on the western elevation. There will be a ground floor plant room in the south west corner housing only water tanks (i.e. not motive equipment.) The community facility will include ventilation and extract equipment. There will also be 4 external roof mounted condensers on the roof of the building.

A site layout plan is shown in Attachment 1. Basement, ground, first, fifth floor and roof layouts are shown in Attachment 2. Sketches showing the proposed plant layout is shown in Attachment 3.

There are existing residences in Nigel Buildings to the north east and in Gooch House to the west. There is an existing commercial building at Peer House on Verulam Street to the south west. In addition, there will be new residences at 1st floor level and above within the development itself. These locations are the potentially most affected by noise from the proposed plant.

### 2.1 Plant proposals

Attachment 3 shows the current floor layout plans for the basement, ground floor and roof including the proposed external plant layout which includes the following plant selections:

Basement Plant Room

- Gas fired Boilers - 2 x Hamworthy Fleet Horizontal F350H
- CHP – 2 x ENER-G 50 kW (Thermal)
- Pressurisation unit – Grundfos Impress
- Primary and secondary heating pumps x 3 – Grundfos TPED 50- 23
- Water booster – Grundfos Hydro Multi E
- Gas booster x 2 – Dunphy B1 Duplex booster
- Boiler Room supply and extract fans x 2 – Nuaire AVS 8 1.3m3/Sec

Community Hall

- Fans MVHR – as located on attached drawing Vent Axia SENTINEL MINI or MAXI data as noted

- Fans Extract - as located on attached drawing Vent Axia SENTINEL D-Box data as noted

Roof

- Roof mounted AC external condensers – 4 no @ 53dbA per unit

Manufacturer's data for the plant is as shown in Attachment 4.

### 2.2 Plant operation

The mechanical system for the community centre is timer controlled to operate during daytime hours only. The basement plant can operate continuously (24 hr) but would be demand controlled and, therefore, unlikely to operate at full duty in the quietest part of the night. Highest load upon the system is likely to occur during the early morning period and evenings during winter.

In this analysis, it is assumed that the basement and roof plant operate at rated duty at all times and that community centre plant operates during the daytime.

## 3. BACKGROUND NOISE SURVEY

### 3.1 Date, Location and Equipment

Ambient noise measurements were carried out during a site survey between 11 and 14 April, 2014, consisting of automatic unattended noise measurements on the site at the location shown in Attachment 1 at a height of 2m in free field conditions. This is close to the locations which would be nearest to the proposed plant and representative of the ambient noise conditions there.

The following equipment was used during the survey:

- Bruel & Kjaer Type 2260 Sound Level Meter s/n 2290597
- Bruel & Kjaer Type 4189 Microphone s/n 2529662
- Bruel & Kjaer Type 4231 Acoustic Calibrator s/n 2291483
- Bruel & Kjaer Type UA 1404 Outdoor microphone attachment, and
- Bruel &Kjaer Type AO 0441 10m microphone extension cables

Before and after the survey, the sound level meter was field-calibrated in accordance with the manufacturer's guidelines. Drift was less than 0.2 dB and therefore acceptable. The meter, microphones and field calibrator are laboratory calibrated biennially in accordance with UKAS procedures or to traceable National Standards.

The weather during the survey period was dry with little wind. This represents acceptable conditions for measurements undertaken.

Measurements have been summarised into contiguous 5 minute periods to present the noise profile throughout the period of noise monitoring. Noise metrics consisted of equivalent continuous ($L_{Aeq}$) noise levels and maximum ($L_{Amax}$) noise levels as well as statistical noise levels (termed $L_n$, where n is the percentage of time the level is exceeded during the measurement period). This included $L_{A90}$ levels. Measurements were stored for later analysis.

