Powys County Council

NORTH POWYS BULKING FACILITY

Noise Assessment

70109458
MAY 2024

PUBLIC

Powys County Council

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Noise Assessment

NOISE ASSESSMENT (FOR ISSUE) PUBLIC

PROJECT NO. 70109458

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1 INTRODUCTION

1.1 INSTRUCTION

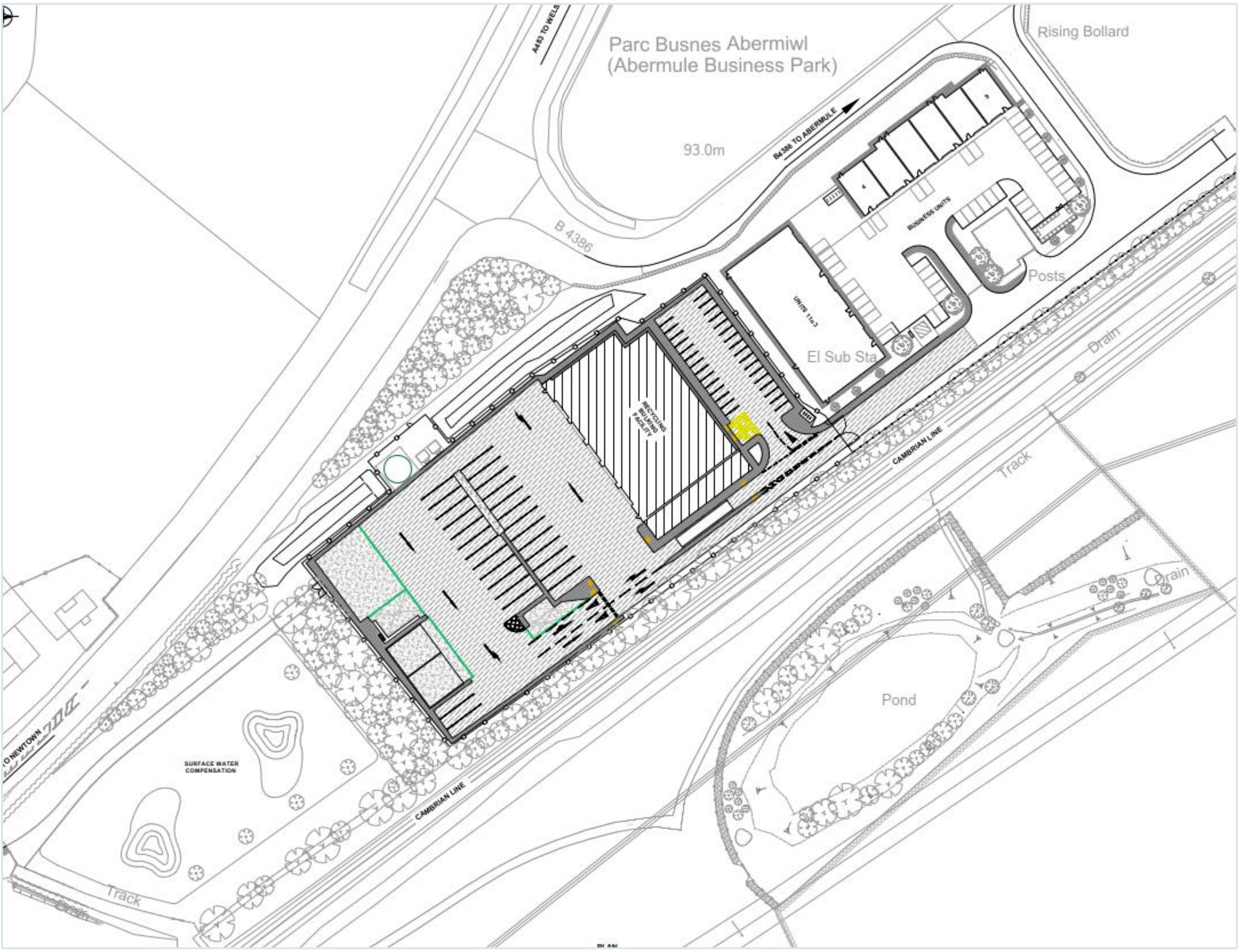
1.1.1. WSP has been instructed by Powys County Council ('PCC') to undertake the noise impact assessment ('NIA') required under the environmental permit (reference EPR/CB3991ZT) for the North Powys Bulking Facility ('NPBF') issued by Natural Resources Wales ('NRW') on the 31 July 2023.

1.2 NORTH POWYS BULKING FACILITY

1.2.1. The NPBF is located on the south-west half of the Abermule Business Park which was granted hybrid planning permission by PCC in October 2019 (PCC reference P/2018/0587). The NPBF received detailed permission with the remainder of the Business Park (the north-east part) granted permission in outline. The north-east part of the Business Park is being developed in two phases, with the first now complete, and part occupied, and the latter still under construction.

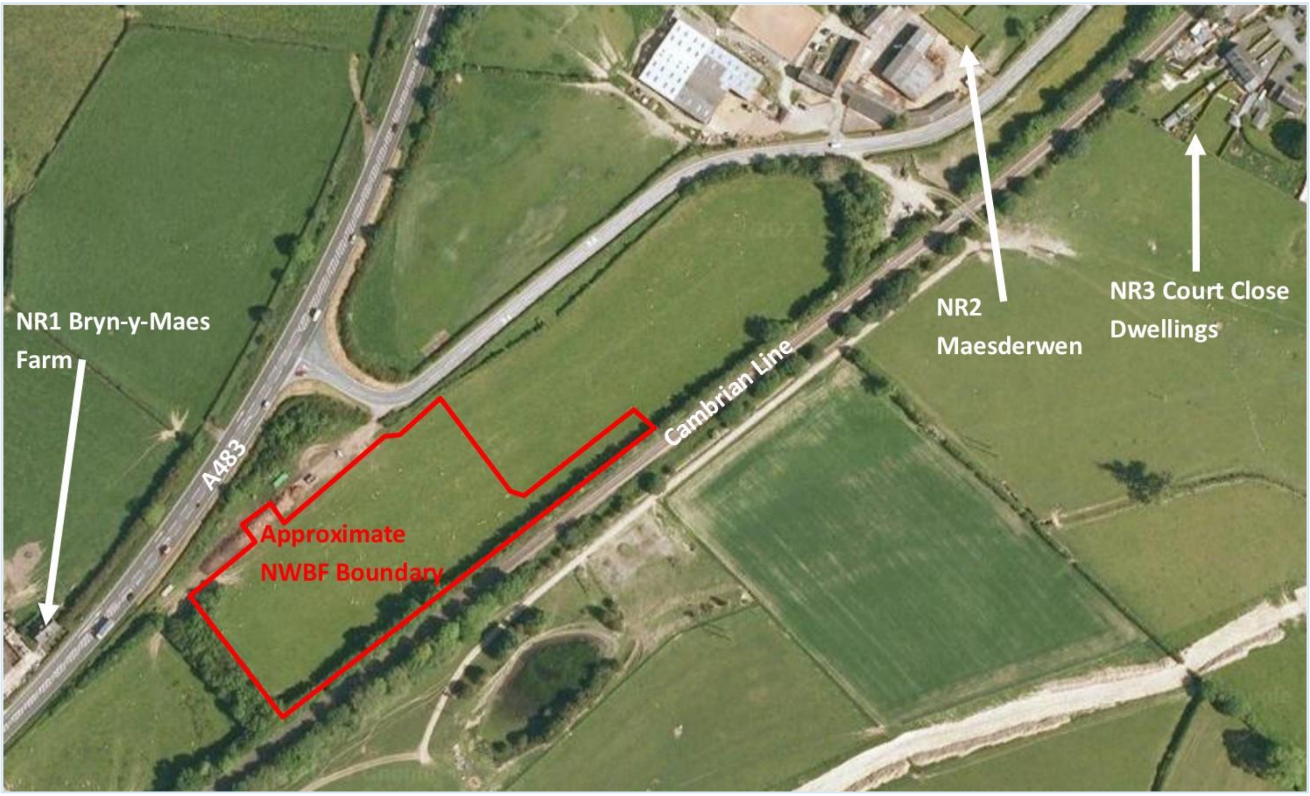
1.2.2. The NPBF is bounded by the Cambrian Line to the south-east and the A483 to the north-west. The remainder of the Business Park is to the north-east and agricultural land to the south-west. The overall layout of the site, as shown in the 2018 planning application, is shown in Figure 1-1.

Figure 1-1 – Overall site location and layout



1.2.3. The approximate extent of the permitted process and the three closest noise receptor (NR) locations are shown in Figure 1-2.

Figure 1-2 – Site extent and noise receptor locations



1.3 THE ENVIRONMENTAL PERMIT

1.3.1. The environmental permit ('the permit') is a Tier 3 bespoke permit for a non-hazardous waste transfer facility and requires the operator to manage activities in accordance with an approved written management system. That management system is set out in the PCC document 'North Powys Bulking Facility Operating Techniques Document' (project code COL202-155, dated June 2022).

1.3.2. The 'noise limit' condition is presented at section 3.3.1 of the permit and is reproduced below:

'Emissions from the activities shall be free from noise and vibration at levels likely to cause pollution outside the site, as perceived by an authorised officer of Natural Resources Wales, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved noise and vibration management plan to prevent or where that is not practicable to minimise the noise and vibration.'

1.3.3. Requirement IPC4 of Schedule 1 of the permit sets out the requirements for the NIA and is reproduced below:

'Following successful commissioning and establishment of routine steady operation, the Operator shall undertake a noise impact assessment following BS4142:2014 and guidance set out in Noise and Vibration Management: Environmental Permits. The assessment should include an objective

assessment of narrow band (FFT) measurements to identify any tonal elements from on-site sources and off-site at sensitive receptors.

The assessment should include consideration of the Welsh Government's Noise and soundscape action plan 2018-2023.

Upon completion of the work, a written report shall be submitted to Natural Resources Wales for approval. Within 6 months of the date of the permit being issued.'

1.3.4. This NIA is necessarily technical in nature, and, for that reason, a glossary of acoustic terms is provided at **Appendix A** for the convenience of the reader.

2 GUIDANCE AND STANDARDS

2.1 APPLICABLE GUIDANCE AND STANDARDS

2.1.1. The two documents most relevant to the NIA are BS 4142[1] and the document Noise and vibration management: environmental permits ('the EA guidance')[2] which is applicable in all UK regions including Wales. The IPC4 condition also refers to the Welsh Government's Noise and soundscape action plan 2018-2023 although that document largely references BS 4142 and the 'Horizontal Guidance Note' IPPC HE (the latter having been replaced by the EA guidance) and has limited relevance to the assessment methodology in this NIA.

2.2 BS 4142

2.2.1. This Standard provides an assessment method for noise arising from commercial noise sources, including external plant, on-site vehicle movements and unloading, at residential receptors. It is a relative assessment approach whereby the predicted commercial sound level (suitably penalised for potentially annoying characteristics, if appropriate) is compared with the prevailing background sound level. A summary of the BS 4142 approach is set out below.

- Establish the specific sound level of the source(s).
- Measure the representative background sound level.
- Correct the specific sound level for on-time and any noise contributions from unrelated sources if necessary.
- Rate the specific sound level to account for distinguishing characteristics.
- Estimate the impact by subtracting the background sound level from the rating level.
- Consider the initial impact estimation in the context of the noise and its environs.

2.2.2. Where the sound source is not yet present, the specific sound level is established by calculation.

2.2.3. The representative background sound level is established by measurement at the receptor location, or at a suitable alternative location.

2.2.4. The specific sound level is rated using the feature corrections set out below:

- Tonality up to 6 dB
- Impulsivity up to 9 dB
- Other sound characteristics up to 3 dB
- Intermittency 3 dB

[1] BS 4142 :2014+A1:2019 Methods for rating and assessing industrial and commercial sound.
[2] Environment Agency Guidance Noise and vibration management: environmental permits. 31 January 2022

2.2.5. An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level as described in section 11 of BS 4142. The results of this comparison are assessed on the basis of the following guidance:

- Typically, the greater the difference, the greater the magnitude of the impact.
- 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.

2.2.6. All pertinent contextual considerations should be taken into account including the following:

- The absolute level of the sound.
- The character and level of the residual sound compared to the character and level of the specific sound.
- The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.

The reporting requirements for the standard include details of how assessment uncertainties were considered and minimised and the qualifications and experience of acousticians involved in the assessment. These details are presented at **Appendix B** and **Appendix C** respectively.

2.3 NOISE AND VIBRATION MANAGEMENT: ENVIRONMENTAL PERMITS

2.3.1. This guidance produced by Natural Resources Wales in conjunction with the EA, SEPA and Northern Ireland EA, last updated in January 2022, states that NIAs should be carried out by competent personnel who should use BS 4142 to quantify the noise impact from industrial processes.

2.3.2. Four steps are then suggested as follows:

1) Desktop risk assessment to identify potentially noisy plant and/or operations and rank them in terms of potential impacts at identified receptors.
2) Off-site monitoring survey and observations at NRs based on BS 4142.
3) Source assessments to quantify emissions from critical plant and/or operations to estimate the impact of these sources at NRs.
4) Demonstrate that BAT or other appropriate measures are being used to prevent or minimise noise impacts.

2.3.3. Guidance is also provided on how some of the principles of BS 4142 should be applied in the assessment.

2.3.4. A soundscape assessment is also now a requirement of the guidance and necessitates a contextual review of various acoustic and non-acoustic factors.

2.4 METHOD IMPLEMENTATION DOCUMENT (MID) FOR BS 4142

2.4.1. This Department of the Environment guidance, produced by the ‘environment agencies’ of England, Wales and Northern Ireland, provides additional guidance on how BS 4142 should be implemented in the assessment of noise from permitted processes.

2.4.2. Important points set out in the MID include:

- The importance of soundscape in the contextual assessment
- The importance of field calibration testing
- The need to ensure that wind speed and direction is suitably measured and recorded
- The priority of subjective character evaluation (at the assessment location) over objective assessment methods.

3 DESKTOP ASSESSMENT

3.1 PREVIOUS ASSESSMENTS

3.1.1. There are two previous noise reports and an addendum that are relevant to the desktop assessment. These are:

1) The Hybrid Planning Application NIA – WSP report number 70032991-NV1-02-R1, dated June 2018 ('the WSP report').
2) The Hybrid Planning Application NIA addendum – WSP, dated June 2018 ('the WSP planning addendum').
3) The Environmental Permit Application – Noise Impact Assessment and Noise Management Plan. SRL Consulting Ltd, report no. 416.00798.00038, dated June 2022 ('the SLR report').

3.1.2. With respect to the identification of potentially noisy plant and/or operations, the latter report is the most relevant as it is much more recent, so operational plans for the NPBF were more detailed and advanced.

