acoustics & noise limited

Noise Assessment of Recycling Centre

Job No:	*1805050*
Dated:	*15th November 2019*
Report Status:	*Final*
Prepared for:	*Amgen Cymru* *Bryn Pica* *Llwydcoed* *Aberdare* *CF44 0BX*
Site address:	*Treherbert Community Recycling Centre* *Treherbert Industrial Estate* *Treherbert* *Rhondda Cynon Taff* *CF42 5HZ*

Acoustics & Noise Limited

55 Malpas Road, Newport, South Wales, NP20 5PJ

TEL: +44(0)1633-850880

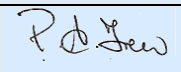
FAX: +44(0)1633-850882

www.acousticsandnoise.co.uk

office@acousticsandnoise.co.uk

acoustics & noise limited

Document Management

Issue / Revision	First issue	Revision 1	Revision 2	Final
Job Number	1805050			1805050
Report Number	R04			R04
ANL File Reference	Shared Folders\Job Files\P - T\RCTCBC\Report\1805050R04			Shared Folders\Job Files\P - T\RCTCBC\Report\1805050R04
Remarks	Draft			Final
Date	14th November 2019			15th November 2019
Prepared by	Chris McDonagh			Chris McDonagh
Signature				
Checked by	Paul Trew			Paul Trew
Signature				
Authorised by	Paul Trew			Paul Trew
Signature				

Acoustics and Noise Ltd prepared and completed this report based on a defined programme of work, terms and conditions agreed with the Client. This report was prepared using all reasonable skill and care within the resources agreed by the client including prevailing site conditions and the degree of manpower and resources allocated to the project. No responsibility is accepted from matters outside the terms and scope of the agreement under which this report was prepared. Recommendations in this report are for acoustics purposes only, and it is the responsibility of the Client, Project Manager or Architect to ensure that all other requirements are met including (but not limited to) structure, fire, planning and Building Control matters. Similarly, no responsibility in any form is accepted for third party use of this report or parts thereof, the contents of which are confidential to the client. If any third party whatsoever comes into possession of this report, they rely on it at their own risk and Acoustics and Noise Ltd accepts no duty or responsibility (including in negligence) to any such third party.

Unless specifically assigned or transferred within the terms of the agreement, Acoustics and Noise Ltd retains all copyright and other intellectual property rights, on and over the report and its contents.

© Acoustics and Noise Ltd. 2019

acoustics & noise limited

CONTENTS

APPENDICES

acoustics & noise limited

TABLES

FIGURES

acoustics & noise limited

BRIEF FOR CONSULTANCY:

This report has been prepared by Acoustics & Noise Limited, Newport, South Wales, for Amgen Cymru, Bryn Pica, Llwydcoed, Aberdare, CF44 0BX under the instructions of Mr. Lee Foulkes.

Order No: n/a

OBJECTIVES:

To objectively assess the acoustic performance of the recently installed, 2m high acoustic barrier fence and compare the results with the modelled.

To investigate the sound levels being experienced at a the neighbouring dwellings and to carry out an assessment of the potential for adverse impact as defined in BS 4142 following the installation of the acoustic fence.

acoustics & noise limited

NON-TECHNICAL SUMMARY:

Amgen Cymru operate a community waste recycling facility on the outskirts of Treherbert. The operations are subject to environmental permit number EPR/AB3091HR. The facility is located at the southern edge of the town of Treherbert on a small industrial estate. Sound Sensitive Receptors (SSR) are located at Eleanor Street and George Street, 60m to the north east of the facility.

In response to complaints due to noise from the facility, Acoustics and Noise Ltd assessed the sound emissions from the waste recycling centre and made recommendations for a scheme of mitigation based on modelling to control the sound levels from the site. The findings of this assessment are detailed in report '*1805050R03*'. The recommended scheme comprised the installation of an acoustic barrier located along the north-east and south-east boundary of the site. This acoustic barrier was recommended to have a minimum effective height of 2m with a minimum superficial mass of 15 kg/m^2.

The installation meeting this specification was confirmed during a site visit carried out by Acoustics and Noise Ltd prior to this assessment.

Following the installation of the barrier, NRW requested that '*…a follow up noise assessment with further noise monitoring should be conducted to assess the performance of the recently installed acoustic fence, as well as the other appropriate measures implemented on the site'*.

This report details the follow up measurements and an updated assessment of impact on the residential receptors following the installation of the acoustic barrier.

Measurements of the ambient and residual sound level were taken at the assessment location during a typical 1-hour period. On-site activities observed during the ambient survey period included 31 vehicle visits, 2 compactor operations and 2 skip change overs and is inclusive of all significant sound sources at the site.

To ensure that the modelling accurately reflected the noise levels experienced on site a monitoring position was set up at the boundary of the site and recorded noise levels were compared with the model. These were found to be within 1db.

acoustics & noise limited

The initial assessment, on which the recommendations for an acoustic barrier were based, utilised a combination of near field sound measurement and 3D acoustic modelling techniques to predict the specific sound level at the assessment location during a typical 1-hour operating period. This prediction considered the effectiveness of the 2m high acoustic barrier located along the north-east and south-east boundary of the site. The results of that assessment predicted that the specific sound level would be 39 dB ± 3 $L_{Aeq,1hr}$.

This follow up assessment details the measured sound emissions from the site, to confirm that the in-situ acoustic barrier is as effective as predicted. The results of this assessment indicate that the specific sound level measured at the assessment location was determined to be 36 dB $L_{Aeq,1hr}$ and confirms that the in-situ acoustic performance of the barrier is effective in eliminating any adverse impact at the assessment location resulting in lower specific sound levels than those initially predicted.

The assessment of the site noise levels indicates that, the likelihood of adverse impact from site activities will be low. Hence the recommended mitigation reduces the sound emissions from the waste recycling site to a practicable minimum at the nearest sound sensitive receptor as required by the operational environmental permit.

acoustics & noise limited

1.0 DESCRIPTION OF SITE

1.1 The site is located at Treherbert Community Recycling Centre, Treherbert Industrial Estate, Treherbert, Rhondda Cynon Taff, CF42 5HZ and is currently utilised community recycling facility for household waste.

1.2 The site is located at the southern edge of the town of Treherbert on a small industrial estate.

1.3 The nearest sound sensitive receptors (SSR) are at the rear of residential dwellings located at Eleanor Street and George Street, 60m to the north east of the facility.

acoustics & noise limited

2.0 DISCUSSION

2.1 Amgen Cymru operate a community waste recycling facility on the outskirts of Treherbert. The operations are subject to environmental permit number EPR/AB3091HR.

2.2 Section 3.3 of the permit refers to noise and vibration emissions from the facility. The relevant paragraphs are reproduced below:

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

3.3.2 The operator shall:

a) if notified by National Resources Wales that the activities are giving rise to pollution outside the site due to noise and vibration, submit to Natural Resources Wales for approval within the period specified, a noise and vibration management plan which identifies and minimises the risks of pollution from noise and vibration.

b) implement the approved noise and vibration management plan, from the date of approval, unless otherwise agreed in writing by Natural Resources Wales."

2.3 In response to complaints due to noise from the facility, Acoustics and Noise Ltd were initially engaged by Amgen Cymru to investigate whether the noise impact can be practically mitigated by physical means, e.g. acoustic fence or earth bund etc. and if not to advise on any other practical mitigation.

2.4 Acoustics and Noise Limited subsequently assessed the sound emissions from the waste recycling centre and made recommendations for a scheme of mitigation, based on modelling, to control the sound levels from the site.

acoustics & noise limited

2.5 The results and recommendations from our assessment for the above are detailed in report '1805050R03' [1]. The recommended scheme comprised the installation of an acoustic barrier located along the north-east and south-east boundary of the site. The acoustic barrier should have a minimum effective height of 2m with a minimum superficial mass of 15 kg/m^2.

2.6 The installation, meeting this specification, was subsequently confirmed during a site visit carried out by Acoustics and Noise Ltd prior to this assessment.

2.7 Following the installation of the recommended barrier, NRW requested that '*…a follow up noise assessment with further noise monitoring should be conducted to assess the performance of the recently installed acoustic fence, as well as the other appropriate measures implemented on the site*'.

2.8 This report details the measurements to confirm the modelled results and an updated assessment of impact on the residential receptors following the methods detailed in BS 4142[3], the recommended assessment method detailed in '*IPPC Horizontal Guidance Note for Noise Assessment and Control' [2]*.

2.9 BS 4142 describes the methods and procedures for rating and assessing sound of an industrial and/or commercial nature by comparing the rating level of the sound source(s) with the underlying sound level, or background sound level, at the assessment location.

