# Appendix 03 – 06 Noise Assessment

ARUP

**Colliers Properties LLC**

# Linmere Island Site, Houghton Regis

## Noise Impact Assessment

Reference: 302321-ARP-XX-XX-RP-Z-0015

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# 1. Introduction

Arup has carried out a Noise Impact Assessment on behalf of Colliers Properties LLC, in support of an application for full planning permission to develop a data centre campus at the Linmere Island Site, Houghton Regis, Central Bedfordshire (hereafter 'the Proposed Development site').

The Site falls within the administrative area of Central Bedfordshire Council (CBC) and therefore the CBC Local Planning Authority will determine the planning application.

A glossary of acoustic terminology used in this report is in Appendix A.

## 1.1 Site location and context

The Proposed Development Site is located north-west of Houghton Regis, Bedfordshire, UK, approximately 7km Northwest of Luton town centre and accessed via Chantry Way, located off the M1 motorway and comprises a parcel of land measuring approximately 9 hectares (see Figure 1).

The Proposed Development site forms part of a wider network of sites that comprise a strategic mixed-use development, known as 'HRN1' (Houghton Regis North 1). The site is part of a wider masterplan strategy that includes a public open space to the west, beyond which is the Barratt Homes housing development under construction approximately 230m from the Proposed Development site.

There is a Lidl supermarket and proposed residential development 60m to the south, and a Lidl Distribution Centre approximately 300m to the south-east, on the east side of Woodside Link (A5505).

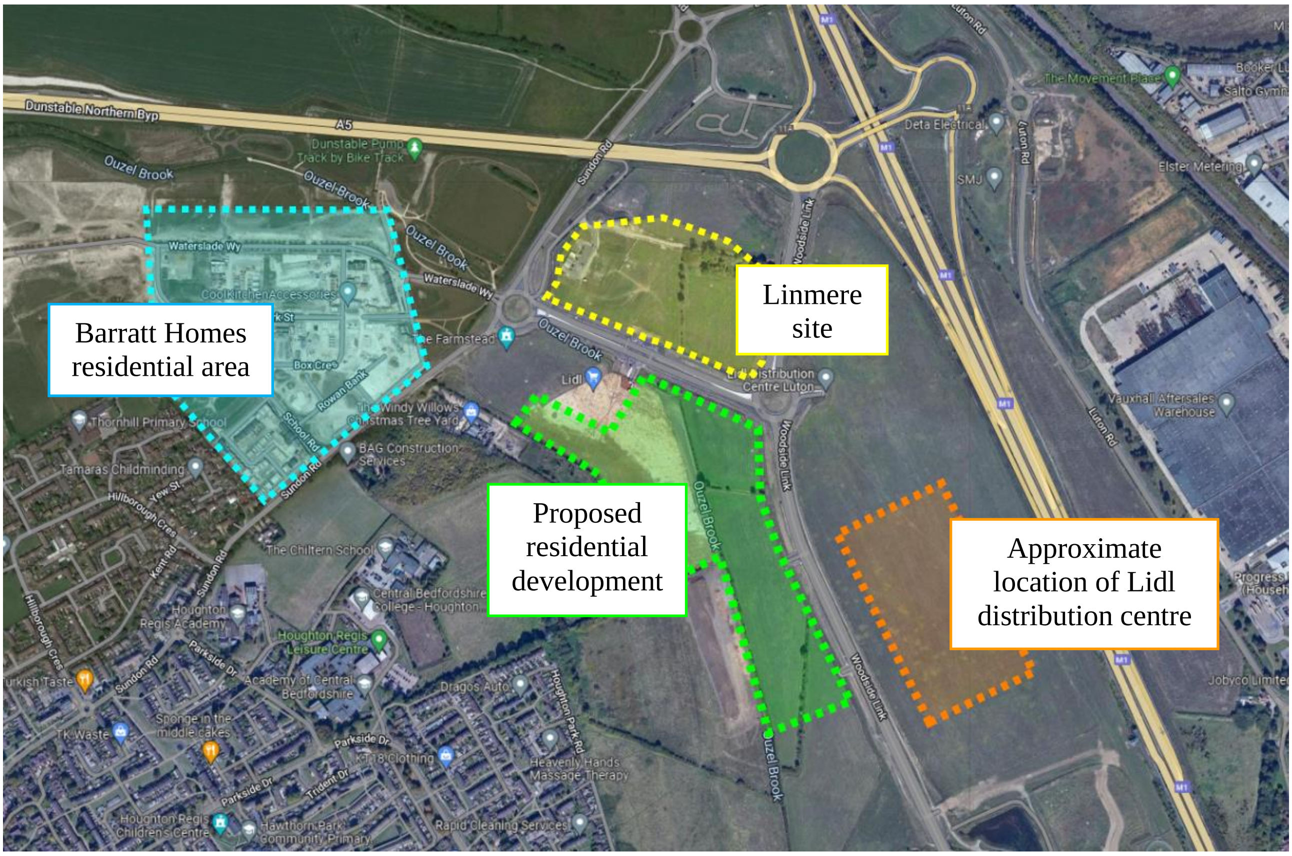


Figure 1: Site location relative to the surrounding area

# 2. Baseline Conditions

## 2.1 Site Description and Noise Sensitive Receptors

The noise climate is dominated by traffic noise arising from the local roads and nearby M1 motorway.

The closest existing noise sensitive (residential) receptors are the new Barratt Homes to the west and the proposed residential development to the south of the Proposed Development site.

The Lidl distribution centre may have administrative spaces with facades exposed to the Proposed Development site.

## 2.2 Environmental Sound Survey Results

A baseline environmental sound survey has been carried out by Arup, the details of which can be found in Appendix B.

Sound levels at nearby noise sensitive receptors vary throughout the day and night, mostly dictated by traffic flow on the nearby roads.

In accordance with BS4142, the ‘typical’ background ($L_{A90,15min}$) sound level (i.e. not necessarily the lowest background sound level) at sensitive receptors should be established for assessment purposes.