3.2 IDENTIFICATION OF NOISE SOURCES

3.2.1. The noise sources identified in the SLR report were broadly correct but have been updated below following discussions with the operator:

1) Glass deposition in a three-sided bay on the site (Figure 3-1). This occurs numerous times each day.
2) Management of the glass stockpile. This involves the telehandler scooping or pushing the spread of glass back into the bay and occurs after every one or two deposits (Figure 3-2). It typically involves four 'cycles', each comprising a forward manoeuvre, 'scoop', and reverse, lasting around three minutes in total.
3) Glass collection, comprising the loading of an articulated lorry by the telehandler, in proximity to the glass bay. This usually occurs weekly, but occasionally two collections occur in the same week (typically around once every six weeks).
4) Deposition of materials in the bulking shed by Romaquips, stillage trucks and bulk vehicles. This happens relatively frequently throughout the working day.
5) Deposition of materials in the green waste bay by the green waste vehicles (in season).
6) Materials collection in the bulking shed, involving the top loading of articulated lorries with materials by the telehandler (Figure 3-3) with noise escape predominantly via the doors, although some also escapes via the building louvres. Loading an articulated lorry usually takes around forty minutes but may take up to an hour.
7) Vehicles and plant accessing/leaving the site.
8) A jet wash for cleaning the vehicle fleet (Figure 3-4). This was broken at the time of the site visit, so measurements of the sound level were not possible. WSP library data has been used to inform the assessment of this source.

3.2.2. Based on information provided by the operator, the following vehicular activity is typical on Monday to Friday.

- Domestic refuse (2 x 26 tonne and 2 x 15 tonne lorries) park at the site but do not tip.
- Trade recycling – (2 x 26 tonne lorries) occasionally use the site but are based at the other depot (Rhayader)
- Street cleaning caged tippers (Figure 3-5) – 7 vehicles park at the site but do not tip.
- Romaquips (8 large – see Figure 3-6 – and 3 small lorries – Figure 3-7). There are 11 – 19 deliveries daily with the small lorries tipping only once and the large lorries tipping either once or twice depending on each day's collection route.
- Green waste (1 x 26 tonne, 1 x 15 tonne) – 2 deliveries April to September only. These were not active during the survey.
- Plant and go, stillage (Figure 3-8) and bulk vehicles – 5 deliveries.

3.2.3. There are also two on-site mobile plant which are used for loading/unloading/stockpile management:

- A telehandler (Figure 3-9).
- A teletruck (Figure 3-10).

3.2.4. Both the SLR report and the WSP report included three-dimensional digital noise modelling based on the operational information available at that time. The sound sources adopted in the modelling were based on measurements undertaken at the Brecon Waste Transfer Station by WSP in February 2018. The full details of those measurements are presented in Appendix D of the WSP report.

3.2.5. The three-dimensional modelling presented in the WSP report included a source apportionment exercise which quantified the relative energy contributions from the four most significant noise sources, along with a description of the noise character and estimated audibility of each at the closest receptor (Bryn-y-Maes). The results of the exercise are presented in Table 3-1 below.

Table 3-1 – Main noise sources ranked with respect at NR1 (Bryn-y-Maes)

Noise source	Worst-case specific source noise contribution $L_{Aeq,1h}$	Noise character	Estimated audibility
Bay doors	56 dB	Broadband, steady	Barely audible during traffic passes; slightly audible during lulls in traffic
Mobile loader white noise alarm	53 dB	Impulsive, repetitive	Barely audible during traffic passes; slightly audible during lulls in traffic
Glass deposit	49 dB	Tonal, impulsive	Distinguishable for short periods during activity
Mobile loader manoeuvring	40 dB	Intermittent	Likely to be inaudible over ambient sound and other noise sources

3.2.6. NR1 is by far the closest NR to the primary noise sources, at around 65 m from the closest activity areas. The intervening area comprises arable land and the A483, with the A483 slightly higher than the land to either side.

3.2.7. NR2 and NR3 are significantly further away (around 319 m and 400 m respectively) and have no direct line of sight to the noise sources, being screened by the newly constructed business units.

3.2.8. The B4386 also runs between the NPBF and NR2, which also benefits from some local screening from adjacent farm buildings. The Cambrian railway also runs between the NPBF and NR3 with some agricultural land also intervening. The closest noise sensitive elements of NR3 comprise the back gardens of some of the houses on Court Close which, under some circumstances, may be less sensitive than the dwellings themselves.

Figure 3-1 – The glass bay

Figure 3-2 – Telehandler managing the glass stockpile

Figure 3-3 – Telehandler loading a bulk lorry with food waste in the shed

Figure 3-4 – The jet wash bay

Figure 3-5 – A caged tipper

Figure 3-6 – A large Romaquip

Figure 3-7 – A small Romaquip

Figure 3-8 – A stillage truck

Figure 3-9 – The telehandler

Figure 3-10 – The teletruck

3.3 ASSESSMENT STRATEGY

3.3.1. Based on the desktop assessment and discussions with the operator, the monitoring strategy was developed as follows:

- Undertake site assessment when the noisiest activities are anticipated – to include HGV collections of waste from inside the shed and from the glass bay (the glass collection programmed for the 10 January 2024 was cancelled on the day due to a lorry break-down, so the loading was simulated for measurement purposes).
- Make simultaneous attended sound level measurements at different distances from plant and activities.
- Make audio recordings of activities, to enable reference methods to be applied on analysis if necessary.
- Make simultaneous sound level measurements with audio samples at the closest assessment locations.
- Measure the weather conditions at the closest assessment location and wind speeds at the on-site measurement location.

4 HISTORICAL SURVEY DATA

4.1.1. Baseline sound level surveys were undertaken as part of both previous assessments (WSP 2017 and SLR 2020). The historical background sound level data derived from these surveys are important to check that the adopted background sound levels are not significantly affected by noise from the operation being assessed. As these surveys both took place before the NPBF was constructed or operational, the monitoring data were clearly unaffected.

4.1.2. Relatively long term (>24 hours) monitoring has been undertaken at four locations which are shown in Figure 4-1 and summarised in Table 4-1 below.

Figure 4-1 – Historical long-term background monitoring locations

Table 4-1 – Historical background surveys and adopted sound levels

Monitoring position (MP)	MP Name in original report	Representative of receptor	Dates
WSP1	1	NR1 Bryn-y-Maes	11/05/2017 – 18/05/2017
WSP2	3	NR3 Court Close	11/05/2017 – 12/05/2017
SLR1	MP1	NR2 Maesderwen	04/09/2020 – 08/09/2020
SLR2	MP2	NR1 Bryn-y-Maes	28/08/2020 – 01/09/2020

4.1.3. The background sound level representative of the operating hours of the NPBF is derived based on the range of values observed at receptor locations. The distribution of 15-minute background sound levels ($L_{A90,15m}$) measured at each of the monitoring locations between 08:00 and 18:00 Monday to Friday are shown in the following figures.

Figure 4-2 – Distribution of background sound levels at (a) WSP1 and (b) WSP2

(a) **(b)**

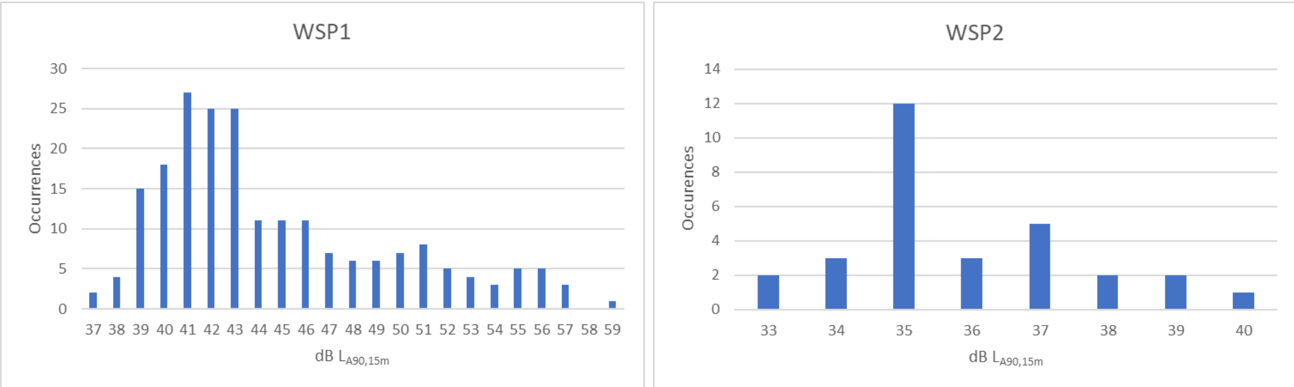
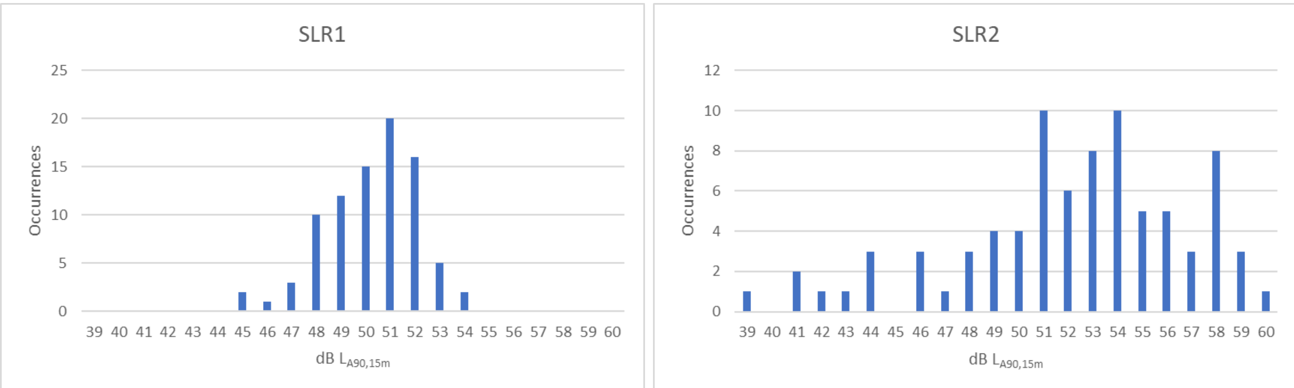


Figure 4-3 – Distribution of background sound levels at (a) SLR1 and (b) SLR2

(a) **(b)**



4.1.4. The mode (most commonly occurring) and mean (arithmetic average) values for each monitoring location based on the historical monitoring are presented in Table 4-2.

Table 4-2 – Background sound levels derived from historical survey data

Monitoring Position	Mode dB $L_{A90,15m}$	Mean dB $L_{A90,15m}$
WSP1	41	45
WSP2	35	36
SLR1	51	50
SLR2	51 – 54	52

4.1.5. Monitoring positions WSP1 and SLR2 are both in proximity to NR1 but the sound levels measured at those two locations vary significantly. This is thought to be because WSP1 was set back from the road and partially screened from road traffic noise by the dwelling itself. Given that the data gathered at SLR2 are more recent and the good agreement between the SLR2 and the WSP 2024 measurement (explained in the following section), the SRL data have been relied on in the derivation of the background sound level for NR1 below.

4.1.6. Based on the historical data the following background sound levels could be adopted for each of the three Noise Receptors for the NPBF operating hours:

NR1	54
NR2	50
NR3	36

5 NOISE SURVEYS 2024

5.1 DESCRIPTIONS OF MEASUREMENTS

5.1.1. Attended on-site and unattended off-site measurements of sound levels and meteorological conditions were made over a period of 24 hours on the 10 and 11 January 2024.

5.1.2. The period was selected due to an acceptable weather forecast, the anticipated loading of all types of articulated lorries on the 11 January and local residents being available for installations.

5.1.3. Off-site measurements were made at Bryn-y-Maes (ML1) and Maesderwen (ML2).

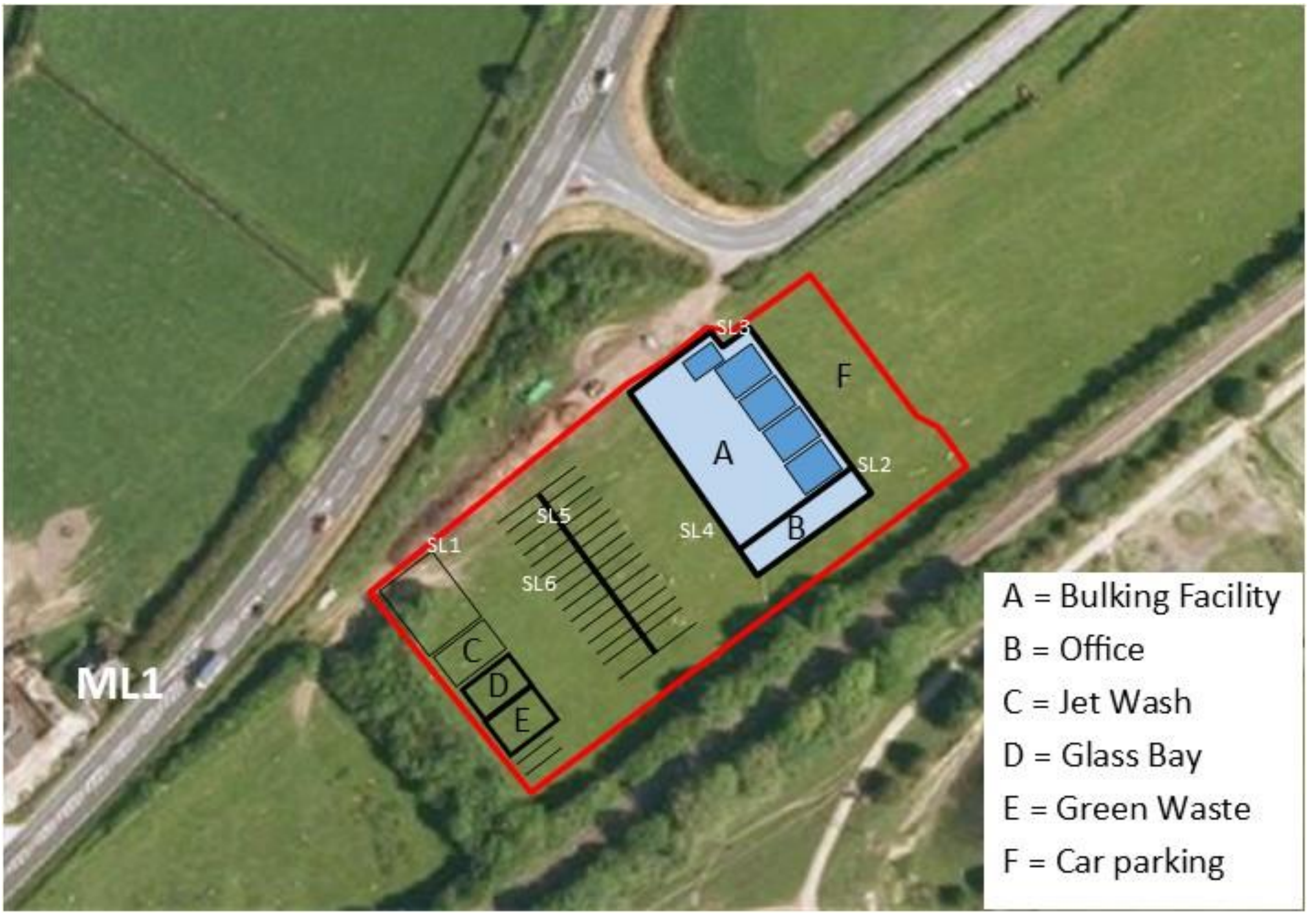
5.1.4. On-site measurements were made at six locations, with one (SL1) almost continuous measurement and five shorter term largely attended measurements (SL2 – SL6).