2.10 For the previous assessment [1], it was not possible to determine the specific sound level as discrete entity, distinct and free of other influences by measurement at the assessment location due to the relatively high residual sound level. The specific sound level in that case was determined from a combination of near-field activity measurement and sound propagation calculation, using a 3D acoustic model, as recommended by BS 4142 [3].

2.11 For the purposes of this assessment, sound pressure level measurements were made at the assessment location with concurrent audio recordings to enable clear identification of all audible instances of the waste recycling activity occurring during the survey.

acoustics & noise limited

2.12 Measurements were also made at the boundary of the site to allow comparison of the "real world" activity noise levels with the modelled.

2.13 To enable a robust assessment of the impact, the loudest 1-hour period was extracted from the survey data. Observations made on site during this period indicated that site activity included two skip changeover operations, 31 vehicle visits and two uses of the compactor. This is inclusive of all significant sources of sound emissions at the site and is deemed to be representative of a typical, worst-case, hour at the site.

2.14 The results of this assessment were compared with the results of the earlier predicted results [1] to determine the practical efficacy of the installed acoustic barrier.

acoustics & noise limited

3.0 ASSESSMENT METHODOLOGY

3.1 Impact

3.1.1 Relevant Guidance

3.1.1.1 As a matter of best practice, this assessment has been undertaken based on the relevant guidance on noise. This includes but not necessarily exclusive to:

3.2 Horizontal Guidance Note, IPPC H3 [2]

3.2.1 Integrated Pollution Prevention and Control (IPPC) is a regulatory system that employs an integrated approach to control the environmental impacts of certain industrial activities. It involves determining the appropriate controls for industry to protect the environment through a single Permitting process.

3.2.2 To gain a Permit, Operators will have to show that they have systematically developed proposals to apply the Best Available Techniques (BATs) and meet certain other requirements, taking account of relevant local factors.

3.2.3 The purpose of the *IPPC Horizontal Guidance Note for Noise Assessment and Control* is to provide supplementary information, relevant to all sectors, to assist Applicants in preventing and minimising emissions of noise and vibration as described in the IPPC Sector Guidance Notes.

3.2.4 This guidance is in two parts:

- *Part 1 Regulation and Permitting: Outlines the main considerations relating to the setting of Permit conditions and subsequent regulation of noise. It is aimed primarily at the information needs of Regulators.*
- *Part 2 Noise Assessment and Control: This document, describes the principles of noise measurement and prediction and the control of noise by design, by operational and management techniques and abatement technologies. It forms a background to Part 1 and will assist in determining BAT for a given installation.*

3.2.5 The guidance documents provide information and procedures for assessing the impact from noise sources. The impact from noise will depend upon many factors

acoustics & noise limited

including the difference between the off-site noise and the existing background sound level, the nature of the noise, its frequency, duration, and the times of the day the exposure occurs.

3.2.6 The measurement and evaluation of noise and vibration is covered in a number of British Standards. These give guidance on a wide range of related topics including equipment types, calibration, measurement techniques and locations and also the interpretation of data. Wherever possible a recognised method should be followed as closely as possible.

3.2.7 The Horizontal Guidance highlights a number of relevant British Standards and documents with particular emphasis on the application of BS 4142:1997. Since the publication of the Horizontal Guidance, BS 4142 was comprehensively revised and updated in 2014.

3.2.8 Part 2 describes a hierarchy for control of noise which needs to be considered on a process or site specific operation basis to minimise the risk of adverse impact.

3.3 Objective Assessment using BS 4142:2014+A1:2019 [3]

3.3.1 General guidance

3.3.1.1 The Foreword to the standard states "*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 the acoustic environment, as well as local attitudes to the source of the sound and the character of the neighbourhood.*"

3.3.1.2 The scope of BS 4142 includes the following guidance "*The methods described in this British Standard use outdoor sound levels to assess the likely effects of sound on people who might be inside or outside a dwelling or premises used for residential purposes upon which sound is incident*".

3.3.1.3 It should be noted that exclusions to the use of the standard is carefully defined as follows:

acoustics & noise limited

- *"The determination of noise amounting to a nuisance is beyond the scope of this British Standard "and that the*
- *"Sound of an industrial and/or commercial nature does not include sound from the passage of vehicles on public roads and railway systems" also*
- "*This standard is not intended to be used to assess the extent of the impact at indoor locations*" and "*…is not intended to be applied to the assessment of indoor sound levels*" and
- *"The standard is not applicable to the assessment of low frequency noise"*

Therefore, the consideration of any of the above is outside the scope of this report.

3.3.1.4 The Scope of the standard goes on to state that:

"*This standard is applicable to the determination of the following levels at outdoor locations:*

- *Rating levels for sources of sound of an industrial and/or commercial nature; and*
- *Ambient, background, and residual levels*

For the purposes of:

- *Investigating complaints;*
- *Assessing sound from proposed, new, modified or additional sources(s) of sound of an industrial and/or commercial nature; and*
- *Assessing sound at a proposed new dwellings or premises used for residential purposes.*"

3.3.1.5 The unit of measurement usually used for measuring environmental sound is the A weighted decibel (dB). The "A weighting" is an internationally agreed frequency response, generally similar to that of the human ear, so that measured sound levels correspond reasonably well with what is heard.

3.3.1.6 In most situations, sound levels vary continuously, and it is customary to use a system of percentile values, which enable the noise climate to be described statistically. For example, the L_{A10} is the A-weighted noise level exceeded for 10%

acoustics & noise limited

of a given time period and in the case of road traffic, for which it is widely used, it provides an indication of typical maximum levels. The L_{A90}, being the noise level exceeded for 90% of the time, represents the typical minimum noise level in an area and is often referred to as the background noise level.

3.3.1.7 Sometimes it is convenient to give a single figure summarising all the sound received by equating it to the equivalent continuous sound level L_{Aeq} in dB, which would contain the same sound energy as the actual fluctuating sound levels.

3.3.1.8 Measurement locations are chosen that will give results that are representative of the ambient sound and residual sound at the assessment location(s). Specific, ambient and background sound measurements are usually taken at a height of 1.2m to 1.5m above the ground and under similar conditions to the assessment location(s) and at least 3.5m from any other reflecting surface. Where this is not possible, calculated levels as per an accepted methodology e.g. BS 5288 or ISO 9613-2, can be used.

3.3.2 **Specific Sound Level**

3.3.2.1 The specific sound level in terms of L_{Aeq}, produced by the sound source under investigation, is determined at the assessment location(s) as a discrete entity, distinct and free of other influences contributing to the ambient sound.

3.3.3 **Reference Time Interval**

3.3.3.1 The specific sound level is evaluated over an appropriate reference time interval, T_r defined in the standard as:

- 1 hour during the daytime period (07:00 – 23:00 hours)
- 15 minutes during the night time period (23:00 – 07:00 hours)

3.3.4 **Background Sound Level**

3.3.4.1 The background sound level is discussed in Clause 8.1 in BS 4142 as follows "*The background sound level is an underlying level of sound over a period, T, and might in part be an indication of relative quietness at a given location. It does not reflect the occurrence of transient and/or higher sound level events and is generally governed by continuous or semi-continuous sounds".*

acoustics & noise limited

3.3.4.2 And *"…Since the intention is to determine a background sound level in the absence of the specific sound that is under consideration, it is necessary to understand that the background sound level can in some circumstances legitimately include industrial and/or commercial sounds that are present as separate to the specific sound.*

3.3.4.3 BS 4142 [3] gives guidance on the lowest limit to which the background sound level can be measured as follows "*Care is necessary in circumstances where background sound levels are low to ensure that self-generated and electrical noise within the measurement system does not unduly influence reported values, which might be the case if the measured background sound levels are less than 10 dB above the noise floor of the measuring system".*

3.3.4.4 BS 4142 provides extensive guidance on assessing the representative background sound level advising that "*In practice, there is no "single" background sound level as this is a fluctuating parameter. However, the background sound level used for the assessment should be representative of the period being assessed."*

3.3.5 **Residual Sound Level**

3.3.5.1 The ambient sound level i.e., all sounds near and far measured without the specific sound level present is termed the residual level. If the residual level is close to the specific sound level, the specific sound level is corrected to account for the addition of the background sound to the specific sound level measured.

3.3.5.2 Where the ambient sound level and the measured specific sound level are within 10dB of each other, then the specific sound level is corrected as follows

$$L_S = 10lg\left(10^{\frac{L_A}{10}} - 10^{\frac{L_R}{10}}\right)$$

where:
L_S is the specific sound level;
L_A is the ambient sound level; and
L_R is the residual sound level.

