# Proposed Solar Farm and Battery Energy Storage System on Land Adjacent to A614, Worksop

## Construction Noise Management Plan Information

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inacoustic | bristol
20 Melrose Place, Clifton, Bristol, BS8 2NG
0117 325 3949 | www.inacoustic.co.uk | bristol@inacoustic.co.uk
inacoustic is a trading name of Inacoustic Ltd, registered in the UK 10873933

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| Authored By | Neil Morgan MSc MIOA | Neil Morgan MSc MIOA | Neil Morgan MSc MIOA |
| Checked By | Victor Valeron BEng MSc MIOA | - | - |
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# 1. Introduction

## 1.1. Overview

inacoustic has been commissioned to provide a Noise and Vibration Management Plan for the construction works associated with a solar farm and battery energy storage system on land adjacent to the A614, Worksop, S80 3PA.

The assessment is based upon environmental noise measurements undertaken at the site and a predictive exercise.

This noise assessment is necessarily technical in nature; therefore a glossary of terms is included in Appendix A to assist the reader.

## 1.2. Scope and Objectives

The scope of the noise assessment can be summarised as follows:

- A sound monitoring survey was undertaken at discrete locations around the Site;
- An assessment of predicted construction noise; and
- Recommendation of mitigation measures, where necessary, in accordance with the principles of BS 5228[1].

[1] British Standard Institution. BS 5228:2009+A1:2014 – Code of practice for noise and vibration control on construction and open sites.

# 2. LEGISLATION, STANDARDS AND GUIDANCE

## 2.1. Legislation

### 2.1.1. Control of Pollution Act, 1974

The Control of Pollution Act, 1974, Part III - Noise is a combination and refinement of three earlier Acts: the Public Health Act, 1936 (replaced by the Public Health Act 1990, Part III), the Noise Abatement Act 1960 and the Public Health Act 1990, Part III). Section 60 of the Act enables a local planning authority to serve a notice on a person (this includes a company) who is carrying out, or who are planning to carry out, works of construction, demolition, road works, railway maintenance etc. in order to control the noise from those operations. Section 61 (S61) of the Act also enables such a person to apply to the local authority for consent in respect of such works.

The Act introduces the concept of using ‘Best Practicable Means’ (BPM) to control the impact of noise, where significant impacts are likely to occur. BPM essentially means selection of the quietest techniques and equipment, in addition to considering factors such as timing, duration, location and opportunities for acoustic screening or separation, to ensure that impacts are controlled in so far as is reasonably practicable. The demonstrable use of BPM can also be used as a defence to enforcement action under nuisance legislation.

## 2.2. British Standards

### 2.2.1. BS5228-1:2009+A1: 2014 - Noise

Noise levels generated by construction plant and activities have the potential to impact upon nearby noise-sensitive receptors.

BS 5228 sets out an appropriate methodology for predicting, assessing and controlling noise levels arising from a wide variety of demolition and construction plant and related activities. As such, it can be used to predict noise levels arising from the operations at proposed construction sites. BS 5228 also sets out tables of sound power levels generated by a wide variety of construction plant to facilitate such predictions.

The magnitude of the potential impact on sensitive receptors would depend upon a number of variables, the following of which are of particular relevance to this assessment:

- The amount of noise generated by plant and equipment being used at the Site, generally expressed as a sound power level;
- The periods of operation of the plant at the Site, known as the ‘on-time’;
- The distance between the noise source and the receptor, known as the ’stand-off’;
- The attenuation due to ground absorption or barrier screening effects; and
- The reflection of noise due to the presence of hard vertical faces such as walls.

In order to determine the likely effect of noise during demolition and construction of the proposed development, noise predictions have been carried out in accordance with the procedures presented in BS 5228, taking full account of BPM.

The prediction method described in BS 5228 comprises taking the source noise level of each item of plant and correcting it for the following variables:

- distance effects between source and receiver;
- percentage operating time of the plant;
- barrier attenuation effects;
- ground absorption; and
- facade corrections.

BS 5228 gives several examples of acceptable limits for construction or demolition noise. The most simplistic is based upon the exceedance of fixed noise limits and Annex E.2 states that: "*Noise from construction and demolition sites should not exceed the level at which conversation in the nearest building would be difficult with the windows shut.*"

Annex E.2 goes on to state: "*Noise levels, between say 07.00 and 19.00 hours, outside the nearest window of the occupied room closest to the Site boundary should not exceed: 70 decibels (dBA) in rural, suburban areas away from main road traffic and industrial noise or 75 decibels (dBA) in urban areas near main roads in heavy industrial areas. These limits are for daytime working outside living rooms and offices.*"

In respect of potentially more sensitive residential receptors, this assessment considers the criteria set out in Annex E.3 of BS 5228, which considers impact significance based upon the change in ambient noise associated with construction activities. BS 5228 states that this can be considered as *"an alternative and/or additional method to determine the significance of construction noise levels".*

Paragraph E.3.2 describes Example Method 1 (The ABC Method), which considers the existing ambient noise environment (the $L_{Aeq}$ noise level environment) at the neighbouring sensitive receptors and identifies levels that if exceeded would be considered to result in a significant adverse effect and is noted to apply to residential receptors only.

Table E.1 of BS 5228 sets out significance effect threshold values at receptors. The process for determining this requires the determination of the ambient noise level at the relevant receptor (rounded to the nearest 5 dB), which is then compared to the total noise level, including the predicted construction noise level. If the combined noise level exceeds the appropriate category value, then the impact is deemed to be significant. The relevant statistics from Table E.1 are set out in Table 1 below: Compliance with these guidance levels would ensure that no significant adverse effects are experienced at receptor locations.