5.1.5. All of the sound instrumentation equipment used to make the measurements was class one and with in-date calibration certification. The equipment is listed in **Appendix D**.

5.1.6. The off-site locations are indicated on the aerial photograph at Figure 5-1 and the on-site locations on the drawing at Figure 5-2.

Figure 5-1 – Aerial view of the off-site monitoring locations

Figure 5-2 – Plan showing the on-site monitoring locations



BRYN-Y-MAES (ML1)

5.1.7. The sound level meter was set up in the front garden of the property, with the microphone mounted on an extended tripod to ensure that the microphone height was higher than the garden wall and had an unobstructed line of sight to the NPBF. The assembled system was subject to a field calibration test prior to starting the measurement run at 13:30. The system was configured to fast log sound levels and to capture an audio sample of 1 minute duration every fifteen minutes.

5.1.8. The microphone was located around 4 m from the front wall of the house and around 1.5 m back from the garden wall.

5.1.9. A logging weather station was also set up immediately adjacent to the front garden of the property (to the south). The locations of both the sound level meter and the weather station can be seen in the aerial photographs above and in the photograph at Figure 5-3.

5.1.10. Road traffic noise was strongly dominant at this location, with the very frequent vehicle passes correlating with maximum levels of around 80 dB(A). The vehicle passes were frequent but not constant. Discussions with the occupier indicated that noise from the NPBF was occasionally audible but was not significant in comparison to the road traffic noise.

5.1.11. The system was collected on 11 January at 15:44 at which time it was found to be as left and operating normally. It was subjected to a calibration drift check prior to disassembly which indicated drift of 0.10 dB had occurred during the measurement run. That level of drift is insignificant and indicative of a well performing measurement system.

5.1.12. The measurement data and audio records were downloaded immediately on return to the office and retained unaltered on a secure network drive.

Figure 5-3 – The monitoring location at Bryn-y-Maes (ML1)

MAESDERWEN (ML2)

5.1.13. A class 1 integrating sound level meter was first set up in the lawned garden to the east of the dwelling before being moved, at the request of the resident, onto an area of decking to the south of the dwelling.

5.1.14. The system comprised a sound level meter, extension cable and tripod mounted microphone. The microphone was 3.5 m away from the retaining wall adjacent to the house and the wall of an outbuilding in a relatively sheltered location. The assembled system was subject to a field calibration test prior to the measurement run starting.

5.1.15. Distant road traffic was the main contributor to sound levels with birdsong also contributing at times. Discussions with the occupier indicated that noise from the NPBF was not generally audible but the noise from glass deliveries into the glass bay were sometimes discernible.

5.1.16. The system was collected on the 11 January at 15:50 at which time it was found to be operating normally. It was subjected to a calibration drift check prior to disassembly which indicated a drift of -0.14 dB, which is insignificant.

5.1.17. The measurement data and audio records were downloaded immediately on return to the office and retained unaltered on a secure network drive.

Figure 5-4 – The monitoring location at Maesderwen (ML2)

SL1

5.1.18. SL1 was a partially unattended monitoring location which was virtually static for the duration of the monitoring exercise.

5.1.19. As shown in Figure 5-5, it was set up in on the north-west boundary of the NPBF site, around 18 m from the south-west boundary. The microphone was field calibrated and mounted just above the height of the site fencing, at 2.5 m above ground level.

5.1.20. SL1 was selected following discussions with the operator, to be remote from commonly occurring noisy activities and to assist in the derivation of sound power levels and calibrating the noise propagation model.

5.1.21. SL1 had an unobstructed line of sight to the roller doors of the bulking facility (65 m). It was also 10 m from the closest point of the route for vehicles driving around the one-way system (which is anti-clockwise around the HGV parking bays shown in Figure 5-2). It was also located on a direct line between the NPBF shed and ML1. It had a direct line of sight to the entrance to the glass bay (40 m) but activities actually within the glass bay were screened from SL1 by the concrete side walls of the bay.

5.1.22. The SL1 microphone was partially screened from road traffic on the nearest section of the A483 by the earth bund to the north-west, which was estimated to be slightly above 2 m in height. This helped to reduce extraneous noise (particularly the maxima from passing road traffic), to minimise interferences with the measurement of site noise. Road traffic noise levels, in terms of dB $L_{Aeq,T}$, were noted, immediately following installation, to be ranging between the high fifties and mid-sixties.

5.1.23. Sound levels and audio recordings of various site activities were captured at SL1, time synchronised with roaming measurements (SL2 and SL4 – 6), detailed observations and contemporaneous notes.

These allowed noise sources and measurement distances to be identified and provided information on sound levels, sound character and propagation.

5.1.24. The SL1 installation is pictured from the south in Figure 5-5 and from the south-west in Figure 5-6.

Figure 5-5 – SL1 Photographed from the south

Figure 5-6 – SL1 Photographed from the south-west

5.1.25. The SL1 measurement run was started on 10 January at 15:12 with continuous audio running until 16:12. The instrument deployed at SL1 was briefly relocated (to SL3) between 07:55 and 08:05 on the 11 January without pausing the measurement run. The measurement run was terminated on 11 January at 15:20 at which time a system calibration drift of -0.12 dB was noted (insignificant).

SL2 AND SL3

5.1.26. SL2 and SL3 were used for partially attended, short, measurements of steady fan noise.

5.1.27. The extraction fans on the north-east elevation of the Bulking Facility building only operate twice a day (at around 06:30 and 17:30), for an hour or two on each occasion. There are five extraction fans, all on the north-east building elevation. Four are located on the main elevation and a fifth on the most northerly section (next to SL3 as shown in Figure 5-8).

5.1.28. SL2 was located at 10 m horizontal distance to the east from the most southerly of the fans, at an angle of 45° from it with the microphone tripod mounted at a height of 1.3 m The sound level meter is shown in Figure 5-7, pictured from the south-east.

5.1.29. SL3 was positioned directly in front of the most northerly fan, at a horizonal distance of 6 m, with the microphone tripod mounted at a height of 1.3 m. SL3 is pictured from the north-east in Figure 5-8.

5.1.30. The measurement at SL2 was started at 07:51 and was terminated at 08:22 on the 11 January. The sound level meter was subjected to a field calibration check before and after the measurement, which indicated no measurement drift.

5.1.31. The ambient sound level at SL2 was influenced by various sources but the background sound level ($L_{A90,T}$) was very steady and provided an accurate measure of the acoustic energy from the fans, which was 54 dB $L_{A90,T}$. The fan noise was steady, innocuous, and broadband in nature.

5.1.32. The measurement at SL3 started at 07:56 and finished at 08:05, when the instrument was returned to the SL1 location. Although the fan stopped for around 1 minute during the measurement, the sound level attributed to the fan, based on observation of the logged sound levels, was 58 dB $L_{A90,T}$.

5.1.33. It was noted that the noise from the fans was subjectively inaudible at a position 32 m to the north-east from the site access (around 50 m from the closest fan).

Figure 5-7 – SL2 Photographed from the south-east

Figure 5-8 – SL3 Photographed from the north-east

SL4

5.1.34. SL4 was located 5 m in front of the most south-easterly roller doors to the Bulking Facility building whilst the telehandler was top loading an HGV with plastics inside the building. The measurement commenced at 08:24 and was terminated at 08:42 at which time the sound level meter was checked for calibration drift with no drift observed. The loading operation proceeding continuously throughout the measurement duration.

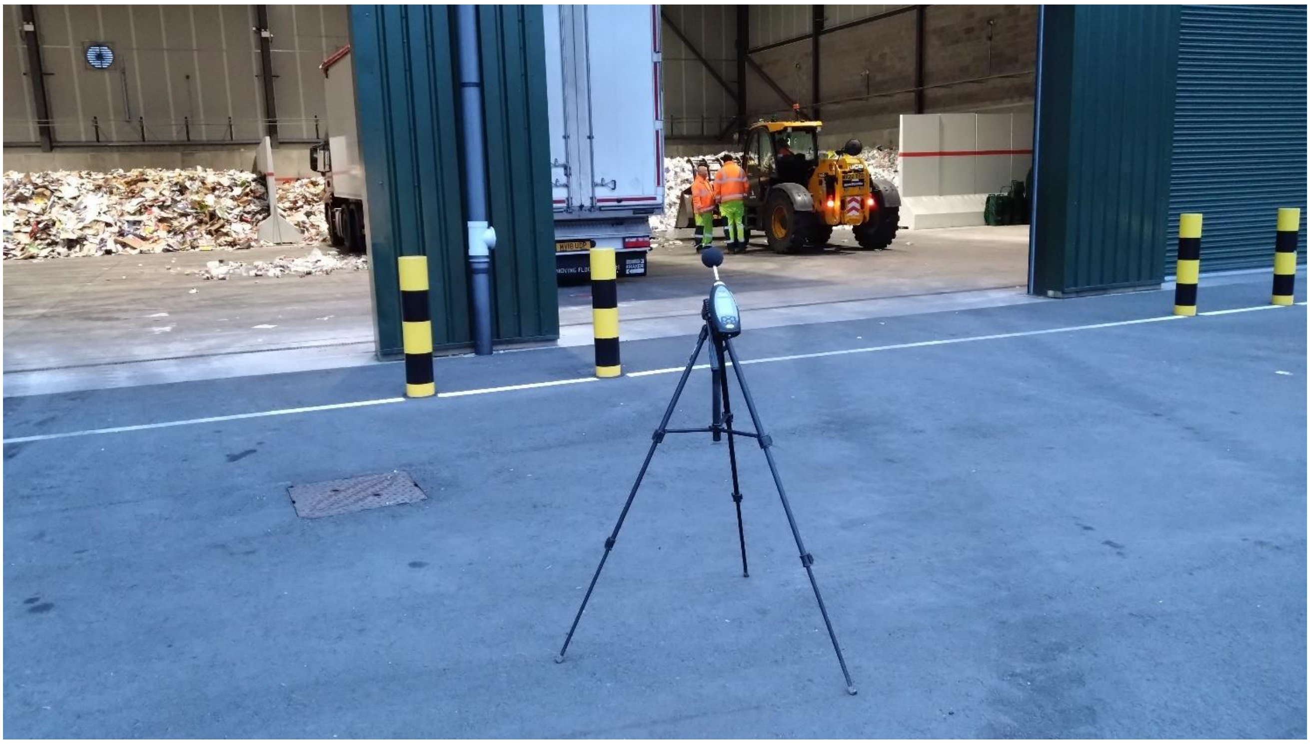
5.1.35. The telehandler was observed to be operating in a relatively steady pattern of around 1 minute in duration, comprising:

1) Driving into the plastics in the bay (20 seconds – 70 dBA at 25 m)
2) Shovelling the plastics (5 seconds – 70 dBA at 25 m)
3) Reversing out from the bay (18 seconds – 81 dBA at 15 m, directly behind vehicle, 78 dBA at 45° and 76 dB at 90°)
4) Driving forwards to the side of the HGV (5 seconds – 65 dB at 15 m)
5) Unloading the bucket into the HGV (15 seconds – 75 dB at 15 m)

5.1.36. It is important to note that the distances above are from the actual activity causing the noise (the 'direct' source), rather than the building opening (which was 5 m away). This is an important consideration as the building opening comprises the effective source of reverberant energy from within the structure, which will have contributed to the measured sound levels.

5.1.37. The SL4 measurement location is pictured in Figure 5-9, with the open doors, telehandler and HGV shown in the background. The overall sound level recorded during the measurement at SL4 was 76 dB $L_{Aeq,17m}$ which correlates extremely well with the equivalent sound level calculated from the repeating pattern described above.

Figure 5-9 – SL4 Photographed from the South-West



SL5

5.1.38. The sound level meter was relocated to SL5 at 08:43 and a new measurement was started. SL5 was located on an area of pavement in between the HGV parking bays, relatively centrally in the yard and on a line of sight between the ongoing loading operation, SL1 and ML1. It was 31 m back from the façade of the Bulking Facility building It is pictured in Figure 5-10 which also shows the tripod mounted anemometer which was deployed throughout the day.

Figure 5-10 – SL5 Photographed from the west

5.1.39. The plastics loading operation continued, with both southerly doors open, until 09:28 with the operational pattern noted above relatively continuous. The corresponding sound levels at SL2 were:

1) Driving into the plastics in the bay (20 seconds – 67 dBA at 55 m)
2) Shovelling the plastics (5 seconds – 70 dBA at 25 m)
3) Reversing out from the bay (18 seconds – 69 dBA at 45 m, directly behind vehicle and 64 dB at 90°)
4) Driving forwards to the side of the HGV (5 seconds – 65 dB at 55 m)
5) Unloading the bucket into the HGV (15 seconds – 65 dB at 55 m)

5.1.40. The sound levels observed at SL5 do not all correlate neatly with those recorded at SL4 as would be expected based on distance attenuation alone. This results from the variations in screening, reflections, and directivity effects caused by the building and the HGV. As for the measurements at

SL4, the sound levels calculated at SL5 based on the repeating pattern above correlate very well with the overall sound level measured during the loading operation at SL5, which was 67 dB $L_{Aeq,43m}$.

5.1.41. WSP were informed by the NPBF that the member of staff operating the telehandler during the measurements described above was relatively new and, for that reason, the individual manoeuvres and overall duration of the operation were more protracted than would normally be the case. The HGV plastics loading operation observed lasted a total of around one hour twenty minutes but would typically only take thirty to forty minutes.

5.1.42. The measurement at SL5 continued, with sound levels resulting from various on-site vehicle movements and activities recorded, until 11:46 when the measurement run was stopped so that the sound level meter could be redeployed at SL6.

5.1.43. The SL5 measurement was recommenced 12:00, following a calibration drift check that indicated 0 dB drift. The SL5 measurement location was attended throughout the afternoon, with notes maintained in relation to site activities, vehicle movements and sound levels. The measurement was finally terminated at 15:18 when it was subject to another calibration drift check which showed 0 dB drift.

SL6

5.1.44. SL6 was located in the middle of the pavement area in the centre of the yard, around 30 m to the north-east from the glass bay.

5.1.45. The measurement at SL6 was designed to capture the sound levels from the loading of an HGV with glass from the glass bay. Unfortunately, the lorry that was due make a bulk collection of glass on the 11 January broke down and the collection was cancelled on that day. For that reason, a glass collection was simulated by the telehandler repeatedly driving into the glass pile, raising the bucket to the maximum height (as if top loading an HGV) and then tipping the glass, from height, back onto the pile. It was thought that the simulation would have been noisier than an actual collection, as the drop height of the glass was higher than would otherwise be the case, and the noise from the glass impact was unscreened by the sides of the HGV.

