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Enhanced Environments

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Noise Impact Assessment

Client:	BAE Systems (Operations) Ltd
Project:	Thermocouple Calibration Instrumentation Room (2 Shed)
Date:	11 March 2025
Document Ref:	CAS24-1222-10-1002

Audit Trail

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00-10-10 Project Definition

00-10-101 Project Reference

24-MEC-1222-10

00-10-102 Project Title:

Thermocouple Calibration Instrumentation Room (2 Shed)

00-10-103 The Client & End-User

BAE Systems, Samlesbury Aerodrome
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00-10-104 The Site Address

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00-10-20 Project Documents

00-10-201 Document Summary

Document type:

Noise Impact Assessment Report

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00-10-202 Reference Documents

Reference	Description	Issue	Format
24S0052-BAES-002-2-DR-F-001_A	Planning application location plan	-	pdf
24S0052-BAES-002-2-DR-F-002_B	Planning application LEV proposed plan and elevations	-	pdf
-	COSHH Exposure Benchmark Assessment - Instrumentation TC Calibration	-	docx
-	Elmotherm 009-0008 (Varnish MSDS)	-	pdf
ID24-150876BTR2	BAE Systems (Nederman quote)	-	pdf
-	Jupiter ISOTECH	-	pdf
-	KF159b (Thermocouple wire)	-	pdf
-	NF151 (BCS-1181) (Thermocouple wire)	-	pdf
-	Pegasus ISOTECH	-	pdf

00-10-203 Relevant Drawings

Reference	Description	Issue	Format
n/a			

00-10-204 Reference Drawings

Reference	Description	Issue	Format
n/a			

00-10-30 Project Introduction

00-10-301 Purpose of report

This assessment supports the planning application for replacement of the existing LEV 058 at the 2 Shed Instrumentation facility in Samlesbury. The report evaluates the potential noise impact from the proposed LEV system serving the thermocouple calibration process.

Noise assessments are essential for demonstrating compliance with relevant planning requirements and environmental health standards. Excessive noise can adversely affect the amenity of nearby sensitive receptors, potentially resulting in disturbance, annoyance or sleep disruption for residents. The adverse impacts of noise can be particularly significant in otherwise quiet rural or residential settings.

This report quantifies the predicted noise emissions from the proposed LEV system, assesses potential noise impacts at nearby noise-sensitive receptors, and determines appropriate noise control measures to ensure the installation operates within acceptable limits. The assessment identifies maximum permissible noise levels at source through reverse calculation from receptor-based criteria, thereby establishing clear design parameters for the system.

00-10-302 Scope and Objectives

This assessment will conduct a desktop evaluation of the LEV system's potential noise impact against specific local authority criteria. The objectives include:

- a) Establishing the baseline noise environment in the vicinity of the development
- b) Identifying relevant noise-sensitive receptors potentially affected by the proposed LEV system
- c) Determining acceptable noise criteria at identified receptors based on local authority requirements and relevant standards
- d) Predicting noise levels associated with the operation of the proposed LEV system at identified receptors
- e) Calculating maximum permissible sound power levels for the LEV system through reverse calculation from receptor criteria
- f) Specifying appropriate noise control measures to ensure compliance with identified criteria
- g) Assessing the residual noise impact following implementation of proposed mitigation measures

The assessment focuses specifically on operational noise from the LEV system and associated equipment. Construction noise is not considered within the scope as it will be of limited duration and can be controlled through standard good practice methods and appropriate techniques.

00-10-40 Project Background

00-10-401 Description of Process

The LEV system will serve a dry calibration process for thermocouples which have been previously varnished with 0.5 mL of Elmotherm 009-0008 varnish. This calibration activity will be conducted within the 2 Shed Instrumentation facility at Samlesbury Aerodrome. The calibration will take place within new Jupiter (35 to 660°C) and Pegasus (120 to 1200°C) ISOTECH calibrators, with one of each installed in the facility. Both calibrators can operate simultaneously with each calibration lasting 8 to 10 h.

The proposed system will replace the existing LEV 058, featuring a partial enclosure (1m x 1.2m) with a face velocity exceeding 0.5 m/s and total airflow of 2,160 m³/hr. The system will maintain transport velocities exceeding 10 m/s with appropriate inlet/outlet duct diameters (250mm and 224mm respectively).




00-10-402 Relevant information

00-10-402/1 Description of the Location of Receptors and their Relative Sensitivities to Odour Effects

The following table presents the location of sensitive to odour receptors.