### 3.2 Results

The results of the measurements are shown graphically in Attachment 5. The results have been summarised into relevant daytime (07:00-23:00 hours) and night-time (23:00-07:00 hours) periods, coinciding with the reference periods used in BS 4142:1997 *Method for rating industrial noise affecting mixed residential and industrial areas*. In addition, the background noise level for the early morning period

6am to 7am has been derived, as this corresponds to times when plant operation is most likely to be at a maximum. Table 1 below summarises the typical minimum measured daytime and night time background noise levels.

| Daytime (0700-2300) | Night-time (2300-0700) | Early morning (0600-0700) |
|---|---|---|
| **LA90 (1 hour) dB** | **LA90 (5min) dB** | **LA90 (5min) dB** |
| 40 | 37 | 43 |

**Table 1:** Summary of the measured day and night time background noise levels

These are the levels used within the assessment reported here to specify the criteria for acceptability from plant.

## 4. TECHNICAL REQUIREMENTS OF CONDITION 9 – CONTROL OF MECHANICAL PLANT NOISE.

Condition 9 requires that the details of the plant and equipment to be used within the plant areas be provided and approved, along with an assessment to indicate that noise from the plant complies with the Council's requirements and any mitigation required to ensure this. It also specifies that noise from the operation of this plant is at least 5 dB(A) below the background noise level outside any nearby residential property with all equipment operating together, when the plant noise does not include and feature corrections as described in Section 8 of BS4142, that is, those described in the 2nd and 3rd rows of Table E of DP28 (in Figure 1, above).

Spectrum have considerable experience in the measurement and control of noise from domestic and commercial mechanical plant. In our experience, noise of the type proposed here will not be significantly tonal or intermittent, nor will it possess any of the features which would attract a 5 dB feature correction, according to Section 8 of BS4142, therefore, no lower noise level criterion is applicable.

Accordingly, the noise targets for assessment purposes are as shown in Table 2, below.

| Daytime (0700-2300) | Night-time (2300-0700) | Night-time (0600-0700) |
|---|---|---|
| **LAeq (1 hour) dB** | **LAeq (5min) dB** | **LAeq (5min) dB** |
| 35 | 32 | 37 |

**Table 2:** LAeq plant noise limits for compliance with planning condition 9.

## 5. PLANT NOISE LEVEL PREDICTION METHOD

### 5.1 Calculation of plant noise within the basement area

Attachment 3 shows the layout plan of plant within the basement for Block 1. All of the combined heat and power plant is internal with cooling / discharge air provided via louvres in the southern external façade. There will be a flue duct from the CHP's / boilers which rise to discharge above roof level.

The reverberant sound pressure level within the plant room has been calculated assuming all equipment is operating at its rated duty and that all walls, ceiling and floor are hard reflective surfaces. This results in the following predicted reverberant sound pressure level:

| Sources | dB(A) | Octave Band Centre Frequency (Hz) 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
|---|---|---|---|---|---|---|---|---|---|
| Boilers | 80 | 88 | 88 | 83 | 78 | 73 | 70 | 66 | 63 |
| CHP | 83 | 90 | 90 | 85 | 80 | 75 | 72 | 68 | 65 |
| Pressurisation | 84 | 66 | 66 | 66 | 71 | 74 | 78 | 78 | 76 |
| Heating pumps | 79 | 72 | 77 | 77 | 74 | 74 | 72 | 69 | 67 |
| Fan Casing | 48 | 41 | 46 | 46 | 43 | 43 | 41 | 38 | 36 |
| Water Booster | 81 | 63 | 63 | 63 | 68 | 71 | 75 | 75 | 73 |
| Gas Booster | 75 | 68 | 73 | 73 | 70 | 70 | 68 | 65 | 63 |
| **Sum of Sound Powers** | **89** | **92** | **92** | **88** | **83** | **81** | **82** | **81** | **79** |
| Reverberation Times (room vol. ~300m$^3$) | - | 1.4 | 1.8 | 1.7 | 1.4 | 1.3 | 1.1 | 1.0 | 0.9 |
| **Reverberant Sound Pressure Level** | **78** | **82** | **83** | **79** | **73** | **71** | **70** | **69** | **66** |

**Table 3:** Plant room predicted reverberant sound pressure level

The noise from this equipment can propagate through the supply and extract ductwork to the external louvres and emit into the surrounding environment. In addition, the general reverberant noise in the plant space can break out of the closed service access doors on the western façade.

Finally, in addition to plant room reverberant noise breaking out from the wall louvres, these will also include the supply and extract ventilation fan noise, as indicated in Attachment 4.