5.1.46. SL6 is shown in Figure 5-11, pictured from the north, with the telehandler active in the background.

5.1.47. The simulated loading took place for a period of ten minutes with a repeating pattern as follows:

1) Drive into glass pile (5 seconds – 83 dB at 30 m)
2) Lift bucket to maximum height (7 seconds – 78 at 30 m)
3) Tip glass (7 seconds – 88 dB at 30 m)
4) Reverse (7 seconds – 83 dB at 25 m)

5.1.48. The sound level calculated at SL6 based on the repeating pattern described above correlates with the measured value of 81 dB $L_{Aeq,10m}$. The corresponding sound level logged at SL1 was around 13 dB Lower (68 dB $L_{Aeq,10m}$) which correlates well with the anticipated distance attenuation (2.5 dB) and screening from the bay wall (10 dB).

Figure 5-11 – SL6 Photographed from the north

5.2 AMBIENT, RESIDUAL AND BACKGROUND SOUND LEVEL RESULTS

5.2.1. Time history graphs of the wind speeds logged at ML1 and the synchronised fifteen-minute data sets (ML1, ML2, SL1, SL2, SL5) are presented at Figure 5-12 (wind speed), Figure 5-13 ($L_{Aeq,15m}$), Figure 5-14 ($L_{A90,15m}$) and Figure 5-15 (L_{AFmax}, logged every fifteen minutes).

5.2.2. The ambient, residual and background sound level data derived from the survey are presented in Table 5-1 and Table 5-2. The background sound levels adopted for the assessment are presented in Table 5-3. The residual sound levels derived for ML1, SL1 and SL5 (which have been used in source corrections), based on a combination of monitoring data and road traffic noise modelling, are presented in Table 5-4.

5.2.3. The sound levels derived for the specific sources on-site are presented in section 5-3.

Figure 5-12 – Wind speeds logged at ML1

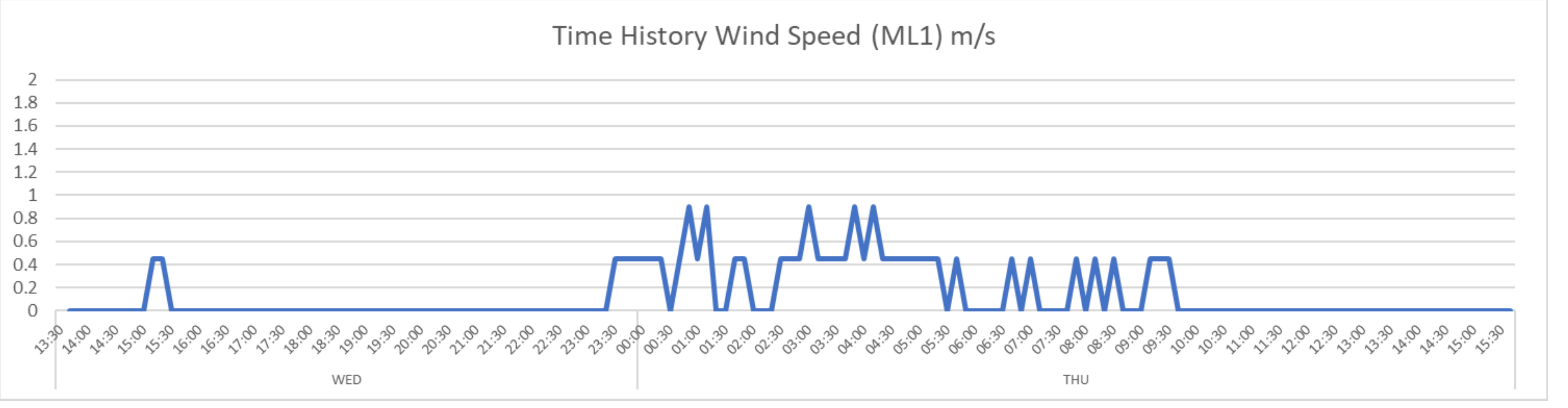


Figure 5-13 – Average sound levels, dB $L_{Aeq,15min}$

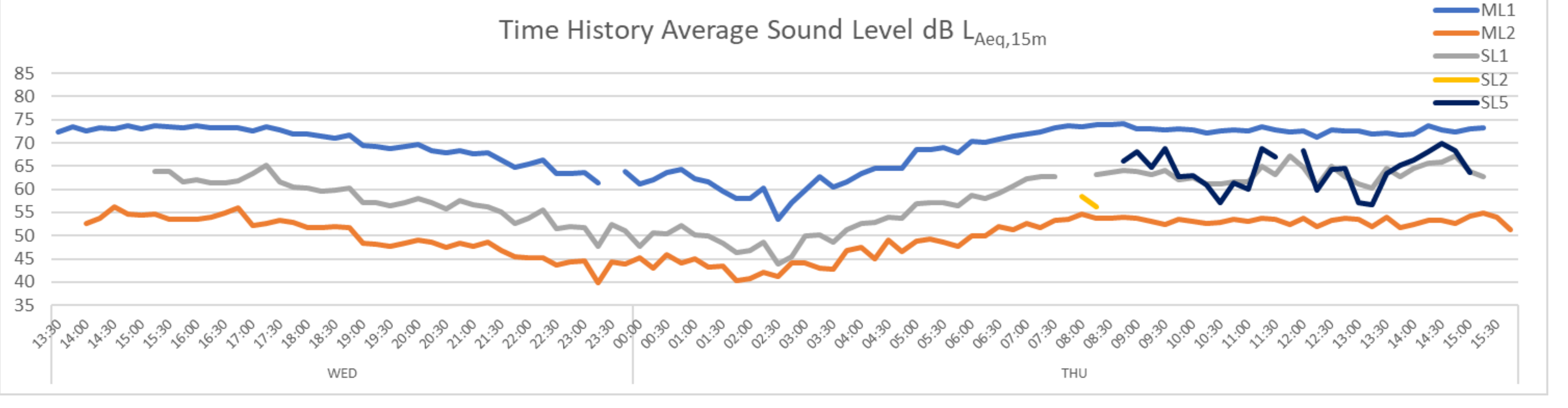


Figure 5-14 – Background sound levels, dB $L_{A90,15min}$

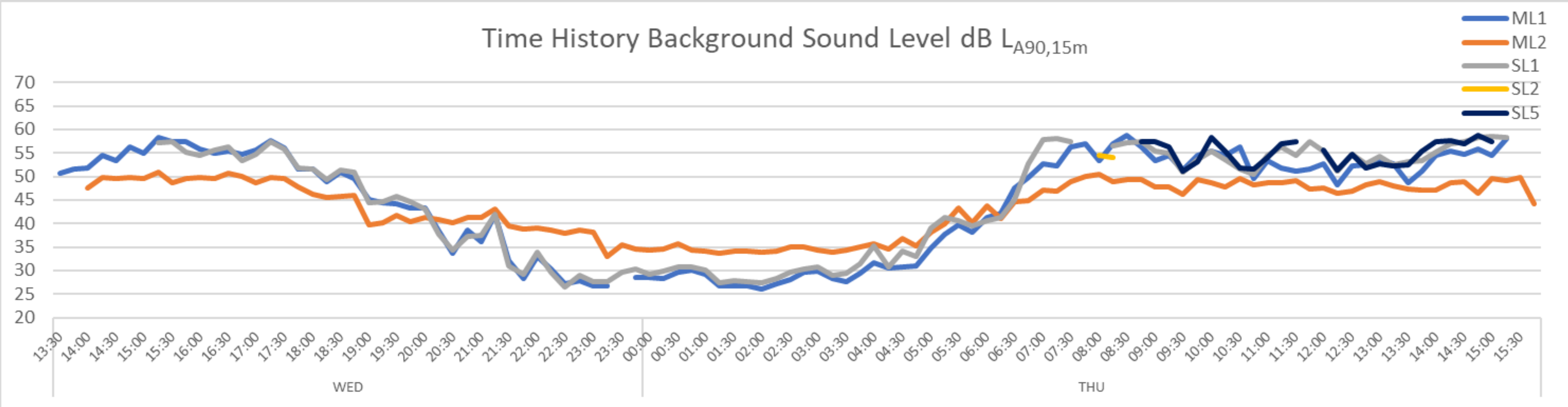


Figure 5-15 – Maximum sound levels logged every fifteen minutes, dB L_{AFmax}

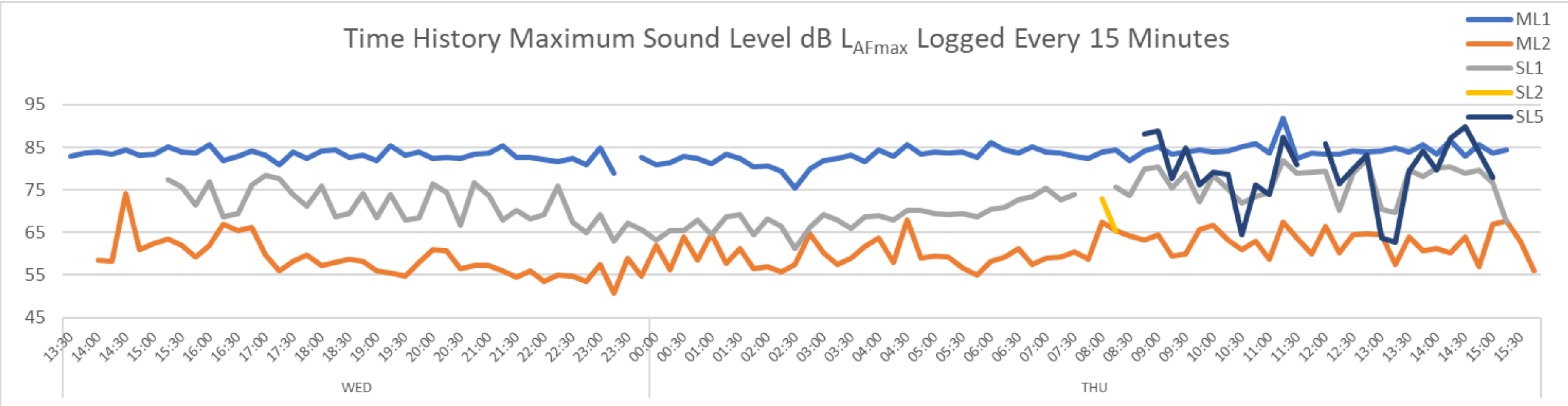


Table 5-1 – Ambient and Residual (Average) Sound Levels, dB $L_{Aeq,T}$

Monitoring Location	Ambient Sound Level Day (07:00-23:00)	Ambient Sound Level Operating Hours (07:30-16:00)	Residual Sound Level 'Shoulder periods'[1]	Adopted Residual Sound Level
ML1 (NR1)	72	73	72	73
ML2 (NR2)	53	54	53	53
SL1 (On-site)	62	64	61	62

Table 5-2 – Background Sound Levels[2], dB $L_{A90,T}$

Monitoring Location	Background Sound Level Day (07:00-23:00)	Background Sound Level Operating Hours (07:30-16:00)	Background Sound Level 'Shoulder periods'[1]	Adopted Background Sound Level
ML1 (NR1)	50	54	54	54
ML2 (NR2)	47	49	48	48
SL1 (On-site)	50	55	55	55

Notes to Tables

1) The 'shoulder periods' are the hour immediately before and after operations at the NPBF, taken as 06:30-07:30 and 16:00-17:00.
2) The background sound levels are taken as the arithmetic average of fifteen-minute values. A review of the cumulative distribution and mode values was undertaken for the daytime and operating hours, but there were insufficient data to do so for the shoulder periods.

5.2.4. The background sound levels adopted as representative from the 2024 data are broadly commensurate with those adopted based on the historical survey data. These data are compared, and the background sound levels adopted in this assessment are presented in Table 5-3 below.

Table 5-3 – Adopted Background Sound Levels For Receptor Locations, dB $L_{A90,T}$

Monitoring Location	Background Sound Level from Historical Data	Background Sound Level From 2024 Data	Adopted Background Sound Level
NR1	54	54	54
NR2	50	48	48
NR3	36	-	36

5.2.5. The residual sound levels (the average sound levels representative of operating hours, but in the absence of the specific sound) have been estimated from reviewing the monitoring data at ML1, SL1 and SL5 during lulls in site activity and predictions of road traffic noise levels from the A483, which is the dominant source at those locations. The agreement between the observed measured levels and the predicted road traffic noise are excellent, which permits a high level of confidence in the adopted residual levels. An extract of the road traffic noise plot is presented at Figure 5-16 and the summary data are presented in Table 5-4.

Figure 5-16 – Road Traffic Noise Level Predictions, dB L_{Aeq}, at 2 m Grid Height

Table 5-4 – Adopted Residual Sound Levels For Source Corrections, dB $L_{Aeq,T}$

Monitoring Location	Measured residual sound level	Predicted sound level based on A483 road traffic	Adopted residual sound level
ML1	73	73	73
SL1	62	62	62
SL5	57	57*	57

*The sound level for SL5 shown in Figure 5-16 was predicted at 2 m height, whereas the measurement height was actually 1.5 m, resulting in an over prediction. The SL5 receptor point prediction for the correct height is 57.0 dB.

5.3 DERIVATION OF SOURCE LEVELS

DISCOUNTED NOISE SOURCES

5.3.1. During the on-site observations and measurements, it was concluded that noise from on-site traffic movements, comprising light and heavy road vehicles and mobile plant movements, was insignificant beyond the site boundary. This was due to the relatively low level of noise generated by vehicle movements on-site and the dominance of noise from road traffic on the A483. Subjectively, it was impossible to identify 'normal' on-site vehicle noise from beyond the site boundary.

5.3.2. Noise from the fans on the north-east side of the bulking facility building was also determined to be insignificant. The noise from the fans is steady and without character. With all of the fans operating, the noise directly to the north-east (on the access road) was found to be inaudible at a distance of 32 m. Based on simple distance calculations the sound level attributable to the fans (with no screening or absorption taken into account) at NR2 and NR3 would be around 23 dB $L_{Aeq,T}$, which would be inaudible.

POTENTIALLY SIGNIFICANT NOISE SOURCES

5.3.3. Activities that were identified as sufficiently noisy to be potentially significant and comprise worst-case conditions were as follows:

1) Loading HGVs inside the NPBF building by telehandler, with the doors open.
2) Loading an HGV with glass, by telehandler in, and adjacent to, the glass bay (outside).
3) Jet washing vehicles.

5.3.4. Unfortunately, the jet washer was broken at the time of the on-site measurements, so library data have been used in the assessment of that source.

5.3.5. The sound levels from sources 1 and 2 have been quantified using the on-site measurements, as explained in section 5-1, and iterative three-dimensional modelling of the NPBF. Bespoke sound power data were adopted based on the model settings which could most realistically create the operational conditions and measured sound levels. The noise model plots showing the noise propagation predicted from the NPBF building and the loading of an HGV with glass are shown in Figures 5-17 and 5-18.