However, the ongoing construction works in the area will have, to some extent, contaminated the daytime measurements. Therefore, daytime baseline levels have been established based on the $L_{A95}$ and $L_{A99}$ measured levels, i.e. the levels exceeded 95% or 99% of the measurement period which are typically lower than the $L_{A90}$ levels usually referred to. This method is intended to 'filter out' where possible the influence of transient construction activities to determine representative baseline noise levels in between noisy construction activities. Furthermore, the weekend daytime periods when no construction works would have been carried out have also been included in the dataset.

In summary, based on statistical analysis to determine the typically regular occurring background sound levels at the survey locations, the proposed background sound levels for assessment purposes for each of the receptors are detailed in Table 1 below.

| Receptor Location | Time Period | Typical background sound level |
|---|---|---|
| Barratt Homes residential development (R1 in Figure 2) | 07:00 – 23:00 (daytime) | 52dB$L_{A99,15min}$ |
| | 23:00 – 07:00 (night time) | 45dB$L_{A90,15min}$ |
| Residential development to the south (R2 and R3 in Figure 2) | 07:00 – 23:00 (daytime) | 49dB$L_{A95,15min}$ |
| | 23:00 – 07:00 (night time) | 41dBLA$_{90,15min}$ |

**Table 1: Representative baseline sound levels applied to each receptor for assessment purposes**

# 3. Assessment criteria

## 3.1 Residential dwellings

Central Bedfordshire Council (CBC) require that the 'rating level' for normally operating plant should not exceed 'typical' background sound levels when assessed in accordance with BS4142:2014+A1:2019 *Methods for rating and assessing industrial and commercial sound* (BS4142). Furthermore, whilst CBC do not specifically limit sound levels from plant operated during an emergency (e.g. emergency backup generators that would become operational in the event of a power cut), there is an expectation to mitigate emergency plant noise as much as practicable, with the aim of not causing a 'significant adverse impact' (in accordance with BS4142).

BS4142 explains that typically, the greater level of difference between the plant noise rating level (i.e. the specific sound level plus any adjustment for the characteristic features of the sound, dB$L_{Ar,Tr}$) and background sound level at the receptor, the greater the magnitude of the impact. In summary, BS4142 states:

- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *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.*

Therefore, in meeting CBC's requirement not to exceed the 'typical' background noise levels at the nearest residential properties, the Proposed Development would be well below any indication of an adverse impact.

In addition, emergency plant (when operating simultaneously with normally operating plant) should not exceed 10dB above the 'typical' background level which would avoid causing a 'significant adverse impact'.

Plant noise emission limits for both normal and emergency plant operations are shown in Table 2 below.

| Receptor | Plant operational scenario | Plant noise limit, $dBL_{Ar,Tr}$ |
|---|---|---|
| Barratt Homes residential development (R1 in Figure 2) | Normally operating plant and during generator testing | 52 daytime |
| | | 45 night time |
| | Normally operating plant + emergency plant (full emergency scenario) | 62 daytime |
| | | 55 night time |
| Residential development to the south (R2 and R3 in Figure 2) | Normally operating plant and during generator testing | 49 daytime |
| | | 41 night time |
| | Normally operating plant + emergency plant (full emergency scenario) | 59 daytime |
| | | 51 night time |

**Table 2: Plant noise emission limits**

## 3.2 Lidl Distribution Centre – BS8233 criteria

British Standard BS8233:2014 *Guidance on sound insulation and noise reduction for buildings* (BS8233) suggests for administrative spaces, daytime internal ambient noise limits can typically range between 40-50 $dBL_{Aeq,T}$ for cellular - open plan spaces.

Given the proximity to the M1 and nearby roads, it has been assumed any administration spaces will not be dependent upon natural ventilation and therefore closed windows can be assumed. A modern sealed façade is conservatively estimated to provide around 32dB level difference, which indicates that an external sound level of 72-82$dBL_{Aeq,T}$ during the daytime would be acceptable outside the windows of administrative spaces.

In order to avoid having a material effect upon internal noise levels, an external noise threshold is proposed which is 5dB lower. Accordingly, an external noise limit at the Lidl distribution centre façade (R4 in Figure 2) of 67$dBL_{Aeq,T}$ (during daytime) is proposed, assuming sealed windows or solid façade.

## 3.3 Noise Receptor Locations Considered

The nearest noise sensitive receptors have been identified as follows:

- Barratt Homes residential development to the west of the site, (R1 in Figure 2)
- Residential development to the south of site (R2 and R3 in Figure 2); and
- Lidl distribution centre to the southeast of the site (R4 in Figure 2).

The locations of the receiver locations listed above relative to the Proposed Development site are shown in Figure 2 below.


Figure 2: Overview of the proposed data centre site relative to the nearest noise sensitive receptors used for assessment purposes

## 3.4 Plant Layout

The Proposed Development site layout consists of two, two storey data centre buildings, each with an approximate rooftop height of 20m.

The plant equipment included in the acoustic modelling are detailed below and shown in Figure 3.

### 3.4.1 Building A data hall building

- 100 air handling units (AHU) supplying cool air to the data halls (located inside the building served by louvres in the east and west facade).
- 148 exhaust fans extracting air from the data halls (located at rooftop level).
- 52 CRAC condensers serving the data halls (located at rooftop level).
- 1 AHU serving the administration spaces (located at rooftop level).
- 4 VRF condensers and 6 split unit condensers and serving the administration spaces (located at rooftop level).
- 4 toilet extract fans serving the administration spaces (1 located in the south facing façade and the other 3 located at rooftop level)

- 27 emergency generators (including the house and redundancy generators) located at ground level along the east facade.

#### 3.4.2 Building A MVR Room

- 6 split unit condensers

#### 3.4.3 Building B data hall building

- 50 AHUs supplying cool air to the data halls (located inside the building served by louvres in the east and west facade).
- 74 exhaust fans extracting air from the data halls (located at rooftop level).
- 28 CRAC condensers serving the data halls (located at rooftop level).
- 1 AHU serving the administration spaces (located at rooftop level).
- 4 VRF condensers and 6 split unit condensers and serving the administration spaces (located at rooftop level).
- 4 toilet extract fans serving the administration spaces (1 located in the south facing façade and the other 3 located at rooftop level)
- 15 emergency generators (including the house and redundancy generators) located at ground level along the east facade.