3.3.5.3 As per the guidance in BS 4142 "*Where it is not possible to determine the specific sound level by measurement of the ambient sound level and the residual sound level at the assessment location(s), for example, because the difference between the*

acoustics & noise limited

ambient sound level and the residual sound level is ≤3 dB, determine the specific sound level by a combination of measurement and calculation. Report the method of calculation in detail and give the reason for using it."

3.3.6 **Correction to Specific Sound for On-Time of Source**

3.3.6.1 If the specific sound is intermittent and either steady or cyclic and the on-time of the source is less than the reference time period, then the specific sound level corrected for the effect of the residual level determined above is further corrected for the on-time using the correction term:

$$10 \lg \left(\frac{T_o}{T_r} \right)$$

where T_o is the on-time of the specific source

and T_r is the reference time period

3.3.7 **Specific Sound Acoustic Features Corrections**

3.3.7.1 Certain acoustic features can increase the significance of impact over that expected from a basic comparison between the specific sound level and the background level.

3.3.7.2 If the source sound has a feature which makes it particularly noticeable, e.g., a tonal or impulsive characteristic, a character correction is added to the measured or calculated specific sound level to obtain the rating level in order to account for its more noticeable nature.

3.3.7.3 BS 4142 specifies the following methods to assess this penalty

- Subjective method;
- Objective method for tonality;
- Reference method.

3.3.8 **Subjective method**

3.3.8.1 Where appropriate, establish a rating penalty for sound based on a subjective assessment of its characteristics. This would also be appropriate where a new

acoustics & noise limited

source cannot be measured because it is only proposed at that time, but the characteristics of similar sources can subjectively be assessed.

3.3.8.2 Guidance as to the application of the penalties is given is given as follows, "*Where tonal and impulsive characteristics are present in the specific sound within the same reference period then these two corrections can both be taken into account. If one feature is dominant then it might be appropriate to apply a single correction. Where both features are likely to affect perception and response, the corrections should normally be added arithmetically"*.

3.3.8.3 BS 4142 specifies the following penalties for tones:

- 2 dB for a tone which is just perceptible at the noise receptor
- 4 dB where it is clearly perceptible
- 6 dB where it is highly perceptible

3.3.8.4 BS 4142 specifies the following penalties for impulsivity:

- 3 dB for impulsivity which is just perceptible at the noise receptor
- 6 dB where it is clearly perceptible
- 9 dB where it is highly perceptible

3.3.8.5 Where the specific sound features characteristics are neither tonal nor impulsive, though otherwise are readily distinctive against the residual acoustic environment, a penalty of 3 dB can be applied.

3.3.8.6 Where the specific sound is intermittent and has identifiable on/off conditions that are "*readily distinctive against the residual acoustic environment*", a penalty of 3 dB can be applied.

3.3.9 **Rating Level**

3.3.9.1 The correction for any acoustic features present in the sound source is added to the specific sound level to give the rating level $L_{Ar,Tr}$ which is then compared with the background sound level, $L_{A90,T}$, by subtracting the background sound level from the rating level and the significance of impact is assessed.

acoustics & noise limited

3.3.10 Uncertainty

3.3.10.1 Consideration should be given to the level of uncertainty in the data and associated calculations. Where the level of uncertainty could affect the conclusion, any assessment should take reasonably practicable steps to reduce the level of uncertainty.

3.3.11 Assessment of the Impacts

3.3.11.1 The significance of sound of an industrial and/or commercial nature depends upon both the margin by which the rating level of the specific sound source exceeds the background sound level and the context in which the sound occurs. It is essential to place the sound in context when arriving at conclusions.

3.3.11.2 An initial estimate of the impact of the specific sound is obtained by subtracting the measured background sound level from the rating level and using the magnitude of this difference to assess the magnitude of impact as summarised in Table 1 below. Typically, the greater this difference, the greater the magnitude of the impact.

Table 1 – BS 4142 Impact Significance Criteria

Rating Level minus Background Sound Level	BS 4142 Significance of Impact
+10 dB	A difference of around +10 dB or more is likely to be an indication of a significant adverse impact, depending on the context
+5 dB	A difference of around +5 dB or more is likely to be an indication of an adverse impact, depending on the context
≤ 0 dB	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 context.

3.3.11.3 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 significant adverse impact, depending on the context. Adverse impacts include, but are not limited to, annoyance and sleep disturbance.

acoustics & noise limited

3.3.11.4 It should be noted that not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

3.3.11.5 Where the initial estimate of the impact needs to be modified due to the context, all pertinent factors will need to be taken into account, including:

- *The absolute level of the sound.*
- *The character and level of the residual sound compared to the character and level of the specific sound.*
- *The sensitivity of the receptor and whether dwellings or other premises used for residential purposes will already incorporate design measures that secure good internal and/or outdoor acoustic conditions such as façade insulation treatment, ventilation and/or cooling to reduce the need to open windows, and acoustic screening.*

3.3.12 **Efficacy of Barrier**

3.3.12.1 The boundary modelled noise levels were compared with the measured noise levels at the same location.

acoustics & noise limited

4.0 ASSESSMENT PROCEDURES

4.1 The survey was carried out by two consultants from Acoustics and Noise Ltd. One consultant carried out the measurements the assessment location whilst the other remained on site to witness all on-site activities during the survey.

4.2 **ASSESSMENT OF IMPACT AS PER BS 4142 [3]**

4.2.1 **Assessment Location**

4.2.1.1 The same assessment location was used as previously agreed with Natural Resources Wales and was deemed to be representative of the acoustic climate at the nearest sensitive receptor (see Appendix 3).

4.2.2 **Reference Time Interval**

4.2.2.1 The site operates during the hours of 08:00 – 17:30, November to April and 08:00 – 19:30 hours April to November. Therefore, the appropriate reference time period for a daytime impact assessment is 1 hour as defined in BS 4142.

4.2.3 **Suitability of Measurement Equipment**

4.2.3.1 BS 4142 [3] gives guidance on the lowest limit to which the background sound level can be measured. The requirement for the measurement equipment is that the measured background sound levels are greater than 10 dB above the noise floor of the measuring system.

4.2.3.2 The meter used for the surveys was a B&K 2250 which has a specified internal noise floor of 16.6 dB which means that sound levels of equal to or greater than 16.6 + 10 dB(A) = 27 dB will meet the above criteria.

4.2.3.3 The lowest recorded background sound level during the survey was 41.9 dB $L_{A90,1s}$. This comfortably exceeds the internal noise floor of the measurement equipment as described above.

4.2.4 **Specific Sound Level**

4.2.4.1 The specific sound level is determined from the measured ambient sound level at the assessment location.

acoustics & noise limited

4.2.4.2 Following analysis of the complete survey data, the loudest 1 hour period was extracted to represent worst case sound emissions from the site. Due to the intermittent and random nature of the activities at the site, the audio recordings were analysed to identify all audible instances of activity associated with the recycling centre. These instances were combined using the B&K Evaluator software to determine both the total on-time and level for the ambient sound from on-site activity.

4.2.4.3 The results of the analysis are presented in Appendix 4 and summarised in Table 2 below.

Table 2 – Summary of Calculated Ambient Sound Level at SSR

Sound Sensitive Receptor	Free-Field Ambient Sound Level $L_{Aeq,2min,49sec}$ (dB)
SSR	53

4.2.4.4 The ambient sound level is further corrected for the effect of the residual sound, the on-time of the specific sound source and any acoustic features where present as detailed in the following sections.

4.2.5 **Representative Background Sound Level**

4.2.5.1 The representative daytime background sound level was determined from the remaining data not identified as being associated with activities at the waste recycling site.

4.2.5.2 The total duration for the background sound data was 57 minutes 11 seconds and is deemed representative of the acoustic conditions during the reference time interval of 1 hour.

4.2.5.3 The results of the analysis are presented in Appendix 4 with the representative daytime background sound levels summarised in Table 3 below.

Table 3 – Summary of Representative Background Sound Level

acoustics & noise limited

Reference Time Period	Free-Field Background Sound Level $L_{A90,t}$ (dB)
Daytime, t = 1 hour	45

4.2.6 **Residual Sound Level**

4.2.6.1 The residual sound level was determined from the data extracted for the background sound level as described above and represents the daytime acoustic climate in the absence of site activity. The residual sound level during the 1-hour reference time period was determined to be 51 dB $L_{Aeq,1hr}$.

4.2.6.2 The ambient sound levels determined during the survey can now be corrected for the addition of the background as detailed in Table 4 below.