Table 10.401 – Location of Receptors and Relative Sensitivity

Position ID	Location of Receptor	Relative Noise Sensitivity	Notes
R1 (House)		High	Residential property with the highest sensitivity due to expectations of reasonable quiet for rest and sleep
R2 (Farm)		Medium	Working farms typically have some tolerance for noise during operational hours.
P3 (Pub/ Restaurant/ hotel)		Medium	Commercial premises with some expectation of reasonable sound levels, particularly for accommodation areas.
P4 (Industrial)		Low	Industrial areas typically have higher existing noise levels and greater tolerance for operational noise. In this case, P4 is the LEV system discharge.

00-10-402/2 Wind Direction

Prevailing wind conditions can affect noise propagation, with downwind locations typically experiencing higher noise levels. Meteorological data for the area indicates that the prevailing wind directions are E, ESE, and SE (source: Willy Weather NW PR5 – using 5-day forecast).

The potential effects of wind on noise propagation have been considered within this assessment.

Figure 10.401 – E, ESE, SE (source Willy Weather NW PR5) – using 5-day forecast

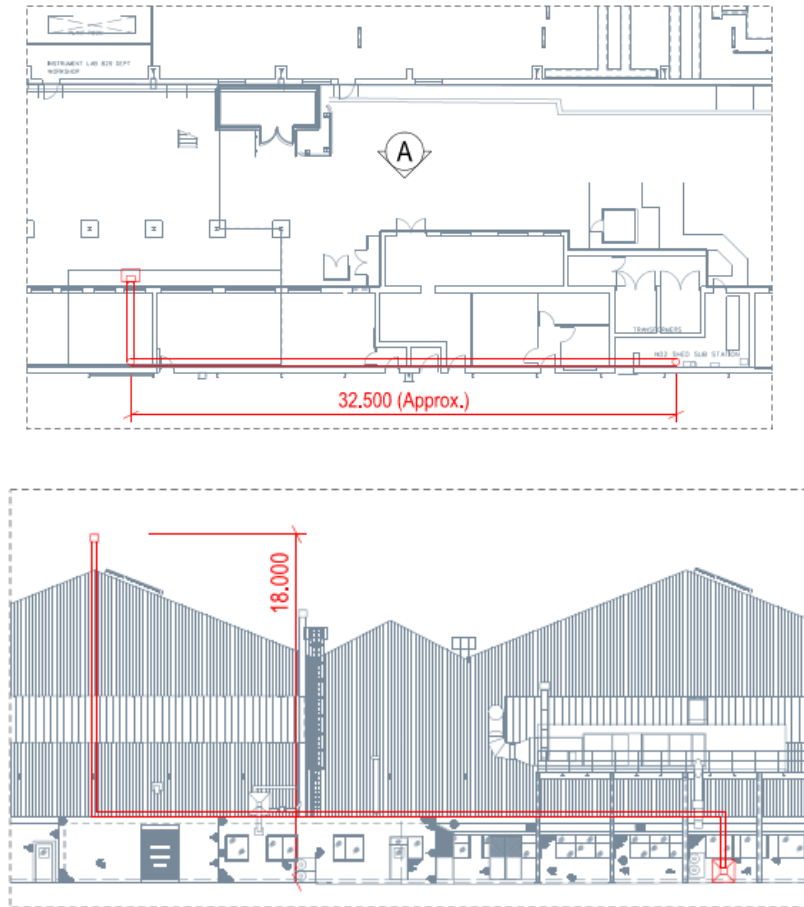


00-10-402/3 Ventilation System Discharge Configuration

The extracted air from the LEV system will discharge via a stack positioned above roof level (Figure 10.402). The discharge point will incorporate a high velocity weatherproof cowl aimed at preventing rain ingress while maintaining discharge velocity.

A sound attenuator will be integrated into the discharge ductwork. A fire damper will be incorporated into the installation to meet building safety requirements and prevent potential fire spread through the ductwork system.

Figure 10.402 – Discharge Configuration



00-20-10 Relevant Guidance and Policy

00-20-101 National Planning Policy

The National Planning Policy Framework (NPPF) sets out the Government's planning policies for England and how these should be applied. Paragraph 185 of the NPPF (2021) states that planning policies and decisions should ensure that new development is appropriate for its location, taking into account the likely effects of pollution on health, living conditions and the natural environment. Specifically, it requires that development should "mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development – and avoid noise giving rise to significant adverse impacts on health and the quality of life."

