



ACOUSTIC CONSULTANTS LTD

Proposed Condenser Units
The Abbey Junior School, Reading

Noise Impact Assessment

Reference: 7576/JA/BL

March 2019



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The Abbey Junior School, Reading

Noise Impact Assessment

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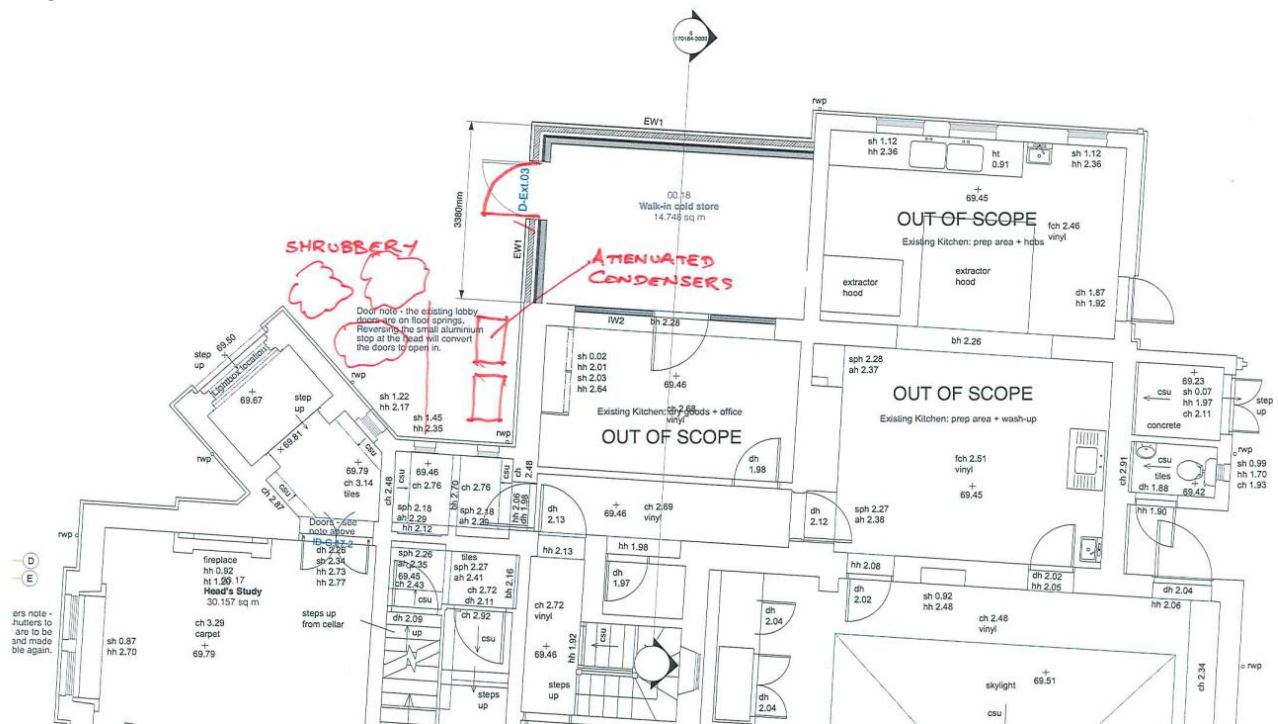
1. Introduction

The Abbey Junior School appointed Acoustic Consultants Limited to undertake a noise survey and a noise impact assessment for the proposed condenser plant at The Abbey Junior School, Christchurch Road, Reading in support of a planning application.

A noise survey was completed on site in December 2018 to determine the background sound levels on the site, the plant noise data has been supplied and a noise impact assessment has been carried out. The noise impact assessment has been undertaken in accordance with the NPPF, NPPG, NPSE, and British Standard 4142:2014.

The proposal is for two new condenser units to be installed within the grounds of the school at the proposed location shown below in Figure 1 below.

Figure 1: Plant Location





2. Planning and Noise

2.1. National Planning Policy Framework

The National Planning Policy Framework (NPPF) was published in March 2012 and revised in February 2018. Section 15 entitled 'Conserving and enhancing the natural environment' addresses noise as a requirement of planning. Paragraph 170 states:

"170. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate."

