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# Acoustic Survey and Assessment for Proposed Service Station and Shop at, 245 Barnsley Road, Wombwell, Barnsley, S73 8DT.

Prepared for:

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Revised Report

# Contents

1. Introduction ..... 3
Site Location and Context ..... 3
2. Policy and Guidance ..... 4
3. The Assessment ..... 9
Vehicle Wash ..... 11
Plant Noise ..... 12
Vehicle movements ..... 14
BS4142:2014 Assessment ..... 14
4 Conclusion ..... 16
Figure 1 – Aerial Photograph ..... 17
Figure 2 – Proposed site layout ..... 18
Appendix A – Calculations ..... 19
Vehicle Wash ..... 19
External Plant ..... 21
To rear to site ..... 21
BS4142: 2014 ..... 23
Appendix B – Calibration Certificates ..... 24

# 1. Introduction

1.1. Martin Environmental Solutions has been commissioned to undertake a noise survey and an acoustic assessment to support planning application for a service station and associated shop at 245 Barnsley Road, Wombwell, Barnsley, S73 8DT.

1.2. Following the Original report dated May 2018 further comments have been received from the Council's Environmental Health Department requesting additional monitoring be undertaken.

## Site Location and Context

1.3. The site is located to the west of the busy A633, Barnsley Road. Surrounding the site are residential properties, with a community sports field beyond these to the west and a large heavy manufacturing site on the far side of the road to the east. An aerial photograph is shown in Figure 1 with an outline site plan in Figure 2.

1.4. It is the close proximity to the residential properties that has raised concerns over sound levels and the request for this report.

## 2. Policy and Guidance

2.1. The impact of noise can be a material consideration in the determination of planning applications. The planning system has the task of guiding development to the most appropriate locations. It is recognised that on occasions it will be difficult to reconcile some land uses, such as housing, hospitals or schools, with other activities that generate high levels of noise. However, the planning system is tasked to ensure that, wherever practicable, noise-sensitive developments are separated from major sources of noise (such as road, rail and air transport and certain types of industrial development).

2.2. The Government's publication of the National Planning Policy Framework (NPPF), which seeks to prevent new and existing development from contributing to or being put at unacceptable risk from noise pollution, has replaced previous Planning Policy Statements and Planning Policy Guidance Notes.

2.3. The Government have also issued the Noise Policy Statement for England (NPSE). The NPSE clarifies the Government's underlying principles and aims in relation to noise and sets a vision to promote good health and a good quality of life through the effective management of noise while having regard to the Government's sustainable development strategy. The NPSE aims to mitigate and minimise adverse impacts on health and quality of life through the effective management and control of noise.

2.4. The NPSE introduces the following terms although no sound levels are given to represent these many authorities including those within Lancashire for example have identified the sound level criteria in line with the World Health Organisation, BS8233:2014 and BS4142: 2014 levels. The terms introduced by the NPSE are:

NOEL – No Observed Effect Level (<30dB(A)inside <50dB(A) outside, 10dB below background)
LOAEL – Lowest Observed Adverse Effect Level (30-35dB(A) inside 50-55dB(A) outside, background to +5dB)
SOAEL – Significant Observed Adverse Effect Level (>35dB(A) inside, >55dB(A) outside, >+10dB above background)

2.5. The sound levels within the brackets of the previous paragraph are those determined by Lancashire authorities as appropriate levels to indicate the relevant effect levels represented by the NPSE.

2.6. Other commonly used examples of standards utilised by Local Planning authorities for the consideration of noise impacts include comparison of the likely noise levels to be experienced at a development, with levels that have been recommended by the World Health Organisation (WHO) as Guidelines for the prevention of Community Noise Annoyance and within BS8233: 2014.

2.7. The WHO recommended noise levels for outdoor amenity areas (gardens) that should not be exceeded are 55dB(A) $L_{Aeq,16hr}$ in order to avoid 'Serious Community Annoyance or 50dB(A) $L_{Aeq,16hr}$ to avoid 'Moderate Community Annoyance' during the day. For indoor levels WHO set 35dB(A) $L_{Aeq,16hr}$ during the day to prevent Moderate Annoyance and 30 dB(A) $L_{Aeq,8hr}$ at night to prevent sleep disturbance.

2.8. The WHO guidance also recommends that maximum sound levels at night should not regularly exceed 45dB(A) within bedrooms to prevent sleep disturbance. Regularly is considered to be more than 10 times during any 8-hour night time period.

2.9. BS 8233:2014 'Guidance on sound insulation and noise reduction for buildings' also specifies desirable noise levels to be achieved inside dwellings.

2.10. BS 8233:2014 'Sound insulation and noise reduction for buildings – Code of Practice' also specifies desirable noise levels to be achieved inside dwellings. BS 8233 presents two levels, the first between the hours of 07:00 – 23:00 and the second between 23:00 -07:00.