TABLE 1: CONSTRUCTION NOISE IMPACT SIGNIFICANCE CRITERIA

| Assessment Category and Threshold Value Period | Threshold Value, in Decibels – $L_{Aeq}$ dB | | |
|---|---|---|---|
| | Category A | Category B | Category C |
| Daytime (07:00-19:00) and Saturdays (07:00-13:00) | 65 | 70 | 75 |
| Evenings and weekends) | 55 | 60 | 65 |
| Night-time (23:00-07:00) | 45 | 50 | 55 |
| *NOTE 1 A significant effect has been deemed to occur if the total $L_{Aeq}$ noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.* | | | |
| *NOTE 2 If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total $L_{Aeq}$ noise level for the period increases by more than 3 dB due to construction activity.* | | | |
| *NOTE 3 Applied to residential receptors only.*<br>*A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values.* | | | |

*B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.*

*C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.*

*D) 19:00-23:00 weekdays, 13:00-23:00 Saturdays and 07:00-23:00 Sundays.*

### 2.2.2. BS5228-1:2009+A1: 2014 - Vibration

Vibration may be impulsive such as that due to hammer-driven piling; transient such as that due to vehicle movements along a railway; or continuous such as that due to vibratory driven piling.

The primary cause of community concern in relation to vibration generally relates to building damage from both construction and operational sources of vibration, although, the human body can perceive vibration at levels which are substantially lower than those required to cause building damage.

Damage to buildings associated solely with ground-borne vibration is not common and although vibration may be noticeable, there is little evidence to suggest that they produce cosmetic damage such as a crack in plaster unless the magnitude of the vibration is excessively high. The most likely impact, where elevated levels of vibration do occur during the demolition and construction phases, is associated with perceptibility.

Table 2 presents a summary of the guidance contained within BS 5228, in terms of peak particle velocity (PPV) as it is the simplest indicator for both perceptibility and building damage.

TABLE 2: GUIDANCE ON EFFECTS OF VIBRATION LEVELS

| Vibration Level, $mms^{-1}$ PPV | Effect |
|---|---|
| 10.0 | Vibration is likely to be intolerable for any more than a very brief exposure to this level. |
| 1.0 | It is likely that vibration of this level in residential environments will cause complaint, but can be tolerated if prior warning and explanation has been given to residents. |
| 0.30 | Vibration might be just perceptible in residential environments. |
| 0.14 | Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration. |

***Notes***

*The above vibration limits relate to maximum PPV ground borne vibration occurring in any one of three mutually perpendicular axes (one of which may be vertical). Vibration is to be measured on the foundation or on an external façade no more than 1m from the ground, or failing this, solid ground as near to the building façade as possible.*

It is worth noting that the guidance identifies that, although vibration levels in excess of 1 $mms^{-1}$ PPV would be considered adverse in respect of the likelihood of perceptibility, they would not be considered significant in terms of the potential for building damage, which would require levels of at least 15 $mms^{-1}$ PPV to result in minor cosmetic damage in light / unreinforced buildings.

# 3. Site Description

## 3.1. Site and Surrounding Area

The Site is located on agricultural fields two kilometres to the north-west of Bothamsall, adjacent to the A614 (Blyth Road) and to the south of the River Poulter. The Site comprises five fields of agricultural land currently used for arable agriculture and bordered by mature woodland. The site is mainly flat with one field sloping gently north down to the River Poulter.

The closest Noise-Sensitive Receptors (NSRs) to the site are the residential dwellings to the south (NSR3) and north-east (NSR2), at approximately 400 and 500 metres from the Site boundary respectively, and a hotel (NSR1) located 30 metres from the planning application boundary, 60 metres from the proposed perimeter fence and 64 metres from the closest point of any solar arrays.

The location of the Site with reference to the nearest noise sensitive receivers (NSRs) can be seen in Figure 1.

The ambient sound environment in the area is influenced by road traffic noise arising from Blyth Road to the west and the A1 to the north-east of the site

FIGURE 1: SITE LOCATION PLAN

## 3.2. Proposed Development Overview

The development comprises the construction and operation of a solar farm and a battery energy storage system (BESS) together with all associated works, equipment, necessary infrastructure and landscaping.

There are 17no. MV power stations (transformer and inverter) distributed throughout the solar farm development. The solar farm equipment is likely to run up to approximately 1-hour after sunset. The earliest the equipment will begin working is 04:30. This assumption is a worst-case scenario, as the times of operation are seasonally dependent.

Furthermore, there is an energy storage compound comprising 12no. battery containers, 12no. Power Conversion Systems (PCS)/inverters and 6no. MV transformers located in the site. The battery storage facility would be utilised to reinforce the power generation of the solar PV, storing energy at times of low demand and releasing in periods of higher demand or when solar irradiance is lower. It is assumed that battery units will be served by an integrated cooling system, being the main sources of noise from these units.

An overview of the proposed site layout can be seen below in Figure 2.

FIGURE 2: PROPOSED DEVELOPMENT LAYOUT

## 3.3. Works Overview

The works span an overall contract period of 6 months, as set out in Appendix C – Works Phasing / Program.

The core construction works will comprise the site set-up, construction access modifications, internal access road construction, ground works, piling, installation of the solar panels and final connection.

Working hours will not exceed 08:00-18:00 Monday to Friday, and 08:00-13:00 on Saturdays, with an hour either side for start-up and shut-down.

Deliveries to the site shall not occur outside of 07:00-19:30 on Monday to Friday, and 08:00-17:30 on Saturdays.

No works or deliveries will occur outside of these times, or on bank holidays, with any necessary activities outside of those hours being subject to the necessary agreements with Bassetlaw District Council and/or Nottinghamshire County Council, as required.