Paragraph 180 states:

"180. Planning policies and decisions should also ensure that new development is appropriate for its location taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- a) 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 life⁶⁰*
- b) identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason; and*
- c) limit the impact of light pollution from artificial light on local amenity, intrinsically dark landscapes and nature conservation.*

60 See Explanatory Note to the Noise Policy Statement for England (Department for Environment, Food & Rural Affairs, 2010).



2.2. Noise Policy Statement for England

The NPPF refers to the Noise Policy Statement for England (NPSE). This was published in March 2010 by DEFRA and aims to provide clarity regarding current policies and practices to enable noise management decisions to be made within the wider context, at the most appropriate level, in a cost-effective manner and in a timely fashion. It applies to all forms of noise including environmental noise, neighbour noise and neighbourhood noise. The NPSE introduces the concept of “Significant Adverse” and “Adverse” impacts of noise. These are applied as follows:

NOEL – No Observed Effect Level

This is the level of noise exposure below which no effect at all on health or quality of life can be detected.

LOAEL – Lowest Observed Adverse Effect Level

This is the level of noise exposure above which adverse effects on health and quality of life can be detected.

SOAEL – Significant Observed Adverse Effect Level

This is the level of noise exposure above which significant adverse effects on health and quality of life occur.

The NPSE does not provide any assessment criteria for the noted effect levels.

2.3. National Planning Practice Guidance, Noise

The National Planning Practice Guidance (NPPG) on noise referred to here is based on the current version (January 2015) as provided on the Planning Guidance Website. It states that: *“Noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment.”*

It provides generic guidance on how to determine the noise impact and what factors could be a concern. It includes the option types to mitigate any adverse effects of noise stating that there are four broad types of mitigation. These are engineering, layout, using planning conditions or obligations and noise insulation.



Paragraph 5 of the NPPG provides a table identifying the effect level and examples of effect relating to the impact effect levels provided in the NPSE. The table is duplicated below:

Table 1: NPPG Noise – Perception of Effect Levels

Perception	Examples of Outcomes	Increasing Effect Level	Action
Not noticeable	No Effect	No Observed Effect	No specific measures required
Noticeable and not intrusive	Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life.	No Observed Adverse Effect	No specific measures required
		Lowest Observed Adverse Effect Level	
Noticeable and intrusive	Noise can be heard and causes small changes in behaviour and/or attitude, e.g. turning up volume of television; speaking more loudly; where there is no alternative ventilation, having to close windows for some of the time because of the noise. Potential for some reported sleep disturbance. Affects the acoustic character of the area such that there is a perceived change in the quality of life.	Observed Adverse Effect	Mitigate and reduce to a minimum
		Significant Observed Adverse Effect Level	
Noticeable and disruptive	The noise causes a material change in behaviour and/or attitude, e.g. avoiding certain activities during periods of intrusion; where there is no alternative ventilation, having to keep windows closed most of the time because of the noise. Potential for sleep disturbance resulting in difficulty in getting to sleep, premature awakening and difficulty in getting back to sleep. Quality of life diminished due to change in acoustic character of the area.	Significant Observed Adverse Effect	Avoid
Noticeable and very disruptive	Extensive and regular changes in behaviour and/or an inability to mitigate effect of noise leading to psychological stress or physiological effects, e.g. regular sleep deprivation/awakening; loss of appetite, significant, medically definable harm, e.g. auditory and non-auditory	Unacceptable Adverse Effect	Prevent

The table does not provide any objective assessment which equates to the noted effect levels however the NPPG identifies that where noise is audible it is not necessarily intrusive. The effect and impact on people is based primarily on the level of noise.



3. Assessment Methodology

The following section identifies guidance which is considered to provide noise criteria equivalent to or below the LOAEL described in NPPG and NPSE, i.e.

"Noise can be heard, but does not cause any change in behaviour or attitude. Can slightly affect the acoustic character of the area but not such that there is a perceived change in the quality of life."

For plant noise, the most relevant guidance is provided within British Standard 4142:2014. The British Standard 4142:2014 entitled 'Method for rating and assessing industrial and commercial sound' was published on the 31st October 2014.