### 5.2 External plant

In addition to the basement plant, the scheme also includes the following external plant:

- Ground floor substation having a sound power level of $L_{WA}$ 38 dB (Spectrum measurements)
- Kitchen extract fan at high level in southern elevation the drive-through (Data in Attachment 4)
- Community centre MVHR at high level in southern elevation the drive-through (Data in Attachment 4)
- Community space 2 MVHR at high level in north-west elevation overlooking Portpool Lane (Data in Attachment 4)
- Community centre WC extract at high level in north elevation overlooking Portpool Lane (Data in Attachment 4)
- Roof level condensers – $L_{WA}$ 61 dB each.
- Roof level flue discharge – $L_{WA}$ 63 dB.

### 5.3 Analysis method

The proposals result in a number of noise sources that are located about the building which are subject to varying degrees of screening, distance attenuation and reflection. In addition, there are a number of noise-sensitive receivers at varying heights and locations.

Accordingly, the analysis method which is most appropriate is a numerical noise model of the building and surrounding area. This uses information about the noise emission, propagation path difference, screening, diffraction, absorption, etc. to calculate the component noise level for a number of noise sources at a number of receptor locations. These can then be accumulated and / or ranked for each receptor as a guide to the significance of each source at each receiver and as an aid to noise control design.

The particular noise prediction model that has been used for this analysis is Bruel & Kjaer's Type 7810 'Predictor' software. This acoustic model implements the procedures set out in ISO 9613-2:1996 "Acoustics – Attenuation of sound during propagation outdoors Part 2: General method of calculation to determine noise levels". Items of plant equipment have been modeled as individual point sources at the locations shown in the plant layout drawings. The proposed buildings have been modeled as solid bodies,

around which sound can diffract. Receptor positions representing the most affected residential windows have been modeled as being 1m above the internal floor level.

As described in Section 4, in this analysis, the predicted noise level is equal to the rating level.

A layout plan and 3D visualisation of the Predictor noise model showing plant room and roof plant, buildings and receptors are shown in Attachment 6.

The predicted noise levels from plant operation are then compared with the plant noise limits set out in Table 2, above.

## 6. PLANT NOISE LEVEL PREDICTION RESULTS AND NOISE MITIGATION MEASURES

### 6.1 Noise control measures

Initial calculations of the (unsilenced) equipment showed a number of excesses of the allowable noise levels. Accordingly, the effect of a number of noise mitigation measures have been included within the numerical model. These are discussed below:

#### 6.1.1 BASEMENT PLANT ROOM LOUVRES

The combined effect of plant room reverberant noise and supply / exhaust fan noise emitted from the ground level louvres on the southern elevation of the building must be limited to $L_{WA}$ 61 dB. In order to achieve this, the following silencer dynamic insertion loss is required between the fan and the louvre.

| | Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Dynamic insertion loss | 3 | 5 | 14 | 22 | 26 | 27 | 16 | 11 |

**Table 4:** Required insertion loss for the two basement plant room louvres.

#### 6.1.2 BASEMENT PLANT ROOM EMERGENCY ACCESS / MAINTENANCE ACCESS DOOR

The sound power emitted from the service access door on the western elevation must be limited to $L_{WA}$ 46 dB. In order to achieve this, the following door sound reduction index must be achieved.

| | Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Sound reduction index | 15 | 21 | 23 | 26 | 29 | 31 | 34 | 32 |

**Table 5:** Basement maintenance access door sound reduction index.

This is equivalent to a 40mm solid core timber door with good quality acoustic seals.