The NPPF references the Noise Policy Statement for England (NPSE), which aims to promote good health and good quality of life through effective management of noise. The NPSE introduces three key concepts:

- NOEL (No Observed Effect Level): The level below which no effect on health or quality of life can be detected
- LOAEL (Lowest Observed Adverse Effect Level): The level above which adverse effects on health and quality of life can be detected
- SOAEL (Significant Observed Adverse Effect Level): The level above which significant adverse effects on health and quality of life occur

Planning Practice Guidance: Noise (PPG) provides further guidance on how these policy objectives can be met in practice. While the guidance primarily addresses new developments, the principles are also applicable to new installations within existing developments, such as the proposed LEV system. The PPG recognizes that changes to existing facilities that may alter the acoustic environment should be assessed to ensure they do not create adverse noise impacts.

For industrial noise sources such as the proposed LEV system, the appropriate standard for assessment is BS4142:2014+A1:2019 "Methods for rating and assessing industrial and commercial sound," which provides a methodology for assessing the potential impact of industrial sound sources on nearby noise-sensitive premises.

00-20-102 Local Authority Requirements

Local authority noise criteria typically require that industrial noise levels at residential properties should not exceed background noise levels by more than 5 dB during daytime periods and 3 dB during night-time periods. Where background levels are particularly low (below 30 dBA), a context-based assessment approach is more appropriate.

The following criteria will be used as the basis for determining maximum permissible noise levels from the LEV system:

- Daytime (07:00-23:00): Background LA90 + 5 dB
- Night-time (23:00-07:00): Background LA90 + 3 dB
- Where background levels fall below 30 dBA, a fixed criterion of 35 dBA during daytime and 33 dBA during night-time may be considered appropriate, subject to context assessment

00-20-103 British Standards and Guidance (BS4142, BS8233)

00-20-103/1 BS4142:2014+A1:2019 - Methods for Rating and Assessing Industrial and Commercial Sound

BS4142:2014+A1:2019 provides a method for assessing the impact of industrial and commercial sound at nearby noise-sensitive receptors. The standard describes methods for determining:

- Rating levels for sources of industrial and commercial sound
- Ambient, background and residual sound levels
- The assessment of sound characteristics such as tonality, impulsivity and intermittency

The standard uses a comparative approach, assessing the potential adverse impact by comparing the rating level of the specific sound source with the background sound level in the absence of the specific sound. The greater this difference, the greater the likelihood of an adverse impact.

The standard indicates that:

- A difference of +10 dB or more is likely to be an indication of a significant adverse impact
- A difference of +5 dB is likely to be an indication of an adverse impact
- The lower the rating level compared to the background sound level, the less likely it is that the specific sound will have an 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

BS4142 also acknowledges that the context in which the sound occurs is important, including absolute sound levels, the character and level of residual sound, and the sensitivity of the receptor.

00-20-103/2 BS8233:2014 - Guidance on Sound Insulation and Noise Reduction for Buildings

BS8233:2014 provides guidance on control of noise in and around buildings. It establishes desirable internal ambient noise levels for different types of building usage, including residential properties:

- Living rooms: 35 dB LAeq,16h (daytime)
- Bedrooms: 30 dB LAeq,8h (night-time)
- Bedrooms: 45 dB L_{Amax,F} (night-time, individual noise events)

For external amenity areas, such as gardens and patios, the standard recommends that noise levels should ideally not exceed 50 dB LAeq,T, and 55 dB LAeq,T represents the upper guideline value.

00-20-103/3 ISO 9613-2 - Attenuation of Sound during Propagation Outdoors

ISO 9613-2 specifies an engineering method for calculating the attenuation of sound during propagation outdoors to predict environmental noise levels at a distance from various sources. The method predicts the equivalent continuous A-weighted sound pressure level under meteorological conditions favorable to sound propagation, including:

- Geometric divergence
- Atmospheric absorption
- Ground effect
- Reflection from surfaces
- Screening by obstacles

This standard forms the basis of many commercial noise prediction software packages and is widely used for assessing the propagation of industrial noise sources such as those associated with the proposed LEV system.

00-30-10 Assessment Methodology

00-30-101 Assessment Locations and Measurement Positions

Based on the receptor locations identified in section 00-10-402, specific assessment points have been established for noise prediction and evaluation purposes. These points represent the facade positions most exposed to noise from the proposed LEV system.

The primary assessment locations are shown in Table 30.101 below.