2.11. The daytime period suggests internal noise levels of 35dB $L_{Aeq,16hr}$, for resting in living rooms and bedrooms while for night time a level of 30dB LAeq,8hr is recommended. Criteria for external areas mirrors that within the WHO guidance.

2.12. Another commonly used standard is British Standard 4142:2014 'Method for rating industrial and commercial sound' compares the sound predicted by the source in question against the background, $L_A90$ sound levels.

2.13. The "residual" $L_{Aeq}$ measurement is then subtracted from the "ambient" $L_{Aeq}$ measurement (with the sound source) to calculate the sound level created by the "problem" sound alone -termed the "specific" sound level.

2.14. If the "problem" sound is tonal, such as whine or hum, or if it is impulsive such as bangs or clatters or if it is irregular enough to attract attention a correction is added to the "specific level" to produce the "rating level". The "background" $L_{A90}$ measurement is then compared against the "rating level".

2.15. If the "rating level" exceeds the "background" by around 10dB(A) or more this "indicates a significant adverse impact". A difference of around 5dB(A) 'indicates an adverse impact. The lower the commercial noise level is, the lower the likely impact.

2.16. In addition, the recently published 'ProPG Planning & Noise, Professional Practice Guidance on Planning & Noise, New Residential Development' provides a 4-staged approach to undertaking a risk assessment in relation to anticipated sound levels at new residential development and the provision of mitigation measures. The guidance is principally aimed at sites exposed predominantly to noise from transportation sources.

2.17. The first stage consists of an initial noise risk assessment, based on indicative day and night-time *noise* levels. Simple put the higher the ambient noise in an area the greater the impact. The levels given are shown below although it should be noted that these are in excess of the WHO and BS 8233: 2014.

| Noise Risk Category* | Potential Effect if Unmitigated | Pre-Planning Application Guidance |
|---|---|---|
| **0 – Negligible** $L_{Aeq,16hr}$ **<50dB** $L_{Aeq,8hr}$ **<40dB** | May be noticeable but no adverse effect on health and quality of life | In this category the development is likely to be acceptable from a noise perspective, nevertheless a good acoustic design process is encouraged to improve the existing environment and/or safeguard against possible future deterioration and to protect any designated tranquil areas. A noise assessment may be requested to demonstrate no adverse impact from noise. Application need not normally be delayed on noise grounds. |
| **1 – Low** $L_{Aeq,16hr}$ **50-63dB** $L_{Aeq,8hr}$ **40-55dB** | Adverse effect on health and quality of life | In this category the development may be refused unless a good acoustic design process is followed and is demonstrated via a Level 1 Acoustic Design Statement which confirms how the adverse impacts of noise on the new development will be mitigated and minimised and that a significant adverse impact will not arise in the finished development. Planning conditions and other measures to control noise may be required. |
| **2 – Medium** $L_{Aeq,16hr}$ **63-69dB** $L_{Aeq,8hr}$ **55-60dB** $L_{AFmax}$ **>80dB**** | Significant adverse effect on health and quality of life | In this category the development is likely to be refused unless good acoustic design process is followed and is demonstrated via a Level 2 Acoustic Design Statement which confirms how the adverse impacts of noise on the new development will be mitigated and minimised, and clearly demonstrates that a significant adverse noise impact will not arise in the finished development. Planning conditions and other measures to control noise will normally be required. |
| **3 – High** $L_{Aeq,16hr}$ **>69dB** $L_{Aeq,8hr}$ **>60dB** $L_{AFmax}$ **>80dB**** | Unacceptable adverse effect of health and quality of life | In this category the development is very likely to be refused on noise grounds, even if a good acoustic design process is followed and is demonstrated via a Level 2 Acoustic Design Statement. Applicants are advised to seek expert advice on possible mitigation measures. Advice on the circumstances when the refusal of a new housing on noise grounds should normally be anticipated is included in the ProPG. |

2.18. Stage 2, consists of a full assessment of the prevailing ambient noise and is required considered 4 elements to be considered:

I. Element 1 – Good Acoustic Design
II. Element 2 – Internal Noise Level Guidelines
III. Element 3 – External Amenity Area Nosie Assessment
IV. Element 4 – Assessment of Other Relevant Issues

2.19. A good acoustic design is implicit in meeting the requirements of the NPPF and can help to resolve many potential acoustic issues.

2.20. Details of the criteria considered suitable are provided above for both internal and external sound levels. Element 4 includes such issues as local and national policy, likely occupants, wider planning objectives.

## 3. The Assessment

3.1 Following the comments received from the Environmental Health Department a conversation was held with Mr James Gardham to agree further monitoring on site. It was agreed to undertake additional background sound level monitoring on a Sunday from 06:00 to lunchtime.

