Noise Impact Assessment

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P. H. Winterton & Son Ellastone Rd, Leek, ST13 7QY

Project Consultant

I. Baxter BSc (Hons)

Acoustic Consultant

info@acousticsurveys.co.uk

Proofing Consultant

L. Hatton BSc (Hons) AMIOA

Acoustic Consultant

info@acousticsurveys.co.uk

Peak Acoustics Ltd.
Fernbank House,
Springwood Way,
Macclesfield,
SK10 2XA

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1. Assessment Summary

Peak Acoustics Ltd. have been commissioned to assess the noise impact from a sawdust extractor currently installed at P. H. Winterton & Son Ellastone Rd, Leek, ST13 7QY. This report assesses the impact of the extractor upon on the nearest sensitive receptors (NSRs).

The Nearest sensitive receptor (NSR_2) is considered to be the adjacent residential property at Moorside Farm, taken to be approximately 45m from the sawdust extractor. A second sensitive receptor (NSR_1) with direct line of site to part of the sawdust extractor is determined to be the garden of the residential dwelling located at Cottonbank Farm, Stoke-on-Trent, ST10 3DU, taken to be approximately 1630m away.

Sound from the sawdust extractor was measured as 85.5dB $L_{Aeq\ 10minutes}$ and was determined to be primarily from the exterior motor.

Levels of existing background sound were measured as 35.6dB $L_{A90,\ 1hr}$ and 38.3dB $L_{A90,\ 1hr}$ at NSR_1 and NSR_2 respectively during representative noise periods (15:20 – 16:20 for NSR_1 and 13:25 – 14:25 for NSR_2).

The specific noise levels of the extractor at NSR_1 and NSR_2 are 16.5dB L_{Assl} and 47.6dB L_{Assl} respectively. A correction factor of +4dB has been applied for tonal characteristics. Therefore, the Sound Rating level at NSR_1 and NSR_2 is 20.5dB L_{Ar} and 51.6dB L_{Ar} respectively. The noise level is thus 15.1dB below the existing background sound levels at NSR_1, receiving a "**Low Impact"** rating. The Noise level is thus 13.3dB above the existing background sound levels at NSR_2, receiving a "Significant Adverse Impact" rating.

Mitigation has been recommended in the form of an acoustic enclosure of the motor which will reduce the rating level at NSR_2 to 38.2dB L_{Ar}, 0.1dB below background level receiving a "**Low Impact"** rating.

The Low frequency noise at NSR_1 has been assessed using the DEFRA Procedure for the assessment of low frequency noise complaints. Comparing the L_{eq} spectrum of the sawdust extractor to the DEFRA criterion curve shows that no third octave band is exceeded and it is concluded that there is no impact upon NSR_1 from low frequency noise nuisance.

2. Legislation, Policy and Guidance

[1] British Standards 4142:2014

[2] DEFRA Procedure for the assessment of low frequency noise complaints

3. Site Description

3.1 Existing Site Conditions

The sawdust extractor is located on the south west side of the site at P. H. Winterton & Son approximately 1630m from NSR_1 (Cottonbank Farm) and 45m from NSR_2 (Moorside Farm).

There is an acoustic bund of approximately 2m height located along the south western perimeter of the site between part of the extractor (including the motor) and NSRs.

A site location plan can be found in **Appendix F**.

4. Noise Survey Details

Measurements of the sawdust extractor and ambient sound levels at NSR_1 were carried out on 10th June 2016 between 14:00 - 15:00.

A survey of existing Background Sound Levels was carried out on 16th June 2016 between 13:00 - 16:30.

4.1 Measurement Equipment

A Class 1 sound level microphone was placed in an all-weather dedicated outdoor monitoring housing, fitted to a tripod and connected to a Class 1 sound level meter. The system was calibrated using a Class 1 field calibrator before and after measurements.

Equipment and calibration information may be found in more detail in **Appendix C & D**.

4.2 Weather Conditions

Weather conditions were deemed acceptable for exterior noise measurement; detailed weather conditions are given in **Appendix E**.

4.3 Measurement location

Measurements were taken at representative locations to the NSRs, approximately 1.5m above ground level.

Measurement locations are shown in **Appendix F**.