#### 3.4.4 Building B MVR Room

- 6 split unit condensers

#### 3.4.5 Security building

- 2 split unit condensers
- 1 toilet extract fan

#### 3.4.6 Substation compound

- 2 transformers
- 1 emergency generator

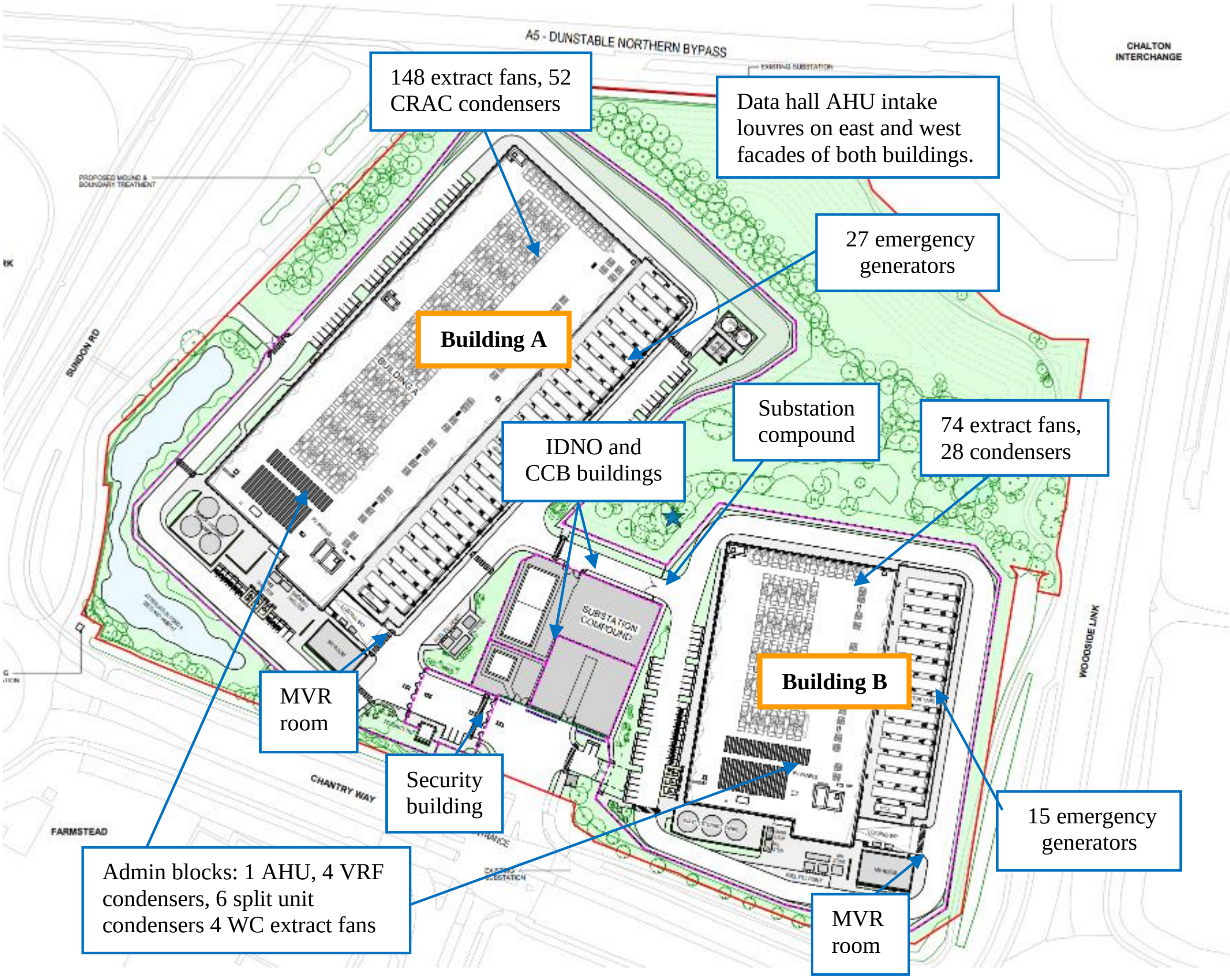


Figure 3: Proposed plant layout

## 3.5 Plant Noise Levels

The following sections summarise the plant noise sources based on information received from the developer.

On average, the plant is expected to operate at around 80% duty for most of the time and is only expected to operate at 100% duty for a relatively short duration during a year. However, in the absence of manufacturer's acoustic data for lower operational duties, the sound levels presented are based on 100% duty and therefore represent a worst-case scenario. Furthermore, it is unlikely that all mechanical plant will ever operate at 100% duty simultaneously.

All plant and equipment will be specified to a high standard and will be regularly maintained by the operator's on-site maintenance team. Furthermore, due to number of different sources operating simultaneously over a 24 hour period, no acoustic characteristics are envisaged for the heat rejection plant. Therefore, noise level corrections in accordance with BS4142 for acoustic characteristics (i.e. tonality, impulsivity or intermittency) have not been included for the various heat rejection plant sources.

### 3.5.1 Façade louvres

The sound power level associated with each façade louvre is shown in Table 3 and is the combination of the internal reverberant noise contribution from all of the data hall servers and the operational noise from the AHUs serving the data halls.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Façade louvre | 85 | 87 | 87 | 86 | 82 | 80 | 76 | 70 | 69 |

**Table 3: Sound power level for each façade louvre**

#### 3.5.1.1 *Façade louvres – attenuation*

Each of the façade louvres facing into the site (i.e. east facing louvres on Building A and west facing louvres on Building B) will have 1800 mm long attenuators.

Each of the façade louvres facing away from the site (i.e. west facing louvres on Building A and east facing louvres on Building B) will have 600 mm long attenuators.