HGV traffic associated with the works is not anticipated to exceed 5 vehicles per day (10 trips in total), and as such, considered to be within the normal daily fluctuations in local HGV traffic.

# 4. MEASUREMENT METHODOLOGY

## 4.1. General

The prevailing sound conditions in the area have been determined by an environmental noise survey conducted during both daytime and night-time periods between Thursday 8th and Tuesday 13th February 2024.

## 4.2. Measurement Details

All noise measurements were undertaken by a consultant certified as competent in environmental noise monitoring, and, in accordance with the principles of BS 7445[2].

All acoustic measurement equipment used during the noise survey conformed to Type 1 specification of British Standard 61672[3]. A full inventory of this equipment is shown in Table 3 below.

TABLE 3: INVENTORY OF SOUND MEASUREMENT EQUIPMENT

| Position | Make, Model & Description | Serial Number | Calibration Certificate Number | Calibration Due Date |
|---|---|---|---|---|
| MP1 | Rion NL-52 Sound Level Meter | 01009671 | 1141898 | 20/03/2025 |
| | Rion NH-25 Preamplifier | 9976 | | |
| | Rion UC-59 Microphone | 18146 | | |
| MP2 | Rion NL-52 Sound Level Meter | 00764926 | 1129328 | 26/06/2024 |
| | Rion NH-25 Preamplifier | 76427 | | |
| | Rion UC-59 Microphone | 12922 | | |
| MP3 | Brüel & Kjær 2238 Sound Level Meter | 2163634 | 1144539 | 14/05/2025 |
| | Brüel & Kjær ZC 0030 Preamplifier | - | | |
| | Brüel & Kjær 4188 Microphone | 2200693 | | |
| All | Cirrus CR:515 Acoustic Calibrator | 82501 | 1141302 | 07/03/2024 |

The sound measurement equipment used during the survey was field calibrated at the start and end of the measurement period. A calibration laboratory has calibrated the field calibrator used within the twelve months preceding the measurements. A drift of less than 0.2 dB in the field calibration was found to have occurred on the sound level meter.

The weather conditions during the survey were conducive to noise measurement; it being predominantly dry, with low wind speeds, as measured on-site using a rain-tipping gauge and anemometer, respectively. When periods of inclement weather occurred, they have been removed from the dataset used to derive the typical ambient and background sound levels. The microphones were fitted with protective windshields for the measurements, which are described in Table 4, with an aerial photograph indicating their locations shown in Figure 3.

[2] British Standard 7445: 2003: *Description and measurement of environmental noise.* BSI.
[3] British Standard 61672: 2013: *Electroacoustics. Sound level meters.* Part 1 *Specifications.* BSI.

TABLE 4: MEASUREMENT POSITION DESCRIPTIONS

| Measurement Position | Description |
|---|---|
| MP1 | Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located at the south-west boundary of the Site.<br>The sound environment at this location was dominated by consistent road traffic noise arising in the west from Blyth Road.<br>This position was deemed representative of NSR1. |
| MP2 | Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located to the north-east of the Site.<br>The sound environment at this location was influenced by road traffic arising in the north and north-east, towards the A1.<br>This position is deemed representative of NSR2. |
| MP3 | Largely unattended daytime and night-time measurement of sound under free-field conditions, at a height of 1.5 metres above local ground level, located to the south of the Site.<br>The sound environment at this location was dominated by consistent road traffic noise from Blyth Road to the west. Residual noise contributions arose from intermittent traffic noise from the lane to the south of the site boundary.<br>This position was deemed representative of NSR3. |

FIGURE 3: MEASUREMENT POSITIONS

## 4.3. Sound Indices

The parameters reported are the average Equivalent Continuous Sound Level, $L_{Aeq,T}$ , the statistical index (typical) Background Sound Level, $L_{A90,T}$, as well as the typical Maximum Sound Pressure Level, $L_{AFmax}$. An explanation of the sound units presented is given in Appendix A.

The measured $L_{Aeq}$, $L_{AFmax}$, and $L_{AF90}$ sound levels are presented as time histories in a graph in Appendix B. Furthermore, the statistical distribution of the measured background sound levels to derive the typical representative $L_{A90,T}$ values are presented in a graphical format in Appendix C.

## 4.4. Summary Results

The summarised results of the environmental noise measurements are presented in Table 5, with full time histories and statistical analyses presented under Appendix B.

TABLE 5: SUMMARY OF NOISE MEASUREMENT RESULTS

| Measurement Position | Period | Noise Level, dB | |
|---|---|---|---|
| | | $L_{Aeq,T}$ | $L_{A90}$ |
| MP1 | Day – 07:00-19:00 | 47 | 43 |
| | Evening – 19:00-23:00 | 44 | 39 |
| | Night – 23:00-07:00 | 42 | 37 |
| MP2 | Day – 07:00-19:00 | 47 | 38 |
| | Evening – 19:00-23:00 | 38 | 34 |
| | Night – 23:00-07:00 | 38 | 32 |
| MP3 | Day – 07:00-19:00 | 49 | 42 |
| | Evening – 19:00-23:00 | 47 | 39 |
| | Night – 23:00-07:00 | 43 | 37 |

## 4.5. Noise Threshold Values

The noise measurement results set out in Table 5 result in the Noise Threshold Values, set out in Table 6, derived in accordance with the ABC method of BS 5228

TABLE 6: NOISE THRESHOLD VALUES

| Period | BS5228 Noise Threshold Category | BS5228 Noise Threshold Value $L_{Aeq}$ - dB |
|---|---|---|
| **MP1** | | |
| Day (07:00-19:00) | A | 65 |
| Evening (19:00-23:00) | A | 55 |
| Night (23:00-07:00) | A | 45 |
| **MP2** | | |
| Day (07:00-19:00) | A | 65 |
| Evening (19:00-23:00) | A | 55 |
| Night (23:00-07:00) | A | 45 |
| **MP3** | | |
| Day (07:00-19:00) | A | 65 |
| Evening (19:00-23:00) | A | 55 |
| Night (23:00-07:00) | B | 50 |

# 5. Operational Noise Assessment

## 5.1. Noise Modelling

### 5.1.1. Source Data

The sound levels, presented in Table 7 have been utilised within the noise modelling process. The specifics will be determined by the principal contractor and detailed within a CEMP; however, these input parameters represent those associated with similar schemes of this nature and represent a robust basis for prediction and analysis.