Table 4 – Calculation of Specific Sound Level

Sound Source	Ambient Sound Level $L_{Aeq,\ t}$ (dB)	Residual Sound Level $L_{Aeq,t}$ (dB)	Specific Sound Level $L_{Aeq,t}$ (dB)
Waste Recycling	53	51	49

4.2.6.3 Where the specific sound is intermittent and the total on-time of the source is less than the reference time interval, then the specific sound level corrected for the effect of the residual level determined above is further corrected for the on-time as detailed in BS 4142 [3].

4.2.6.4 As described above, the on-time for the identified recycling activity was determined to be 2 minutes and 49 seconds in total during the 1 hour reference time period.

4.2.6.5 The on-time correction to be applied is 10*log(169/3600) = -13 dB resulting in a corrected specific sound level for the 1 hour reference time period of 36 dB $L_{Aeq,1hr}$.

4.2.7 **Acoustic Feature Correction**

acoustics & noise limited

4.2.7.1 At the time of the survey, the sound characteristics of the waste recycling site activities were subjectively described as random and mainly impulsive in nature. There was a barely audible tone associated with the reversing alarms used during the skip changeover procedures. An occasional alarm was just audible only during lulls in the ambient sound. These observations were made at the assessment location.

Tonality

4.2.7.2 The audio recording was analysed to identify an instance of the reversing alarm during the skip changeover operation. A 1 second sample was selected which comprised a single instance of the alarm with minimal extraneous sound. An objective analysis of the one-third-octave spectrum for this sample was completed following the procedures detailed in BS 4142 [3] as presented in Appendix 4. This objective analysis did not identify the presence of a discrete tone.

4.2.7.3 As the reversing alarms are barely audible and only occur during the short periods of reversing manoeuvres during a skip changeover, the tonal characteristic is considered to be minor in comparison to the dominant impulsive characteristics and it is considered appropriate to apply a zero correction to the specific sound.

Impulsivity

4.2.7.4 At the time of the measurement, the survey engineer at the assessment location, described the specific sound as being impulsive and clearly perceptible at the assessment location. A +6dB impulsive feature correction was applied to the specific sound.

Other Sound Characteristics

4.2.7.5 The waste recycling activities do not feature any other acoustic characteristics that would be *"readily distinctive against the residual acoustic environment"* and no additional acoustic feature corrections were applied.

Intermittency

4.2.7.6 At the time of the measurement, the survey engineer subjectively described the activities at the waste recycling site as intermittent with clearly identifiable on/off

acoustics & noise limited

conditions and therefore, a +3dB acoustic feature correction was applied to the specific sound level.

4.2.7.7 To account for the acoustic features described above, a total correction of + 9 dB is applied to the specific sound level to determine the rating level.

4.2.8 **Rating Level**

4.2.8.1 The acoustic corrections are added to the specific sound level to give the rating levels for the operations at the site, $L_{Ar,Tr}$, and are summarised in Table 5 below.

Table 5 – Summary of Calculated Rating Levels

Sound Sensitive Receptor	Specific Sound Level $L_{Aeq,1hr}$ (dB)	Acoustic Feature Correction (dB)	Rating Level $L_{Ar,Tr}$ (dB)
SSR	36	+9	45

4.2.8.2 The rating level is then compared with the background sound level, by subtracting the background sound level from the rating level. and the significance of any impact is assessed as per BS 4142 [3].

4.2.9 **Uncertainty**

4.2.9.1 There is a potential for uncertainty in the determination of the representative daytime background sound levels due to the relatively short survey period. This uncertainty was minimised by analysing the audio recordings to exclude any extraneous noise and site activity.

4.2.9.2 All measurements, assumptions and calculations have adopted a worst-case approach to minimise the significance of uncertainty.

4.2.9.3 The uncertainty due to atmospheric effects is minimal due to the short source receiver distance.

4.3 **Significance of Impact**

acoustics & noise limited

4.3.1 The initial estimate of the impact of the specific sound is summarised in Table 6 below. Typically, the greater this difference, the greater the magnitude of the impact.

Table 6 – Summary of BS 4142 Daytime Assessment

Sound Sensitive Receptor	Rating Level (dB)	Background Sound Level (dB)	Excess over Background (dB)	BS 4142 Assessment of Impact
SSR	45	45	0	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 context.

4.3.2 The initial estimate of the impact of the specific sound indicates that the rating level equals the background level and the likelihood of an adverse impact is low, when assessed at the nearest sound sensitive receptor, depending on the context.

4.3.3 It should be noted that not all adverse impacts will lead to complaints and not every complaint is proof of an adverse impact.

4.4 Consideration of the Context

4.4.1 The acoustic climate at the site is dominated by the sound of road traffic travelling along the nearby roads in addition to intermittent train pass-bys. The acoustic climate was also impacted upon by plant noise from the industrial unit adjacent to the waste recycling site and a commercial premise adjacent to the SSR.

4.4.2 Even though the absolute sound levels from the site are below the residual sound levels, the activity sound levels are still perceptible due to the differing acoustic characteristics.

4.4.3 Following consideration of the context, modification of the initial estimate of impact is not appropriate and the conclusion of a low impact would still apply.

acoustics & noise limited

5.0 EFFICACY OF MITIGATION

5.1 The previous assessment [1] utilised a combination of near field sound measurement of the activities and 3D acoustic modelling techniques to predict the specific sound level at the assessment location during a typical 1-hour operating period. The prediction considered the effectiveness of a 2m high acoustic barrier located along the north-east and south-east boundary of the site.

5.2 The results of the modelling predicted that the specific sound level would be 39 dB $L_{Aeq,1hr}$.

5.3 A comparison of the on-site measurements collected at the north-east corner of the site with the results of the initial modelling results indicate that the predicted on-site noise levels at the measurement position were within 1 dB of the on-site measurements (56 dB $L_{Aeq,1hr}$ modelled compared with 57 dB $L_{Aeq,1hr}$ measured).

5.4 This clearly demonstrates that the input sound levels used for the initial modelling exercise were a robust representation of the actual sound levels during the loudest 1 hour period used in this assessment and that the predicted acoustic performance of the barrier is comparable with the in-situ performance.

5.5 The results of this assessment indicate that the specific sound level measured at the assessment location was determined to be 36 dB $L_{Aeq,1hr}$ compared with the modelled levels of 39 ± 3dB $L_{Aeq\ 1hr}$.

5.6 The results of this assessment confirm that the in-situ acoustic performance of the barrier is effective in eliminating any adverse impact at the assessment location resulting in lower specific sound levels than those predicted.

acoustics & noise limited

6.0 CONCLUSIONS

6.1 The in-situ acoustic performance of the barrier is consistent with the performance predicted by the initial modelling procedures.

6.2 The installation of the 2m high acoustic barrier along the north-east and south-east site boundary is effective in eliminating the likelihood of adverse impact as assessed using the methodology contained in BS 4142 [3].

P.A.T. 14/11/19
M.Sc., I.Eng., M.I.O.A.,
M.Inst.SCE., M.A.E.S.

acoustics & noise limited

Appendix 1
Survey Details

acoustics & noise limited

A1.0 SURVEY DETAILS

Background, Residual and Specific Sound Survey

A1.1.1 The meters were calibrated at the start of the measurement procedure and checked after each set of measurements. No significant deviation i.e. > 0.5 dB was recorded.

A1.1.2 Measurements were carried out on 8th November 2019 over a 3-hour measurement period during typical operational activities.

A1.1.3 The survey commenced at 10:51 hours.

A1.1.4 Weather conditions: 10% cloud cover, 12°C, dry, slight intermittent breeze (<3ms^{-1}).

A1.2 **Measurement Procedure:**

A1.2.1 The 2250 was located on a tripod at a height of 1.4m and positioned at an assessment location at the rear of sound sensitive receptors (SSR) along Eleanor Street.

A1.2.2 This location was agreed with Mr Lee Foulkes of Rhondda Cynon Taff County Borough Council and Natural Resources Wales and was deemed representative of the acoustic climate at the nearest SSR.

A1.2.3 The meter was adjusted to log and store L_{Aeq} and L_{A90} in 1-second periods for the duration of the survey. Simultaneous audio was also captured to aid identification of the specific operational activity.

The 2260 was located at the boundary of the site (see Appendix 2) and adjusted to log and store L_{Aeq} in 1 second periods in 1 hours segments.

A1.2.4 On completion of the survey, the data was downloaded to a computer for further analysis.