4.4 Subjective Impressions

Noise at the southwestern boundary of the site (P. H. Winterton & Son) was primarily from the sawdust extractor motor which was approximately 1m above ground level. Secondary noise sources were noted as HGV movement on site and from other exterior plant equipment. Standing within the immediate proximity of the extractor the noise was clearly perceived with notable presence in the lower frequencies.

Noise at NSR_2 (Moorside Farm) was primarily from birdsong. Secondary noise sources were noted infrequent HGV movement from P. H. Winterton & Son and infrequent distant road traffic.

Noise at NSR_1 was primarily from birdsong. Secondary noise sources were noted as animals and a distant stream.

4.5 Measured Sound Levels

The hours of operation of P. H. Winterton & Son are 07:00 – 19:00 Monday – Friday. Attended background sound levels were taken at a representative location to the NSRs and determined to be as follows:

Attended Measured Background Levels

Background Level	dB $L_{A90, 1hr}$	dB $L_{Aeq, 1hr}$
Daytime NSR_1	35.6	42.8
Daytime NSR_2	38.3	46.9

An attended ambient sound level was taken at a representative location to NSR_1 and determined to be as follows:

Attended Measured Ambient Level

Background Level	dB $L_{Aeq, 5minutes}$
Daytime NSR_1	42.8

A measurement was taken of the sawdust extractor approximately 1m away and determined to be as follows:

Measured Specific Sound Level

Source	dB $L_{Aeq, 10minutes}$
Sawdust Extractor	85.5

Full measurement details can be found in **Appendix G**.

5. BS4142:2014 Assessment

This section of the report identifies current background sound levels as measured in **Appendix G** and summarised in section 4.5, and makes comparisons with the Sound Rating Level of the sawdust extractor. The Sound Rating Level corrects measured Specific Sound Levels for tonality, impulsivity and intermittency.

An overall impact outcome is presented, as determined by BS4142:2014.

Background levels were measured at a representative location to the NSRs and will thus allow a noise limit for noise emissions to be set for achieving low impact criteria.

The noise level from the sawdust extractor at the NSR is to be compared to the noise limit to obtain a noise impact rating.

5.1 Noise Criteria Calculations

Noise limit criteria noise levels

Description	Noise Limit, dB L_{A90}
NSR_1	35.6
NSR_2	38.3

By ensuring the noise from the sawdust extractor does not emit noise at the NSRs exceeding the levels stated in the table above, the low impact criterion will be met.

5.2 Distance Attenuation

The sound level of the sawdust extractor at 1m is 85.5dB L_{Aeq}.

Sound levels decay over distance, and the following point source distance correction is utilised to determine the magnitude of the extractor at the NSRs.

$$L_{As} = L - 20\log (r)$$

(Where L is the extractor noise level, r is the distance between the NSR location and noise source)

Distance Correction Table

Description	Distance, m	Attenuation, dB	Corrected sound level, dB L_{Aeq}
NSR_1	1630	64.2	21.3
NSR_2	45	33.1	52.4

This gives a distance-corrected sound level at NSR_1 and NSR_2 as **21.3dB L_{Aeq}** and **52.4dB L_{Aeq}** respectively.

The 2m high acoustic bund can be assumed to give a minimum 4.8dB reduction from grazing incidence (path difference = 0) due to the relatively large distance between the noise source and the NSRs, derived as follows:

$$\text{Barrier reduction} = 10\log (3+20 (2\delta/\lambda))$$

$$\text{Barrier reduction} = 10\log (3)$$

$$\text{Barrier reduction} = 4.8\text{dB}$$

(Where δ is the path difference and λ is the wavelength component of the noise source)

This reduces the distance corrected sound levels to **16.5dB L_{As}** and **47.6dB L_{As}** at NSR_1 and NSR_2 respectively.

5.3 Sound Rating Level

This section of the report describes the effects of character within sound emissions, leading to their increased perceptibility. Corrections are applied in order to account for spectral character (tone, pitch, hum, etc.) and temporal character (bangs, rattles, pops, etc.).

The sound source is used continuously with no impulsive characteristics. The sound source emits a clearly perceptible tone and is thus subject to a 4dB penalty for tonality.