Table 7: Sound Level Source Data

| Plant Item | Number | $L_{Aeq,T}$ @ 10m | % On-Time / Trips per hour | $L_{WA}$ - dB |
|---|---|---|---|---|
| **Track and Compound Construction** | | | | |
| 13t Excavator | 2 | 71 | 75 | 101 |
| 9t Dumper | 2 | 76 | 50 | 104 |
| HGV | 1 | 79 | 10 | 97 |
| TOTAL: | | | | 106 |
| **Solar PV Framework Installation** | | | | |
| Mini Piling Rig | 2 | 76 | 75 | 106 |
| Hydraulic Ram | 2 | 66 | 50 | 94 |
| Telehandler | 1 | 78 | 15 | 98 |
| HGV | 1 | 79 | 10 | 97 |
| TOTAL: | | | | 107 |

### 5.1.2. Calculation Process

Calculations were carried out within the Cadna/A noise modelling program, in accordance with guidance given in BS 5228.

### 5.1.3. Specific Sound Level Summary

A summary of the predicted specific sound levels at the NSRs can be seen below in Table 8.

TABLE 8: PREDICTED SPECIFIC SOUND LEVEL SUMMARY

| NSR | Specific Sound Level (dB) |
|---|---|
| **Track and Compound Construction** | |
| 1 – Muthu Clumber Park Hotel | 42 |
| 2 – Forest Road | 33 |
| 3 – Normanton Larches | 33 |
| **Solar PV Framework Installation** | |
| 1 – Muthu Clumber Park Hotel | 53 |
| 2 – Forest Road | 37 |
| 3 – Normanton Larches | 36 |

## 5.2. Assessment

### 5.2.1. Receptor Limit

With reference to the ABC method set out within BS 5228:2009+A1:2014 and the measured baseline sound levels in the area, as set out in Table 5.

### 5.2.2. BS5228 Assessment

The BS 5228:2009+A1:2014 noise assessment, considering the predicted specific noise levels against the derived operational noise level limit is set out in Table 9.

TABLE 9: BS5228 NOISE ASSESSMENT AT RECEPTORS

| Receptor | Predicted Specific Noise Level – $L_{Aeq,1\text{-}hour}$ - dB | Adopted Noise Level Limit – $L_{Aeq,1\text{-}hour}$ - dB | | | Excess over Adopted Noise Level Limit - dB | | |
|---|---|---|---|---|---|---|---|
| | | D | E / W | N | D | E / W | N |
| **Haul Road Construction & Site Compound Establishment** | | | | | | | |
| 1 | 42 | 65 | 60 | 55 | -23 | - | - |
| 2 | 33 | 65 | 55 | 55 | -32 | - | - |
| 3 | 33 | 65 | 55 | 50 | -32 | - | - |
| **Solar PV Framework Installation** | | | | | | | |
| 1 | 53 | 65 | 55 | 50 | -12 | - | - |
| 2 | 37 | 65 | 55 | 55 | -28 | - | - |
| 3 | 36 | 65 | 55 | 50 | -29 | - | - |

### 5.2.3. Discussion

The predictions set out above show that peak operations are likely to give rise to noise levels that will meet the adopted noise threshold limits set out in BS 5228, when the works are located at their closest possible point to the off-site receptors. It should be noted that the predictions are based on an absolute worst-case scenario of all listed plant operating simultaneously in the same location, when, in reality, the listed plant will be distributed throughout the working area of the site.

The Contractor will commit to the adoption of BPM measures throughout the works. A summary of commonly adopted BPM measures is set out in the following section.

# 6. Vibration

## 6.1. General

Given that the separation distances between any receptors and the closest point of any works is not less than 60 to 64 metres, coupled to the low risk of vibration effects associated with mini piling methods, no specific measures are considered necessary with regard to construction-related vibration impacting upon sensitive receptors in the area, beyond those already incorporated into the construction methodology.

To justify the above, auger piling generally produces ground vibration levels of:

- 0.1 – 1.0 mm/s PPV at 5 m
- <0.3 mm/s PPV at 10 m in most soils
- Effectively negligible beyond 15–20 m

(These values are consistent with common UK BS 5228-2 guidance for rotary/augered piling.)

For context:

- Cosmetic damage to buildings typically requires >15 mm/s PPV
- Human noticeability starts around 0.3 mm/s PPV

Consequently, auger-based mini piling sits well below disturbance thresholds outside a very short radius.