3.2 As a result, additional on-site sound level monitoring was undertaken on the 1st July 2018 between 05:30 and 13:00 in addition to that which had been reported in the original report undertaken on the 8th May 2018. The dominant sound source during both periods of monitoring is the passing traffic along the busy Barnsley Road.

3.3 The May monitoring results have been used to calculate the $L_{Aeq,16hr}$ and the $L_{Aeq,8hr}$ sound level at two monitoring locations on site. The first location was on the front boundary of the site adjacent to the main road. The second location was to the rear of the site along the boundary with the new residential properties. The meter in this location was placed on the boundary adjacent to the new driveway. This location is significantly higher than the ground level of the development site.

3.4 During the monitoring on the first of July only one monitoring location was utilised this being the position to the rear of the site in front of the nearby residential properties.

3.5 All measurements were taken using a Cirrus, Optimus Green CR-171B and CR-171CC, Type 1 sound level meters. The meters were calibrated before and after use and no significant deviation was identified. The calibration certificates are shown in Appendix B. The sound level meters were set at 1.2-1.5m above the ground level. Weather during the monitoring period was very warm, dry with clear skies and wind below 2m/s, during both monitoring sessions.

3.6 The table below details the results at each monitoring location. The monitoring locations are shown in Figure 2.

| Location | Time | Duration | $L_{Aeq}$ (dB) | $L_{A90}$ (dB) |
|---|---|---|---|---|
| Front | 08/05/2018 11:00 | 01:00:00 | 72.5 | 63.4 |
| | 08/05/2018 12:00 | 01:00:00 | 73.4 | 63.2 |
| | 08/05/2018 13:00 | 01:00:00 | 72.7 | 64.3 |
| Rear | 08/05/2018 11:00 | 01:00:00 | 52.6 | 47.5 |
| | 08/05/2018 12:00 | 01:00:00 | 53.5 | 47.1 |
| | 08/05/2018 13:00 | 01:00:00 | 51.8 | 47.0 |

| Time | Duration | LAeq (dB) | LAMax (dB) | LA90 (dB) |
|---|---|---|---|---|
| 01/07/2018 05:32 | 00:27:24 | 54.1 | 77.9 | 37.4 |
| 01/07/2018 06:00 | 01:00:00 | 47.9 | 69.4 | 36.9 |
| 01/07/2018 07:00 | 01:00:00 | 48.7 | 71.6 | 38.0 |
| 01/07/2018 08:00 | 01:00:00 | 49.4 | 74.8 | 37.5 |
| 01/07/2018 09:00 | 01:00:00 | 51.3 | 72.2 | 40.9 |
| 01/07/2018 11:00 | 01:00:00 | 54.9 | 89.3 | 48.1 |
| 01/07/2018 12:00 | 01:00:00 | 52.3 | 68.7 | 48.0 |

*the period 10-11 has not been downloaded from the meter and the data lost

3.7 The above monitoring results from May were used to calculate the daily and night-time average sound levels using the guidance from the *Department for Transport- Welsh Office; Estimating Road Traffic Noise 1988'*. This method involves measuring the $L_{A10}$ of the traffic noise between 10:00 and 17:00 hours in three separate 1-hour periods. From this data, an estimate can be made of both the 18-hour $L_{A10}$ and then the 16-hour $L_{Aeq}$. This method is very useful in combating variable weather conditions since consistent conditions for 16-hours are fairly rare in the UK.

The formula are: $L_{A10(18hr)} = \sum 3x\ L_{A10(1hr)}/3 - 1dB$

PPG24 $L_{Aeq(16hr)} = L_{A10(18hr)} - 2dB$

3.6 For night-time sound levels, the Transport Research Laboratory provides a method for converting the LA10,$_{18hr}$ level to the $L_{night}$ level using the following formula.

$$L_{night} = 0.90 \times L_{A10(18hr)} - 3.77dB$$

The resulting sound levels indicate a daily average of 69.9 dB $L_{Aeq,16hr}$ and 60.9dB $L_{Aeq,8hr}$ at the front and 49.6 dB $L_{Aeq,16hr}$ and 42.7dB $L_{Aeq,8hr}$ at the rear. Assuming a similar affect the background $L_{A90}$ sound level, background sound levels will be in the region of 60.6/52.6dB at the front and 44.6/38.2 at the rear for day and night respectfully.

3.7 The monitoring undertake on the Sunday morning in July confirms this with night-time background levels being slightly lower than predicted at 36.4dB(A) and daytime background levels ranging from 38- 48dB(A). These figures will be used within the assessment as a worse-case scenario.

3.8 The proposed development will consist of a petrol service station forecourt, shop and vehicle wash. The site will operate between the hours of 06:00 – 23:00. Therefore, potential sources of noise include the arrival and departure of vehicles for refuelling and to visit the shop, the washing of vehicles and external plant associated with the shop e.g. air handling units and refrigeration units.