The methods described in the British Standard use outdoor sound levels to assess the likely effects of sound upon people who might be inside or outside a dwelling or other premises used for residential purposes. The principle is that of establishing the 'difference' between the 'rating level' and the 'background sound level'.

The 'rating level' is the 'specific sound level' of the source over a period of one hour during the day (07:00 to 23:00 hours) and over a period of 15 minutes during the night (23:00 to 07:00 hours). Section 9 entitled 'Rating Level' states:

"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."

An acoustic character correction should be added to the 'specific sound level' if it exhibits any tonality, impulsivity, other specific characteristics and/or intermittency at the assessment location. The value of the character correction varies, dependent on the prominence of the character of the sound source at the assessment location.

In Section 11 of the Standard, entitled 'Assessment of the Impacts', it states:

"Obtain an initial estimate of the impact of the specific sound by subtracting the measured background sound level (see Clause 8) from the rating level (see Clause 9), and consider the following."



- *Typically, the greater this difference, the greater the magnitude of the impact.*
- *A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context.*
- *A difference of around +5 dB is likely to be an indication of an adverse impact, depending on the context.*
- *The lower the rating level is relative to the measured background sound level, the less likely it is that the specific sound source will have an adverse impact or a significant adverse impact. Where the rating level does not exceed the background sound level, this is an indication of the specific sound source having a low impact, depending on the context."*

Based on the initial assessment outcomes of British Standard 4142, and depending on context, it is our opinion that the NOEL, LOAEL and SOAEL levels stated in the Noise Policy Statement for England would generally fall within the following categories when considered in conjunction with the effect levels of the NPPG Noise.

- NOEL – The No Observed Effect Level is considered to apply where the rating level does not exceed the background sound level (less than or equal to 0dB) would fall within the No Effect level or No Observed Adverse Effect level of the NPPG Noise.
- LOAEL – The Lowest Observed Adverse Effect Level is considered to fall between a difference of 0dB (where according to British Standard 4142:2014 the impact is low) and 5dB (where according to British Standard 4142:2014 there is a likely indication of adverse impact).
- SOAEL – The Significant Observed Adverse Effect Level is considered to fall between a difference of 5dB (where according to British Standard 4142:2014 there is a likely indication of adverse impact) and 10dB (where according to British Standard 4142:2014 there is a likely indication of significant adverse impact). A difference in excess of 10dB is expected to result in an unacceptable adverse effect and therefore exceeds the significant observed adverse effect level.

In all instances the context needs to be considered when determine the overall impact and Observed Effect Level. In terms of context British Standard 4142:2014 states:

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following.



- 1) *Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.*
- 2) *The character and level of the residual sound compared to the character and level of the specific sound. Consider whether it would be beneficial to compare the frequency spectrum and temporal variation of the specific sound with that of the ambient or residual sound, to assess the degree to which the specific sound source is likely to be distinguishable and will represent an incongruous sound by comparison to the acoustic environment that would occur in the absence of the specific sound. Any sound parameters, sampling periods and averaging time periods used to undertake character comparisons should reflect the way in which sound of an industrial and/or commercial nature is likely to be perceived and how people react to it.*

NOTE 3 Consideration ought to be given to evidence on human response to sound and, in particular, industrial and/or commercial sound where it is available. A number of studies are listed in the "Effects on humans of industrial and commercial sound" portion of the "Further reading" list in the Bibliography.

- 3) *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions, such as:*
 - i) *façade insulation treatment;*
 - ii) *ventilation and/or cooling that will reduce the need to have windows open so as to provide rapid or purge ventilation; and*
 - iii) *acoustic screening."*



4. Baseline Noise Measurements

An assessment to British Standard 4142 requires that the "Background Sound Level", typical for the area, be established. Due to the nature of the proposed units, the condensers will be running for 24 hours a day. As such, a monitoring exercise was completed over the day and night time hours.