The minimum effective insertion loss of the façade louvre attenuators (i.e. taking account of any regenerated noise) are shown in Table 4 below.

| Description | Insertion loss, octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| 600 mm attenuator | -6 | -9 | -14 | -22 | -36 | -28 | -21 | -15 |
| 1800 mm attenuator | -12 | -20 | -34 | -50 | -50 | -50 | -49 | -39 |

**Table 4: Façade louvre attenuator minimum insertion loss**

### 3.5.2 Exhaust fans

The sound power of each rooftop extract fan serving the data halls is shown in Table 5 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Extract fan outlet | 89 | 92 | 92 | 86 | 86 | 85 | 81 | 76 | 71 |
| Casing radiated | 58 | 73 | 67 | 61 | 52 | 50 | 45 | 39 | 34 |

**Table 5: Sound power level ($L_w$) for each extract fan**

#### 3.5.2.1 *Exhaust fans outlets – attenuation*

Each extract fan outlet will have a 1000 mm long attenuator providing the minimum effective insertion loss (i.e. taking account of any regenerated noise) shown in Table 6 below.

| Description | Insertion loss, octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| 1000 mm attenuator | -2 | -4 | -12 | -22 | -18 | -11 | -8 | -6 |

**Table 6: Extract fan attenuator minimum insertion loss**

### 3.5.3 CRAC condensers

The sound power of each rooftop CRAC condenser serving the data halls is shown in Table 7 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| CRAC condenser | 92 | 94 | 94 | 83 | 74 | 71 | 67 | 59 | 54 |

**Table 7: Sound power level for each CRAC condenser**

### 3.5.4 AHU – administration blocks

The sound power of the AHU serving each administration block is shown in Table 8 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Admin AHU inlet | 56 | 58 | 68 | 51 | 52 | 47 | 45 | 44 | 41 |
| Admin AHU exhaust | 89 | 73 | 81 | 76 | 84 | 85 | 81 | 80 | 71 |
| Admin AHU breakout | 71 | 65 | 70 | 66 | 67 | 64 | 67 | 54 | 31 |

**Table 8: Sound power level for each admin AHU**

### 3.5.5 VRF condensers – administration blocks

The sound power of each VRF condenser serving each administration block is shown in Table 9 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| VRF condenser | 73 | 82 | 72 | 74 | 72 | 67 | 63 | 57 | 53 |

**Table 9: Sound power level for each admin VRF condenser**

### 3.5.6 Toilet extract fans – administration blocks

The sound power of each toilet extract fan serving each administration block is shown in Table 10 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Toilet extract fan | 75 | 63 | 68 | 69 | 73 | 70 | 69 | 62 | 54 |

**Table 10: Sound power level for each admin toilet extract fan**

### 3.5.7 Split unit condensers – administration blocks, MVR rooms and security building

The sound power of each split unit condenser serving each administration block, each MVR room and the security building is shown in Table 10 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Split unit condenser | 67 | 37 | 44 | 49 | 54 | 57 | 61 | 62 | 62 |

**Table 11: Sound power level for each split unit condenser**

### 3.5.8 Emergency backup generators

The sound power of each emergency and house generator is shown in Table 12 below.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Left side | 92 | 95 | 101 | 87 | 87 | 84 | 84 | 78 | 84 |
| Right side | 92 | 95 | 101 | 87 | 87 | 84 | 84 | 78 | 84 |
| Front | 93 | 103 | 101 | 93 | 88 | 86 | 86 | 80 | 78 |
| Rear (intake) | 92 | 107 | 107 | 82 | 68 | 64 | 63 | 62 | 73 |
| Roof (solid) | 95 | 102 | 106 | 95 | 89 | 87 | 86 | 81 | 84 |
| Roof (discharge) | 103 | 114 | 117 | 94 | 70 | 68 | 68 | 73 | 98 |
| Exhaust outlet | 101 | 115 | 114 | 100 | 94 | 90 | 88 | 84 | 80 |

**Table 12: Sound power levels for each emergency generator and house generator**

#### *3.5.8.1 Generator exhaust outlet silencer*

Each generator exhaust outlet will have a silencer providing the minimum insertion loss shown in Table 13 below.

| Description | Insertion loss, octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Exhaust silencer | -8 | -9 | -12 | -22 | -27 | -27 | -21 | -15 |

**Table 13: Generator exhaust silencer minimum insertion loss**

#### *3.5.8.2 Generator cooling air discharge outlet attenuator*

Each generator cooling air discharge outlet will have a 900mm long attenuator providing the minimum insertion loss shown in Table 14 below.

| Description | Insertion loss, octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| 900mm attenuator | -7 | -13 | -19 | -27 | -41 | -41 | -30 | -22 |

**Table 14: Generator cooling air discharge outlet attenuator minimum insertion loss**

### 3.5.9 Transformers

The sound power level for each of the two transformers located at ground level is shown in Table 15.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Transformer | 83 | 79 | 90 | 87 | 83 | 70 | 62 | 63 | 65 |
| Note: As spectral data has not been provided by the manufacturer, spectral data for similar plant have been adopted and adjusted to meet the overall level as shown. | | | | | | | | | |

Table 15: Sound power level for each transformer

### 3.5.10 Substation emergency backup generator

The sound power level for the substation emergency backup generator enclosed within the substation building is shown in Table 16.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| Left side | 91 | 96 | 102 | 91 | 86 | 83 | 80 | 75 | 80 |
| Right side | 91 | 96 | 102 | 91 | 86 | 83 | 80 | 75 | 80 |
| Front | 91 | 102 | 99 | 87 | 83 | 81 | 84 | 81 | 84 |
| Rear (intake) | 94 | 105 | 108 | 95 | 79 | 66 | 65 | 73 | 87 |
| Roof (solid) | 91 | 96 | 102 | 91 | 86 | 83 | 80 | 75 | 80 |
| Exhaust outlet | 101 | 115 | 114 | 100 | 94 | 90 | 88 | 84 | 80 |

Table 16: Sound power levels for the substation emergency generator

### 3.5.11 DX condensers – IDNO and CCB buildings

The sound power level for each of the twelve DX condenser units serving the IDNO and CCB buildings is shown in Table 19.

| Description | Sound power, dB(A) | Octave band centre frequency, Hz, dB | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 63 | 125 | 250 | 500 | 1k | 2k | 4k | 8k |
| DX condenser unit | 70 | 40 | 46 | 52 | 56 | 60 | 64 | 65 | 65 |

Table 17: Sound power level for each transformer

## 3.6 Data Centre Operational Plant Scenarios Modelled

The acoustic modelling has been based on the information, drawings, sketches and noise data provided by the manufacturer.