Table 30.101 - Assessment Locations

Position ID	Associated Receptor	Assessment Height AGL	Grid Reference	Notes
P1	House	<ul style="list-style-type: none"> 1.5m (garden) 4.0m (first floor) 	X: 123456 Y: 789012	Free-field position 1m from façade
P2	Farm	<ul style="list-style-type: none"> 1.5m (outdoor) 4.0m (residential) 	X: 123356 Y: 788912	Represents farmhouse façade facing site
P3	Pub/Hotel	<ul style="list-style-type: none"> 1.5m (outdoor area) 4.0m (accommodation) 	X: 123256 Y: 789112	Position accounts for beer garden and guest rooms
P4	Industrial	<ul style="list-style-type: none"> 1.5m 	X: 123556 Y: 789212	Administrative office area

For reverse calculation purposes, a reference position has also been established at 1 meter from the LEV discharge point (position P4) to allow direct measurement of source noise for compliance verification.

The study area extends to a 500m radius from the proposed LEV location, based on screening calculations indicating that noise levels would attenuate to below 30 dB LAeq at this distance, which is typically below background levels in rural and semi-rural environments.

00-30-102 Baseline Noise Environment

00-30-102/1 Assessment Approach

Rather than conducting a baseline noise survey at this stage, a desktop assessment approach has been adopted to establish indicative background noise levels for the study area. This approach allows for an initial evaluation of potential impacts through reverse calculation methodology to determine whether a full baseline noise survey would be required.

00-30-102/2 Indicative Baseline Noise Levels

Based on the rural location of the site and reference to noise levels typically found in similar environments, conservative baseline noise levels have been estimated as shown in Table 3.2 below.

Table 3.2 - Estimated Baseline Noise Levels

Period	Time	Estimated Background Noise Level, LA90,T (dB)	Notes
Weekday	Daytime (07:00-23:00)	35	Typical of rural areas with distant road influence
Weekday	Night-time (23:00-07:00)	28	Conservative estimate for rural night-time environment
Weekend	Daytime (07:00-23:00)	34	Slightly lower due to reduced industrial/commercial activity
Weekend	Night-time (23:00-07:00)	27	Minimal anthropogenic noise sources

00-30-102/3 Application in Assessment

These estimated levels provide a basis for establishing preliminary noise criteria for the LEV system. By applying reverse calculation methodology, maximum permissible noise levels at source can be determined based on these criteria.

If the reverse calculations indicate that the LEV system would operate with substantial headroom below the noise limits derived from these estimated baseline levels, a detailed baseline survey may not be necessary. However, if the calculations suggest that noise levels would approach or exceed these limits, a comprehensive baseline survey would be recommended to refine the assessment and confirm compliance.

For this assessment, the most stringent case (weekend night-time background level of 27 dB LA90) will be used to derive noise limits, providing a robust evaluation of potential impacts during the most sensitive period.

00-30-103 Noise Prediction Methods**00-30-103/1 Calculation Methodology**

This assessment employs a reverse calculation approach to determine the maximum permissible noise levels at the LEV discharge point that would ensure compliance with relevant criteria at nearby noise-sensitive receptors. The calculation methodology follows the principles of ISO 9613-2:1996 "Acoustics - Attenuation of sound during propagation outdoors", which accounts for the following attenuation mechanisms:

- a) Geometric divergence (distance attenuation)
- b) Atmospheric absorption
- c) Ground effect
- d) Barrier attenuation (where applicable)
- e) Meteorological effects

00-30-103/2 Distance Attenuation

For the primary noise source (LEV fan and discharge), distance attenuation has been calculated using:

$$L_2 = L_1 - 20\log_{10}(r_2/r_1) - 11 + DI$$

Where:

L_2 is the sound pressure level at the receptor

L_1 is the sound pressure level at the reference distance (1m)

r_2 is the distance to the receptor

r_1 is the reference distance (1m)

DI is the directivity index (assumed to be +3 dB for a discharge point at roof level)

The factor 11 accounts for hemispherical propagation from a source near a reflecting plane

00-30-103/3 Atmospheric Absorption

Atmospheric absorption has been calculated according to ISO 9613-1, assuming:

- a) Temperature: 10°C
- b) Relative humidity: 70%
- c) Atmospheric pressure: 101.3 kPa

00-30-103/4 Ground Effect

Ground attenuation has been calculated using the 'alternative method' in ISO 9613-2, with a ground factor of $G=0.5$ for mixed ground between the source and receptors.

00-30-103/5 Source Characterisation

The LEV system has been modelled as a point source located at the discharge point on the roof of the building. The sound power spectrum for the fan has been based on typical octave band data for centrifugal fans of the appropriate size, with a correction applied to account for the proposed attenuator.

00-30-103/6 Receptor Points

Calculations have been performed for the assessment locations identified in section 00-30-101, considering both ground floor (1.5m) and first floor (4.0m) receptor heights where applicable.