4.1. Monitoring Equipment

Sound Pressure Levels were measured using a Class 1 Sound Level Meter with a half-inch condenser microphone using the "fast" setting. The equipment is checked regularly using a Quality System meeting the requirements of British Standard EN ISO/IEC 17025:2017 "General requirements for the competence of testing and calibration laboratories"; in accordance with British Standard EN 10012:2003 "Measurement management systems. Requirements for measurement processes and measuring equipment"; and traceable to the National Standards.

This equipment was checked and calibrated as noted below and the certificates are available for inspection.

Table 2: Monitoring Equipment

Equipment Description / Manufacturer / Type	Serial number	Date of calibration	Calibration Certification Number
Sound Level Meter, Svantek, 959	14784	23/05/2018	28638
Microphone, GRAS, 40AE	183810	23/05/2018	28637
Calibrator, Norsonic, 1251	424062	23/05/2018	28636

The measuring systems were checked for calibration before and after the tests. No drift was detected, having no effect over the measurements taken.

4.2. Monitoring Procedure

Noise monitoring was undertaken between 16:00 hours on the 11th December 2018 and 14:15 hours on the 12th December 2018 at a location representative of the residential noise sensitive receiver.



Noise monitoring was undertaken in accordance with British Standard 4142:2014. The monitoring location is shown on Figure 2 below.

Figure 2: Monitoring Location



The monitoring location is considered representative of the baseline noise level at the nearby noise sensitive receivers.

For the baseline noise level survey, the microphone was on a tripod at a height of approximately 1.5 metres in a façade position.

The main noise source affecting the monitoring location was road traffic surrounding the site.

4.3. Meteorological Conditions

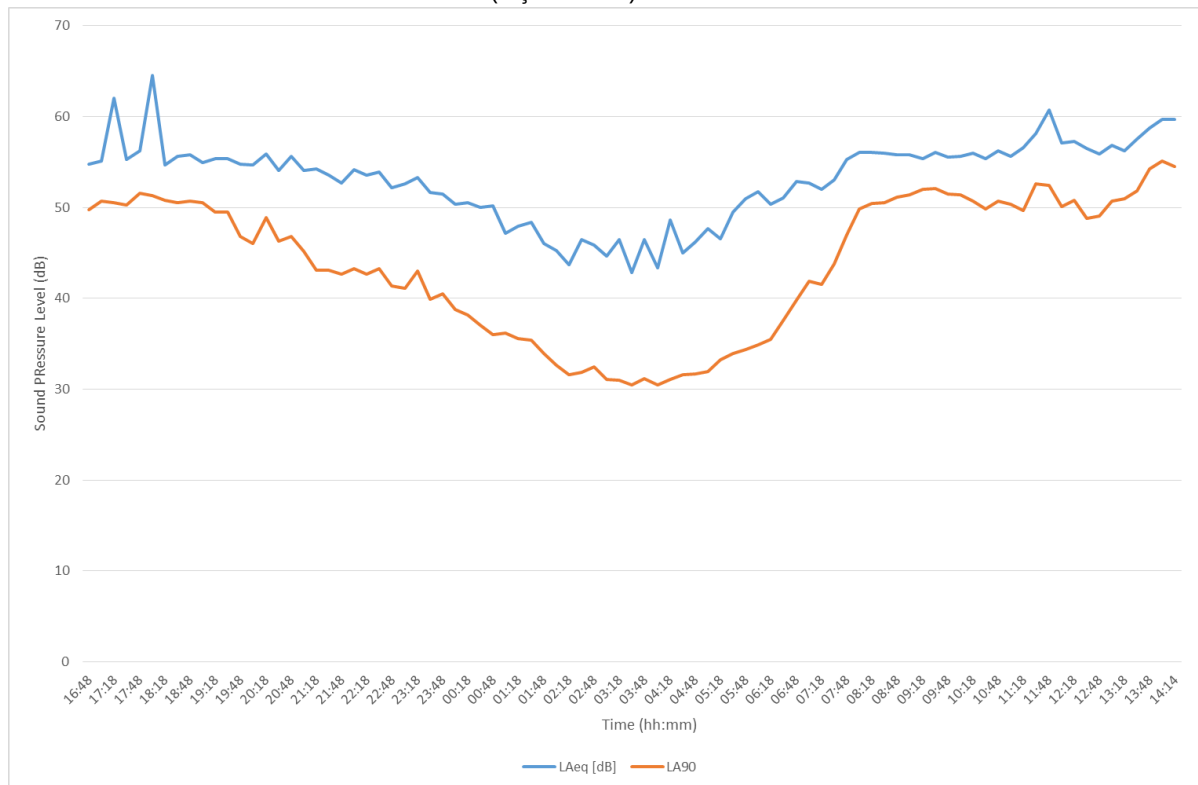
During the monitoring, conditions were dry but overcast with an average air temperature of 7 degrees Celsius. The wind speed was low. These conditions were not expected to have affected the monitoring procedure.