A1.2.5 The audio and measurement data were further analysed to determine the following:

- Extraneous noise was excluded from the data. The extraneous noise was attributed to neighbouring cars manoeuvring close to the measurement microphone.

acoustics & noise limited

- Using the B&K Evaluator software, the loudest 1-hour period was identified to represent worst case emissions from the site.
- The ambient sound level was extracted from the data using the audio recording to identify all audible operational sound emissions from the waste recycling site.
- The residual and background sound levels were determined from the remaining periods not identified above.

A1.2.6 **SUBJECTIVE OBSERVATIONS**

A1.2.7 The acoustic environment during the survey was characterised by road traffic and frequent intermittent birdsong. During the survey, regular intermittent tonal sound was also observed from the plant at the rear of the convenience store on the main road (Bute Street).

A1.2.8 Additional sources were from regular train pass-bys along the line to the south of the recycling site approximately 150m from the assessment position.

A1.2.9 Activities at the waste recycling site were perceptible at the measurement position and mostly impulsive in character with occasional barely audible sound from the reversing alarm which were used during the skip changeover.

A1.3 **Equipment Used:**

Table 7 – Equipment Used

ITEM	Serial No	UKAS Calibration Certificate Date (if applicable)
(ANL-M4) B&K 2250 Handheld Analyser	2567736	Certificate: 15417 Date: 16/05/18
(ANL-C4) B&K 4231 Calibrator	2567363	Certificate: 15416 Date: 15/05/18
(ANPM2) B&K 2260 Investigator Analyser	2520465	Certificate: 15406 Date: 11/04/18
(ANPC2) B&K 4231 Calibrator	2528149	Certificate: 15185 Date: 11/04/18

acoustics & noise limited

Appendix 2
Site Monitoring Position

acoustics & noise limited

A2.0 SITE MONITORING POSITION

Figure 1 – Monitoring position

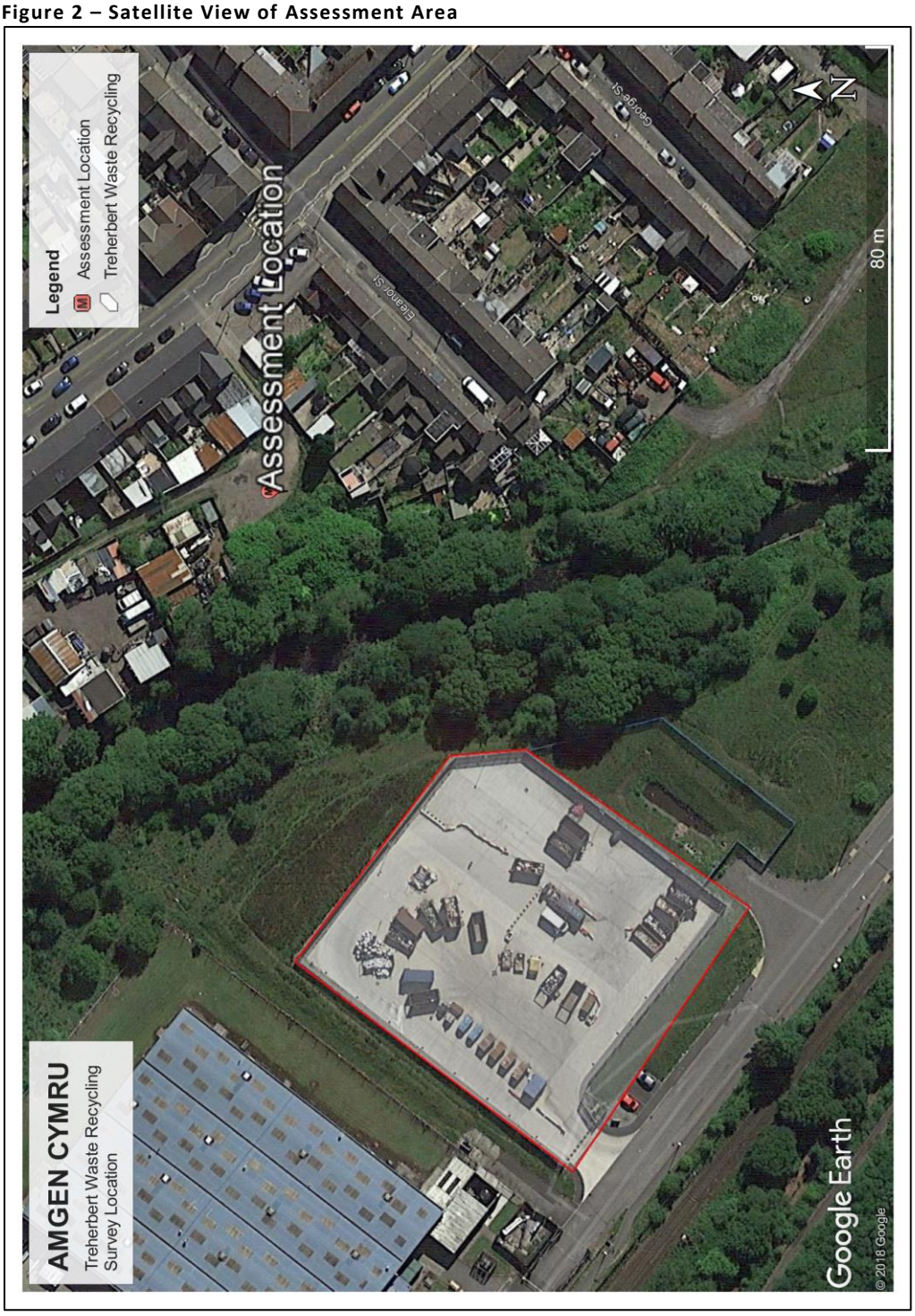
acoustics & noise limited

Appendix 3
View of Assessment Area

acoustics & noise limited

A3.0 VIEW OF ASSESSMENT AREA

Figure 2 – Satellite View of Assessment Area



acoustics & noise limited

Appendix 4
Survey Results

acoustics & noise limited

A4.0 SURVEY RESULTS

A4.1 Measurements Completed at Assessment Location

Figure 3 – Complete Survey Data, Profile Data

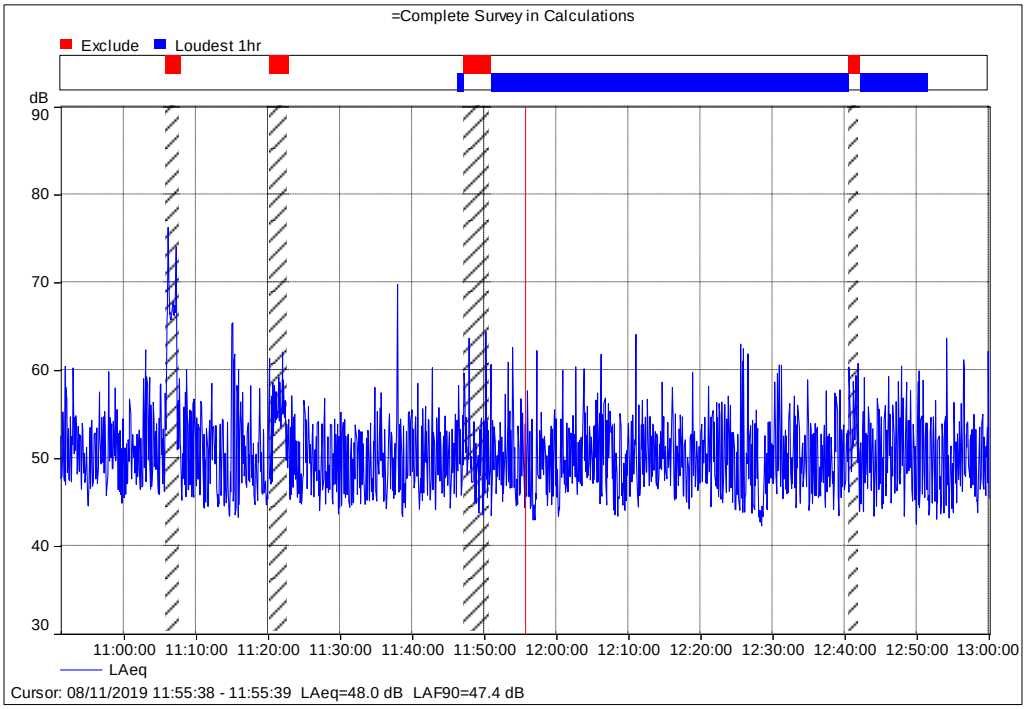


Table 8 – Complete Survey, Summary Data

Name	Start time	Overload [%]	Duration, t	$L_{Aeq,t}$ [dB]	$L_{AF90,t}$ [dB]
Total	08/11/2019 10:51:12	0	1:58:42	50.8	45.4
Exclude	08/11/2019 11:05:47	0	0:10:12	60.5	47
Unmarked	08/11/2019 10:51:12	0	0:58:42	50.8	45.4
(All) Exclude	08/11/2019 11:05:47	0	0:10:12	60.5	47
(All) Loudest 1hr	08/11/2019 11:46:15	0	1:00:00	50.8	45.3
Exclude	08/11/2019 11:05:47	0	0:02:10	66.5	52
Exclude	08/11/2019 11:20:12	0	0:02:44	54.9	49.1
Exclude	08/11/2019 11:47:13	0	0:03:46	51.8	45.5
Exclude	08/11/2019 12:40:39	0	0:01:32	53.4	46.7
Loudest 1hr	08/11/2019 11:46:15	0	0:00:58	51.9	47.1
Loudest 1hr	08/11/2019 11:50:59	0	0:49:40	50.7	45.3
Loudest 1hr	08/11/2019 12:42:11	0	0:09:22	51.2	45.2