The Sound Rating Level at NSR_1 is therefore **20.5dB $L_{Ar,\ 1hr}$.**

The Sound Rating Level at NSR_2 is therefore **51.6dB $L_{Ar,\ 1hr}$.**

5.4 BS4142 Outcomes

With regards to BS4142:2014 difference between the rating and background levels is assessed as follows:

A difference of around +10dB or more indicates that complaints are likely. A noise rating level of ***≥45.6dB*** *at* NSR_1 *or* ***≥48.3dB*** *at* NSR_2 *would result in the impact having a* ***"Significant Adverse Impact"*****.**

A difference of around +5dB is deemed an indication of an ***"Adverse Impact"****, resulting from a noise rating level of* ***40.6dB*** *at* NSR_1 *or* ***43.3dB*** *at* NSR_2*.*

Any sound lower than ***35.6dB*** *at* NSR_1 *and* ***38.3dB*** *at* NSR_2 *as* ***"Low Impact"****.*

5.5 Assessment Outcome

Calculation of the rating level at NSR_1 and comparing this to the measured background hour results in a difference of **15.1dB** below the background, receiving a ***"Low Impact"*** rating. This is supported by comparing the ambient and background levels which were measured as 42.8dB $L_{Aeq,\ 5minutes}$ and 42.8dB $L_{Aeq,\ 1hr}$ respectively, demonstrating that there is no increase in noise when the sawdust extractor is in operation.

Calculation of the rating level at NSR_2 and comparing this to the measured background hour results in a difference of **13.3dB** above the background, receiving a ***"Significant Adverse Impact"*** rating.

6. DEFRA Low Frequency Noise Assessment, NSR_1

Due to the relatively large distance between the source and receiver it has been requested by the local authority to further assess the noise impact from the sawdust extractor on NSR_1 utilising the method specified in 'DEFRA – Procedure for the assessment of low frequency noise complaints'.

This consists of comparing the spectrum of the sawdust extractor at NSR_1 to a criterion curve.

The noise criterion curve in third octave bands for a source that only occurs during daytime hours (07:00 – 23:00) is as follows:

Proposed Reference Curve

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB, Leq	97	92	88	79	69	61	54	48	47	45	43	41	39

The spectrum of the extractor at NSR_1 in third octave bands is calculated using a point source distance correction and is as follows:

Sawdust Extractor Spectrum at NSR_1

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB, Leq	0.0	0.0	0.6	3.5	8.1	7.8	9.6	12.9	6.3	9.6	15.4	18.5	33.7

Comparing the L_{eq} spectrum of the sawdust extractor to the criterion curve shows that no third octave band is exceeded. The difference is shown below:

Difference between Sawdust Extractor Spectrum at NSR_1 and Criterion Curve

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB, Leq	-97	-92	-87.4	-75.5	-60.9	-53.2	-44.4	-35.1	-40.7	-35.4	-27.6	-22.5	-5.3

As the third octave bands of the sawdust extractor at NSR_1 are below the criterion curve it can be concluded that there is no impact upon NSR_1 from low frequency noise nuisance.

7. Mitigation

It is recommended to mitigate the noise impact from the sawdust extractor on NSR_2 by installing an acoustic enclosure around the extractor motor with a minimum reduction value of 13.4dB. This will reduce the rating level at the NSR_2 to 38.2dB L_{Ar}, resulting in a difference of **0.1dB** below the background level, receiving a ***"Low Impact"*** rating.

Case studies for such enclosure systems (in most cases built/engineered to specification) have been demonstrated by to reduce noise levels between 15-30dB R_w, subject to requirements. Dedicated MRE enclosure firms such as Environ or Wakefield Acoustics should be approached to design and engineer an enclosure solution.

Enclosures should have sufficiently high reduction indices at frequencies of interest (see appendix G for detailed octave band measurements of sawdust extractor), should be lined with an absorptive material to prevent build-up and should have no fissures, cracks or openings other than for services. Any indirect transmission paths should be treated using sealant and fixings.

APPENDIX A – GLOSSARY OF ACOUSTIC TERMINOLOGY

To aid the understanding of acoustic terminology and the relative difference between noise levels the following background information is provided.