Based on typical small rigs e.g. 150-400mm augers for fences and solar panel arrays, the following applies:

Table 10: Practical Vibration Effect Radius of Small Augers

| Distance from Augering | Expected Vibration | Practical Impact |
|---|---|---|
| 0–2 m | Highest local vibration; still low compared with driven piling | Safe for most structures; watches utilities depth |
| 2–5 m | Noticeable vibration close to rig | No risk of structural damage |
| 5–10 m | Very low vibration | Generally below human perception |
| 10–20 m | Barely measurable | No practical impact |
| >20 m | None | Out of range |

# 7. Summary Mitigation Measures

Measures to be considered in implementing Best Practicable Means will be consistent with the recommendations of BS 5228-1:2014 and will, where reasonably practicable, include the following:

- Toolbox talks on minimising noise;
- No shouting, loud music, radios;
- Using 'silenced' plant and equipment;
- Switching off engines where vehicles are standing for a significant period of time;
- Use of white noise reversing alarms wherever possible;
- Plan daily Inspection (PDI) of all plant and equipment before it arrives onsite;
- Acoustically considerate materials handling practices, to reduce impact sounds, particularly when handling sonorous materials;
- Fitting of acoustic enclosures to suppress noisy equipment as appropriate;
- Operating plant at low speeds and incorporating of automatic low speed idling;
- Selecting electrically driven equipment where possible, in preference to internal combustion powered, hydraulic power in preference to pneumatic and wheeled in lieu of tracked plant;
- Properly maintaining all plant (greased, blown silencers replaced, saws kept sharpened, teeth set and blades flat, worn bearings replaced, etc.);
- Considering the use of temporary screening or enclosures for static noisy plant to reduce noise emissions as appropriate;
- Certifying plant to meet any relevant EC Directive standards; and
- Undertaking awareness training of all contractors/staff in regards to BS5228 (Parts 1 and 2), which would form a prerequisite of their appointment.

Typically, adopting BPM would reduce overall construction noise levels by approximately 5 dB.

In addition to the BPM measures set out above, the following measures will be incorporated into the operational management of the site:

- The use of white noise reversing alarms for site-based vehicles;
- Operation of equipment in the mode of operation that minimises noise;
- Use of loudspeakers and outdoor radios prohibited except for safety and urgent communication; and
- Site induction includes instruction on measures to minimise noise.

Depending on the source of noise different measures will be taken. Control of noise arising from fixed plant and equipment will be controlled through design and the implementation of a routine maintenance scheme, noise arising from all other sources (vehicle movements, mobile plant and any external operations) is subject to control through Best Practicable Means.

# 8. Monitoring & Response Procedure

## 8.1. General

Given the low likelihood of significant impact from the proposed working regime, it is not considered that routine noise monitoring during the works is necessary. Any monitoring should be undertaken on a reactive basis and in response to complaints being received, such that activities can be reviewed and, where necessary, operational changes implemented for the following shifts.

The risk of complaint and subsequent requirement for any monitoring would be significantly reduced by the strict adoption of the BPM measures set out within this document and good community liaison.

Any noise monitoring positions should be located at between 1.5 and 2.0 metres above local ground level and at 1.0 metre from the closest habitable façade in the identified receptor location. Monitoring at each position should comprise not less than 1-hour of continuous measurement, such that compliance with the $L_{Aeq,1\text{-}hour}$ requirements can be determined.

## 8.2. Complaints

In the event of noise complaints, either direct to the contractor or Local Authority, the following complaints investigation procedure will be implemented:

- Full details of each complaint and all actions taken in response will be recorded in the Consultation and Complaints Register and the Project Diary.
- Depending on the nature of the complaint, and where practicable, mitigating action will be taken, or the activity ceased pending investigation.
- Where the initial response does not address the complaint, further investigation, mitigating action and follow-up monitoring will be undertaken, as appropriate.
- The complainant will be kept informed at all times of actions taken.
- Once resolved, a copy of the complaint and response will be archived by the IT Systems.

Where a complaint is received, any monitoring shall be undertaken within the 7-day period following its receipt, with results fed back within the 7 days following the exercise.

## 8.3. Contacts

Prior to the commencement of construction works, full contact details for the Project Manager and Principal Contractor will be made available to the Local Authority and Parish Council for use and dissemination to the local community as necessary.

Under circumstances where the named site contact is unavailable for any reason, details of the alternative site contact will be set out on the site information board.

# 9. Conclusion

inacoustic has been commissioned to provide a Noise and Vibration Management Plan for the construction works associated with a solar farm and battery energy storage system on land adjacent to the A614, Worksop, S80 3PA.

The assessment is based upon environmental noise measurements undertaken at the site and a predictive exercise.

The exercise has identified that the levels of construction noise, at the closest off-site noise-sensitive receptors are predicted to meet the BS 5228 noise threshold criteria, due to the low-impact nature of the works, spatial distribution of the site elements and proximity of receptors. Despite the predictions identifying that no noise-specific mitigation measures are required, a series of BPM measures have been proposed that will minimise the noise effects upon the closest acoustically sensitive receptors.

The information and acoustic control measures proposed within this report are considered sufficient to satisfy the requirements of Bassetlaw District Council and/or Nottinghamshire County Council.

# 10. Appendices

## 10.1. Appendix A – Definition of Terms

| | |
|---|---|
| Sound Pressure | Sound, or sound pressure, is a fluctuation in air pressure over the static ambient pressure. |
| Sound Pressure Level (Sound Level) | The sound level is the sound pressure relative to a standard reference pressure of 20µPa ($20x10^{-6}$ Pascals) on a decibel scale. |
| 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 log10 ( 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 20µPa. |
| 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. |
| Noise Level Indices | Noise levels usually fluctuate over time, so it is often necessary to consider an average or statistical noise level. This can be done in several ways, so a number of different noise indices have been defined, according to how the averaging or statistics are carried out. |
| $L_{eq,T}$ | A noise level index called the equivalent continuous noise 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. |
| $L_{max,T}$ | A noise level index defined as the maximum noise level during the period T. $L_{max}$ is sometimes used for the assessment of occasional loud noises, which may have little effect on the overall $L_{eq}$ noise level but will still affect the noise environment. Unless described otherwise, it is measured using the 'fast' sound level meter response. |
| $L_{90,T}$ | A noise level index. The noise level exceeded for 90% of the time over the period T. $L_{90}$ can be considered to be the "average minimum" noise level and is often used to describe the background noise. |
| $L_{10,T}$ | A noise level index. The noise level exceeded for 10% of the time over the period T. $L_{10}$ can be considered to be the "average maximum" noise level. Generally used to describe road traffic noise. |
| Free-Field | Far from the presence of sound reflecting objects (except the ground), usually taken to mean at least 3.5m |
| Facade | At a distance of 1m in front of a large sound reflecting object such as a building façade. |
| Fast Time Weighting | An averaging time used in sound level meters. Defined in BS 5969. |