4.4. Measured Data

The measured data for the baseline noise survey consists of the Equivalent Noise Level ($L_{Aeq,15min}$) and Background Noise Level ($L_{A90,15min}$) and is displayed in Chart 1 below:

Chart 1: Variation in Noise Levels with Time (façade level)



This data is summarised for the full period in the table below, and the full tabular results can be provided upon request. The level has been corrected by -3dB for façade effect.

Table 3: Summary of Noise Levels (Free-Field)

Time Period	L _{Aeq} (15 minutes) dB		L _{A90} (15 minutes) dB	
	Range	Typical	Range	Modal
07:00 – 23:00	49-61	52	38-52	47
23:00 – 07:00	39-50	43	27-40	28

From the measured data we have determined a typical design modal background free-field sound level of 28 dB $L_{A90(15\text{ minutes})}$.



5. Plant Noise Predictions

5.1. Proposed Plant

A proposed location of the plant is to the front of the school building to the south of the car parking area. The following sound pressure levels have been provided for the relevant units and are measured at a reference distance of 10 metres.

Table 4: Plant Noise Data

Plant Make and Model	Sound Pressure Level /dB
Foster JEH2-0175-B2-L1 V3	37
Foster JEHR-0100-B1-M-1 V3	30

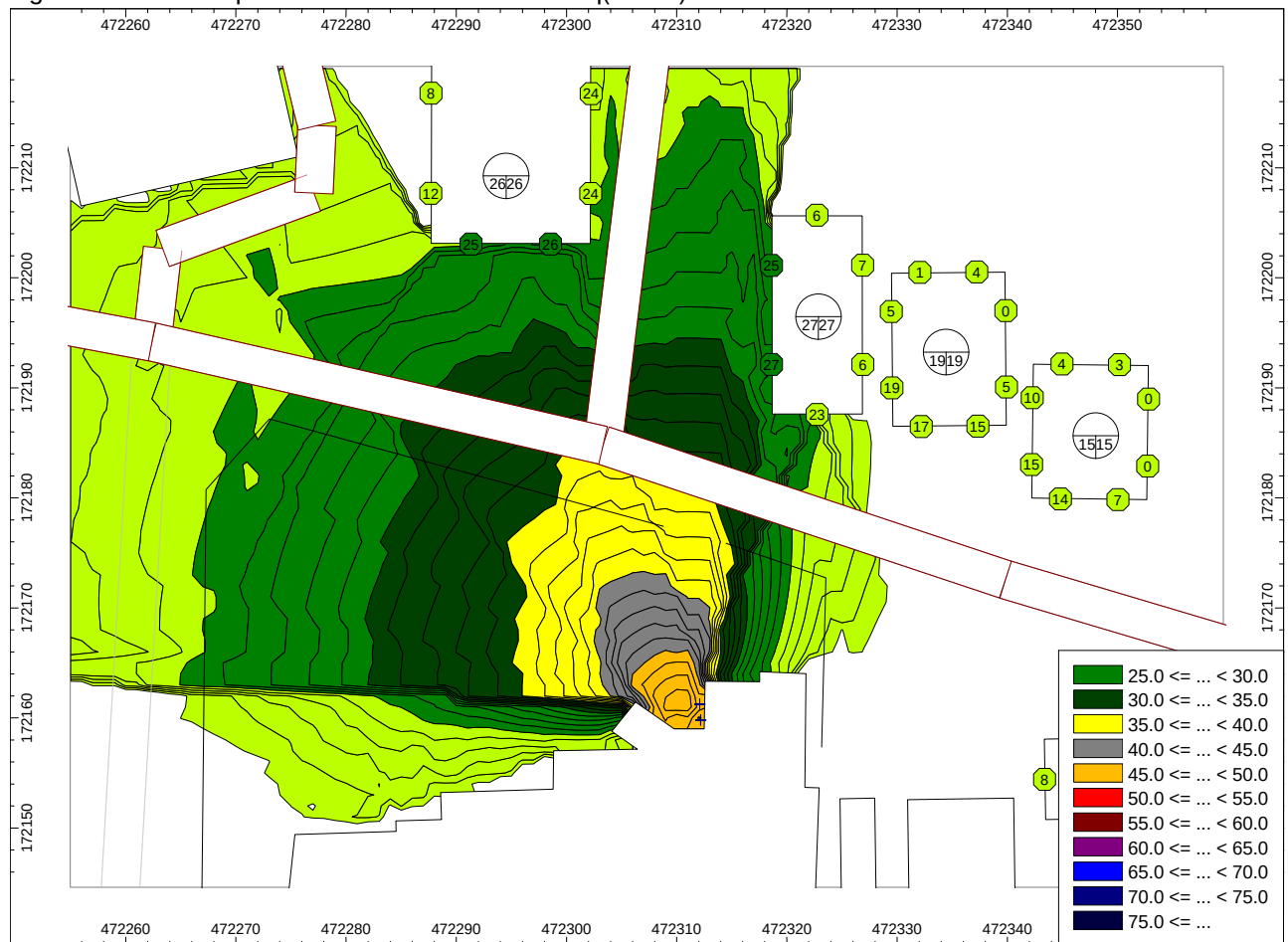
5.2. Predicted Specific Sound Level

The plant noise emission has been modelled in the noise modelling software Cadna:A by DataKustik. The modelling software calculates sound levels based on the inputted sound emission values, source and receiver locations, and primarily distance, barrier and ground attenuation. Calculations are undertaken using the General Method of Calculation from ISO 9613.

The parameters within the Cadna:A model are as follows and are considered reasonable assumptions:

- The existing buildings have been assumed to 6metres tall and based on google earth observations.
- The order of reflections is 3, and all buildings are reflective.
- The ground across the site and surrounding area is considered hard and reflective.
- The topography of the site is assumed to be flat.