We perceive sound when the ear detects fluctuations in air pressure (sound waves), which are then processed by the brain and perceived as sound. Humans can hear an incredibly wide range of sound intensities ranging from jet engines to fingertips lightly brushing against each other. This range is quantified using a logarithmic scale called the decibel scale (dB). The comfortable range of the decibel scale typically ranges from 0dB (the threshold of hearing) to around 140dB. Here are some examples common environments and their typical noise levels.

Noise Level	Environment
0 dB (A)	Threshold of hearing
20 to 30 dB (A)	Quiet bedroom at night
30 to 40 dB (A)	Living room during the day
40 to 50 dB (A)	Typical office
50 to 60 dB (A)	Inside a moving car
60 to 70 dB (A)	Typical high street
100 to 110 dB (A)	Fire alarm at 1 metre away
140 dB (A)	Threshold of pain

Terminology

dB (decibel) – A unit used to quantify the pressure level of sound. Defined as 20 times the logarithm of the ratio between the root-mean-square pressure of a given sound field and a reference pressure level ($2x10^{-5}$Pa – threshold of hearing).

dB(A) – A-weighted decibel. A-weighting is a correction factor applied to decibel values in order to give a more accurate representation of human hearing, which compensates for the varying sensitivity of the human ear with frequency.

$L_{Aeq, h}$ – The equivalent continuous sound level over a stated period. Quantifies a fluctuating sound level over a given period as the RMS-averaged sound level in which the same amount of acoustic energy is contained over. This can be deemed the "average sound level" over a given period. A-weighting applies.

L_{A90} – The sound level exceeded 90% of the time. Typically used to describe background noise the L_{90} is regarded as the 'average minimum level' and quantifies the common sound level of a fluctuation sound field i.e. the sound level that occurs 90% of the time. Alternatively L_{10} describes the sound level exceeded 10% of the time and therefore quantifies the 'average maximum level' of sound which is often used during the calculation of road traffic noise. A-weighting applies.

L_{AFmax} – The maximum fast-measured, A-weighted sound pressure level. This effectively describes the highest noise level recorded at an instant in time, over a given time period. It is used to measure individual, short-lived noise events that may not have a significant effect on the L_{Aeq} of that period.

APPENDIX B - Measurement Details

Measurement	Kit	Start Date	Start Time	End Date	End Time
M1	A3	10/06/16	13:00	10/06/2016	16:30
M2	A3	16/06/16	14:00	16/06/16	15:00

APPENDIX C - MEASUREMENT EQUIPMENT

Kit	Equipment	Make	Model	Class	Serial Number
A1	Sound Meter	Svantek	958	1	34525
A1	Pre-Amp	Svantek	SV18	1	41651
A1	Calibrator	Svantek	SV31	1	43806

APPENDIX D - Calibration Details

Measurement	Calibrator Ref Level (dB)	Level Before (dB)	Deviation Before (dB)	Level After (dB)	Deviation After (dB)
M1	114.0	113.8	0.2	114.4	-0.4
M2	114.0	114.3	-0.3	114.6	-0.6

APPENDIX E - Meteorology Details

Measurement	Temp C	Wind Speed m/s	Wind Direction	Humidity %	Precipitation mm	Cloud Cover (Oktas)
M1	19	1.7	S	88	0.0	4/8
M2	16	2.5	N	87	0.0	5/8