Furthermore, the source sound power levels described in section 3.5 have been included as necessary in each of the modelled scenarios as follows:

- **Scenario 1, normal operation** - Heat rejection plant and transformers operating 24 hours per day (no generators in operation).
- **Scenario 2, southern generator testing on Building A** - Heat rejection plant and transformers operating 24 hours per day plus the single, southern most generator operating during the daytime only.
- **Scenario 3, southern generator testing on Building B** - Heat rejection plant and transformers operating 24 hours per day plus the single, southern most generator operating during the daytime only.
- **Scenario 4, full emergency** - Heat rejection plant and transformers operating 24 hours per day plus all generators operating during the daytime and night-time.

## 3.7 Results

### 3.7.1 Scenario 1 – normal plant operation only

Predicted plant noise levels for normally operating plant during the daytime and night-time periods when assessed at the nearest sensitive receptors are detailed in Table 18 below.

| Receiver | Predicted daytime plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit | Predicted night time plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit |
|---|---|---|---|---|---|---|
| R1 | 38 | 52 | -14 | 38 | 45 | -7 |
| R2 | 41 | 49 | -8 | 41 | 41 | 0 |
| R3 | 41 | 49 | -8 | 41 | 41 | 0 |
| R4 | 35 | 67 | -32 | 35 | 67 | -32 |

**Table 18: Predicted plant noise at the nearest sensitive receptors for normally operating plant**

### 3.7.2 Scenario 2 – normal plant operation plus a single southern most generator on Building A being tested during the daytime

The generators are broadly arranged in rows from the northern end of the site to the southern end (as shown in Figure 3). This scenario considers the southern most generator (single generator per building) being tested on Building A i.e. representing the worst-case noise assessment (during Building A generator testing) for the nearest residential receptors to the south of the site.

Generator testing will only take place during the daytime. Therefore, night-time results do not include noise from generator operation and so are the same as Scenario 1. The predicted noise levels when assessed at the nearest sensitive receptors are detailed in Table 19 below.

| Receiver | Predicted daytime plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit | Predicted night time plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit |
|---|---|---|---|---|---|---|
| R1 | 39 | 52 | -13 | 38 | 45 | -7 |
| R2 | 45 | 49 | -4 | 41 | 41 | 0 |
| R3 | 43 | 49 | -6 | 41 | 41 | 0 |
| R4 | 36 | 67 | -31 | 35 | 67 | -32 |

**Table 19: Predicted plant noise at the nearest sensitive receptors during Building A generator testing**

### 3.7.3 Scenario 3 – normal plant operation plus single southern most generator on Building B being tested during the daytime

The generators are broadly arranged in rows from the northern end of the site to the southern end (as shown in Figure 3). This scenario considers the southern most generator (single generator per building) being tested on Building B i.e. representing the worst-case noise assessment (during Building B generator testing) for the nearest residential receptors to the south of the site.

Generator testing will only take place during the daytime. Therefore, night-time results do not consider any noise arising from generator operation. The predicted noise levels when assessed at the nearest sensitive receptors are detailed in Table 20 below.

| Receiver | Predicted daytime plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit | Predicted night time plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit |
|---|---|---|---|---|---|---|
| R1 | 38 | 52 | -14 | 38 | 45 | -7 |
| R2 | 42 | 49 | -7 | 41 | 41 | 0 |
| R3 | 45 | 49 | -4 | 41 | 41 | 0 |
| R4 | 38 | 67 | -29 | 35 | 67 | -32 |

Table 20: Predicted plant noise at the nearest sensitive receptors during Building B generator testing

### 3.7.4 Scenario 4 – full emergency, all normal plant plus all generators operating

Predicted plant noise levels assessed at the nearest sensitive receptors for a full emergency scenario (i.e. when all heat rejection plant plus all generators serving both datacentre buildings would be operating simultaneously) are shown in Table 21 below.

| Receiver | Predicted daytime plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit | Predicted night time plant noise, $dBL_{Ar,Tr}$ | Noise limit, dB(A) | Difference between predicted noise and limit |
|---|---|---|---|---|---|---|
| R1 | 44 | 62 | -18 | 44 | 55 | -11 |
| R2 | 54 | 59 | -5 | 54 | 51 | 3 |
| R3 | 54 | 59 | -5 | 54 | 51 | 3 |
| R4 | 47 | 67 | -20 | 47 | 67 | -20 |

Table 21: Predicted plant noise at the nearest sensitive receptors during full emergency scenario

### 3.7.5 Assessment

The results in Table 18 to Table 20 show that for ‘normal’ and ‘generator testing’ operational scenarios, the predicted plant noise should not exceed the noise emission limits during the day or night at any of the closest sensitive receptors.

Predicted noise levels at the Barratt Homes residential development (R1) comply with the noise limits for all operational scenarios.

During a full emergency scenario, predicted sound levels at the closest residential areas to the south around the assessment locations R2 and R3 exceed the day and night-time noise limits by 3dB.

For all operational plant scenarios considered, predicted plant noise is not expected to exceed the limits and/or cause disturbance to noise sensitive spaces inside the Lidl distribution centre administrative spaces (R4).

The results demonstrate that the significant mitigation included in the assessment and described in section 3.5 are required to control noise emission to the nearby residential developments, particularly those in close proximity to the south, for both normally operating plant and the emergency generator operations.

All generators would only become operational during a power outage across the whole site. Therefore, given the rarity, potential scale and assumed short term duration of such an event, plant noise arising from the proposed data centre in this context, is not expected to cause a significant adverse impact at the nearest sensitive receptors.