- The predictions are based on the supplied plant noise levels.
- The predictions are based on all plant operating continuously.
- The predicted night-time noise map level is at a height of 4.5 metres.

A noise map of the plant specific sound levels is provided below for the daytime and night-time plant operation.

**Figure 3: Predicted Specific Sound Level of Plant LAeq(15min)**

From the noise mapping, the predicted free-field specific sound level of plant at the worst-case noise sensitive receiver is 27 dB $L_{Aeq}(15 \text{ minutes})$.



6. Noise Impact Assessment

A British Standard 4142:2014 initial estimate of the impact has been undertaken at the sensitive receivers around the site and is as follows:

6.1. Background Sound Level

From the measured data we have determined a typical free-field design background sound level to be 28 dB $L_{A90(15\text{ minute})}$ during the night, at a location representative of the noise sensitive receivers.

6.2. Specific Sound Level

The cumulative specific sound level at the worst-case receiver is 27 dB $L_{Aeq(15\text{ minutes})}$ (free-field level). This is the level determined at the noise sensitive receivers without any character corrections applied.

6.3. Character Corrections

Character corrections should be added to the “specific sound level” if the “specific sound level” exhibits any *tonality, impulsivity, other specific characteristics and/or intermittency* at the assessment location. Based on our site visit, the character corrections to be applied are as follows:

Tonality– It’s not possible to determine if the plant is tonal. The supplier should ensure any tonality is not distinguishable at the noise sensitive receivers.

Impulsivity– Plant noise is not impulsive.

Intermittency– As the condensers are responsive to the surrounding temperature, there will be ‘on’ and ‘off’ conditions, and as such the plant is considered to be intermittent, however our predictions are based on continuous operation and therefore the correction has not been applied.