APPENDIX F – Noise Measurement Location

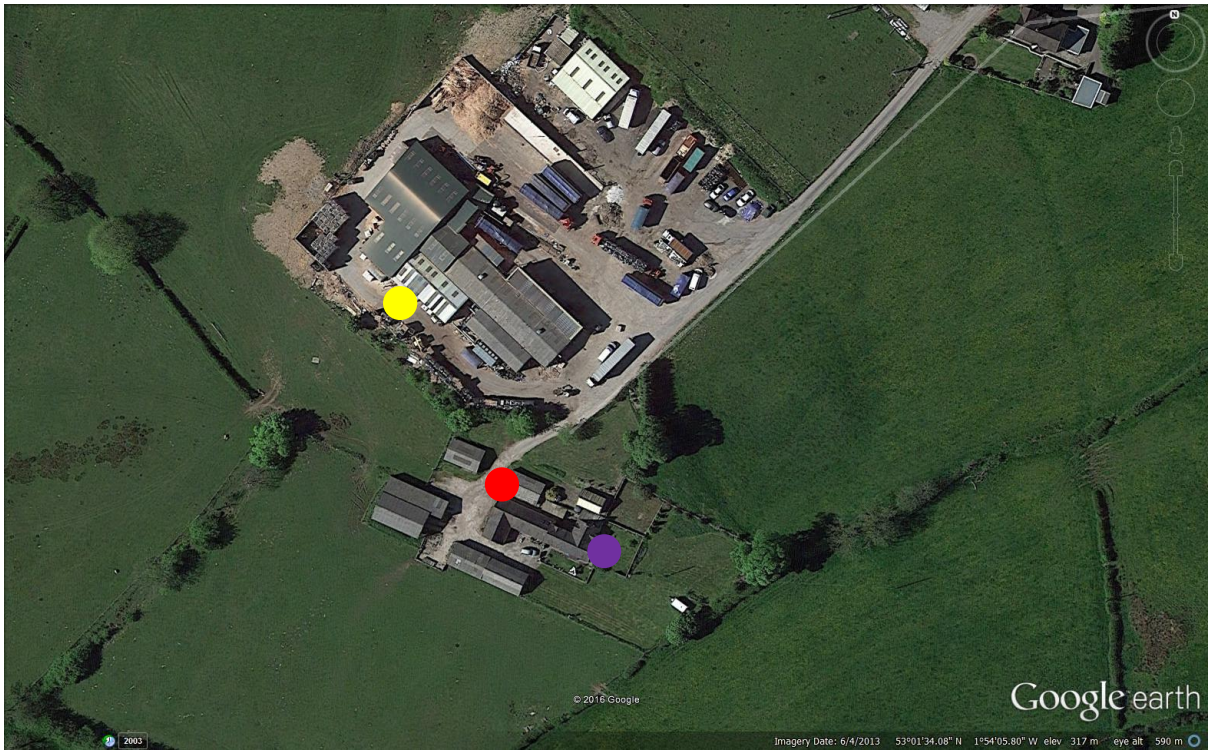
Attended Measurement Location 1



NSR_1 and Attended Measurement Location

Sawdust Extractor Location

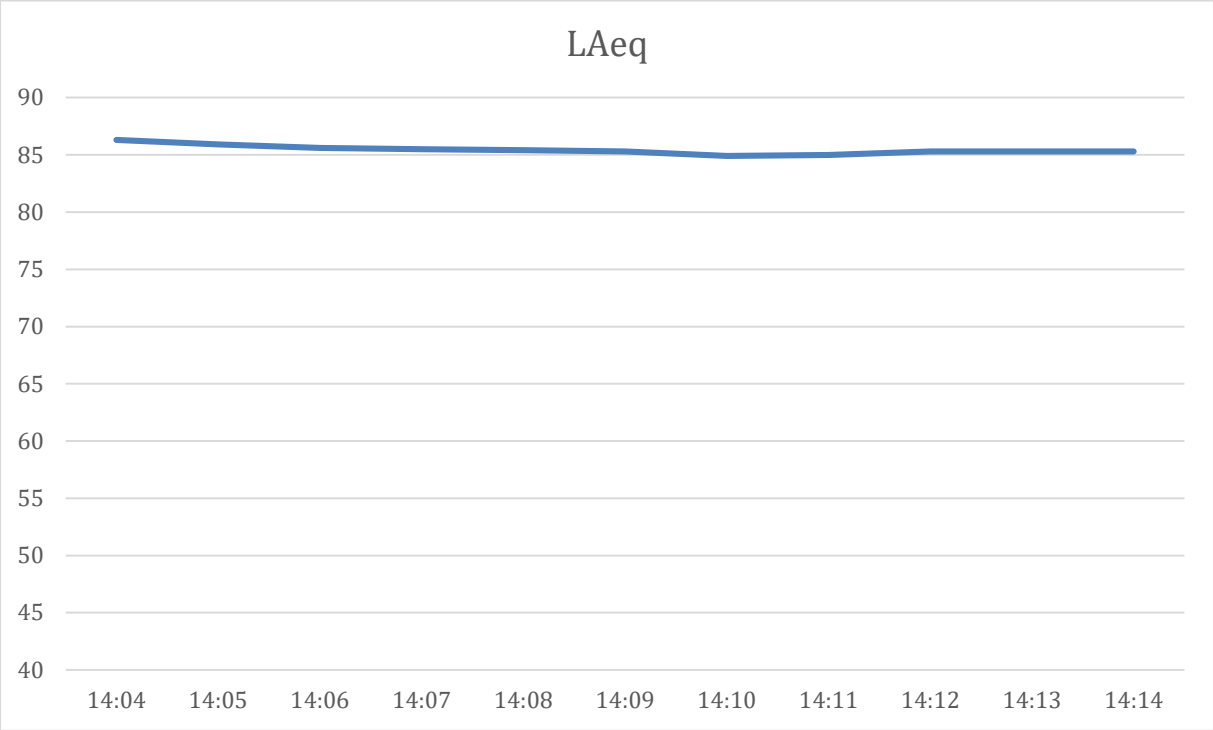