Furthermore, the assessments overall are considered conservative as all the mechanical plant is highly unlikely to be operating at 100% duty simultaneously, especially during night time periods.

As noted in section 3.5, predicted plant noise levels do not include any corrections for acoustic characteristics (in accordance with BS4142).

# 4. Conclusion

Arup has carried out a baseline environmental noise survey around the Proposed Development site. Statistical analysis for the measured data has been carried out to establish the typical daytime baseline sound levels least affected by the local construction activities, and night-time baseline levels. The established baseline levels have been used to inform the day and night-time plant noise emission limits and are aligned with the local authority requirements.

For ‘normal’ (scenario 1) and ‘generator testing’ (scenarios 2 and 3) operational scenarios, the results show that predicted plant noise levels would not exceed the noise emission limits during the day and night-time periods at the nearest sensitive receptors.

During a full emergency scenario (scenario 4), the predicted plant noise levels marginally exceed the night-time noise emission limits at two of the closest receptor assessment locations (R2 and R3). However, given the small magnitude of the exceedance (it is widely accepted that a 3dB change in noise levels is considered ‘barely perceptible’); and the rarity of this event (i.e. a total utility power failure combined with maximum cooling needs); and the likely short duration of such an emergency event, this is not expected to cause a significant adverse impact at the nearest sensitive receptors. Furthermore, the scheme design has been optimised to minimise noise in a way which is considered to be proportionate to the degree of risk and other development and site constraints.

For all scenarios that have been assessed, predicted plant noise is not expected to exceed the proposed limits and/or cause disturbance to the noise sensitive spaces inside the nearby Lidl distribution centre.

# Appendix A

## Acoustic Terminology

## Decibel (dB)

The ratio of sound pressures which we can hear is a ratio of $10^6$:1 (one million:one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' ($L_p$) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.

## dB(A)

The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz.

In some statistical descriptors the 'A' weighting forms part of a subscript, such as $L_{A10}$, $L_{A90}$, and $L_{Aeq}$ for the 'A' weighted equivalent continuous noise level.

## Equivalent continuous sound level

An index for assessment for overall noise exposure is the equivalent continuous sound level, $L_{eq}$. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.

## Frequency

Frequency is the rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the hertz (Hz), which is identical to cycles per second. A 1000Hz is often denoted as 1kHz, eg 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

## Sound power level

The sound power level ($L_w$) of a source is a measure of the total acoustic power radiated by a source. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located.

## Sound pressure level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level ($L_p$) is ten times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x $10^{-5}$Pa (the threshold of hearing).

Thus $L_p$ (dB) = 10 log $(P1/P_{ref})^2$ where $P_{ref}$, the lowest pressure detectable by the ear, is 0.00002 pascals (ie 2x$10^{-5}$ Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB$L_A$ and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

## Statistical noise levels

For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The $L_{10}$, the level exceeded for 10% of the time period under consideration, and can be used for the assessment of road traffic noise (note that $L_{Aeq}$ is used in BS 8233 for assessing traffic noise). The $L_{90}$, the level exceeded for 90% of the time, has been adopted to represent the background noise level. The $L_1$, the level exceeded for 1% of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted $L_{A10}$, $dBL_{A90}$ etc. The reference time period (T) is normally included, e.g. $dBL_{A10, 5min}$ or $dBL_{A90, 8hr}$.

## Typical levels

Some typical dB(A) noise levels are given below:

| Noise Level, dB(A) | Example |
|---|---|
| 130 | Threshold of pain |
| 120 | Jet aircraft take-off at 100m |
| 110 | Chain saw at 1m |
| 100 | Inside disco |
| 90 | Heavy lorries at 5m |
| 80 | Kerbside of busy street |
| 70 | Loud radio (in typical domestic room) |
| 60 | Office or restaurant |
| 50 | Domestic fan heater at 1m |
| 40 | Living room |
| 30 | Theatre |
| 20 | Remote countryside on still night |
| 10 | Sound insulated test chamber |

# Appendix B

## Environmental Sound Survey

# B.1 Introduction

An environmental sound survey has been carried out by Arup to determine the existing noise climate in and around the Linmere development site. This appendix details the baseline sound survey and results.

# B.2 Instrumentation

The sound level meters and microphones are Class 1 conforming to BS EN 61672-1:2013. All equipment is calibrated annually as required according to international standards, with traceable records. Calibration certificates can be provided upon request. Onsite calibration checks were conducted, and no significant drift was recorded.

The RION NL-52 and RION NL-62 sound level meters used for the long term (unattended) measurements were fitted with environmental wind shields.

# B.3 Measurement Locations

Unattended sound level measurements were carried out at the locations (L1 and L2) shown in Figure B1 below.

