AIRO

PLANNING INQUIRY

SOLAR ENERGY GENERATING STATION

LAND NORTH OF BUTTERFLY LANE,

LAND SURROUNDING HILFIELD FARM AND

LAND WEST OF HILFIELD LANE

ALDENHAM

HERTFORDSHIRE

PROOF OF EVIDENCE ON NOISE

D L WATTS

SEPTEMBER 2022

Hertsmere Borough Council
Reference 21/0050/FULEI

PINS Reference
APP/N1920/W/22/3295268

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1.0 **CREDENTIALS OF WITNESS**

1.1 I am David Watts and I am the Technical Director of Acoustical Investigation & Research Organisation Ltd (AIRO).

1.2 Since 1990 I have been engaged in the field of acoustics and vibration with AIRO which followed graduation as a Bachelor of Engineering with honours in Electrical and Electronic Engineering from Hatfield Polytechnic. During this time I have been awarded the Institute of Acoustics' Diploma in Acoustics and Noise Control with merits and the Institute of Acoustics' Certificate of Competency in Workplace Noise Assessment. I am registered as a Chartered Engineer (CEng) with the Engineering Council, as a European Engineer (Eur Ing) with the European Federation of National Engineering Associations and I am a Fellow of the Institute of Acoustics (FIOA). I am the Honorary Secretary of the Association of Noise Consultants and I serve as a member of the Professional Standards Sub-Committee of the Institute of Acoustics and the Membership Steering Committee of the Association of Noise Consultants. I represent the British Measurement and Testing Association on the British Standards Institution Technical Sub-Committee EH/1/3 Residential and Industrial Noise, and Technical Committee Panel GME/21/6/4 Human Exposure to Mechanical Vibration and Shock. I am listed in the UK Register of Expert Witnesses.

1.3 Over the last 20 years I have specialised in environmental noise assessment and building acoustics including noise nuisance. In relation to building acoustics, my experience and expertise includes the measurement and appraisal of sound insulation in all types of buildings, including domestic premises, and a knowledge of constructions required to achieve specified levels of sound insulation, particularly in respect of Approved Document E and the Building Regulations. My environmental noise experience and

expertise encompasses the assessment of potential noise nuisance of industrial noise, commercial noise, neighbour noise, noise from leisure activities and from pubs and clubs. I have prepared and presented reports and evidence at hearings as required.

1.4 Acoustical Investigation & Research Organisation Ltd (AIRO) is an independent consultancy, which operates in the fields of acoustics and noise control. The services offered in the noise control field are purely and only of a consultancy nature, AIRO being neither a manufacturer nor a contractor in this sphere. Since its incorporation in 1958 AIRO has acted on behalf of a wide spectrum of clients including Government Departments, local authorities, industry, architects, consulting engineers and the public at large. AIRO is accredited by the United Kingdom Accreditation Service (UKAS) as a UKAS testing laboratory no. 0483 and a UKAS calibration laboratory no. 4554.

2.0 **BACKGROUND**

2.1 I have reviewed the noise report submitted with the application entitled Hilfield Farm and Battery Storage Noise Impact Assessment on behalf of Elstree Green Limited (ref 1). I have also considered written comments made by the Environmental Health Officer/Scientific Officer (ref 2).

2.2 I have looked at the Design and Access Statement (ref 3) and at the submitted plans where relevant. I have visited the area.

3.0 **INTRODUCTORY COMMENTS**

3.1 It does not appear from internet searches that there have been many environmental noise assessments of UK Solar Farms.

3.2 This might be because there are very few solar farms, or that they are very small or a long way from noise sensitive locations or that there have not been significant concerns about environmental noise from stakeholders.

3.3 I have no direct experience of measuring or assessing sound from solar farms.

3.4 It does not appear from the submitted noise report or from Inacoustic's website, that Inacoustic have any direct experience of the environmental noise impact assessment of solar farms outwith this application.

3.5 Given the scale of this application, its proximity to noise sensitive dwellings and public footpaths, it is important that decision makers and stakeholders can rely on the environmental noise impact assessment of the proposals.

3.6 I have reviewed the environmental noise impact assessment and have some concerns about the assessment that are described in more detail in this proof of evidence.

3.7 The general theme arising from my review is that there appears to be an over reliance on simplified sound level data that has been provided by the applicant to Inacoustic and does not appear to have been verified in any substantive way. There is insufficient traceability in the work to enable a third party such as myself to check the assessment as thoroughly as I would

like and would consider appropriate given the scale of the proposals and the level of stakeholder concerns.