5.3.6. The sound level data derived for the respective sources are presented in Table 5-5. The noise modelling settings were as follows:

- CadnaA Version 2023 (64 Bit) (Build 195.5312)
- ISO 9613
- 1 order of reflection
- Default ground absorption 1.0 (soft)
- Ground absorptions for areas of hardstanding 0.01 (hard)
- Topography sourced from https://environment.data.gov.uk/survey
- Grid receiver spacing 1.0 m

Figure 5-17 – Loading inside the NPBF building with two doors open, dB $L_{Aeq,T}$

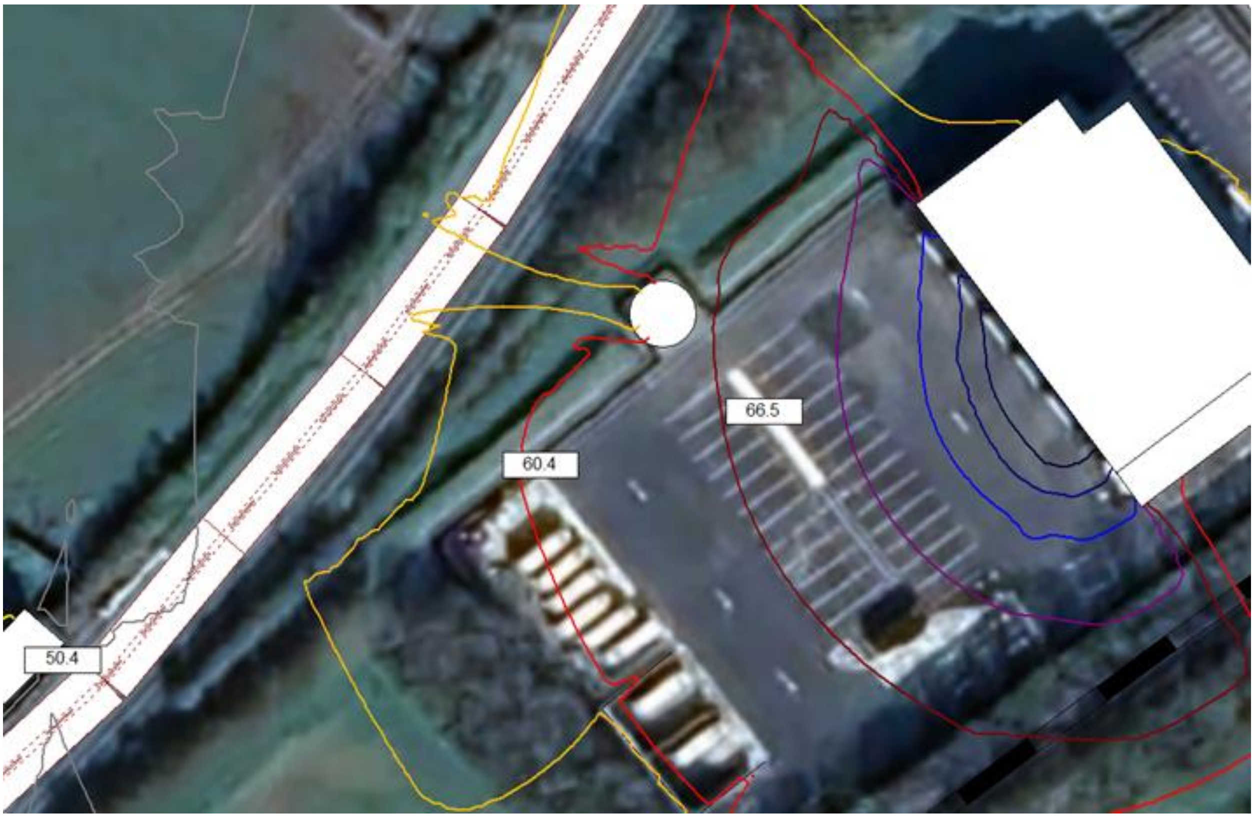


Figure 5-18 – Loading HGV with glass, dB $L_{Aeq,T}$

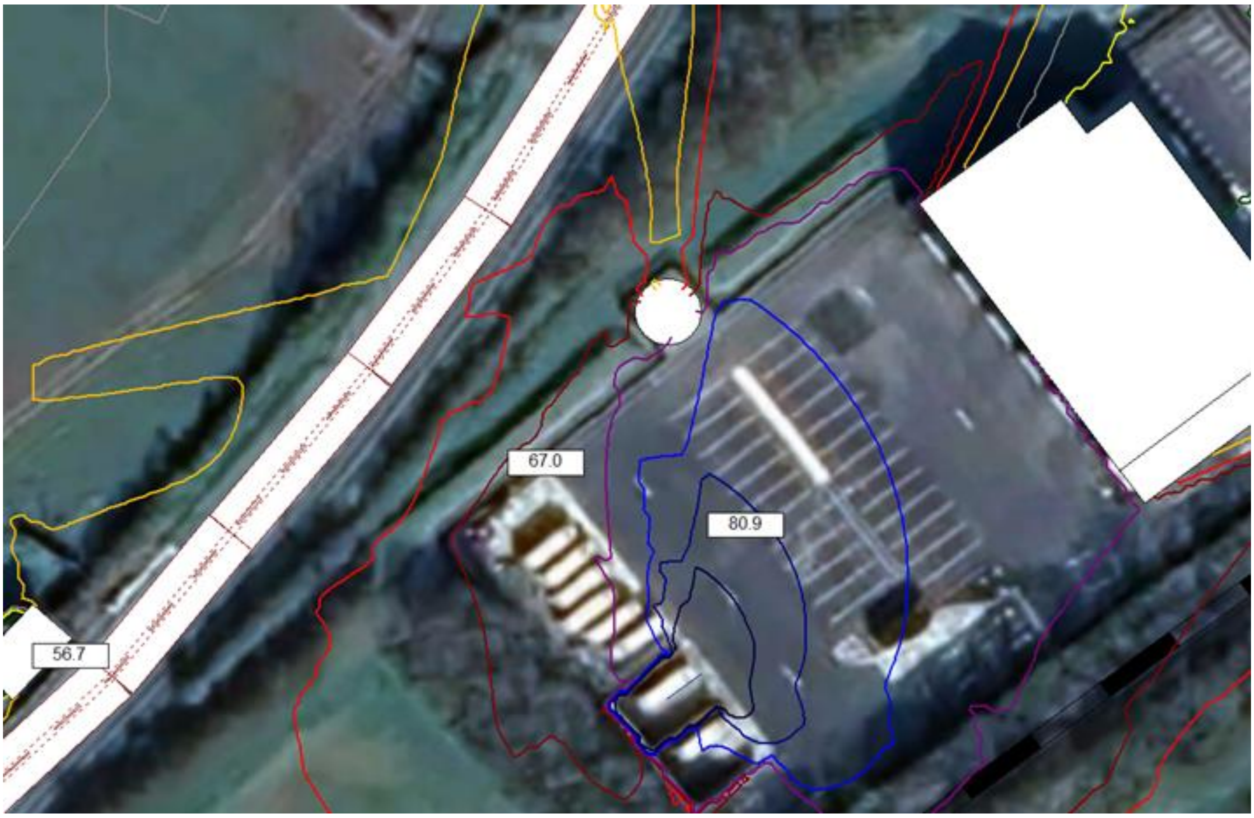


Table 5-5 – Source Levels, dB $L_{Aeq,T}$

Source	Measured Sound Level, dB $L_{Aeq,T}$	Distance (m)	Residual Sound Level, dB $L_{Aeq,T}$	Corrected Level, dB $L_{Aeq,T}$	Sound Power Level dBA	Predicted Sound Level, dB $L_{Aeq,T}$
1	67	45 / 55	57	67	116.5[1]	67
2(a)	81	25 / 30	57	81	115.0[2]	81
2(b)	68	38	62	67	115.0[2]	67
3	-	-	-	-	-	94

Notes to Table 5-5

1) Sound power level based on two vertical area sources positioned to represent two fully open doors (which assumes that the source of the sound is the doorway itself, rather than the activities within the building).
2) Sound power level based on a line source, 6 m in length, mostly within the glass bay, with a directionality factor applied to account for the position of the reversing alarm.

6 NOISE IMPACT ASSESSMENT

6.1 ASSESSMENT SCENARIOS

6.1.1. Loading bulk lorries within the NPBF occurs relatively frequently and may, occasionally, take a whole hour to complete.

6.1.2. Cleaning of vehicle exteriors using the pressure washer also takes place relatively frequently and could, potentially, take a whole hour.

6.1.3. Loading a bulk lorry inside the NPBF building and pressure washing vehicles in the washing bay, simultaneously and continuously for one hour, therefore comprises the noisiest combination of activities that might realistically occur in the same one-hour period on a daily basis. This combination is therefore adopted as a 'typical case' assessment scenario.

6.1.4. Bulk loading of lorries with glass adjacent to the glass bay (so, outside) typically occurs on a weekly basis. As there are usually two telehandlers on-site, it is possible that this activity could occur at the same time as the loading of another bulk lorry within the NPBF building and pressure washing of a vehicle. This combination is therefore adopted as a 'worst case' assessment scenario.

6.1.5. The noise model plots showing the 'typical case' and 'worst case' assessment scenarios are presented in Figures 6-1 and 6-2 respectively.

Figure 6-1 – Noise model predictions 'typical case', dB $L_{Aeq,T}$

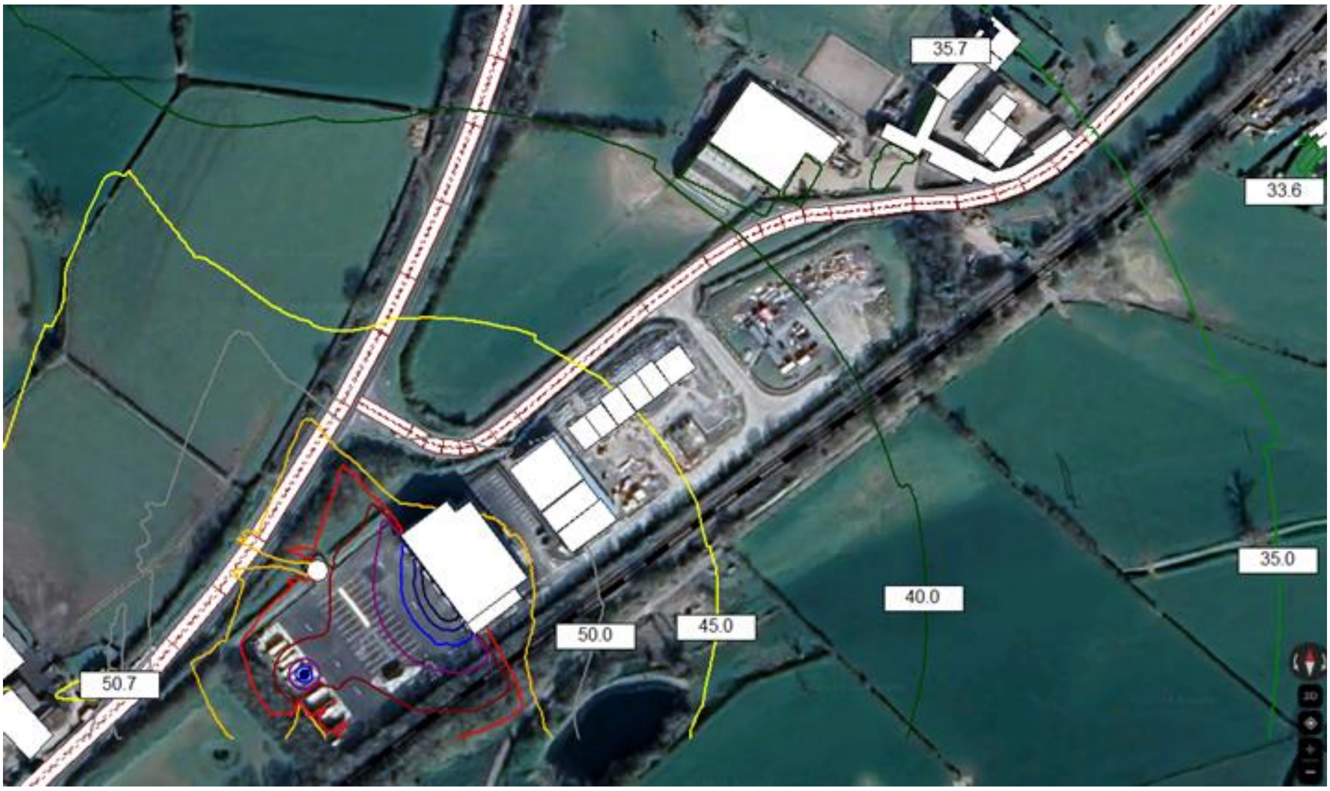


Figure 6-2 – Noise model predictions 'worst case', dB $L_{Aeq,T}$

6.2 INITIAL IMPACT ESTIMATION

6.2.1. The sound levels predicted at the NRs based on the two assessment scenarios presented above, comprise the specific sound levels.

6.2.2. To derive the rating levels, it is necessary to consider the potential applicability of feature corrections to account for acoustic characteristics that may be discernible at the assessment locations.

6.2.3. No feature correction is justified for tonality. No operations exhibit tonality and the site based mobile plant and vehicles use broadband reversing alarms. The only tonal alarms noted during measurements and observations were associated with the domestic refuse lorries, which do not deposit waste at the NPBF and only park there overnight (so only manoeuvre on site very infrequently). Certainly, no tonality would be associated with either of the assessment scenarios nor would it be perceptible at assessment locations.

6.2.4. No feature correction is justified for impulsivity. Whilst impulsive noise occurs on-site relatively frequently, it is not apparent as the assessment locations due to either the level of masking noise (NR1) or the distance and screening between source and receptor (NR2 and NR3).

6.2.5. Plant and operations do not have stop/start conditions that would be identifiable at the assessment locations that may justify a feature correction for intermittency.

6.2.6. The worst-case assessment scenario, which involves the loading of glass, does generate a distinctive sound, akin to a 'whoosh', as a bucket load of glass is shovelled into the bulk lorry. Whilst this sound does not fit into any of the three defined acoustic characteristics, it is distinctive off-site at NR1 and may be (depending on wind direction/masking sound) audible at NR2 and NR3. For that reason, a 3 dB penalty for 'other sound characteristics' is considered appropriate with respect to the worst-case assessment scenario.