In order to assist the understanding of acoustic terminology and the relative change in noise, the following background information is provided.

The human ear can detect a very wide range of pressure fluctuations, which are perceived as sound. In order to express these fluctuations in a manageable way, a logarithmic scale called the decibel, or dB scale is used. The decibel scale typically ranges from 0 dB (the threshold of hearing) to over 120 dB. An indication of the range of sound levels commonly found in the environment is given in the following table.

TABLE 11: TYPICAL SOUND LEVELS FOUND IN THE ENVIRONMENT

| Sound Level | Location |
|---|---|
| 0dB(A) | Threshold of hearing |
| 20 to 30dB(A) | Quiet bedroom at night |
| 30 to 40dB(A) | Living room during the day |
| 40 to 50dB(A) | Typical office |
| 50 to 60dB(A) | Inside a car |
| 60 to 70dB(A) | Typical high street |
| 70 to 90dB(A) | Inside factory |
| 100 to 110dB(A) | Burglar alarm at 1m away |
| 110 to 130dB(A) | Jet aircraft on take off |
| 140dB(A) | Threshold of Pain |

The ear is less sensitive to some frequencies than to others. The A-weighting scale is used to approximate the frequency response of the ear. Levels weighted using this scale are commonly identified by the notation dB(A).

In accordance with logarithmic addition, combining two sources with equal noise levels would result in an increase of 3 dB(A) in the noise level from a single source.

A change of 3 dB(A) is generally regarded as the smallest change in broadband continuous noise which the human ear can detect (although in certain controlled circumstances a change of 1 dB(A) is just perceptible). Therefore, a 2 dB(A) increase would not be normally be perceptible. A 10 dB(A) increase in noise represents a subjective doubling of loudness.

A noise impact on a community is deemed to occur when a new noise is introduced that is out of character with the area, or when a significant increase above the pre-existing ambient noise level occurs.

For levels of noise that vary with time, it is necessary to employ a statistical index that allows for this variation. These statistical indices are expressed as the sound level that is exceeded for a percentage of the time period of interest. In the UK, traffic noise is measured as the $L_{A10}$, the noise level exceeded for 10% of the measurement period. The $L_{A90}$ is the level exceeded for 90% of the time and has been adopted to represent the background noise level in the absence of discrete events. An alternative way of assessing the time varying noise levels is to use the equivalent continuous sound level, $L_{Aeq}$.

This is a notional steady level that would, over a given period of time, deliver the same sound energy as the actual fluctuating sound.

To put these quantities into context, where a receiver is predominantly affected by continuous flows of road traffic, a doubling or halving of the flows would result in a just perceptible change of 3 dB, while an increase of more than 25%, or a decrease of more than 20%, in traffic flows represent changes of 1 dB in traffic noise levels (assuming no alteration in the mix of traffic or flow speeds).

Note that the time constant and the period of the noise measurement should be specified. For example, BS 4142 specifies background noise measurement periods of 1 hour during the day and 15 minutes during the night. The noise levels are commonly symbolised as $L_{A90,1hour}$ dB and $L_{A90,15mins}$ dB. The noise measurement should be recorded using a 'FAST' time response equivalent to 0.125 ms.