4.0 **NOISE SOURCES**

4.1 The environmental noise assessment is based on there being only two components identified as giving rise to noise emissions; "PV Inverters" and "HVAC for Battery Storage". Table 5 of the noise report provides single figure overall A-weighted sound pressure levels at 10 metres (rather than sound power levels referred to in the text above the table). The report says the data were provided by the applicant.

4.2 The source sound level data do not include the measurement standard that was used to determine the values provided or, if not measured to a particular standard, the method used to determine the values, nor is there any description as to whether the values represent the equipment running at maximum or some other operating duty, nor is there a description of how the units were mounted when the source sound levels were determined. The makes and models of the inverters or the HVAC components are not provided.

4.3 Sound propagation effects include effects such as ground absorption that are frequency dependent. The algorithms in ISO 9613-2 (ref 4) (the propagation method cited by Inacoustic) are different for each octave frequency band from 63 Hz to 8 kHz. A single A-weighted sound level does not provide the information needed to carry out propagation calculations in octave frequency bands.

4.4 The rating level in BS 4142 (ref 5) adds where applicable a correction to the specific sound level to account for particular acoustical characteristics that may increase the significance of the impact.

4.5 The noise report only refers to overall A-weighted sound levels for the sources. Therefore, the correction made in the Noise Report (+2 dB) appears to be entirely speculative, and there are no supporting references to for example, general experience of similar equipment to support the correction applied. Given that the range of potential corrections is up to 18 dB, this could substantially alter the assessment conclusions.

4.6 Table 12 of Inacoustic's report shows their calculated Excess of Rating over Night-time Background Sound Level for the Noise Sensitive Receptors considered.

4.7 An acoustical features correction of +12 dB would change the BS 4142 initial estimate of the impact from a "low impact" to an "adverse impact" for 3 receptors, to a significant "adverse impact" for 1 receptor and an impact between adverse and significant adverse for a further 9 receptors.

4.8 The locations of the sound sources cannot be determined precisely from the Noise Report. Figure 5 appears to show about 17 points from which sound radiates but Table 5 refers to 16 PV Inverters and 80 HVAC for battery storage. Presumably there are multiple PV Inverters and/or HVAC for battery storage close to each of the 17 points on Figure 5 but which noise sources are at which locations and the numbers of each are not provided. The height above ground for source positions is also not detailed. The height is relevant for calculating likely attenuation – see Section 5 below.

5.0 **PROPAGATION**

5.1 Sound levels at individual noise sensitive locations of interest or in the form of sound exposure maps may be calculated by taking into account the source sound levels arising from the proposals and the attenuation of sound during propagation outdoors.

5.2 The fundamental starting point for such calculations and modelling is the source data. I have set out concerns about this in Section 4 of this proof of evidence.

5.3 Inacoustic report that they have used the method set out in ISO 9613-2:1996 for propagation calculations using proprietary noise modelling software iNoise 2020.

5.4 The accuracy of the propagation calculations does depend on the accuracy and the level of detail used to model the relevant topograpical and physical features between each source and each calculation point. The description of the sources of information and the way this was modelled is too general to enable me to form an opinion as to whether I would consider the modelling to be suitable. Inacoustic do not describe any steps they may have taken to verify the model and there is no step-by-step calculation that could be audited.

5.5 At the very least, I would expect the heights above ground of the sources to be identified and the height above ground of the calculation points used to generate the sound exposure plot to be stated.

5.6 Normally, sound exposure plots would be generated for calculation points that can be related to the ground floor level of dwellings (1.5 metres above local ground level) and first floor (4 metres above local ground level).

5.7 In general, the attenuation of sound transmitted between a source and receiver will be greater where the source and receiver are close to the ground (for example a fan unit mounted on the ground and a ground floor assessment point) compared with a source and receiver at greater height (e.g. a fan unit on the roof of a cabin and a first floor or higher assessment point).

5.8 If I consider the propagation between approximately the centre of the battery area over the roughly 100 metres to Inacoustic's R1 calculation point, I need to assume that the source height is 0.5 metres above local ground and the calculation point is 1.5 metres above local ground in order to replicate the extent of the attenuation in Inacoustic's work. By making these assumptions, I calculate an attenuation of 13 dB due to ground absorption.

5.9 If I consider a first floor (4 metres above local ground) and a source height of 2.5 metres (approximately the roof height of a shipping container typically used for batteries on solar farms), the ground absorption is less than 0.5 dB. On this basis the sound exposure plot may be understating the sound levels from the proposals by about 12 dB in relation to first floor rooms and more likely source heights in relation to ventilation fans for batteries. In subjective terms, it may be twice as loud as indicated in the assessment.