## Vehicle Wash

3.9 Previous monitoring undertaken by Martin Environmental Solutions has identified the sound levels produced from the washing of vehicles using the jet washes to be installed on site. A typical wash cycle lasts for 5 minutes and the average sound level over this period has been recorded at 69dB(A) with a maximum of 75.9dB(A), calculated as a sound power level of 89dB(A). It is this figure that will be used within the following calculations.

3.10 The vehicle wash will consist of two jet washes to the south corner of the site and operate between the hours of 09:00-21:00. The nearest property to the vehicle wash are 9m to the north, although this is the side façade of the property with no windows into the property apart from a small one to the stairwell. Windows to the front of the property and into the rear garden amenity area are 11m away. The rear garden being surrounded by a 1.8m high solid fence.

3.11 The above would result in a combined sound level of 63.2dB(A) at the window of property and 56dB(A) in the rear garden (without taking account of the fence). This is above the recommended guidelines published by the World Health organisation and within BS8233:2014. Therefore, further mitigation is required.

3.12 It is therefore proposed to erect a 2.5m high barrier to the rear (north) and western side of the car wash. This barrier will have two uses, firstly to provide additional attenuation to any sound being produced from the jet washes and secondly to provide a barrier to prevent spray from exiting the site on to the highway.

3.13 The 2.5m high barrier which can be constructed from brick, timber or toughen glass[1], will result in an additional 16.4dB attenuation to the front ground floor, 11.8dB to the first floor and 15.9dB attenuation to the rear garden. See Appendix A for calculations.

[1] http://www.pilkington.com/en-gb/uk/products/product-categories/glass-systems/pilkington-planar, Pilkington Planar glass offers a sound reduction of 42dB $R_w$

3.14 An open window provides 15dB attenuation[2], in addition the windows at the front of the property are at $90^0$ to the proposed washes and will experience a further 6dB reduction. The above barrier will therefore reduce the combined sound levels from the vehicle washes at the nearest property to the rear of the site to 25.8dB on the ground floor, 30.4dB(A) on the first floor and 40.1dB(A) in the rear garden of the property.

3.15 The property has a direct line of sight from the front of the house to the main road and as such standard distance attenuation identifies a further reduction of 10.5dB from the monitoring results.

$$Dist\ att = 10log\left(\frac{r}{R}\right)$$

$$Dist\ att = 10log\left(\frac{4}{45}\right)$$

$$Dist\ att = 10.5dB$$

$$Daytime\ bckground\ sound\ level = 60.9 - 10.5$$

$$Daytime\ bckground\ sound\ level = 50.4$$

From the July monitoring data this would fall to 40.5dB(A), reduced further in the rear garden due to the surrounding fence.

3.16 The resulting sound levels to be experienced from the vehicle wash at the nearest residential property will therefore be substantially below the recommended guidance for daytime sound levels and below the background sound levels measured on site.

## Plant Noise

3.17 Details of the external plant to be installed at the new shop are currently, at the time of writing, unknown. The location of the external plant has however been identified. This will be located to the rear of the store in the northwest corner of the site. All plant will be located at ground level and therefore no higher than 1m from the ground. Typical plant will include refrigeration units and air handling units.

[2] BS8233: 2014; Guidance on sound insulation and noise reduction for buildings

3.18 To the rear of the site the ground level rises sharply to the new residential properties creating a 2m high barrier, a new retaining wall is to be constructed along this banking. To the north of the site is a concrete high wall with an effective height of approx. 3m above the site level.

3.19 The low level of the proposed plant and existing ground levels provide a natural sound barrier between the plant and the surrounding properties, in addition the road to the rear provides further sound attenuation. Appendix A details the calculations undertaken to assess the reduction that will be experienced between the proposed plant location and the existing properties.

3.20 The façade of the existing properties to the rear is 16.5m from the boundary and a further 6m to the proposed plant location. To the north the plant will be 2m from the boundary of the site with an additional 23m to the facade of the house, 16.5m to the patio area.

3.21 The resulting barrier attenaution from the plant will be 8.4dB at the first floor of the properties to the rear and 20.6dB at the first floor to the properties to the north (side) of the site. The ground floor areas experiencing a greater reduction.

3.22 To ensure a suitable night-time sound level is achieved inside the properties of 30dB(A) a façade level of 45dB(A) needs to be obtained. This takes account of the 15dB attenuation for an open window. This more or less equates to the identified background sound level average over the day of 44.6dB(A), with the 0.4dB(A) difference being undetectable by the human ear. However, it has been suggested from the monitoring data that a background sound level in the area will fall to around 36.9dB(A) at night. This lower night-time background level will therefore be used within the calculations for the night-time criteria sound level.