Other Sound Characteristics – We do not believe a character correction is necessary for other sound characteristics.

Therefore, the British Standard 4142:2014 initial estimate at the most sensitive location is as follows:



Table 5: British Standard 4142:2014 Initial Estimate

Parameter	Night time
Background Level, $L_{A90}(15min)$	28 dB
Specific Sound Level, $L_{Aeq}(15min)$	27 dB
Acoustic Character Correction	0 dB
Rating Level	27 dB
Excess of rating over background level	-1 dB

This means that the plant rating noise level will result in a British Standard 4142:2014 assessment 'difference' -1 dB at the nearest noise-sensitive receiver during the night time and is considered to be of a low impact.

6.4. Context

It should be noted that in all instances the context needs to be considered. In terms of context British Standard 4142:2014 states:

"Where the initial estimate of the impact needs to be modified due to the context, take all pertinent factors into consideration, including the following".

Absolute Levels

Where background sound levels and rating levels are low, absolute levels might be as, or more, relevant than the margin by which the rating level exceeds the background. This is especially true at night. Where residual sound levels are very high, the residual sound might itself result in adverse impacts or significant adverse impacts, and the margin by which the rating level exceeds the background might simply be an indication of the extent to which the specific sound source is likely to make those impacts worse.

With regard to 'absolute levels', the most relevant guidance is British Standard 8233:2014. Section 7.7.2 Table 4 of the British Standard provides internal ambient noise levels for dwellings from noise sources 'without a specific character' and are based on existing guidelines issued by the World Health Organisation in 1999.

Internally to a dwelling during the day the internal ambient noise levels should not exceed 35 dB $L_{Aeq}(16hr)$ and 30 dB $L_{Aeq}(8hr)$ to night time sleeping rooms.



The internal level is approximately 15 dB quieter than the external free-field level (as stated by the BS8233/WHO) allowing for the attenuation of a partially open window. Therefore, based on the predicted rating levels noted above, the internal absolute levels are as follows.

Table 6: Comparison with British Standard 8233:2014

Predicted External Level, $L_{Ar(15\text{ min})}$ dB	Open Window Correction dB(A)	Predicted Internal Level $L_{Ar(15\text{ min})}$ dB	Within Criteria
27	-15	12	YES

As can be seen from the table above, the internal rating sound level is within the BS8233 criteria. Therefore, once context is considered it is clear plant noise is of low impact and acceptable.



7. Limitations

The report limits itself to addressing solely on the noise control and acoustic aspects as included in this report. We provide advice only in relation to noise and acoustics.

The report has been prepared in good faith, with all reasonable skill and care, based on information provided or available at the time of its preparation and within the scope of work agreement with the Client. We disclaim any responsibility to the Client and others in respect of any matters outside the scope of the above.

The report is provided for the sole use of the named Client and is confidential to them and their professional advisors. No responsibility is accepted to other parties.

It should be noted that noise predictions are based on the current information as we understand it and on the performances noted in this report. Any modification to these parameters can alter the predicted level. All predictions are in any event subject to a degree of tolerance of normally plus or minus three decibels. If this tolerance is not acceptable, then it would be necessary to consider further measures.



8. Summary & Conclusions

The Abbey Junior School appointed Acoustic Consultants Limited to undertake a noise survey and a noise impact assessment for the proposed condenser plant at The Abbey Junior School, Christchurch Road, Reading in support of a planning application.

The noise impact assessment has been undertaken in accordance with British Standard 4142:2014. Plant noise levels at the nearest noise-sensitive residential properties have been predicted and a British Standard 4142:2014 assessment undertaken. The British Standard 4142 assessment “difference” has been determined to be -1 decibels at the worst-case receiver during the night time. This would be an initial estimate of a low impact.

Once context is considered and the noise impact of the plant is compared to the existing noise climate, plus internal noise levels compared to the relevant adopted guidance, then the plant is 18 dB below the BS 8233:2014 criteria of internal ambient noise levels within bedrooms at the noise sensitive receiver.

Therefore, once context is considered, it is clear plant noise is of low impact and acceptable.



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