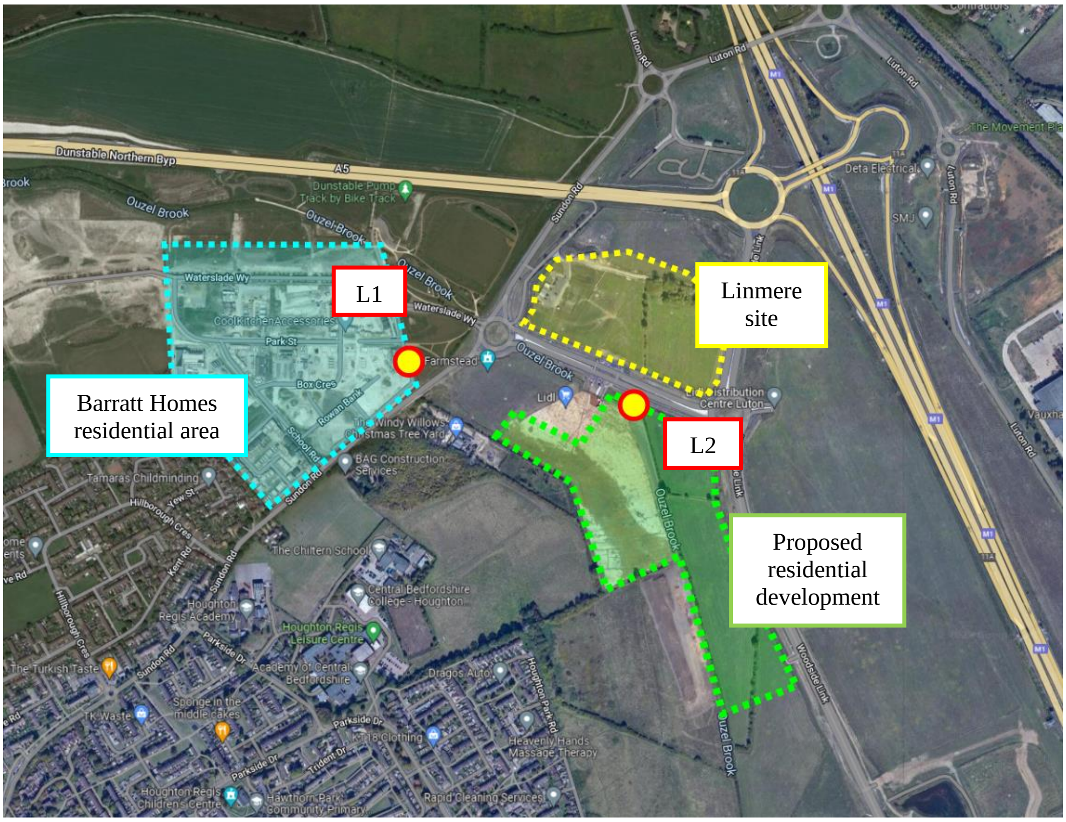


Figure B1: Environmental sound survey locations relative to the Linmere site and surrounding area

The automatic sound level loggers were configured to measure and store data in fifteen minute samples. This enabled the time history information about the ambient and background noise climate to be established at the static measurement location.

Whilst we cannot be certain about the detailed weather conditions throughout the unattended survey duration, meteorological conditions during the instillation and removal of the loggers were dry and calm with wind speeds significantly less than 5m/s.

### B.3.1 Location A1

**Date and Time:**

Wednesday 15/06/22 15:05 to Tuesday 21/06/22 13:55

**Location description:**

The logger was positioned just inside the boundary of the Barratt Homes construction site near to Sallow Field and approximately 45m north-west of Sundon Road.

The microphone was supported on a tripod approximately 2m above the local site security hoarding to avoid unrepresentative acoustic screening effects (cause by the hoarding) whilst also reducing the influence of nearby acoustically reflective surfaces (see Figure B2 below).

A windshield was fitted to the microphone to minimise the effects of wind-induced noise across the microphone diaphragm.

**Figure B2: Unattended measurement location L1 (looking north and south respectivly)**

**Environment and Observations:**

As the noise loggers were installed during the daytime, construction noise arising from the Barratt Homes site and the area to the south of the B5790 (being developed for residential dwellings) was prevalent. However, besides construction noise, the local noise climate was dominated by local road traffic noise particularly from Sundon Road. Distant road traffic noise arising from the A5 to the north and the M1 to the east was also occasionally noticeable.

### B.3.2 Location A2

**Date and Time:**

Friday 08/07/22 11:21 to Wednesday 13/07/22 10:43[1]

**Location description:**

The logger was positioned to the south of the B5790 approximately 9m from the closest kerb of the B5790 and the microphone was supported approximately 1.5m above local ground. (see Figure B3 below).

A windshield was fitted to the microphone to minimise the effects of wind-induced noise across the microphone diaphragm.

Figure B3: Unattended measurement location L2 (looking east and south respectivly)

**Environment and Observations:**

At Location L2, as previously noted, construction noise arising from the Barratt Homes site to the west and the site area immediately to the south-west of the measurement location (being developed for residential dwellings) was prevalent.

Besides construction noise, the local noise climate at this location was dominated by local road traffic noise particularly from the B5790. Distant road traffic noise arising from the A5 to the north and the M1 to the east was also occasionally noticeable.

## B.4 Measurement Results

The measured data for the unattended surveys are presented in Figures B4 and B5 respectively.

[1] A survey at location L2 was previously carried out during the same survey period as location L1 (detailed in section B.3.1). However, due to an equipment malfunction, the data was not recoverable and therefore the survey needed to be repeated.