3.23 In addition, the lowest daytime background, $L_{A90}$, sound level recorded during the July monitoring was 38.0dB(A) quickly rising well over 40dB(A). Likewise this figure will also be used within the calculations.

3.24 Based on the above the distance and barrier attenuation calculations, shown in appendix A the combined sound level of the external plant must not exceed a sound

level of 88dB(A) during the day and 80.6dB(A) at night to ensure no adverse effect is caused to the nearby residential properties.

## Vehicle movements

3.25 The movement of vehicles arriving and leaving the site is another source of potential noise which may affect surrounding properties. Data obtained by Martin Environmental Solutions previous has identified typical sound levels from customer vehicles. At a distance of 5m typical sound levels for vehicles pulling in the parking bays or at the petrol pumps and exiting the site will be 50-59dB $L_{Amax.}$ while sound from the closing of vehicle doors varies from 52-62dB $L_{Amax}$.

3.26 Vehicle movements during the day will not be discernibly different from the passing traffic along the main road, however at night when the traffic flow is reduced the vehicles may be distinctive.

3.27 Distance attenuation alone suggests maximum façade levels of 51.4dB(A) to the property facing Roy Kilner Road and 48dB(A) to the other properties directly behind the site. In addition, the difference in height between the site and the properties behind will provide an attenuation of 6dB, with a further reduction of 15dB for an open window maximum internal levels will be in the region of 30.4dB(A) & 27dB(A) respectfully. Substantially below the background sound level of 36.9dB(A).

## BS4142:2014 Assessment

3.28 A BS4142 style assessment has also been undertaken for the vehicle wash and external plant and are shown in Appendix B. Both assessments identify that a slight adverse impact will occur on the surrounding properties as a result of the development.

3.29 However, it should be noted that the above assessment is based on the lowest observed background figures and BS4142:2014 states that the background sound level should not simply be based on the lowest reading observed but a typical sound level covering the period being considered.

3.30 The on-site monitoring has identified that the daytime background sound level rises significantly during the day to +48dB(A), with an average of over 47dB(A) during both the week day and at weekends. If this typical background sound level is used within the calculations as suggested by the BS 4142:2014, the resulting impact to the neighbouring properties is significantly reduced with levels well below the prevailing background. Indeed, a wet road would increase this background level further, something that is frequently encountered in this part of the world.

3.31 As part of the BS4142 assessment a correction factor was added to both the vehicle wash, and the external plant due to intermittency of the refrigeration units and use of the vehicle wash, however in contradiction to this it has been assumed that the plant will have a 100% on-time. If this is reduced to 50% or lower then the resulting specific sound level would subsequently be reduced by +3dB.

3.32 The assessment undertaken therefore represents a worse-case scenario.

# 4 Conclusion

4.1 Based on the lowest monitored background sound levels and the information obtained on the sound emissions from the vehicle wash the above assessment has shown that a slight impact will be experienced by the surrounding residential properties from the proposed use of the site.

4.2 However, for the vast majority of the time it has been demonstrated that no impact will be experienced by the nearby residents.

4.3 The assessment identifies maximum combined sound levels for external plant along with a 2.5m high barrier around the vehicle wash area to ensure that the surrounding properties will be adequately protected from the site.