6.2.7. Based on the above, the initial impact assessment is presented in Table 6-1.

Table 6-1 – Initial impact estimation

Scenario	Receptor	Specific Sound Level, dB $L_{Aeq,T}$	Feature Correction, dB	Rating Level, dB $L_{Ar,Tr}$	Backgr'd Sound Level, dB $L_{A90,T}$	Rating minus Backgr'd	Impact Estimation
Typical Case	NR1	51	-	51	54	-3	No impact
	NR2	36	-	36	48	-12	No impact
	NR3	34	-	34	36	-2	No impact
Worst Case	NR1	58	+3	61	54	7	Adverse
	NR2	38	+3	41	48	-7	No impact
	NR3	39	+3	42	36	6	Adverse

6.3 CONTEXTUAL ASSESSMENT

6.3.1. The initial impact estimation presented above is modified based on all pertinent contextual factors. The following contextual factors are considered most relevant in this case:

1) The absolute level of sound.
2) The character and level of the residual sound compared to the character and level of the specific sound.
3) The sensitivity of the receptors.
4) The timing of noisy activities.
5) The frequency and duration of noisy events.

6.3.2. In terms of **point 1**, the absolute levels of sound predicted for most of the time are significantly below the residual sound levels at each of the receptor locations. At all locations other than NR1, the predicted sound levels are also significantly below any of the absolute criteria set out in the ProPG[3] or BS 8233[4]. In-fact, noise from the NPBF will generally be inaudible at the assessment locations, with only occasional noisy operations involving glass being distinguishable. The absolute level of sound detracts from the likelihood of noise amounting to an adverse impact.

6.3.3. In terms of **point 2**, the character of the specific sound is generally comparable with that of the residual sound (road traffic) with the exception of the management of the glass stockpile and loading of bulk lorries with glass, at which times the sound character may be distinctive. The level of the

[3] ProPG: Professional Practice Guidance Planning & Noise, New Residential Development. ANC, CIEH, IoA 2017.
[4] BS 8233:2014 Guidance on sound insulation and noise reduction for buildings. BSI 2014.

specific sound is, in all cases, below that of the residual sound, which detracts from the likelihood of noise amounting to an adverse impact.

6.3.4. With respect to **point 3**, NR1 is not particularly noise sensitive, given that it is located immediately adjacent to a trunk road and, for that reason, is already subject to high levels of road traffic noise. It is also just 80 m from the Cambrian line railway.

6.3.5. NR2 is a dwelling that sits within a working farm environment and is therefore typically subject to noise from farming activities. It is also subject to noise from road and rail traffic from the adjacent roads and railway.

6.3.6. NR3 is within 30 m of the Cambrian line and is immediately adjacent to the premises, and yard, of a steel framed building manufacturer. As such it is exposed to both rail noise and industrial type noise.

6.3.7. In view of the above, all of the noise receptors considered in this report are deemed somewhat less noise sensitive than might generally be expected for dwellings in quieter settings. This detracts from the likelihood of noise amounting to an adverse impact.

6.3.8. **Point 4** is material given that the operating hours of the NPBF are relatively short and constrained to ‘normal working hours’ when masking from other sources would be expected to be relatively high. This detracts from the likelihood of noise amounting to an adverse impact.

6.3.9. **Point 5** is significant because, even whilst operating, the NPBF is often quiet for protracted periods of time. The conditions which comprise the ‘typical case’ assessment scenario will generally occur two or three times per day and will usually only last around forty minutes (not the full hour assumed in the predictions). The worst-case scenario could only occur once in most weeks, with two weekly glass collections only occurring infrequently. This detracts from the likelihood of noise amounting to an adverse impact.

6.4 ASSESSMENT CONCLUSION

6.4.1. Given the strong case for contextual modifications of the initial impact estimation, it is concluded that the operation of the NPBF does not result in any tangible adverse noise impact at receptor locations.

7 ASSESSMENT OF UNCERTAINTY

7.1.1. The WSP assessment uncertainty matrix is presented at **Appendix B**. A more detailed discussion of the key areas of uncertainty is presented below.

SOUND LEVEL MEASUREMENTS

7.1.2. Measurement uncertainties were minimised by using suitable class 1 instrumentation with in-date calibration certification, synchronising measurements from multiple locations and using consultants who are expert in the measurement and assessment of industrial type noise.

BASELINE DATA

7.1.3. Two historical noise surveys and recent measurements have been relied on in the derivation of baseline sound level data which provides a good range of data from before and after operations at the NPBF commenced. However, a discrepancy between the historical background sound levels adopted at different times for NR1 was identified and the reason for the magnitude of this discrepancy was not entirely clear. However, the choice of background sound level values used in this assessment was informed by the most recent measurements to which a high level of confidence is attributed.

ON-SITE SOURCE DATA

7.1.4. Activities on-site are varied and dynamic, with complicating factors including:

- A relatively high residual sound level from road traffic on the A483.
- Mobile sources moving.
- The directionality of reversing alarms noise propagation.
- Multiple activities occurring simultaneously.
- Sources being subject to varying levels of screening from bay walls and building components.
- The cancellation of the glass collection by bulk vehicle, necessitating a simulated collection for measurement purposes.

7.1.5. Measurement uncertainties that may have resulted from these factors were minimised by making synchronised measurements at multiple locations and continually observing and noting activities and measurement distances.

SOUND LEVEL PREDICTIONS

7.1.6. Prediction uncertainties were minimised by developing noise model scenarios based on accurate descriptions of actual on-site activities and verifying the adopted sound power levels based on multiple measurements.

FEATURE CORRECTIONS

7.1.7. Uncompressed audio recordings of activities were logged throughout the on-site measurements to enable objective and reference methods to be applied to the assessment of tonality and impulsivity if necessary.

8 CONCLUSIONS

8.1.1. An assessment of the potential noise impact from the operation of the NPBF has been undertaken based on comprehensive sound level measurements and three-dimensional noise modelling with due regard to BS 4142, the EA guidance and MID (both of which are applicable in Wales).

8.1.2. It has been concluded that operations at the NPBF are often quiet and inaudible at noise receptors.

8.1.3. Noise may be discernible at the closest receptor (NR1) during the loading of bulk lorries inside the NPBF building, although the noise would typically be masked by road traffic noise.

8.1.4. Noise from loading bulk lorries with glass, which takes place outside, may be disenable at all three assessment locations, depending on the wind direction and level of masking noise, but this usually only occurs once each week and is completed in less than an hour.

8.1.5. The initial impact estimation indicates that it is only the weekly glass loading operation that could be aligned with an indication of adverse impact. Once contextual factors have been taken into account, however, noise from this activity is not considered to be impactful or to comprise ‘pollution’.

8.1.6. This report is suitable to allow discharge of Requirement IPC4 of Schedule 1 of the permit.

Appendix A

ACOUSTIC GLOSSARY

ACOUSTIC GLOSSARY

- Acoustic environment: Sound from all sound sources as modified by the environment. Can be actual or simulated, outdoor or indoor, as experienced or in memory. Modifications by the environment includes: effects on sound propagation, resulting, for example, from meteorological conditions; absorption; diffraction; reverberation; and reflection.
- Airborne sound: Sound that reaches the point of interest by propagation through air.
- Ambient sound: Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.
- A-weighting, dB(A): The unit of sound level, weighted according to the A-scale, which takes into account the increased sensitivity of the human ear at some frequencies.
- Background sound: Underlying level of sound over a period, T, which might in part be an indication of relative quietness at a given location.
- Broadband sound/ noise: Sound whose energy is distributed over a wide section of the audible range.
- Calibration: The measurement system/ chain should be periodically calibrated, within a laboratory, against traceable calibration instrumentation, to either National Standards or as UKAS-Accredited, as required. The calibration of the system should also be checked in the field using a portable calibrator before and after each short term measurements, and periodically for longer term monitoring.
- Class 1: The Class of a sound level meter describes its accuracy as defined by the relevant international standards – Class 1 is more accurate than Class 2. The older standard IEC 60651 referred to the grade as "Type", whereas the new standard IEC 61672 refers to it as the "Class". The most accurate meters used in the field (as opposed to a laboratory) are Class 1. Class 2 meters can be used in some instances; however WSP use Class 1 (or Type 1) meters by default, as required by BS 4142:2014+A1:2019 *'Methods for rating and assessing industrial and commercial sound'*, for example.
- Context: The circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood. When considering context, pertinent factors include: the absolute level of sound; the character and level of the residual sound compared to the character and level of the specific sound; evidence on human response to the sound; and the sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions.
- Decibel (dB): A scale for comparing the ratios of two quantities, including sound pressure and sound power. The difference in level between two sounds (s1 and s2) is given by $20 \log_{10}$ (s1/s2). The decibel can also be used to measure absolute quantities by specifying a reference value that fixes one point on the scale. For sound pressure, the reference value is 20 Pa.
- Dwelling: A building used for living purposes. A mobile home used for permanent living should be included in an assessment. If calculations are being conducted for compensation purposes, then some mobile homes are dealt with under the Highways Noise Payments and Moveable Homes Regulations.

- Façade/ façade level: At a distance of 1 m in front of a large sound reflecting object such as a building façade. According to BS 8233:2014, "*Façade level measurements of L_{pA} are typically 1 dB to 2 dB higher than corresponding free-field measurements because of the reflection from the façade*." The Calculation of Road Traffic Noise (1988) uses 2.5 dB, whilst BS 5228-1:2009+A1:2014 recommends 3 dB. Owing to the latter examples, together with other historical documents, it is more usual to apply 3 dB.
- Fast time-weighting (F): Averaging time used in sound level meters. Defined in BS EN 61676-2:2013+A1:2017 Electroacoustics. Sound level meters. Pattern evaluation tests.
- Free-field/ free-field Level: Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5 m away.
- Heavy goods vehicle (HGV): See Heavy vehicles.
- Heavy vehicles: According to the Calculation of Road Traffic Noise (1988), 'heavy vehicles' are vehicles with unladen weight greater than 1.525 tonnes. The classification assumes that vehicles within each group are acoustically similar. However, since this classification system was first introduced in 1975, the proportion of vehicles within the range 1.525 tonnes to 3.5 tonnes has grown significantly and the maximum permissible weight of heavy vehicles has increased from 38 to 44 tonnes. Therefore, the range in vehicle noise emissions within the heavy vehicle category has increased. Those vehicles with an unladen weight between 1.525 and 3.5 tonnes should be treated as light vehicles. Note: heavy duty vehicle (HDV) and heavy goods vehicle (HGV) are typically used interchangeably, as if describing all heavy vehicles matching the adopted weight threshold.
- Hertz (Hz): The unit of Frequency or Pitch of a sound. One hertz equals one cycle per second. 1 kHz = 1000 Hz, 2 kHz = 2000 Hz, etc.
- $L_{AF90,T}$: The A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time fast time-weighting (F). Generally used to describe the 'background' sound conditions.
- L_{AFmax}: The maximum A-weighted sound pressure level during a given time period. L_{max} is sometimes used for the assessment of occasional loud sounds, which may have little effect on the overall L_{eq} noise level, but could still affect the sound environment. Unless described otherwise, it is measured using the fast time-weighting (F).
- $L_{eq,T}$: A sound level index called the equivalent continuous sound level over the time period T. This is the level of a notional steady sound that would contain the same amount of sound energy as the actual, possibly fluctuating, sound that was recorded. Where the value is A-weighted, is will be presented '$L_{Aeq,T}$' or 'dBA $L_{eq,T'}$, otherwise is should be an un-weighted (or linear) value.
- Line source: A sound source composed of many point sources in a defined line, such as a train, flow of traffic on a motorway, or constant aircraft take-offs and landings. Sound levels measured from line sources decrease at a rate of 3 dB per doubling of distance.
- L_p: See Sound pressure level.
- L_W: See Sound power level.

- Noise-sensitive receptor (NSR): A term representing any premises used as a dwelling (including gardens), place of worship, educational establishment, hospital or similar institution, or any other property likely to be adversely affected by an increase in sound level.
- Octave/ octave band: Band of frequencies in which the upper limit of the band is twice the frequency of the lower limit. For example, the 1000 Hz (1 kHz) octave band contains noise energy at all frequencies from 707 to 1414 Hz.
- Percentile level: The sound pressure level exceeded for N% of a specified time interval, see $L_{AF90,T}$ etc.
- Point source: A sound source whose dimensions are small compared to the propagation distances involved. Due to the Inverse Square Law, the sound level pressure level decreases by 6 dB every time the distance between the measurement point and the source is doubled.
- Rating level, $L_{Ar,Tr}$: The equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$, see also Specific sound level) of the sound, plus any adjustment for the characteristic features of the sound.
- Reference time interval, Tr: Specified interval over which the specific sound level is determined. This is 1 hour during the day from 07:00 to 23:00 hours and 15 minutes at night from 23:00 to 07:00 hours.
- Residual sound: ambient sound remaining at the assessment location when the specific sound source is suppressed (or absent) to such a degree that it does not contribute to the ambient sound.
- Residual sound level, $L_r = L_{Aeq,T}$: Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.
- Sound level metrics, indices or parameters: Sound levels usually fluctuate over time, so it is often necessary to consider an average or statistical sound level. This can be done in several ways, so a number of different metrics have been defined, according to how the averaging or statistics are carried out.
- Sound power level, L_W: Sound power measured on a decibel scale, relative to a reference value of 10^{-12} W.
- Sound power: The sound energy radiated per unit time by a sound source. Measured in Watts (W).
- Sound pressure level (sound level), L_p: The sound level is the sound pressure relative to a standard reference pressure of 20 Pa ($20x10^{-6}$ Pascals) on a decibel scale.
- Sound pressure: Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure.
- Specific sound level, $L_S=L_{Aeq,Tr}$: Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.
- Specific sound source: Sound source being assessed.
- Type 1: See Class 1 above.