## 10.2. Appendix B – Full Measurement Results

FIGURE 4: MP1 - MEASURED TIME HISTORY

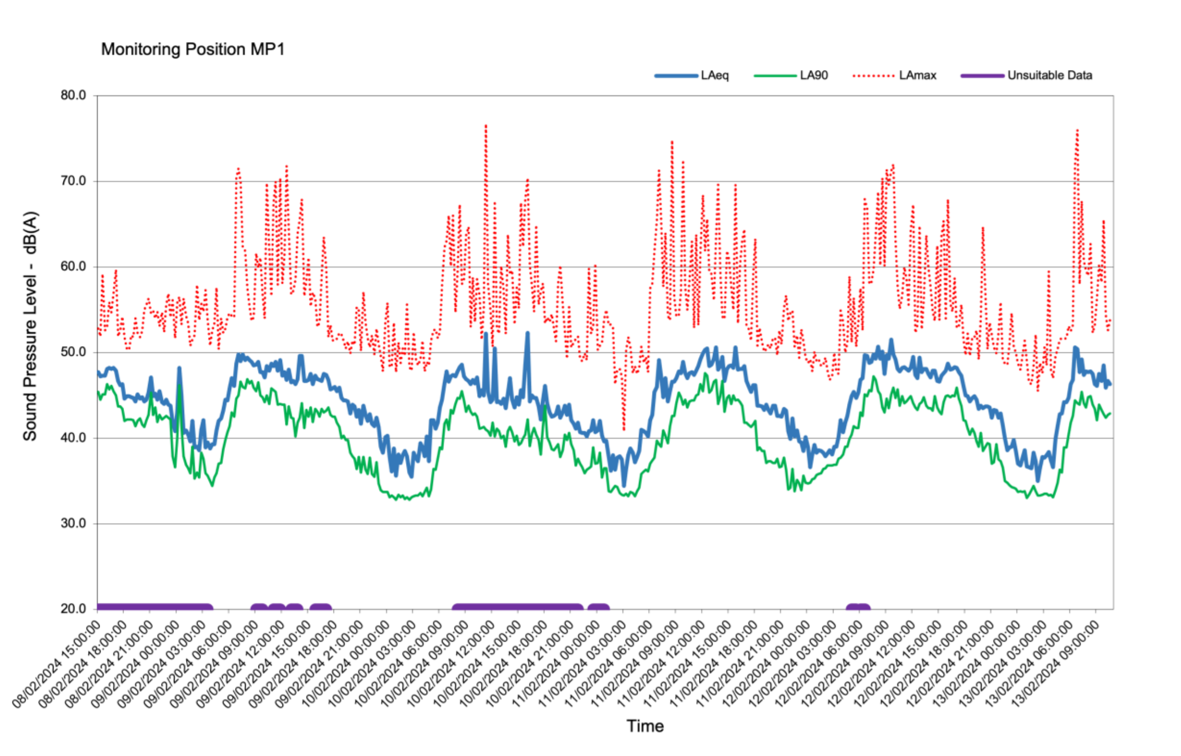



FIGURE 5: MP2 - MEASURED TIME HISTORY

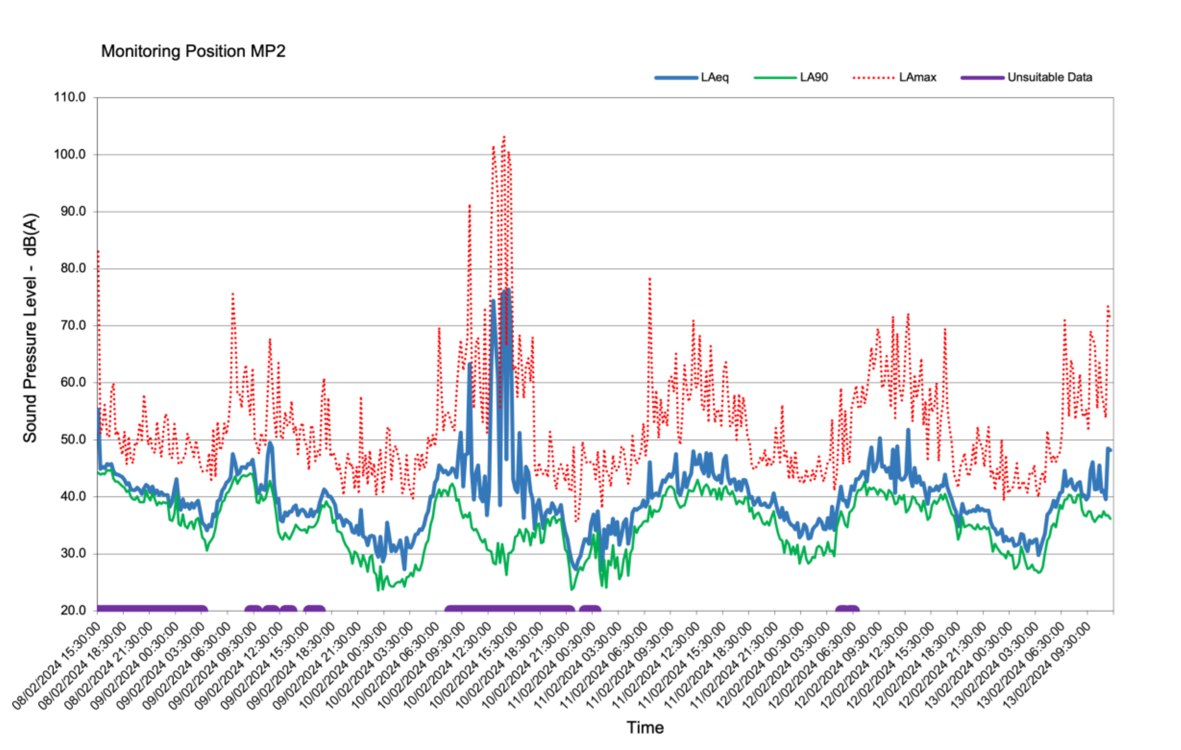
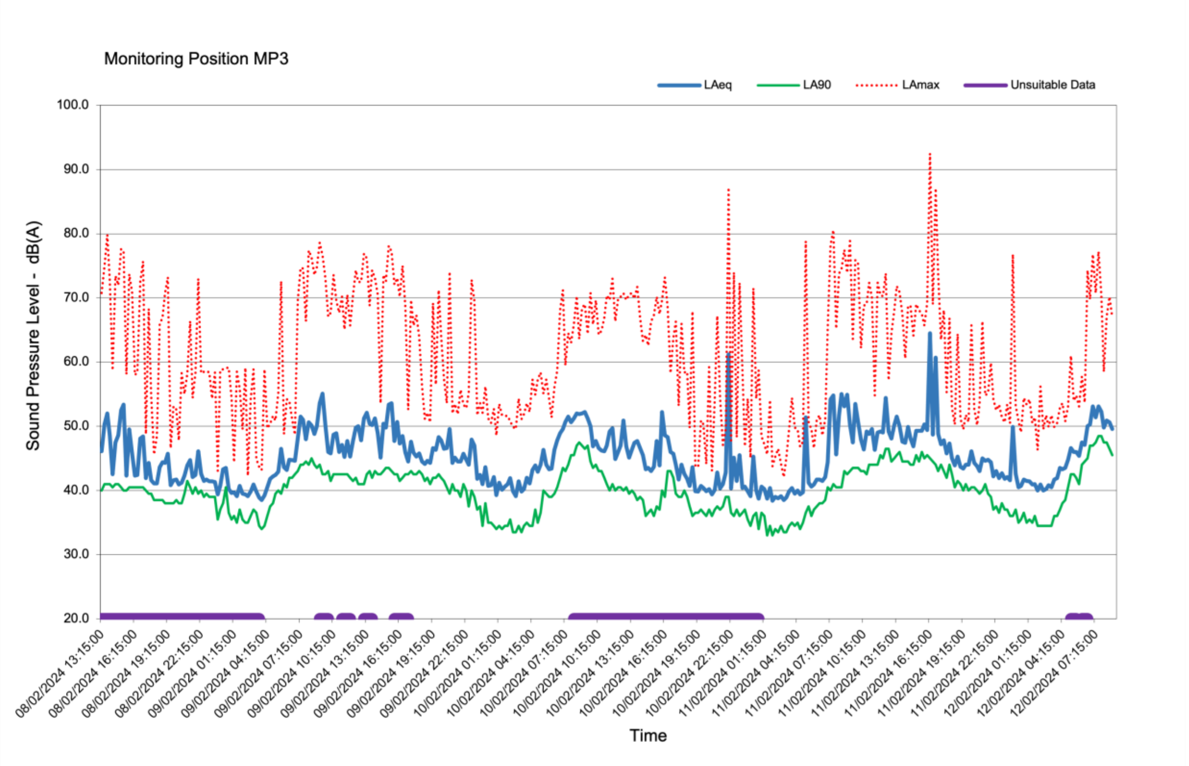