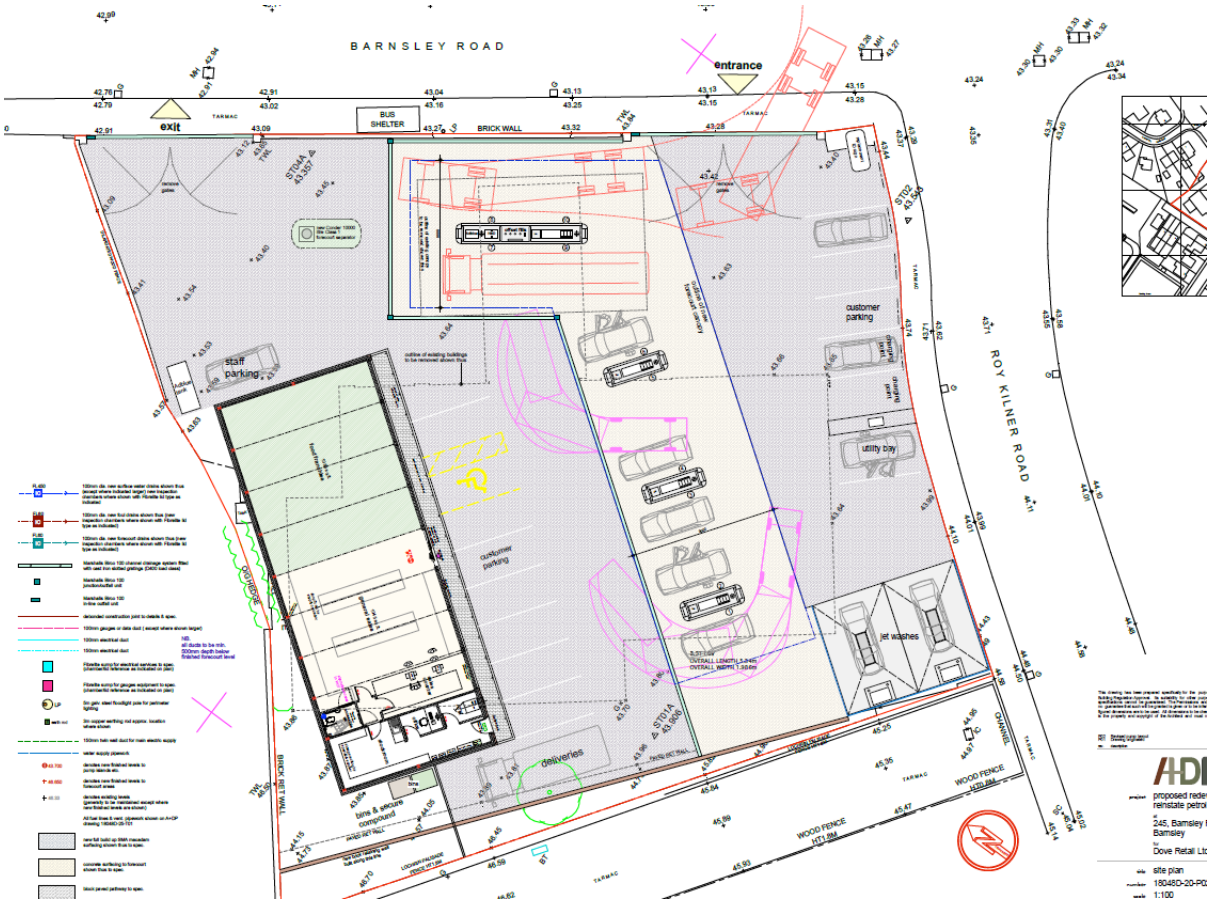
4.4 The resulting sound level to be experienced will be below those recommended within the WHO guidance, BS8233: 2014 and the resulting BS4142:2014 assessment indicates a slight adverse impact, when considering a 100% on-time for plant combined with a correction for intermittency and assessed against the lowest observed background sound levels.

4.5 Therefore, the inclusion of the fencing will ensure the site meets the requirements of the National Planning Policy Framework by preventing a significant adverse impact on neighbouring residential properties.

## Figure 1 – Aerial Photograph


Monitoring locations

## Figure 2 – Proposed site layout



# Appendix A – Calculations

## Vehicle Wash

Distance Attenuation

$$L_w = L_p + 20log(r) + 11 - 3$$

$$L_P = L_w - 20log(r) - 8$$

$$L_P = L_w - 20log(11) - 8$$

$$L_P = 60.2$$

Two vehicle washes

$$L_p = 10log\left(10^{\frac{60.2}{10}} + 10^{\frac{60.2}{10}}\right)$$

$$L_p = 63.2dB(A)$$

Barrier attenuation

Barrier Attenuation has been calculated using the following formula:

$$10\ \log\left(3 + \frac{40\delta}{\lambda}\right)$$

where; $\delta = path\ difference$

$\lambda = wavelength,$

$$\lambda = \frac{speed\ of\ sound\ (330\ m/s)}{frequency\ (Hz)}$$

Ground Floor

Distance = 11m

Height of source = 1.5m above ground level

Height of receiver = 1.5m above ground level

Height of Barrier = 2.5m above ground level

Distance from source to barrier = 1m
Distance from Barrier to receiver = 10m

| | |
|---|---|
| Path Difference | **0.167909609** |
| **Attenuation** | **16.4dB** |

First Floor

Distance = 11m

Height of source = 1.5m above ground level

Height of receiver = 4m above ground level

Height of Barrier = 2.5m above ground level

Distance from source to barrier = 1m
Distance from Barrier to receiver = 10m

| | |
|---|---|
| Path Difference | **0.049568312** |
| **Attenuation** | **11.8dB** |

Rear garden

Distance = 18m

Height of source = 1.5m above ground level

Height of receiver = 1.5m above ground level

Height of Barrier = 2.5m above ground level

Distance from source to barrier = 1m
Distance from Barrier to receiver = 17m

| | |
|---|---|
| Path Difference | **0.147420359** |
| **Attenuation** | **11.8dB** |

Resulting sound level

Sound level – barrier attenuation - directive = *façade level* – window attenuation = **internal sound level**