6.0 **BASELINE (BACKGROUND) SOUND LEVELS**

6.1 I consider that Inacoustic have made appropriate measurements and determinations of background sound levels for general assessment purposes and as described in BS 4142.

6.2 However, in limiting the measurement positions to the vicinity of residential properties, there is little baseline data over wider areas such as along the footpaths that could be compared with the expected sound exposure from the proposals.

6.3 I would also point out that the specific circumstances at individual properties could be different in relation to background sound levels compared with measurement positions that are used as proxies.

6.4 The descriptions of the measurement positions and the figure indicating their approximate location are not sufficiently precise. I would not be able to carry out my own measurements at exactly the same positions.

6.5 If the measurements were made close to a road, background sound levels at a set back property may be significantly lower and lower still on the rear elevation of the property that has no view of the road.

6.6 This could mean that the impact would be more adverse at the rear elevations of set back properties than is described in the Inacoustic assessment.

7.0 **AUDIBLE CHARACTERISTICS**

7.1 In the foreword BS 4142 provides that "Response to sound can be subjective and is affected by many factors, both acoustic and non-acoustic. The

significance of its impact, for example, can depend on such factors as the margin by which a sound exceeds the background sound level, its absolute level, time of day and change in acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood. This edition of the standard recognizes the importance of the context in which a sound occurs."

7.2 It also states at paragraph 9.1 "Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background sound level. Where such features are present at the assessment location, add a character correction to the specific sound level to obtain the rating level. This can be approached in three ways:

a) subjective method;
b) objective method for tonality;
c) reference method.

NOTE1 Sound with prominent impulses has been shown to be more annoying than continuous types of sound (without impulses or tones) with the same equivalent sound pressure level.

NOTE2 The rating level is equal to the specific sound level if there are no such features present or expected to be present."

7.3 I have already commented that the correction made for acoustical characteristics by Inacoustic appears to be highly speculative.

7.4 Inacoustic refer to a "low frequency bias at source" for both PV Inverters and transformers and HVAC for battery storage.

7.5 I note the Environmental Health Officer and Scientific Officer say that *"Low noise levels from tonal sources have historically led to complaints, even with internal noise levels being below 20 dB and close to the measurable limits of the sound level meters."*

7.6 Alternating current electrical equipment such as transformers does, in my experience, give rise to a tonal hum with a dominant frequency of 100 Hz and with other peaks at the harmonic frequencies (200 Hz, 400 Hz and so on). This would suggest that an acoustic features correction greater than the +2 dB correction made by Inacoustic could apply to receptors affected by transformer noise.

8. **UNCERTAINTIES**

8.1 In relation to uncertainty, BS 4142 does not require a numerical evaluation of the potential uncertainties in the assessment, simply that they are considered.

8.2 None-the-less, the Noise Report includes numerical values related to the measurements and to the calculations. The consideration of uncertainty in acoustical measurements and assessments is a relatively new, evolving and complex area.

8.3 In relation to the measurement uncertainty factors in Table 8 of the Noise Report, I would consider showing a 0 dB uncertainty to be unsupportable and conveys a misleading impression in relation to the assessments.

8.4 Simply considering the acceptance limits for a Class 1 sound level meter set out in BS 61672, this alone is generally ±1 dB, not 0 dB, and this is likely to

be the most accurate contributory factor in the assessment. Other factors are likely to be subject to far greater uncertainty.

8.5 In the context of calculation uncertainties shown in Table 9 of the Noise Report, my concerns about the source level data have already been set out. Item b) in Table 9 suggests there is no uncertainty as the "Sound power levels for all plant are based on manufacturer data". In my opinion the opposite is true i.e. there is no certainty in the provided sound power levels.

8.6 As Inacoustic themselves say, the ISO 9613 calculation has an estimated accuracy of ±3 dB which would suggest that a figure of at least 3 dB should be used, rather than the +1 dB used by Inacoustic.

8.7 Therefore, in my opinion, the treatment of uncertainty factors lacks credibility.

9.0 **ASSESSMENT**

9.1 I note that the assessments made only relate to residential locations. This is appropriate in relation to following BS 4142. There is no particular reason not to provide some form of assessment or commentary in relation to footpaths but I am aware that there is no particular objective method to assess the noise impact for footpath users. The baseline sound level measurements do not provide sufficient coverage to enable a comparison to be made with the sound level map of the proposals in relation to footpaths.