FIGURE 6: MP3 - MEASURED TIME HISTORY



# 10.3. Appendix C – Works Phasing / Program

**Normanton Larches Solar Park**

**Traffic Movements**

**Construction HGV delivery**

| | Month 1 | | | | Month 2 | | | | Month 3 | | | | Month 4 | | | | Month 5 | | | | Month 6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Week 11 | Week 12 | Week 13 | Week 14 | Week 15 | Week 16 | Week 17 | Week 18 | Week 19 | Week 20 | Week 21 | Week 22 | Week 23 | Week 24 |
| Fence | 7 | 7 | 7 | | | | | | | | | | | | | | | | | | | | | |
| Site Set-Up / Welfare | | | | 5 | 5 | | | | | | | | | | | | | | | | | | | |
| Construction Machinery | | | | | 5 | | | | | | | | | | | | | | | 5 | | | | |
| Civil works (foundations & track) | | | | | | 20 | 20 | 20 | | | | | | | | | | | | | | | | |
| Mounting Structure | | | | | | 10 | 10 | 10 | 10 | 10 | 10 | 10 | | | | | | | | | | | | |
| Solar Panels | | | | | | | | | | | 20 | 20 | 20 | 20 | 20 | 20 | | | | | | | | |
| Module Testing | | | | | | | | | | | 1 | | | | | | | | | 1 | | | | |
| Inverters | | | | | | | | | | | | | | | 7 | 7 | | | | | | | | |
| Cable | | | | | | | | | | | | | | 5 | 5 | 5 | 5 | 5 | | | | | | |
| Transformers | | | | | | | | | | | | | | | | | 13 | | | | | | | |
| Substation | | | | | | | | | | | | | | | | | | | | | 2 | | | |
| Recycling Containers | | | 1 | | 1 | | 1 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | |
| CCTV | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| Monitoring Equipment | | | | | | | | | | | | | | | | | | | 1 | | | | | |
| Total HGV per day | 1 | 1 | 1 | 1 | 2 | 4 | 4 | 4 | 2 | 2 | 5 | 5 | 3 | 4 | 5 | 5 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |

**Construction workers schedule**

| | Month 1 | | | | Month 2 | | | | Month 3 | | | | Month 4 | | | | Month 5 | | | | Month 6 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Week 11 | Week 12 | Week 13 | Week 14 | Week 15 | Week 16 | Week 17 | Week 18 | Week 19 | Week 20 | Week 21 | Week 22 | Week 23 | Week 24 |
| Fencing and Civil contractors | 80 | 80 | 80 | | | | | | | | | | | | | | | | | | | | | |
| Piling & framing contractors | | | | | | | 80 | 80 | 80 | 80 | 80 | 80 | 80 | | | | | | | | | | | |
| Module mounting contractors | | | | | | | | | | | | 80 | 80 | 80 | 80 | 80 | 80 | | | | | | | |
| Electrical contracors | | | | | | | | | | | | | | | 80 | 80 | 80 | 80 | 80 | 80 | | | | |
| HV contractors | | | | | | | | | | | | | | | | | | | | 40 | 40 | 40 | | |
| Project Managers | | | | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Health & Safety | | | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Security | | | | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 | 40 |
| Other | | | | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| Total worker vehicles per day | 11 | 11 | 11 | 21 | 21 | 21 | 32 | 32 | 32 | 32 | 32 | 43 | 43 | 32 | 43 | 43 | 43 | 32 | 32 | 38 | 26 | 26 | 21 | 21 |
| **Total (HGV + Worker Vehicles) per day** | 12 | 12 | 13 | 21 | 22 | 25 | 36 | 36 | 34 | 34 | 37 | 48 | 47 | 36 | 48 | 48 | 46 | 33 | 32 | 39 | 27 | 26 | 21 | 21 |

inacoustic | bristol
20 Melrose Place, Clifton, Bristol, BS8 2NG
0117 325 3949 | www.inacoustic.co.uk | bristol@inacoustic.co.uk