Ground floor

63.2 - 16.4 - 6 = *40.8dB(A)* – 15 = **25.8dB(A)**

First floor

63.2 - 11.8 - 6 = *45.4dB(A)* – 15 = **30.4dB(A)**

Rear Garden

56.0 – 15.9 = = **40.1dB(A)**

## External Plant

### To rear to site

| | Ground floor | First Floor |
|---|---|---|
| Distance (flat | 22.5 | 22.5 |
| Height of Source | 1 | 1 |
| Height of Receiver | 4.5 | 7 |
| Height of Barrier | 3 | 3 |
| Distance source to barrier (flat) | 6 | 6 |
| Distance barrier to receiver (flat) | 16.5 | 16.5 |
| Path diff. | 0.122001776 | 0.016220125 |
| Attenuation (dB) | 15.1 | 8.4 |

To side of site

| | Ground floor | First Floor | Patio area |
|---|---|---|---|
| Distance (flat | 25 | 25 | 18.5 |
| Height of Source | 1 | 1 | 1 |
| Height of Receiver | 4.5 | 7 | 4.5 |
| Height of Barrier | 3 | 3 | 3 |
| Distance source to barrier (flat) | 2 | 2 | 2 |
| Distance barrier to receiver (flat) | 23 | 23 | 18.5 |
| Path diff. | 0.633477145 | 00.463741925 | 0.568298275 |
| Attenuation (dB) | 21.9 | 20.6 | 21.5 |

Distance attenuation

To rear properties flat distance of 2.5m to side properties flat distance of 18.5 to patio and 25 to house.

| | Sound criteria (dB(A)) | Distance att. (dB) | Barrier att. (dB) | Resulting combined sound emission level from plant |
|---|---|---|---|---|
| Rear ground floor | 38.0 | 35.15 | 15.1 | 88.25 |
| Rear first floor | 36.9 | 35.34 | 8.4 | 80.64 |
| Side ground floor | 38.0 | 36.0 | 21.9 | 95.9 |
| Side First floor | 36.9 | 36.8 | 20.6 | 94.3 |
| Side Patio area | 38.0 | 33.48 | 21.5 | 92.98 |

Therefore, maximum sound level of combined plant is 95dB(A) during the day and 81dB(A) at night.

## BS4142: 2014

| | Car wash | Plant Day | Plant Night | |
|---|---|---|---|---|
| Measured Ambient sound level | | | | |
| Residual Sound level | $L_{Aeq}$ = 69.9dB | $L_{Aeq}$ = 49.6dB | $L_{Aeq}$ = 42.7dB | Average sound level in area over the day from monitoring results |
| Background Sound Level | $L_{A90}$ = 40.9dB | $L_{A90}$ = 38.0dB | $L_{A90}$ = 36.9dB | Lowest background sound level over the day. Taken from the July Sunday morning monitoring |
| Reference period | 60mins | 60mins | 15mins | Normal ref period, |
| Specific sound Level | $L_{Aeq}$ = 40.1dB | $L_{Aeq}$ = 38.0dB | $L_{Aeq}$ = 36.9dB | Calculated level and assumed 100% on-time |
| Acoustic feature | 3dB | 3dB | 3dB | intermittency |
| Rating level | (40.1+3) = 43.1dB | (38+3) = 41dB | (36.9+3) = 39.9dB | |
| Background sound level | $L_{A90}$ = 40.9dB | $L_{A90}$ = 38.0dB | $L_{A90}$ = 36.9dB | Lowest measured on Sunday morning |
| Excess of Rating level over background level | (43.1-40.9) dB = **+2.2dB** indicates a slight adverse impact | (41-38.0) dB = **+3.0dB** indicates a slight adverse impact | (39.9.2-36.9) dB = +3.0**dB** indicates a slight adverse impact | |
| Uncertainty | Assumed 100% on-time and a 3dB for intermittency. If only on for 50% of the time this would reduce the specific level by 3dB. | | | - |
| | Background sound level rises significantly after 9:00 on a Sunday, thus the plant will be well below the background sound level during the day when most in use. | | | |

# Appendix B – Calibration Certificates

## Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

**Equipment Details**

| | |
|---|---|
| Instrument Manufacturer | Cirrus Research Plc |
| Instrument Type | CR:171B |
| Description | Sound Level Meter |
| Serial Number | G066429 |

**Calibration Procedure**

The instrument detailed above has been calibrated to the publish test and calibration data as detailed in the instrument hand book, using the techniques recommended in the latest revisions of the International Standards IEC 61672-1:2013, IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:2003, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

**Calibration Traceability**

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

| | | | | | |
|---|---|---|---|---|---|
| Microphone Type | B&K 4192 | Serial Number | 1920791 | Calibration Ref. | S6450 |
| Pistonphone Type | B&K 4220 | Serial Number | 613843 | Calibration Ref. | S6388 |

Calibrated by

Calibration Date 13 April 2018
Calibration Certificate Number 259073

This Calibration Certificate is valid for 12 months from the date above.

Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH
Telephone: +44 (0) 1723 891655 Fax: +44 (0) 1723 891742
Email: sales@cirrusresearch.co.uk

# Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **118189**

Date of Issue: **13 April 2018**

## Microphone Capsule

Manufacturer: **Cirrus Research plc** Serial Number: **204018A**

Model Number: **MK:224**

## Calibration Procedure

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to the National Physical Laboratory, Middlesex, UK.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Date of Calibration: **04 April 2018**

Open Circuit Sensitivity at 1 kHz: **47.5 mV/Pa** / **-26.5 dB rel 1 V/Pa**

## Environmental Conditions

Pressure: **98.50 kPa**

Temperature: **22.0 °C**

Humidity: **36.0 %**

## Calibration Laboratory

Laboratory: Cirrus Research plc
Acoustic House, Bridlington Road, Hunmanby
North Yorkshire, YO14 0PH, United Kingdom

Test Engineer: Debra Swalwell

**Cirrus Research plc**, Acoustic House, Bridlington Road
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**Web**: www.cirrusresearch.co.uk
UK Registration No: 987160

bsi. ISO 9001 Quality Management ISO 14001 Environmental Management
FM 531001 EMS 552104

# Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **118188**
Date of Issue: **13 April 2018**

## Instrument

Manufacturer: **Cirrus Research plc** Serial Number: **65564**
Model Number: **CR:515**

## Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer s data.

Date of Calibration: **13 April 2018**

## Initial Calibration Results

| Measurement | Level (dB) | Frequency (Hz) | Distortion (% THD + Noise) |
|---|---|---|---|
| 1 | 94.18 | 1000.3 | 0.28 |
| 2 | 94.17 | 1000.3 | 0.28 |
| 3 | 94.19 | 1000.3 | 0.28 |
| Average | **94.18** | **1000.3** | **0.28** |
| Uncertainty | ± 0.13 | ± 0.1 | ± 0.10 |

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

## Adjusted Calibration Results

| Measurement | Level (dB) | Frequency (Hz) | Distortion (% THD + Noise) |
|---|---|---|---|
| 1 | 94.00 | 1000.3 | 0.28 |
| 2 | 93.99 | 1000.3 | 0.28 |
| 3 | 94.01 | 1000.3 | 0.29 |
| Average | **94.00** | **1000.3** | **0.28** |
| Uncertainty | ± 0.13 | ± 0.1 | ± 0.10 |

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

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UK Registration No. 987160



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# Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

## Equipment Details

| | |
|---|---|
| Instrument Manufacturer | Cirrus Research Plc |
| Instrument Type | CR:171C |
| Description | Sound Level Meter |
| Serial Number | G080402 |

## Calibration Procedure

The instrument detailed above has been calibrated to the publish test and calibration data as detailed in the instrument hand book, using the techniques recommended in the latest revisions of the International Standards IEC 61672-1:2013, IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:2003, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

## Calibration Traceability

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

| | | | | | |
|---|---|---|---|---|---|
| Microphone Type | B&K 4192 | Serial Number | 1920791 | Calibration Ref. | S6450 |
| Pistonphone Type | B&K 4220 | Serial Number | 613843 | Calibration Ref. | S6388 |

Calibrated by

Calibration Date 19 March 2018

Calibration Certificate Number 258205

This Calibration Certificate is valid for 12 months from the date above.

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# Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **117501**

Date of Issue: **19 March 2018**

## Microphone Capsule

Manufacturer: **Cirrus Research plc** Serial Number: **210324A**

Model Number: **MK:224**

## Calibration Procedure

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to the National Physical Laboratory, Middlesex, UK.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Date of Calibration: **20 February 2018**

Open Circuit Sensitivity at 1 kHz: **45.6 mV/Pa** **-26.8 dB rel 1 V/Pa**

## Environmental Conditions

Pressure: **101.20 kPa**

Temperature: **22.0 °C**

Humidity: **31.0 %**

## Calibration Laboratory

Laboratory: Cirrus Research plc
Acoustic House, Bridlington Road, Hunmanby
North Yorkshire, YO14 0PH, United Kingdom

Test Engineer: Debra Swalwell

**Cirrus Research plc**, Acoustic House, Bridlington Road
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# Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **117499**
Date of Issue: **19 March 2018**

## Instrument

Manufacturer: **Cirrus Research plc** Serial Number: **83296**
Model Number: **CR:515**

## Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer s data.

Date of Calibration: **28 February 2018**

## Calibration Results

| Measurement | Level (dB) | Frequency (Hz) | Distortion (% THD + Noise) |
|---|---|---|---|
| 1 | 94.00 | 1000.0 | 1.30 |
| 2 | 94.00 | 1000.0 | 1.23 |
| 3 | 93.98 | 1000.0 | 1.27 |
| Average | **93.99** | **1000.0** | **1.27** |
| Uncertainty | ± 0.13 | ± 0.1 | ± 0.10 |

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

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