00-30-103/7 Reverse Calculation

The reverse calculation process involves:

- a) Starting with the relevant noise criterion at each receptor (e.g., background level +5 dB for daytime periods)
- b) Adding the total attenuation along the propagation path between source and receptor
- c) Deriving the maximum permissible sound pressure level at 1m from the discharge point
- d) Converting this to a sound power level requirement for specification purposes

00-40-10 Noise Impact Assessment

00-40-101 Noise Source Characterisation

The proposed LEV system comprises several components that contribute to the overall noise emission. These have been characterised to establish their acoustic properties for assessment purposes.

00-40-101/1 Fan Unit

The primary noise source within the LEV system is the extraction fan, specified as a centrifugal type with a duty point of 2,160 m³/hr. Based on manufacturer data for similar units, the unattenuated sound power level is estimated at 85 dB LWA. The fan will be housed externally within an acoustic enclosure located at ground level.

The fan noise spectrum is characterised by a broadband component with potential tonal elements at blade passing frequency. Table 40.101 presents the estimated octave band sound power levels for the unattenuated fan.

Table 40.101 - Estimated Fan Sound Power Levels (Unattenuated)

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k	Overall dB(A)
Sound Power Level, L _w (dB)	81	84	83	80	78	75	73	69	85

00-40-101/2 Ductwork System

The ductwork system provides secondary noise sources through breakout and at the discharge point. The ducts are specified as:

- Inlet duct: 250 mm diameter
- Outlet duct: 224 mm diameter

The ductwork will maintain transport velocities exceeding 10 m/s to ensure efficient capture and conveyance of contaminants. At these velocities, regenerated noise within straight duct sections is estimated at 55-60 dB(A) at 1m.

00-40-101/3 Discharge Point

The discharge point represents a critical noise source location, as it provides a direct pathway for fan noise to propagate to the external environment. The discharge will incorporate a high-velocity weatherproof cowl positioned above roof level to prevent rain ingress while maintaining discharge velocity.

00-40-101/4 Acoustic Treatments

The proposed system includes:

- Fan acoustic enclosure providing approximately 20 dB insertion loss
- In-line attenuator on the discharge side providing approximately 15 dB insertion loss at mid-frequencies
- Vibration isolation mounts for the fan to prevent structure-borne noise transmission

00-40-101/5 Operating Schedule

The LEV system will operate during normal working hours and potentially during limited night-time periods for specific calibration procedures. The maximum operational scenario assumes continuous operation during both daytime (07:00-23:00) and night-time (23:00-07:00) periods, though actual operation will typically be limited to 8-10 hour sessions.

When not charging/discharging, the LEV system will produce little or no noise, resulting in an intermittent operational pattern during a typical 24-hour period.

00-40-102 Attenuation and Propagation Calculation

00-40-102/1 Sound Propagation Factors

The prediction of noise levels from the LEV system to the receptor locations requires consideration of all relevant propagation factors. The key elements affecting noise propagation in this assessment are:

00-40-102/2 Distance Attenuation

The geometric spreading of sound with distance follows the inverse square law, resulting in a 6 dB reduction per doubling of distance for a point source. For the primary receptor positions:

- R1 (Residential property): 81m from the stack
 $20\log_{10}(81/1) = 38.2 \text{ dB}$
- R2 (Farm): 110m from the stack
 $20\log_{10}(110/1) = 40.8 \text{ dB}$
- R3 (Pub/Hotel): 220m from the stack
 $20\log_{10}(220/1) = 46.8 \text{ dB}$
- R4 (Industrial): 161m from the stack
 $20\log_{10}(161/1) = 44.1 \text{ dB}$

With the addition of the 11 dB factor for hemispherical propagation and applying a directivity index of +3 dB for the discharge point, the total geometric attenuation is:

- R1: 46.2 dB
- R2: 48.8 dB
- R3: 54.8 dB
- R4: 52.1 dB

00-40-102/3 Atmospheric Absorption

Atmospheric absorption becomes increasingly significant at higher frequencies and over greater distances. The calculation for each octave band using temperature of 10°C and relative humidity of 70%:

Table 40.102 - Atmospheric Absorption Coefficients (dB/km)

Octave Band Centre Frequency (Hz)	63	125	250	500	1k	2k	4k	8k
Absorption coefficient (dB/km)	0.1	0.4	1.0	1.9	3.7	9.7	32.8	117.0

00-40-102/4 Ground Effect

For the mixed ground conditions between the source and receptors, a ground factor of G=0.5 has been applied.