#### 6.1.3 COMMUNITY CENTRE MVHR SUPPLY AND EXTRACT LOUVRES

The combined sound power of the inlet and discharge louvres from the 'Maxi' MVHR unit must be limited to $L_{WA}$ 56 dB. In order to achieve this, the following silencer dynamic insertion loss is required between the MVHR and the louvres.

| | Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Dynamic insertion loss | 3 | 5 | 14 | 28 | 42 | 41 | 30 | 24 |

**Table 6:** Required insertion loss for basement plant room louvres.

#### 6.1.4 COMMUNITY SPACE 2 MVHR SUPPLY AND EXTRACT LOUVRES

The combined sound power of the inlet and discharge louvres from the 'Mini' MVHR unit must be limited to $L_{WA}$ 42 dB. In order to achieve this, the following silencer dynamic insertion loss is required between the MVHR and the louvres.

| | Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Dynamic insertion loss | 3 | 5 | 14 | 28 | 42 | 41 | 30 | 24 |

**Table 7:** Required insertion loss for basement plant room louvres.

#### 6.1.5 COMMUNITY CENTRE WC EXTRACT LOUVRE

The combined sound power of the discharge louvre from the Ventaxia D-Box unit must be limited to $L_{WA}$ 45 dB. In order to achieve this, the following silencer dynamic insertion loss is required between the fan and the wall louvre.

| | Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Dynamic insertion loss | 3 | 5 | 14 | 28 | 42 | 41 | 30 | 24 |

**Table 8:** Required insertion loss for basement plant room louvres.

#### 6.1.6 COMMUNITY KITCHEN EXTRACT LOUVRE

The combined sound power of the discharge louvre from the Ventaxia D-Box unit must be limited to $L_{WA}$ 53 dB. In order to achieve this, the following silencer dynamic insertion loss is required between the fan and the wall louvre.

| | Octave Band Centre Frequency (Hz) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Dynamic insertion loss | 3 | 5 | 14 | 22 | 23 | 27 | 16 | 11 |

**Table 9:** Required insertion loss for basement plant room louvres.

#### 6.1.7 ROOF LEVEL FLUE DISCHARGE

The combined sound power of the roof level discharge flues from the boiler and CHP units must be limited to $L_{WA}$ 63 dB. The precise silencer specification to achieve this is currently being established, however, providing this overall level is not exceeded, acceptable receptor noise levels will be achieved

#### 6.1.8 OTHER ITEMS

No noise control is required to the substation louvres or the roof – mounted condensers, providing the sound power levels comply with those shown in Section 5.2, above.

### 6.2 Results

The numerical noise model prediction results for the proposed plant, including the effect of the noise mitigation measures described in the previous section are shown in Attachment 7.

This shows that the highest predicted noise level in the near vicinity of the daytime equipment (Community Centre) is 34 dB, which is 1 dB lower than the allowable level of 35 dB.

In relation to the highest predicted noise level from plant that operates on a 24 hour basis, this is 32 to 33 dBA at first floor residential windows.

Accordingly, the predicted noise levels are in compliance with guideline for acceptability required by Camden Council.

### 6.3 Discussion

It needs to be borne in mind that, in carrying out this assessment, a number of conservative assumptions about noise emission from the plant have been modelled. These are:

- All of the equipment operates at its full rated duty. In fact, the operation of the plant is demand-based and 'ramps up or down' accordingly. As described in this report, the maximum duty is likely to occur at peak periods of demand which are typically in the 6am to 8am morning period or the 6pm to 10pm evening period during the winter when hot water demand is at a maximum.
- All equipment items operate together. This would rarely be the case. For example, the CHP and Boilers have built-in redundancy and simultaneous operation of both items at 'rated duty' is not envisaged. Also, the community centre equipment would not be at maximum duty as the same time as the basement plant.
- This 'worst case' operating condition has been compared with the lowest measured $L_{A90}$ noise levels, i.e. those that occur when activity in the surrounding area is at its lowest. Therefore, the noisiest plant operating condition and the quietest ambient condition are compared. These two situations would generally not be expected to coincide.
- The assessment is based on external noise levels, not internal levels. Noise levels inside residences, where people could be disturbed, will be much lower due to the sound insulation of the building envelope. This is particularly so during cold weather (i.e. peak heating demand) when windows are likely to be closed.

However, even taking these conservative assumptions into account the predicted noise levels comply with the guideline for acceptability established within this assessment.

## 7. CONCLUSION

In summary, provided the noise control measures described within this report are implemented, suitably low levels of plant noise will be provided for residents nearby in accordance with the requirements of Condition 9 of permission 2012/6372/P.

If you have any questions or require further information, please don't hesitate to contact me.

Yours sincerely

Phill Banks
**Principal Consultant**