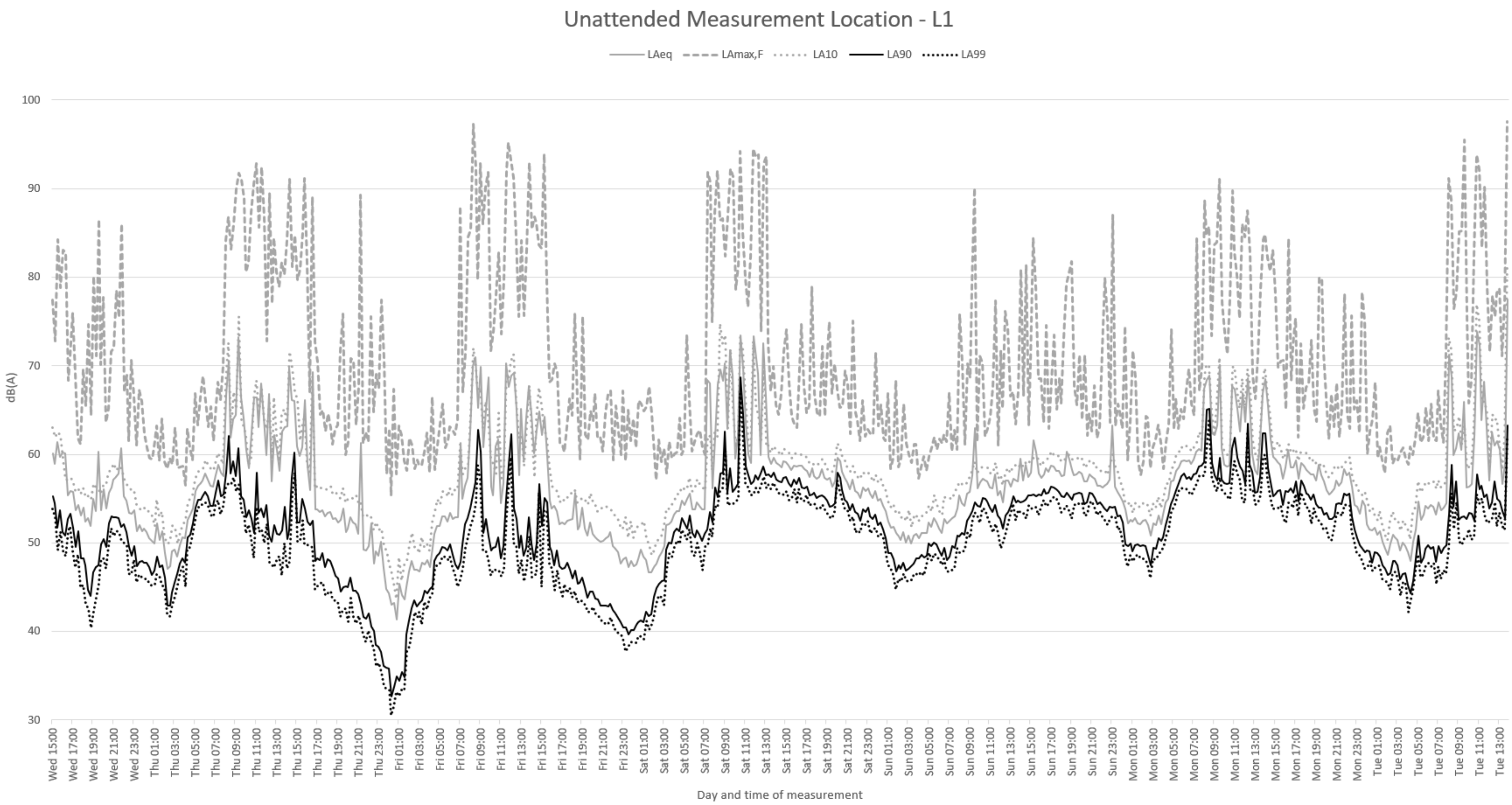


**Figure B4: L1 measurement results**

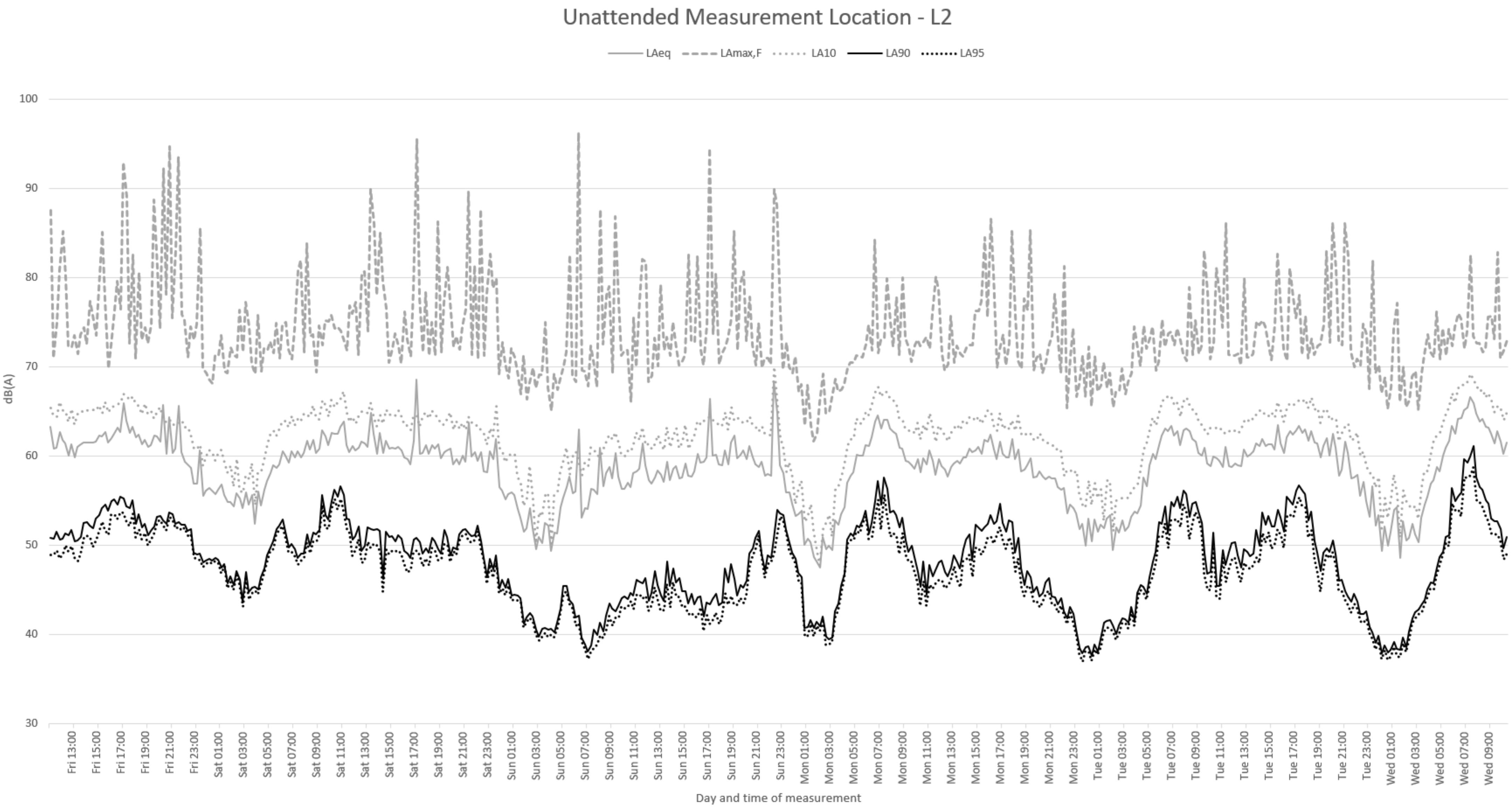


**Figure B5: L2 measurement results**