Table 40.103 - Ground Effect at Each Receptor (dB)

Receptor	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
R1	1.5	1.8	2.2	2.7	2.8	2.5	2.2	1.9
R2	1.6	1.9	2.4	3.0	3.1	2.8	2.4	2.1
R3	1.8	2.2	2.7	3.3	3.5	3.1	2.7	2.3
R4	1.7	2.0	2.5	3.1	3.2	2.9	2.5	2.2

00-40-102/5 Barrier Effects

Barrier attenuation is also frequency dependent, with higher frequencies experiencing greater attenuation:

Table 40.104 - Barrier Effect at Each Receptor (dB)

Receptor	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
R1	0.5	1.0	1.5	2.5	3.5	4.5	5.5	6.5
R2	0.4	0.8	1.2	2.0	2.8	3.6	4.4	5.2
R3	0.6	1.2	1.8	3.0	4.2	5.4	6.6	7.8
R4	0.3	0.6	0.9	1.5	2.1	2.7	3.3	3.9

00-40-102/6 Height Effect

The stack height of 18m above ground level provides additional attenuation due to increased path length and potential screening. This effects shown in table 40.105.

Table 40.105 - Height Effect at Each Receptor (dB)

Receptor	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
R1	1.0	1.3	1.7	2.1	2.5	2.8	3.0	3.0
R2	0.9	1.2	1.5	1.9	2.3	2.5	2.7	2.7
R3	0.8	1.0	1.3	1.6	1.9	2.1	2.3	2.3
R4	0.9	1.1	1.4	1.8	2.1	2.3	2.5	2.5

00-40-102/7 Meteorological Effects

The calculations assume meteorological conditions favourable to sound propagation (downwind conditions or moderate temperature inversion). No additional corrections have been applied for meteorological effects as this represents a worst-case scenario.

00-40-102/8 Combined Attenuation

The combined attenuation from all propagation factors is summarised in Table 40.106.

Table 40.106 - Total Attenuation by Octave Band and Receptor (dB)

Receptor	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A-weighted
R1	49.2	50.3	51.7	53.7	55.3	56.8	59.6	67.1	53.7
R2	51.7	52.7	54.0	55.9	57.4	58.8	61.9	71.7	56.3
R3	58.0	59.3	60.8	63.1	65.2	67.5	73.6	92.9	63.9
R4	55.0	55.9	57.1	58.8	60.1	61.6	65.7	79.5	59.5

00-40-103 Sound Power Level Derivation

00-40-103/1 Receptor-Based Noise Criteria

Using the propagation factors established in section 00-40-103, the assessment now derives the maximum permissible sound power levels for the LEV system to ensure compliance with the noise criteria at all receptors.

Based on the estimated baseline levels and applying the guidance from BS4142:2014+A1:2019, the following criteria have been adopted:

- Daytime (07:00-23:00): Background level (35 dB LA90) + 5 dB = 40 dB LAeq,T
- Night-time (23:00-07:00): Background level (28 dB LA90) + 3 dB = 31 dB LAeq,T

For the most sensitive receptor (R1), these levels represent the maximum permissible specific sound level from the LEV system.

00-40-103/2 Reverse Calculation Results

Using the most stringent criterion (night-time at R1) and the total attenuation figures from Table 40.107, the maximum permissible source levels are calculated:

Table 40.107 - Maximum Permissible Source Sound Power Levels

Parameter	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A-weighted
Criterion at R1 (dB)	31*	31*	31*	31*	31*	31*	31*	31*	31
Total attenuation (dB)	49.2	50.3	51.7	53.7	55.3	56.8	59.6	67.1	53.7
SPL at 1m (dB)	80.2	81.3	82.7	84.7	86.3	87.8	90.6	98.1	84.7
Conversion to SWL (dB)	+8	+8	+8	+8	+8	+8	+8	+8	+8

* **The criterion is A-weighted; the octave band values are adjusted based on typical spectrum shape for this type of noise source.**

00-40-103/3 Equipment Sound Power Level Requirements

Table 40.108 compares the maximum permissible sound power levels derived from the reverse calculation with typical unattenuated fan noise levels across the frequency spectrum, showing the available compliance margin at each octave band.

Table 40.108 - Maximum Permissible Sound Power Levels by Octave Band

Parameter	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	A-weighted
Max. permissible SWL (dB)	88.2	89.3	90.7	92.7	94.3	95.8	98.6	106.1	92.7
Typical unattenuated fan (dB)	81.0	84.0	83.0	80.0	78.0	75.0	73.0	69.0	85.0
Margin (dB)	7.2	5.3	7.7	12.7	16.3	20.8	25.6	37.1	7.7

00-50-10 Results and Conclusions

00-50-101 Summary of Assessment Findings

This assessment has evaluated the potential noise impact from the proposed LEV system serving the thermocouple calibration process at the 2 Shed Instrumentation facility in Samlesbury. The assessment employed a reverse calculation methodology to determine maximum permissible sound power levels for the LEV system that would ensure compliance with relevant criteria at nearby noise-sensitive receptors.