Appendix B

WSP UNCERTAINTY ASSESSMENT

WSP UNCERTAINTY ASSESSMENT MATRIX

Uncertainty Control Measures	Applicable?	Adopted?/Comments
Measurement		
Only use in calibration Type/Class 1 equipment and check (and record) calibration level before and after measurements	✓	Yes
Take measurements using the time and frequency weighting specified by the relevant standard	✓	Yes
Make detailed notes, including details of the equipment, weather, survey positions (including approximate distances), contributing noise sources, presence of screening etc.	✓	Yes
Take photographs, and record survey locations	✓	Yes
Avoid standing waves/interference – listen for effects, take spatial average from several locations or conduct a sweep	✓	Yes
Take measurements at different distances to establish propagation	✓	Yes
Take measurements at different heights where relevant	✓	Yes
Don't just measure at the "noisiest" parts of site, but establish how "quiet" it is, too, where relevant to the assessment	✓	Yes
Measure under different operating conditions relevant to your assessment / adopt worst case if known	✓	Yes – over two days
Measure more than one cycle/ event (ideally at least three)	✓	Yes – over two days
Determine state of repair of any associated source, where relevant	✓	Yes
Use a windshield and avoid windy conditions (i.e. gusts regularly exceeding 5 m/s)	✓	Yes
Avoid wet conditions (particularly in terms of rain on the windshield/microphone and on neighbouring surfaces)	✓	Yes
Avoid electrical and electromagnetic interference (such as from power cables and radio transmitters)	✓	Yes
Avoid extreme temperatures – traffic conditions can be different in freezing conditions, whilst meters can overheat and fail in a case when in direct sunlight during the summer.	✓	Yes
Make measurements during different weather conditions (particularly relevant in terms of wind direction for sites affected by aircraft movements, but also for sites affected by other distant, but significant, sources of noise, in different directions	✓	Yes, some variety in wind speed and directions
Where only one source is dominant (such as a main road), as a minimum, measure during conditions favourable to propagation (i.e. when wind direction is within +/-45º of the line between the source and receiver or during temperature inversion, such as on clear calm nights)	✓	Yes, low speed north westerlies dominant during survey
Avoid tree/leaf (movement) sound where possible – ideally take measurements at comparable distance to receptor locations	✓	Yes, minimal foliage
Avoid dawn chorus sound where possible – ideally take measurements the same distance from trees and bushes as any receptors of interest	✓	Yes, minimal birdsong noted

Uncertainty Control Measures	Applicable?	Adopted?/Comments
Measurement continued/…		
Measure outside the receptor in question where possible; however, it is worst case typically to measure under free-field conditions and apply +3 dB correction to convert to “façade” where applicable – for most planning (new residential development) assessments, free-field is preferable	✓	Yes, free-field
Where it is not possible to install a meter outside the receptor in question, install a meter elsewhere and undertake additional attended measurements, either outside the receptor or at a representative location (when not adequately covered by the installed meter)	✓	Receptors used
Avoid atypical traffic conditions (such as during school holidays and road works – road traffic incidents can significantly affect flows, but no such events can’t be predicted and their occurrence can’t always be established after the survey – check the data for anomalies)	✓	Yes
Avoid presence of you and/or the microphone resulting in atypical conditions.	✓	Yes
Data handling		
Download data immediately after survey and process promptly whilst details are fresh in your head	✓	Yes
Use digital transfer methods and double check data read-off manually	✓	Yes
Look at the time-history (in as fine a resolution as possible) for any unexpected events – preferably with active spectral data (i.e. in dBTRAIT)	✓	Yes
If removing any data (due to an atypical event, for example), ‘save as’ a new file and provide a note to the data.	✓	Yes
Prediction		
Use measurement data at different distances to verify propagation	✓	Yes
Different height measurements to verify screening effects, if relevant	✓	Yes
Use propagation calculation procedure relevant to source and distance	✓	Yes
Use detailed traffic flow data applicable to the methodology	×	No traffic data used
Use detailed sound source data (including octave-band levels), accounting for size, height and directivity, where known	✓	Yes wrt size, height and directivity. A weighted levels used
Use detailed topographical data and base mapping	✓	Yes

Uncertainty Control Measures	Applicable?	Adopted?/Comments
Identify different ground types	✓	Yes, variable ground types based on aerial photography
Apply an order of reflections of at least one	✓	One order applied
Use 3D view feature to check model accuracy of the model	✓	Yes
Produce contour plots as a further means of identifying any abnormalities or errors in the model	✓	Yes

Appendix C

ASSESSOR'S QUALIFICATIONS AND EXPERIENCE

THE ASSESSOR'S QUALIFICATIONS AND EXPERIENCE

This report and all associated work have been compiled and conducted by Toby Lewis, Technical Director Acoustics, who has the following qualifications and experience:

- 23 years in local government employ specialising in acoustics and air quality
- 12 years in part-time and full-time acoustic consultancy
- Chartered Environmental Health Practitioner
- Chartered Scientist
- Fellow of the Institute of Acoustics
- Fellow of the Chartered Institute of Environmental Health
- Member of the Institution of Environmental Sciences
- Member of the Institute of Air Quality Management
- Member of the ANC Good Practice Working Group for BS 4142:2014+A1:2019
- MSc Applied Acoustics
- MSc Environmental Health
- LLM Environmental Law
- MSc Pollution Control
- PgD Acoustics and Noise Control
- HNC Environmental Monitoring and Analysis

Appendix D

INSTRUMENTATION

Public

Monitoring Equipment

Monitoring Location	Instrument name	Description	Manufacturer and type number	Serial number
ML1	CUBE 1	Sound level meter	01 dB CUBE 'Integrating-Averaging Sound Level Meter'	10621
		Pre-amplifier	Acoem PRE 22 Preamplifier	10635
		Microphone	GRAS Type 40CD Condenser Microphone	207269
		Calibrator	01dB-Metravib Cal 21	35293349
ML2	FUSION 1	Sound level meter	01dB-Metravib Fusion Sound Level Meter	10797
		Pre-amplifier	01dB PRE22 Preamplifier	10870
		Microphone	GRAS Type 40CD Condenser Microphone	207593
		Calibrator	01dB-Stell Cal 21	34254631
SL1, SL3	DUO 3	Sound level meter	01dB-Stell Duo 'Datalogging Integrating Sound Level Meter'	10617
		Pre-amplifier	01dB-Stell PRE 22 Preamplifier	10324
		Microphone	G.R.A.S Type 40CD Condenser Microphone	162071
		Calibrator	01dB Cal 21	34924010

SL2, SL4, SL5, SL6	SOLO 19	Sound level meter	01dB-METRAVIB Black Solo 'Datalogging Integrating Sound Level Meter'	65806
		Pre-amplifier	01dB-Metravib PRE 21 S	16461
		Microphone	01dB Metravib MCE 212 Microphone	166412
		Calibrator	01dB-Stell Cal 21	34323904

Appendix E

CALIBRATION CERTIFICATES

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 14 June 2023

Certificate Number: UCRT23/1783

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Limited WSP House 70 Chancery Lane London WC2A 1AF United Kingdom
ORDER No	20161234
Job No	UKAS23/06395
DATE OF RECEIPT	12 June 2023
PROCEDURE	Calibration Engineer's Handbook, section 25: periodic testing of sound level meters to IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49
IDENTIFICATION	Sound level meter 01dB type CUBE serial No 10621 connected via an extension lead type RAL135-10M and preamplifier type PRE 22 serial No 10635 to a half-inch microphone type GRAS 40CD serial No 207269 fitted with a 'DMK01' weatherproof outdoor windshield including nosecone type RA 0208. Associated calibrator 01dB type CAL21 serial No 35293349(2009) with a one-inch housing and adapter type BAC21 for half-inch microphone.
CALIBRATED ON	14 June 2023
PREVIOUS CALIBRATION	Calibrated on 12 May 2021, Certificate No. UCRT21/1611 issued by this laboratory.

The sound level meter was set up using the type CAL21 sound calibrator supplied; it was set to frequency weighting A, and initially read 94.0 dB which was correct. This reading was derived from Calibration Certificate no. UCRT23/1775 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The calibration check frequency was 1kHz.

Procedures from IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 were used to perform the periodic tests.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006 (BS EN 61672-3:2006), for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2 : 2003 (BS EN 61672-2 : 2003), to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003), the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1 : 2002 (BS EN 61672-1 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

13.6 dB (A)   13.3 dB (C)   20.6 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 23 to 24 ºC, 34 to 44 %RH and 100.7 to 100.8 kPa
End: 23 to 24 ºC, 29 to 39 %RH and 100.7 to 100.8 kPa

Technical information including adjustment data specified in the manufacturers' User Manual DOC1112 - May 2015 H with further clarification from 01dB has been used to carry out this verification. These data include manufacturer-specified uncertainties for case reflections and windshield, but NOT for the microphone response.

Publicly-available evidence has been found that this configuration of the 01dB CUBE sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by Physikalisch-Technische Bundesanstalt (PTB), an independent testing organisation responsible for pattern approvals.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

NOTES

Any opinions or interpretations which may be expressed in the following notes are not UKAS Accredited.

1 The high pass filter was set to 10 Hz, the mic correction to 90° and the nosecone usage to "Yes".

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

3 The instrument was running application firmware version 2.45, metrology firmware version 2.12 and modem firmware version 12.00.005 on hardware version LIS001A

4 These periodic tests are valid ONLY for the instrument configuration shown on page 1 of this certificate and for 90° incidence of sound on the microphone.

5 When set up to read correctly in response to the sound calibrator, the sound level meter stored a calibration correction of 1.04 dB and a microphone sensitivity of 46.34 mV/Pa

6 Typical case reflection factors (for the DMK01 unit) specified by the manufacturer have been used for this verification.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 14 June 2023

Certificate Number: UCRT23/1783

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
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Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Limited WSP House 70 Chancery Lane London WC2A 1AF United Kingdom		
ORDER No	20161234	Job No	UKAS23/06395
DATE OF RECEIPT	12 June 2023		
PROCEDURE	Calibration Engineer's Handbook, section 25: periodic testing of sound level meters to IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49		
IDENTIFICATION	Sound level meter 01dB type CUBE serial No 10621 connected via an extension lead type RAL135-10M and preamplifier type PRE 22 serial No 10635 to a half-inch microphone type GRAS 40CD serial No 207269 fitted with a 'DMK01' weatherproof outdoor windshield including nosecone type RA 0208. Associated calibrator 01dB type CAL21 serial No 35293349(2009) with a one-inch housing and adapter type BAC21 for half-inch microphone.		
CALIBRATED ON	14 June 2023		
PREVIOUS CALIBRATION	Calibrated on 12 May 2021, Certificate No. UCRT21/1611 issued by this laboratory.		

The sound level meter was set up using the type CAL21 sound calibrator supplied; it was set to frequency weighting A, and initially read 94.0 dB which was correct. This reading was derived from Calibration Certificate no. UCRT23/1775 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The calibration check frequency was 1kHz.

Procedures from IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 were used to perform the periodic tests.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006 (BS EN 61672-3:2006), for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2 : 2003 (BS EN 61672-2 : 2003), to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003), the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1 : 2002 (BS EN 61672-1 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

13.6 dB (A) 13.3 dB (C) 20.6 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 23 to 24 ºC, 34 to 44 %RH and 100.7 to 100.8 kPa

End: 23 to 24 ºC, 29 to 39 %RH and 100.7 to 100.8 kPa

Technical information including adjustment data specified in the manufacturers' User Manual DOC1112 - May 2015 H with further clarification from 01dB has been used to carry out this verification. These data include manufacturer-specified uncertainties for case reflections and windshield, but NOT for the microphone response.

Publicly-available evidence has been found that this configuration of the 01dB CUBE sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by Physikalisch-Technische Bundesanstalt (PTB), an independent testing organisation responsible for pattern approvals.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

NOTES

Any opinions or interpretations which may be expressed in the following notes are not UKAS Accredited.

1 The high pass filter was set to 10 Hz, the mic correction to 90° and the nosecone usage to "Yes".

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

3 The instrument was running application firmware version 2.45, metrology firmware version 2.12 and modem firmware version 12.00.005 on hardware version LIS001A

4 These periodic tests are valid ONLY for the instrument configuration shown on page 1 of this certificate and for 90° incidence of sound on the microphone.

5 When set up to read correctly in response to the sound calibrator, the sound level meter stored a calibration correction of 1.04 dB and a microphone sensitivity of 46.34 mV/Pa

6 Typical case reflection factors (for the DMK01 unit) specified by the manufacturer have been used for this verification.

The results on this certificate only relate to the items calibrated as identified above.

END

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 13 June 2023

Certificate Number: UCRT23/1775

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
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E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Limited WSP House 70 Chancery Lane London WC2A 1AF United Kingdom
ORDER No	20161234 Job No UKAS23/06395
DATE OF RECEIPT	12 June 2023
PROCEDURE	Procedure TP 1 Calibration of Sound Calibrators
IDENTIFICATION	Sound Calibrator 01dB type CAL21 serial number 35293349(2009) with one-inch housing and adapter type BAC21 for half-inch microphone
CALIBRATED ON	13 June 2023
PREVIOUS CALIBRATION	Calibrated on 13 May 2022, Certificate No. UCRT22/1650 issued by this laboratory.

MEASUREMENTS

The sound pressure level generated by the Sound Calibrator in its half-inch configuration was measured using a B&K type 4134 microphone with the protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output, corrected to the standard atmospheric pressure of 101.3 kPa using manufacturers' data, was

94.18 ± 0.10 dB rel 20 µPa

The fundamental frequency of the sound output was 1003.62 ± 0.12 Hz,
and its total distortion was (1.19 ± 0.09) %.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

During the measurements the laboratory environmental conditions were:

Temperature: 23 to 25 ºC
Atmospheric pressure: 100.4 to 100.5 kPa
Relative humidity: 31 to 41 %

IEC 942:1988 did not specify any test methods. The tests carried out were therefore based on Annex B of BS EN 60942:2003, but with five determinations of sound pressure level, and limited to the above level(s) & freq(s). As public evidence was available from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model fully conformed to the requirements of IEC 942:1988, the sound calibrator tested is considered to conform to all the Class 1 requirements of that Standard.

The results on this certificate only relate to the items calibrated as identified above.

Calibrator adjusted No END

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 24 October 2023

Certificate Number: UCRT23/2393

Calibrated at & Certificate issued by:
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Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Ltd WSP House 70 Chancery Lane London WC2A 1AF
ORDER No	20170424 Job No UKAS23/10727
DATE OF RECEIPT	23 October 2023
PROCEDURE	Calibration Engineer's Handbook, section 25: periodic testing of sound level meters to IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49
IDENTIFICATION	Sound level meter 01dB type DUO serial No 10617 connected via an extension lead type RAL135-10M and preamplifier type PRE 22 serial No 10324 to a half-inch microphone type GRAS 40CD serial No 162071 fitted with a 'DMK01' weatherproof outdoor windshield including nosecone type RA 0208. Associated calibrator 01dB type CAL21 serial No 34924010(2012) with a one-inch housing and adapter type BAC21 for half-inch microphone.
CALIBRATED ON	24 October 2023
PREVIOUS CALIBRATION	Calibrated on 22 October 2021, Certificate No. UCRT21/2304 issued by this laboratory.

The sound level meter was set up using the type CAL21 sound calibrator supplied; it was set to frequency weighting A, and initially read 93.9 dB. It was then adjusted to read 93.8 dB (corresponding to 93.8 dB at standard atmospheric pressure). This reading was derived from Calibration Certificate no. UCRT23/2250 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The calibration check frequency was 1kHz.

Procedures from IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 were used to perform the periodic tests.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006 (BS EN 61672-3:2006), for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2 : 2003 (BS EN 61672-2 : 2003), to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003), the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1 : 2002 (BS EN 61672-1 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

13.9 dB (A) 13.5 dB (C) 18.8 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 24 to 25 ºC, 36 to 46 %RH and 99.0 to 99.1 kPa
End: 23 to 24 ºC, 35 to 45 %RH and 99.0 to 99.1 kPa

Technical information including adjustment data specified in the manufacturers' User Manual DOC1112 - May 2015 H with further clarification from 01dB has been used to carry out this verification. These data include manufacturer-specified uncertainties for case reflections and windshield, but NOT for the microphone response.

Publicly-available evidence has been found that this configuration of the 01dB DUO sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by Physikalisch-Technische Bundesanstalt (PTB), an independent testing organisation responsible for pattern approvals.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

NOTES

Any opinions or interpretations which may be expressed in the following notes are not UKAS Accredited.