Figure 4 – Loudest 1 hour, Profile Data

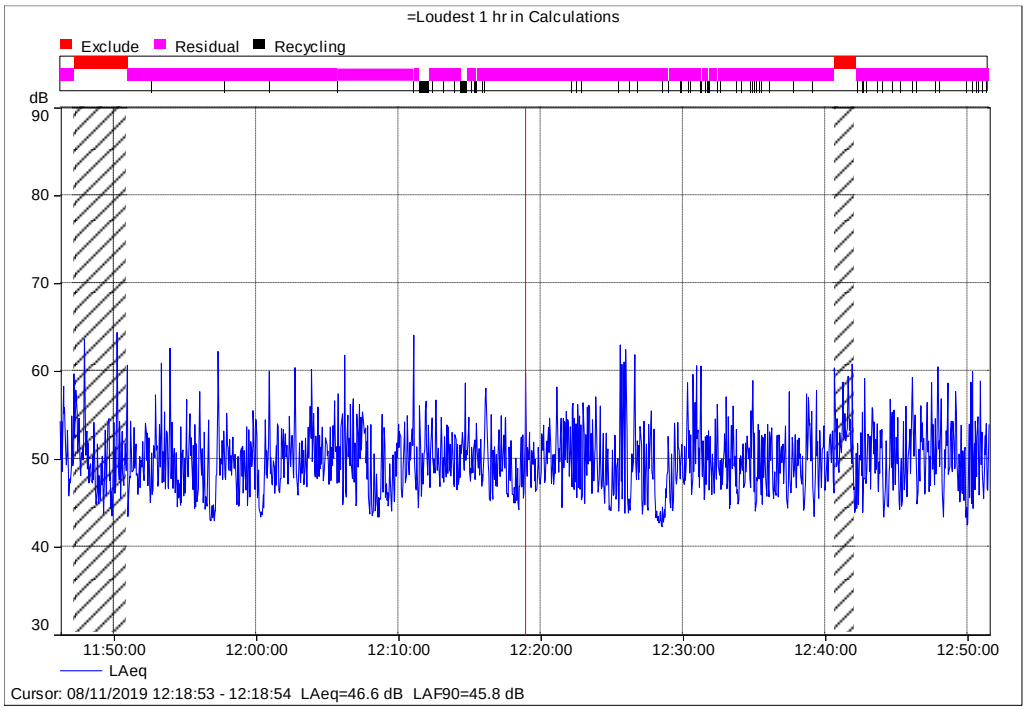


Table 9 – Loudest 1 hour, Summary Data

Name	Start time	Overload [%]	Duration t	$L_{Aeq,t}$ [dB]	$L_{AF90,t}$ [dB]
Total	08/11/2019 11:46:15	0	1:00:00	50.8	45.3
Exclude	08/11/2019 11:47:13	0	0:05:18	52.3	45.6
(All) Exclude	08/11/2019 11:47:13	0	0:05:18	52.3	45.6
(All) Residual	08/11/2019 11:46:15	0	0:57:11	50.7	45.2
(All) Recycling	08/11/2019 11:52:41	0	0:02:49	53.1	46.7
Exclude	08/11/2019 11:47:13	0	0:03:46	51.8	45.5
Exclude	08/11/2019 12:40:39	0	0:01:32	53.4	46.7
Residual	08/11/2019 11:46:15	0	0:00:58	51.9	47.1
Residual	08/11/2019 11:50:59	0	0:01:42	49.7	46.1
Residual	08/11/2019 11:52:42	0	0:05:04	50.7	44.6
Residual	08/11/2019 11:57:47	0	0:03:09	49.7	44.4
Residual	08/11/2019 12:00:59	0	0:04:43	51.3	47.2
Residual	08/11/2019 12:05:43	0	0:05:22	50.7	44.7
Residual	08/11/2019 12:11:08	0	0:00:19	48.1	44.7
Residual	08/11/2019 12:12:09	0	0:00:16	51.1	47.4
Residual	08/11/2019 12:12:26	0	0:00:44	50.5	47.3
Residual	08/11/2019 12:13:12	0	0:00:46	50.4	47.4

acoustics & noise limited

acoustics & noise limited

Name	Start time	Overload [%]	Duration t	$L_{Aeq,t}$ [dB]	$L_{AF90,t}$ [dB]
Residual	08/11/2019 12:14:00	0	0:00:23	49.0	46.4
Residual	08/11/2019 12:14:50	0	0:00:20	50.5	47.6
Residual	08/11/2019 12:15:11	0	0:00:11	49.7	48.5
Residual	08/11/2019 12:15:24	0	0:00:02	48.1	47.3
Residual	08/11/2019 12:15:33	0	0:00:23	49.7	46.9
Residual	08/11/2019 12:15:57	0	0:00:06	49.1	47.4
Residual	08/11/2019 12:16:04	0	0:06:07	50.8	45.9
Residual	08/11/2019 12:22:12	0	0:00:19	51.7	46.6
Residual	08/11/2019 12:22:32	0	0:00:19	51.5	46.1
Residual	08/11/2019 12:22:52	0	0:02:35	50.5	45.1
Residual	08/11/2019 12:25:29	0	0:00:45	53.8	44.0
Residual	08/11/2019 12:26:15	0	0:00:37	52.3	44.6
Residual	08/11/2019 12:26:53	0	0:01:42	48.6	42.9
Residual	08/11/2019 12:28:36	0	0:00:23	45.6	42.6
Residual	08/11/2019 12:29:03	0	0:00:50	49.0	44.7
Residual	08/11/2019 12:29:54	0	0:00:02	49.2	48.1
Residual	08/11/2019 12:29:58	0	0:00:27	51.9	47.3
Residual	08/11/2019 12:30:26	0	0:00:06	50.7	48.4
Residual	08/11/2019 12:30:33	0	0:00:43	53.2	46.9
Residual	08/11/2019 12:31:21	0	0:00:15	48.8	45.5
Residual	08/11/2019 12:31:37	0	0:00:06	49.2	47.0
Residual	08/11/2019 12:31:44	0	0:00:04	50.7	49.6
Residual	08/11/2019 12:31:52	0	0:00:33	49.6	46.2
Residual	08/11/2019 12:32:29	0	0:00:12	49.0	47.9
Residual	08/11/2019 12:32:42	0	0:01:05	50.7	46.2
Residual	08/11/2019 12:33:48	0	0:00:22	47.8	45.1
Residual	08/11/2019 12:34:11	0	0:00:37	49.6	47.0
Residual	08/11/2019 12:34:49	0	0:00:07	50.9	48.3
Residual	08/11/2019 12:34:58	0	0:00:05	48.1	45.8
Residual	08/11/2019 12:35:05	0	0:00:08	45.4	44.0
Residual	08/11/2019 12:35:14	0	0:00:10	50.3	47.1
Residual	08/11/2019 12:35:26	0	0:00:07	47.5	45.6
Residual	08/11/2019 12:35:35	0	0:00:32	49.4	45.5
Residual	08/11/2019 12:36:08	0	0:01:41	49.8	45.8
Residual	08/11/2019 12:37:50	0	0:01:18	51.2	46.0
Residual	08/11/2019 12:39:09	0	0:01:30	50.6	45.7
Residual	08/11/2019 12:42:11	0	0:00:07	47.6	43.7
Residual	08/11/2019 12:42:19	0	0:00:18	49.8	44.8
Residual	08/11/2019 12:42:39	0	0:00:04	45.0	43.7
Residual	08/11/2019 12:42:44	0	0:00:11	53.9	46.7
Residual	08/11/2019 12:42:56	0	0:00:45	51.8	48.1
Residual	08/11/2019 12:43:43	0	0:00:21	50.6	46.7