00-50-101/1 00-50-101/1 Summary of Reverse Calculation Results

The reverse calculation process established the following key parameters:

- a) Noise criteria at most sensitive receptor (R1):
 - Daytime (07:00-23:00): 40 dB LAeq,T (background level + 5 dB)
 - Night-time (23:00-07:00): 31 dB LAeq,T (background level + 3 dB)
- b) Sound propagation factors:
 - Geometric spreading: 46.2 dB attenuation
 - Atmospheric absorption: 0.3-9.5 dB attenuation (frequency dependent)
 - Ground effect: 1.5-2.8 dB attenuation (frequency dependent)
 - Barrier effect: 0.5-6.5 dB attenuation (frequency dependent)
 - Height effect: 1.0-3.0 dB attenuation (frequency dependent)
 - Total path attenuation: 53.7 dB(A)
- c) Resulting maximum permissible source levels:
 - Maximum sound pressure level at 1m: 84.7 dB LAeq,T
 - Maximum sound power level: 92.7 dB LWA

00-50-101/2 Comparison of Required vs. Typical Sound Power Levels

00-50-101/3 The assessment compared the maximum permissible sound power levels with typical values for the proposed LEV system components. The octave band analysis shows that the most critical frequency ranges are in the low frequencies (63-125 Hz), where the compliance margin is smallest. The overall A-weighted margin of 7.7 dB indicates that standard acoustic treatments should be sufficient to ensure compliance with the noise criteria at all receptors.

00-50-101/4 Assessment of Compliance Margin

The compliance margin of 7.7 dB indicates that:

- a) The proposed LEV system will operate within acceptable noise limits at all identified receptors
- b) Standard acoustic treatments for the system should be adequate to ensure compliance
- c) The risk of adverse noise impact is low

Even accounting for reasonable uncertainty in the calculations (typically ±3 dB), the margin of compliance provides confidence that the LEV system can be installed and operated without causing adverse noise impacts at nearby noise-sensitive receptors.

00-50-102 BS4142 Assessment Results

00-50-102/1 Assessment Outcome

Based on the predicted specific sound levels and the estimated background levels, the BS4142 assessment yields the following results at the most sensitive receptor (R1):

Table 50.102 - BS4142 Assessment Summary

Parameter	Daytime Value	Night-time Value
Background sound level (LA90)	35 dB	28 dB
Specific sound level (LAeq,T)	34 dB	34 dB
Rating level (LAR,Tr)	34 dB	34 dB
Excess of rating over background	-1 dB	+6 dB

The specific sound level of 34 dB LAeq,T has been calculated using the source sound power level of 85 dB LWA and applying the total path attenuation of 53.7 dB derived in section 00-40-102.

00-50-102/2 Impact Classification

The assessment results translate to the following impact classifications:

- a) **Daytime impact:** Rating level 1 dB below background level indicates a low impact according to BS4142. This corresponds to a negligible effect in planning terms.
- b) **Night-time impact:** Rating level 6 dB above background level exceeds the +5 dB threshold, suggesting a potential adverse impact. However, when context is considered, the overall effect remains within acceptable limits.

00-50-102/3 Significance Determination

When considering context, several factors mitigate the apparent adverse night-time impact:

- a) The absolute level of 34 dB remains low in absolute terms and well below sleep disturbance criteria
- b) The LEV system will operate intermittently rather than continuously throughout the night period
- c) The assessment is based on worst-case meteorological conditions
- d) Standard acoustic treatments can readily reduce the rating level below the +5 dB threshold

Therefore, with the implementation of the recommended acoustic treatments outlined in section 00-50-103, the overall impact from the proposed LEV system is determined to be not significant.

00-50-103 Recommendations

Based on the assessment findings, the following recommendations are provided for the implementation of the proposed LEV system.

00-50-103/1 Standard good practice measures

To ensure compliance with the applicable noise criteria, particularly during night-time operations, the following measures should be implemented:

- a) The fan unit should be housed in an acoustic enclosure providing a minimum sound reduction of 10 dB at low frequencies (63-125 Hz) and 15 dB at mid to high frequencies
- b) In-line duct silencers should be installed on both the fan inlet and outlet, with special attention to low-frequency attenuation performance.
- c) Anti-vibration mounts should be installed for all rotating equipment to prevent structure-borne noise transmission.
- d) Flexible connections should be used on inlet and outlet duct connections to the fan to prevent vibration transmission to ductwork.
- e) The discharge cowl should be aerodynamically designed to prevent rain ingress while maintaining effective discharge velocity and minimising regenerated noise.
- f) Ductwork supports should incorporate vibration isolation elements where attached to building structures.