1 The high pass filter was set to 10 Hz, the mic correction to 90° and the nosecone usage to "Yes".

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

3 The instrument was running application firmware version 2.34, metrology firmware version 2.10 and modem firmware version 08.01.107 on hardware version 3F2D3D

4 These periodic tests are valid ONLY for the instrument configuration shown on page 1 of this certificate and for 90° incidence of sound on the microphone.

5 When set up to read correctly in response to the sound calibrator, the sound level meter stored a calibration correction of -0.08 dB and a microphone sensitivity of 50.5 mV/Pa

6 Typical case reflection factors (for the DMK01 unit) specified by the manufacturer have been used for this verification.

The results on this certificate only relate to the items calibrated as identified above.

END

CERTIFICATE OF CALIBRATION

Date of Issue: 29 September 2023

Certificate Number: UCRT23/2250

0653

Calibrated at & Certificate issued by:
ANV Measurement Systems
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17 Roebuck Way
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Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Ltd WSP House 70 Chancery Lane London WC2A 1AF United Kingdom
ORDER No	20166767 Job No UKAS23/09672
DATE OF RECEIPT	28 September 2023
PROCEDURE	Procedure TP 1 Calibration of Sound Calibrators
IDENTIFICATION	Sound Calibrator 01dB type CAL21 serial number 34924010(2012) with one-inch housing and adapter type BAC21 for half-inch microphone
CALIBRATED ON	29 September 2023
PREVIOUS CALIBRATION	Calibrated on 26 September 2022, Certificate No. UCRT22/2141 issued by this laboratory.

CERTIFICATE OF CALIBRATION

UKAS ACCREDITED CALIBRATION LABORATORY No 0653

MEASUREMENTS

The sound pressure level generated by the Sound Calibrator in its half-inch configuration was measured using a B&K type 4134 microphone with the protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output, corrected to the standard atmospheric pressure of 101.3 kPa using manufacturers' data, was

93.99 ± 0.10 dB rel 20 µPa

The fundamental frequency of the sound output was 1002.2 ± 0.12 Hz,
and its total distortion was (1.28 ± 0.09) %.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

During the measurements the laboratory environmental conditions were:

Temperature: 23 to 24 ºC
Atmospheric pressure: 100.7 to 100.8 kPa
Relative humidity: 33 to 44 %

The tests carried out were based on Annex B of BS EN 60942:2003, but with five determinations of sound pressure level, and limited to the above level(s) & freq(s). This is a subset of the tests specified in Annex B of BS EN 60942:1998. The mean level, frequency and total distortion of the sound output as measured meet the Class 1 requirements of BS EN 60942:1998 for the environmental conditions under which the tests were performed. This does not imply that the sound calibrator meets this standard under any other conditions. However it has successfully undergone pattern evaluation to the earlier Standard IEC 942:1988

The results on this certificate only relate to the items calibrated as identified above.

Calibrator adjusted No END

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 12 October 2023

Certificate Number: UCRT23/2330

Calibrated at & Certificate issued by:
ANV Measurement Systems
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Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Ltd WSP House 70 Chancery Lane London WC2A 1AF
ORDER No	20170424 Job No UKAS23/10696
DATE OF RECEIPT	09 October 2023
PROCEDURE	Calibration Engineer's Handbook, section 25: periodic testing of sound level meters to IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49
IDENTIFICATION	Sound level meter 01dB type FUSION serial No 10797 connected via an extension lead type RAL135-10M and preamplifier type PRE 22 serial No 10870 to a half-inch microphone type GRAS 40CE serial No 207593 fitted with a 'DMK01' weatherproof outdoor windshield including nosecone type RA 0208. Associated calibrator 01dB type CAL21 serial No 34254631(2015) with a one-inch housing and adapter type BAC21 for half-inch microphone.
CALIBRATED ON	12 October 2023
PREVIOUS CALIBRATION	Calibrated on 20 October 2021, Certificate No. UCRT21/2287 issued by this laboratory.

The sound level meter was set up using the type CAL21 sound calibrator supplied; it was set to frequency weighting A, and initially read 93.8 dB which was correct. This reading was derived from Calibration Certificate no. UCRT23/2073 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter when fitted with the windshield. The calibration check frequency was 1kHz.

Procedures from IEC 61672-3:2006 (BS EN 61672-3:2006) as modified by UKAS TPS 49 were used to perform the periodic tests.

RESULTS

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006 (BS EN 61672-3:2006), for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organization responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2 : 2003 (BS EN 61672-2 : 2003), to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1 : 2002 (BS EN 61672-1 : 2003), the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1 : 2002 (BS EN 61672-1 2003).

The self-generated noise recorded with the microphone replaced by the electrical input device was:

12.7 dB (A)   12.6 dB (C)   17.2 dB (Z)

The environmental conditions recorded at the start and end of testing were:

Start: 22 to 23 ºC, 39 to 49 %RH and 100.2 to 100.3 kPa
End: 23 to 24 ºC, 34 to 44 %RH and 100.2 to 100.3 kPa

Technical information including adjustment data specified in the manufacturers' User Manual DOC1131 - Feb 2017 J with further clarification from 01dB has been used to carry out this verification. These data include manufacturer-specified uncertainties for case reflections and windshield, but NOT for the microphone response.

Publicly-available evidence has been found that this configuration of the 01dB FUSION sound level meter design has successfully undergone pattern evaluation in accordance with IEC 61672-2:2002 (BS EN 61672-2:2003) by Physikalisch-Technische Bundesanstalt (PTB), an independent testing organisation responsible for pattern approvals.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

NOTES

Any opinions or interpretations which may be expressed in the following notes are not UKAS Accredited.

1 The high pass filter was set to 10 Hz, the mic correction to 90° and the nosecone usage to "Yes".

2 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

3 The instrument was running application firmware version 2.34 and metrology firmware version 2.10 on hardware version LIS006E

4 These periodic tests are valid ONLY for the instrument configuration shown on page 1 of this certificate and for 90° incidence of sound on the microphone.

5 When set up to read correctly in response to the sound calibrator, the sound level meter stored a calibration correction of 0.41 dB and a microphone sensitivity of 41.3 mV/Pa

6 Typical case reflection factors (for the DMK01 unit) specified by the manufacturer have been used for this verification.

The results on this certificate only relate to the items calibrated as identified above.

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 15 August 2023

Certificate Number: UCRT23/2073

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory
K. Mistry

CUSTOMER	WSP UK Ltd WSP House 70 Chancery Lane London WC2A 1AF United Kingdom
ORDER No	20166455 Job No UKAS23/08564
DATE OF RECEIPT	14 August 2023
PROCEDURE	Procedure TP 1 Calibration of Sound Calibrators
IDENTIFICATION	Sound Calibrator 01dB type CAL21 serial number 34254631(2015) with one-inch housing and adapter type BAC21 for half-inch microphone
CALIBRATED ON	15 August 2023
PREVIOUS CALIBRATION	Calibrated on 18 August 2022, Certificate No. UCRT22/2014 issued by this laboratory.

MEASUREMENTS

The sound pressure level generated by the Sound Calibrator in its half-inch configuration was measured using a B&K type 4134 microphone with the protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output, corrected to the standard atmospheric pressure of 101.3 kPa using manufacturers' data, was

94.03 ± 0.10 dB rel 20 µPa

The fundamental frequency of the sound output was 1002.62 ± 0.12 Hz,
and its total distortion was (1.15 ± 0.08) %.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

During the measurements the laboratory environmental conditions were:

Temperature: 23 to 24 ºC
Atmospheric pressure: 100.5 to 100.6 kPa
Relative humidity: 34 to 44 %

The tests carried out were based on Annex B of BS EN 60942:2003, but with five determinations of sound pressure level, and limited to the above level(s) & freq(s). This is a subset of the tests specified in Annex B of BS EN 60942:1998. The mean level, frequency and total distortion of the sound output as measured meet the Class 1 requirements of BS EN 60942:1998 for the environmental conditions under which the tests were performed. This does not imply that the sound calibrator meets this standard under any other conditions. However it has successfully undergone pattern evaluation to the earlier Standard IEC 942:1988

The results on this certificate only relate to the items calibrated as identified above.

Calibrator adjusted No END

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 23 September 2022

Certificate Number: UCRT22/2136

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone 01908 642846 Fax 01908 642814
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Ltd WSP House 70 Chancery Lane London WC2A 1AF
ORDER No	20151187 Job No UKAS22/09596
DATE OF RECEIPT	22 September 2022
PROCEDURE	Calibration Engineer's Handbook section 3: verification of sound level meters to BS 7580:Part 1:1997
IDENTIFICATION	Sound level meter 01dB type Black Solo (Master) serial No 65806 connected via a RAL122-10M extension lead and preamplifier type PRE21S serial No 16461 to a half-inch microphone type MCE212 serial No 166412. Associated calibrator 01dB type CAL21 serial No 34323904(2012) with a one-inch housing and adapter type BAC21 for half-inch microphone.
CALIBRATED ON	23 September 2022
PREVIOUS CALIBRATION	Calibrated on 20 December 2021 Certificate No. UCRT21/2541 issued by this laboratory.

The sound level meter was set to frequency weighting A and adjusted to read 93.8 dB (corresponding to 93.8 dB at standard atmospheric pressure) in response to the sound calibrator supplied. This reading was derived from the Calibration Certificate No. UCRT22/2131 supplied by this laboratory and manufacturers' information on the free-field response of the sound level meter .

The sound level meter was then tested, and its overall sensitivity adjusted, in accordance with clause 5 of BS 7580:Part 1:1997 **

The acoustic calibration at 1kHz specified in subclause 5.6.1 of the standard was performed by application of a standard sound calibrator, whilst the tests at 125Hz and 8kHz (subclause 5.6.2) were performed by the electrostatic actuator method.

At the end of the test, the sound calibrator was reapplied to the sound level meter and the meter reading was recorded. The final sensitivity setting in calibration mode was 0.4 dB.

RESULTS

The sound level meter was found to conform to BS 7580:Part 1:1997 ** for a type 1 meter.

The self-generated noise recorded in the test specified in subclause 5.5.2 was:

9.7 dB (A)   8.5 dB (B)   9.8 dB (C)   14.5 dB (Lin)

The sound level meter reading obtained at the end of the test in response to the sound calibrator was 93.8 dB (corresponding to 93.8 dB at standard atmospheric pressure). This reading, corrected for ambient pressure, should be used henceforth to set up the sound level meter for field use.

The expanded level uncertainty of the Laboratory's 1 kHz sound calibrator used during this verification is ± 0.10 dB; that of the calibrator supplied with the sound level meter is ± 0.10 dB.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

All measurement data are held at ANV Measurement Systems for a period of at least six years.

The case reflection factors have been taken as zero, since an extension lead has been used for this verification.

The linearity range and primary indicator range have been obtained from the manufacturer, and are stated to cover the entire measurement range of the instrument, 20 - 137 dB, as given in the handbook (dated 18 June 2003). The maximum level for signals of crest factor 3 has been interpreted from the handbook as 130 dB(A).

The 01dB Solo sound level meter design has successfully undergone pattern evaluation at Physikalisch-Technische Bundesanstalt (PTB). It was found to meet the requirements of BS EN 60651* and BS EN 60804* and was granted pattern approval as a Type 1 sound level meter.

No component of uncertainty for manufacturer-specified corrections has been included in the uncertainty budget and, in accordance with Amendment No 1 to BS 7580:Part 1:1997 ** the measured values obtained during the verification have not been extended by any measurement uncertainty when assessing conformance to the standard.

Conformance as indicated above to BS 7580:Part 1:1997 indicates that the instrument conforms with the relevant accuracy requirements of the testing standard and the expanded measurement uncertainties (*k* =2 for approximately 95% coverage probability) are no greater in magnitude than the accuracy requirements defined in BS 7580:Part 1:1997.

NOTES

*1 BS EN 60651:1994 and BS EN 60804:1994 were formerly numbered BS 5969:1981 and BS 6698:1986 respectively.

**2 BS 7580:Part 1:1997 was formerly numbered BS 7580:1992.

3 No suitable microphone frequency response information was supplied with the instrument. It was therefore measured by this laboratory using the electrostatic actuator method. This response in isolation is not UKAS accredited.

4 The instrument firmware version was 1.405 272A 01107

5 The verification was carried out in L_p / L_{eq} SLM mode only, and may not be valid for any other mode.

6 The frequency weighting designated Z in the meter has been taken as equivalent to *Lin* weighting of BS EN 60651:1994.

7 Any opinions or interpretations which may be expressed in these notes are not UKAS Accredited.

The results on this certificate only relate to the items calibrated as identified above.

END

CERTIFICATE OF CALIBRATION

0653

Date of Issue: 29 September 2023

Certificate Number: UCRT23/2252

Calibrated at & Certificate issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
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E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

K. Mistry

CUSTOMER	WSP UK Ltd WSP House 70 Chancery Lane London WC2A 1AF United Kingdom
ORDER No	20166767 Job No UKAS23/09672
DATE OF RECEIPT	28 September 2023
PROCEDURE	Procedure TP 1 Calibration of Sound Calibrators
IDENTIFICATION	Sound Calibrator 01dB type CAL21 serial number 34323904(2012) with one-inch housing and adapter type BAC21 for half-inch microphone
CALIBRATED ON	29 September 2023
PREVIOUS CALIBRATION	Calibrated on 29 September 2022, Certificate No. UCRT22/2131ATR issued by this laboratory.

MEASUREMENTS

The sound pressure level generated by the Sound Calibrator in its half-inch configuration was measured using a B&K type 4134 microphone with the protective grid in position. The microphone sensitivity was traceable to National Standards.

RESULTS

The mean level of the calibrator output, corrected to the standard atmospheric pressure of 101.3 kPa using manufacturers' data, was

94.00 ± 0.10 dB rel 20 µPa

The fundamental frequency of the sound output was 1002.01 ± 0.12 Hz,
and its total distortion was (1.24 ± 0.09) %.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor *k* =2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

During the measurements the laboratory environmental conditions were:

Temperature: 23 to 24 ºC
Atmospheric pressure: 100.7 to 100.8 kPa
Relative humidity: 33 to 43 %

The tests carried out were based on Annex B of BS EN 60942:2003, but with five determinations of sound pressure level, and limited to the above level(s) & freq(s). This is a subset of the tests specified in Annex B of BS EN 60942:1998. The mean level, frequency and total distortion of the sound output as measured meet the Class 1 requirements of BS EN 60942:1998 for the environmental conditions under which the tests were performed. This does not imply that the sound calibrator meets this standard under any other conditions. However it has successfully undergone pattern evaluation to the earlier Standard IEC 942:1988

The results on this certificate only relate to the items calibrated as identified above.

Calibrator adjusted No END

Appendix F

LIMITATIONS

LIMITATIONS

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The findings and opinions expressed are relevant to the dates of the site works and should not be relied upon to represent conditions at substantially later dates. Opinions included therein are based on information gathered during the study and from our experience. If additional information becomes available which may affect our comments, conclusions or recommendations WSP UK Limited reserve the right to review the information, reassess any new potential concerns and modify our opinions accordingly.

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