acoustics & noise limited

Name	Start time	Overload [%]	Duration t	$L_{Aeq,t}$ [dB]	$L_{AF90,t}$ [dB]
Residual	08/11/2019 12:44:05	0	0:00:38	49.7	44.0
Residual	08/11/2019 12:44:44	0	0:00:37	50.2	44.7
Residual	08/11/2019 12:45:22	0	0:00:47	51.1	45.3
Residual	08/11/2019 12:46:10	0	0:00:15	53.5	50.2
Residual	08/11/2019 12:46:26	0	0:01:19	51.1	46.0
Residual	08/11/2019 12:47:46	0	0:00:19	54.4	49.1
Residual	08/11/2019 12:48:06	0	0:01:50	51.0	45.4
Residual	08/11/2019 12:49:59	0	0:00:24	50.6	42.5
Residual	08/11/2019 12:50:25	0	0:00:14	49.5	44.6
Residual	08/11/2019 12:50:40	0	0:00:06	50.5	47.1
Residual	08/11/2019 12:50:47	0	0:00:16	51.9	45.7
Residual	08/11/2019 12:51:04	0	0:00:01	48.4	47.2
Residual	08/11/2019 12:51:07	0	0:00:13	49.9	45.7
Residual	08/11/2019 12:51:22	0	0:00:11	50.3	46.3
Recycling	08/11/2019 11:52:41	0	0:00:01	50.6	50.0
Recycling	08/11/2019 11:57:46	0	0:00:01	52.5	49.4
Recycling	08/11/2019 12:00:56	0	0:00:03	59.1	54.4
Recycling	08/11/2019 12:05:42	0	0:00:01	49.3	47.0
Recycling	08/11/2019 12:11:05	0	0:00:03	61.8	52.7
Recycling	08/11/2019 12:11:27	0	0:00:42	51.2	46.3
Recycling	08/11/2019 12:12:25	0	0:00:01	51.2	49.5
Recycling	08/11/2019 12:13:10	0	0:00:02	49.8	48.2
Recycling	08/11/2019 12:13:58	0	0:00:02	51.3	46.7
Recycling	08/11/2019 12:14:23	0	0:00:27	51.3	48.7
Recycling	08/11/2019 12:15:10	0	0:00:01	51.2	48.5
Recycling	08/11/2019 12:15:22	0	0:00:02	51.7	49.8
Recycling	08/11/2019 12:15:26	0	0:00:07	52.2	49.4
Recycling	08/11/2019 12:15:56	0	0:00:01	48.1	47.2
Recycling	08/11/2019 12:16:03	0	0:00:01	53.6	50.8
Recycling	08/11/2019 12:22:11	0	0:00:01	54.2	51.4
Recycling	08/11/2019 12:22:31	0	0:00:01	52.5	51.1
Recycling	08/11/2019 12:22:51	0	0:00:01	53.8	52.0
Recycling	08/11/2019 12:25:27	0	0:00:02	49.8	44.0
Recycling	08/11/2019 12:26:14	0	0:00:01	45.4	43.6
Recycling	08/11/2019 12:26:52	0	0:00:01	50.6	49.7
Recycling	08/11/2019 12:28:35	0	0:00:01	44.5	41.9
Recycling	08/11/2019 12:28:59	0	0:00:04	51.6	50.1
Recycling	08/11/2019 12:29:53	0	0:00:01	50.8	50.5
Recycling	08/11/2019 12:29:56	0	0:00:02	51.3	50.5
Recycling	08/11/2019 12:30:25	0	0:00:01	50.4	49.4
Recycling	08/11/2019 12:30:32	0	0:00:01	50.7	49.3
Recycling	08/11/2019 12:31:16	0	0:00:05	57.0	51.3

acoustics & noise limited

Name	Start time	Overload [%]	Duration t	$L_{Aeq,t}$ [dB]	$L_{AF90,t}$ [dB]
Recycling	08/11/2019 12:31:36	0	0:00:01	52.4	50.4
Recycling	08/11/2019 12:31:43	0	0:00:01	52.6	51.7
Recycling	08/11/2019 12:31:48	0	0:00:04	52.4	50.7
Recycling	08/11/2019 12:32:25	0	0:00:04	54.8	52.7
Recycling	08/11/2019 12:32:41	0	0:00:01	49.3	46.9
Recycling	08/11/2019 12:33:47	0	0:00:01	53.3	52.5
Recycling	08/11/2019 12:34:10	0	0:00:01	51.0	50.4
Recycling	08/11/2019 12:34:48	0	0:00:01	55.4	46.1
Recycling	08/11/2019 12:34:56	0	0:00:02	57.7	51.7
Recycling	08/11/2019 12:35:03	0	0:00:02	52.0	46.1
Recycling	08/11/2019 12:35:13	0	0:00:01	47.8	45.3
Recycling	08/11/2019 12:35:24	0	0:00:02	53.0	48.1
Recycling	08/11/2019 12:35:33	0	0:00:02	51.3	46.1
Recycling	08/11/2019 12:36:07	0	0:00:01	53.0	46.8
Recycling	08/11/2019 12:37:49	0	0:00:01	48.8	48.1
Recycling	08/11/2019 12:39:08	0	0:00:01	48.7	47.3
Recycling	08/11/2019 12:42:18	0	0:00:01	51.7	44.7
Recycling	08/11/2019 12:42:37	0	0:00:02	53.7	45.4
Recycling	08/11/2019 12:42:43	0	0:00:01	47.7	46.2
Recycling	08/11/2019 12:42:55	0	0:00:01	49.6	47.5
Recycling	08/11/2019 12:43:41	0	0:00:02	53.9	52.5
Recycling	08/11/2019 12:44:04	0	0:00:01	48.0	46.7
Recycling	08/11/2019 12:44:43	0	0:00:01	53.1	51.7
Recycling	08/11/2019 12:45:21	0	0:00:01	49.5	46.9
Recycling	08/11/2019 12:46:09	0	0:00:01	59.2	53.3
Recycling	08/11/2019 12:46:25	0	0:00:01	52.6	48.6
Recycling	08/11/2019 12:47:45	0	0:00:01	48.7	48.3
Recycling	08/11/2019 12:48:05	0	0:00:01	50.1	49.3
Recycling	08/11/2019 12:49:56	0	0:00:03	44.7	42.5
Recycling	08/11/2019 12:50:23	0	0:00:02	57.4	44.3
Recycling	08/11/2019 12:50:39	0	0:00:01	49.0	46.2
Recycling	08/11/2019 12:50:46	0	0:00:01	54.7	51.4
Recycling	08/11/2019 12:51:03	0	0:00:01	53.0	50.2
Recycling	08/11/2019 12:51:05	0	0:00:02	49.5	46.2
Recycling	08/11/2019 12:51:20	0	0:00:02	53.2	49.4