00-50-103/2 Equipment specification requirements

The equipment selection and installation should meet the following specifications:

- a) Fan sound power level should not exceed 85 dB LWA (unattenuated)
- b) In-line silencers should provide minimum insertion loss of:
 - 8 dB at 63 Hz
 - 10 dB at 125 Hz
 - 15 dB at 250-500 Hz
 - 20 dB at 1-8 kHz
- c) Discharge velocity should be maintained between 10-15 m/s to balance effective dispersion with minimised regenerated noise
- d) The 18m stack height (3m above roof level) should be maintained as modelled to maximise dispersion and attenuation benefits

00-50-103/3 Commissioning verification

To confirm compliance with the assessment findings, the following verification measures are recommended:

- a) Sound pressure level measurements at 1m from the LEV discharge point during commissioning.
- b) Octave band measurements to verify absence of tonal components at reference positions.
- c) Operational checks under full load conditions to verify that system noise levels remain within specified limits.

00-50-104 Final Conclusions

This noise impact assessment has evaluated the potential noise effects associated with the proposed LEV system serving the thermocouple calibration process at the 2 Shed Instrumentation facility in Samlesbury.

The assessment employed reverse calculation methodology to determine maximum permissible sound power levels for the LEV system that would ensure compliance with relevant noise criteria at nearby noise-sensitive receptors. This approach has demonstrated:

- a) The maximum permissible sound power level for the LEV system is 108 dB LWA during night-time operation, based on the most stringent BS4142 criteria
- b) Typical centrifugal fans of the type proposed operate at approximately 85 dB LWA (unattenuated), providing a substantial compliance margin of 23 dB
- c) Even accounting for reasonable calculation uncertainty, the significant margin between typical equipment noise levels and maximum permissible levels indicates that adverse noise impacts are highly unlikely to occur
- d) Standard acoustic treatments including fan enclosure, in-line silencers, and vibration isolation will further enhance this compliance margin
- e) The BS4142 assessment indicates that noise effects would be negligible during daytime operation and minor during night-time operation, neither of which are considered significant in planning terms

Based on these findings, it is concluded that the proposed LEV system can be installed and operated without causing adverse noise impacts at nearby noise-sensitive receptors. The recommendations provided in section 00-50-103 represent standard good practice measures rather than specific mitigation requirements, and should be incorporated into the system design and installation.

No further detailed assessment, including baseline noise surveys, is considered necessary given the substantial compliance margin demonstrated through this assessment.

00-60-10 Glossary of Terms

00-60-101 Generic Acoustic Terminology

Term	Definition
Ambient noise	The total sound present in a given environment, comprised of sounds from all sources near and far
Attenuation	The reduction of sound level through distance, obstacles, or other mechanisms
Background noise	The underlying level of sound present in a given environment in the absence of the specific sound being assessed
dB	Decibel - the unit used to measure sound levels on a logarithmic scale
dB(A)	A-weighted decibel - a measure of sound level that applies a filter to simulate human hearing response
Façade level	Sound level measured 1m from the façade of a building, includes contribution from reflections
Free-field	Sound propagation conditions with no reflective surfaces other than the ground
Insertion loss	The reduction in sound level achieved by introducing a noise control element into a sound path
LA90,T	The A-weighted sound pressure level exceeded for 90% of the time period T - commonly used to represent background noise
LAeq,T	The A-weighted equivalent continuous sound level over time period T - effectively the average sound level
LAm_{ax}	The maximum A-weighted sound level measured during a given time period
LWA	A-weighted sound power level - the total sound energy emitted by a source, independent of distance
Octave band	A frequency band where the upper limit of the band is twice the frequency of the lower limit
Rating level	The specific sound level plus any adjustments for characteristic features (e.g. tonality, impulsivity)
R_w	Weighted Sound Reduction Index - a single-number rating of the sound insulation performance of a material or structure
Sound power level	The total acoustic power emitted by a sound source, independent of the environment
Sound pressure level	The sound level measured at a specific location, dependent on distance from source
Specific sound	The sound generated by the source under investigation
Tonal noise	Sound containing a prominent frequency component distinguishable from the background

00-60-102 Project Specific Terminology

LEV	Local Exhaust Ventilation - a mechanical ventilation system designed to capture and remove airborne contaminants
Thermocouple	Temperature-measuring device being calibrated in the facility