9.2 I have expressed my reservations about the simplified and poorly described data for the sound sources that are the fundamental starting point for the assessment of noise levels from the proposals.

9.3 I am concerned that first floor levels where bedrooms are very likely to be located appear not to have been assessed and would expect noise levels from the proposals to be higher at upper floor levels. This could potentially mean that the noise impact is significantly understated.

9.4 Overall, a low impact in relation to residential locations is reported. I consider that at some first floor locations the impact could be indicated to be adverse according to BS 4142.

9.5 I consider the tabulated numerical attributions of uncertainties to be unsatisfactory and potentially misleading.

10.0 **MITIGATION**

10.1 It is my opinion that the proposals are capable of being adequately mitigated in respect of noise through normal noise control approaches.

10.2 If the development is permitted, I would propose the following condition:

The Rating level of plant and equipment associated with the development shall be at least 10 dB below the background sound level at any affected residential properties and along any public footpath where the Rating level and Background sound level are as defined and determined in accordance with BS 4142:2014+A1:2019

10.3 I consider that such a condition should protect residential and footpath amenity in respect of noise and is capable of being complied with.

11.0 **ENDORSEMENT STATEMENT**

11.1 The evidence which I have prepared and provide for this appeal reference APPEN1920/W/22/32952568 is true and I confirm the opinions expressed are my true and professional opinions.

REFERENCES

1. Hilfield Farm and Battery Storage Noise Impact Assessment
   Inacoustic Limited, December 2020

2. Environmental Health Memo
   Planning Application Number 21/0050/FULEI
   Environmental Health Officer/Scientific Officer
   March 2021

3. Design and Access Statement
   Hilfield Solar Farm and Battery Storage Facility
   enso energy
   May 2021

4. ISO 9613-2
   Attenuation of sound during propagation
   outdoors -Part 2: General method of calculation
   International Organisation for Standardization, 1996

5. British Standard BS 4142:2014+A1:2019
   Method for rating and assessing industrial and commercial sound
   British Standards Institution, 2019

APPENDIX A

Introduction to Noise Units

APPENDIX A – Introduction to Noise Units

A.1 Noise levels are generally presented in terms of "A-weighted" decibels. The "A-weighting" is an internally agreed frequency response similar to that of the average human ear, so that "A-weighted" sound levels correspond well with that is heard.

A.2 Typical noise sources do not radiate sound at a continuous steady level but tend to vary in level over a given time period. The Equivalent Continuous Sound Pressure Level, $L_{Aeq,T}$ is the most widely used objective averaging technique which expresses the acoustic energy of a fluctuating noise climate over a given period, T as the single continuous level having the same energy as the time varying signal.

A.3 To measure background environmental noise levels at the statistical index L_{90} is commonly preferred over the L_{Aeq} index. The L_{90} is the Sound Pressure Level that is exceeded for 90% of the measurement period. The L_{90} therefore discriminates against short duration peaks of noise and is consequently considered to provide a better representation of typical minimum noise levels compared with the L_{Aeq}.

A.4 In the particular case of road traffic noise the L_{10} represents the level exceeded for 10% of a given period and provides a representation of mean maximum noise levels.

A.5 In some circumstances it is useful to quantify the maximum level of fluctuating noise and a commonly used index is L_{Amax}. This represents the maximum reading given by a sound level meter for a given event or period of time and would normally be qualified by either "fast" or "slow" according to the response time setting of the meter.

A.6 It is currently correct practice to identify noise levels as "A-weighted" by incorporation of the "A" within the index descriptor such that "A-weighted" L_{eq}, L_{90}, L_{10} and L_{Amax} values are expressed as L_{Aeq}, L_{A90}, L_{10} and L_{Amax} respectively.

A.7 Table A1 below presents an indication of the noise level of some common sounds.

Table A1 – Guide to Typical Noise Levels in Various Environments

Environment	Approximate Sound Level L_{Aeq} in dB
Threshold of pain	140
Sheet metal shop – hand grinding	110
High Speed Train at 2 metres – peak value	105 – 110
Printing Press Room	100
Heavy Lorry at 3 metres	90
Kerbside of busy street	80
Moderately loud radio in domestic room) Spin dryer in kitchen)	70
Loud speech at 1 metre	65
Restaurant or Department Store	60
Conversational speech at 1 metre	55
General Office – average value	50
Electric Fan Heater in domestic rooms at 1.5 metres	45 – 50
Non-executive Private Office	40
Gas Fire (full on) in domestic room at 1.5 metres	35