acoustics & noise limited

Table 10 – Assessment of Audibility of Tone

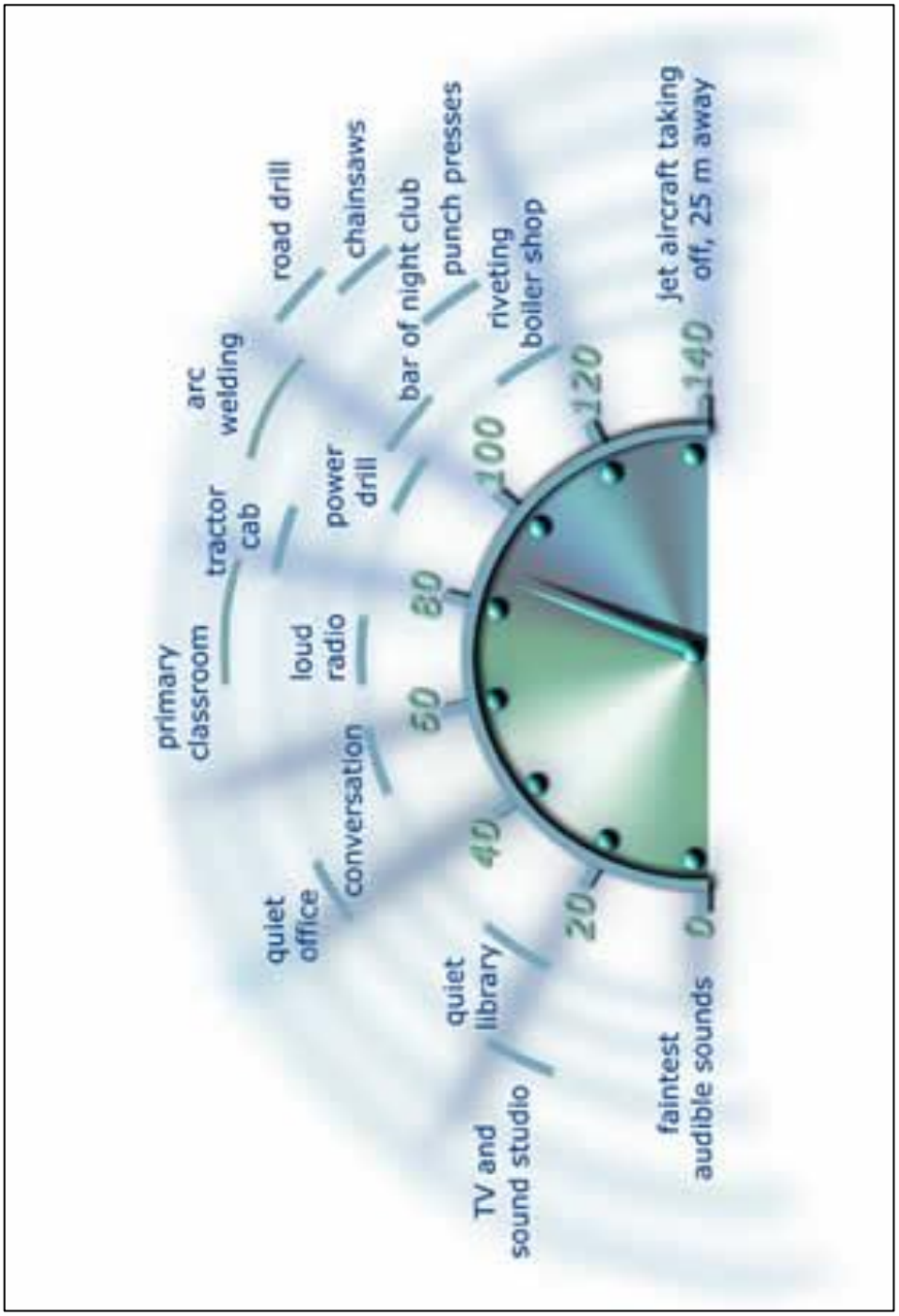
Third-Octave Band Centre Frequency (Hz)	Sound Pressure Level $L_{Zeq,T}$ (dB)	Discrete Tone Identified? (Yes/No)
25	54.0	
31.5	48.0	No
40	45.9	No
50	53.6	No
63	55.2	No
80	43.4	No
100	46.0	No
125	38.2	No
160	36.9	No
200	37.9	No
250	36.5	No
315	36.4	No
400	36.0	No
500	37.5	No
630	38.4	No
800	39.2	No
1000	38.9	No
1250	37.2	No
1600	36.5	No
2000	37.2	No
2500	29.6	No
3150	24.9	No
4000	21.9	No
5000	18.8	No
6300	14.6	No
8000	11.8	No
10000	9.8	No
12500	9.2	

acoustics & noise limited

Appendix 5
Range of Typical Noise Levels

A5.0 RANGE OF TYPICAL NOISE LEVELS

Figure 5 – Range of Typical Noise Levels



acoustics & noise limited

acoustics & noise limited

Appendix 6
Glossary of Acoustic Terms

acoustics & noise limited

A6.0 GLOSSARY OF ACOUSTIC TERMS

A6.1 **Acoustic Environment:**

Sound from all sound sources as modified by the environment.

A6.2 **Ambient Sound:**

Totally encompassing sound in a given situation at a given time, usually composed of sound from many sources near and far.

NOTE: The ambient sound comprises the residual sound and the specific sound when present.

A6.3 **Ambient Sound Level, $L_a = L_{Aeq,T}$:**

Equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the measurement location over a given time interval, T.

NOTE: The ambient sound level is a measure of the residual sound and the specific sound when present.

A6.4 **A-Weighting:**

Normal hearing covers the frequency (pitch) range from about 20 Hz to 20,000 Hz but sensitivity is greatest between about 500 Hz and 5,000 Hz. The 'A-weighting' is an electrical circuit built into noise meters to approximate this characteristic of human hearing.

A6.5 **Background Sound Level, $L_{A90,T}$:**

A-weighted sound pressure level that is exceeded by the residual sound at the assessment location for 90% of a given time interval, T, measured using time weighting F and quoted to the nearest whole number of decibels.

A6.6 **Decibel (dB):**

The logarithmic measure of sound level. 0dB (A) is the threshold of normal hearing. 140 dB (A) is the level at which instantaneous damage to hearing is caused. A change of 1 dB is detectible only under laboratory conditions.

acoustics & noise limited

A6.7 **dB(A):**

Decibels measured on a sound level meter incorporating a frequency weighting (A-weighting) which differentiates between sounds of different frequency (pitch) in a similar way to the human ear. Measurements in dB(A) broadly agree with an individual's assessment of loudness. A change of 3 dB (A) is the minimum perceptible under normal conditions and a change of 10 dB(A) corresponds roughly to doubling or halving the loudness of a sound.

A6.8 **Equivalent Continuous A-weighted Sound Pressure Level, $L_{Aeq,T}$**

Value of the A-weighted sound pressure level in decibels of continuous steady sound that, within a specified time interval, $T = t_2 - t_1$, has the same mean-squared sound pressure as a sound that varies with time, and is given by the following equation:

$$L_{Aeq,T} = 10lg_{10}\left\{\left(\frac{1}{T}\right)\int_{t_1}^{t_2}\left[\frac{p_A(t)^2}{{p_0}^2}\right]dt\right\}$$

where

p_0 is the reference sound pressure (20 µPa); and

$p_A(t)$ is the instantaneous A-weighted sound pressure at time t

NOTE: the equivalent continuous A-weighted sound pressure level is quoted to the nearest whole number of decibels.

A6.9 **Free Field:**

A sound field in which no significant sound reflections occur

A6.10 **Frequency:**

The number of cycles per second of a vibration usually expressed in units of Hertz, Hz

A6.11 **Hertz:**

Unit of frequency, equal to one cycle per second. Frequency determines the pitch of a sound.

A6.12 **$L_{A10,T}$:**

The 'A-weighted' noise level exceeded for 10% of the specified measurement period (T). It gives an indication of the upper limit of fluctuating noise such as that from

acoustics & noise limited

road traffic. $L_{A10,18hr}$ is the arithmetic average of the 18 hourly $L_{A10,1hr}$ values from 06:00 - 24:00.

A6.13 **L_{Amax}:**

The maximum 'A-weighted' level of noise recorded during a noise event. The time weighting used (Fast or Slow) should be stated.

A6.14 **Measurement Time Interval, T_m:**

Total time over which measurements are taken.

NOTE: This may consist of the sum of a number of non-contiguous, short-term measurement time intervals.

A6.15 **Rating Level, $L_{Ar,Tr}$:**

Specific sound level plus any adjustment for the characteristic features of the sound.

A6.16 **Reference Time Interval, T_r:**

Specified interval over which the specific sound level is determined.

NOTE: This is 1h during the day from 07:00 h to 23:00 h and a shorter period of 15min at night from 23:00 h to 07:00 h.

A6.17 **Residual Sound:**

Ambient sound remaining at the assessment location when the specific sound source is suppressed to such a degree that it does not contribute to the ambient sound.

A6.18 **Residual Sound Level, $L_r = L_{Aeq,T}$:**

Equivalent continuous A-weighted sound pressure level of the residual sound at the assessment location over a given time interval, T.

A6.19 **Specific Sound Level, $L_s = L_{Aeq,T}$:**

Equivalent continuous A-weighted sound pressure level produced by the specific sound source at the assessment location over a given reference time interval, T_r.

A6.20 **Specific Sound Source:**

Sound source being assessed.

acoustics & noise limited

A6.21 **Tonality:**

The degree to which a noise contains audible pure tones. Broadband noise (across a wider range of frequencies) is generally less annoying than noise with identifiable tones.

acoustics & noise limited

Appendix 7
References

acoustics & noise limited

A7.0 REFERENCES

1 '1805050R03', Noise Impact Assessment of Recycling Centre, Acoustics and Noise Ltd, January 2019

2 Horizontal Guidance for Noise, Part 2 – Noise Assessment and Control, IPPC, Environment Agency, 2004

3 BS 4142:2014+A1:2019, " Methods for rating and assessing industrial and commercial sound", The British Standards Institution, 2019