Attended Measurement Location 2



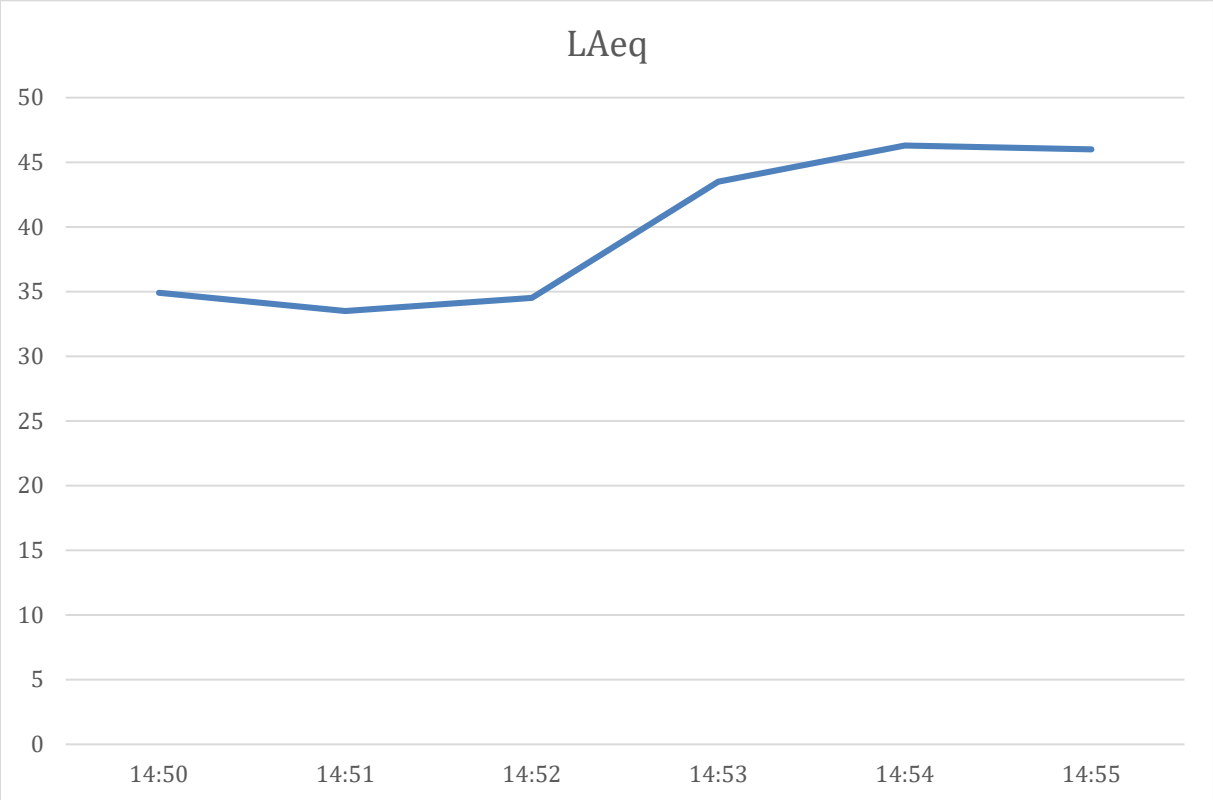
- *NSR_2 Location*
- *Attended Measurement Location*
- *Sawdust Extractor Location*

APPENDIX G – Noise Survey Results

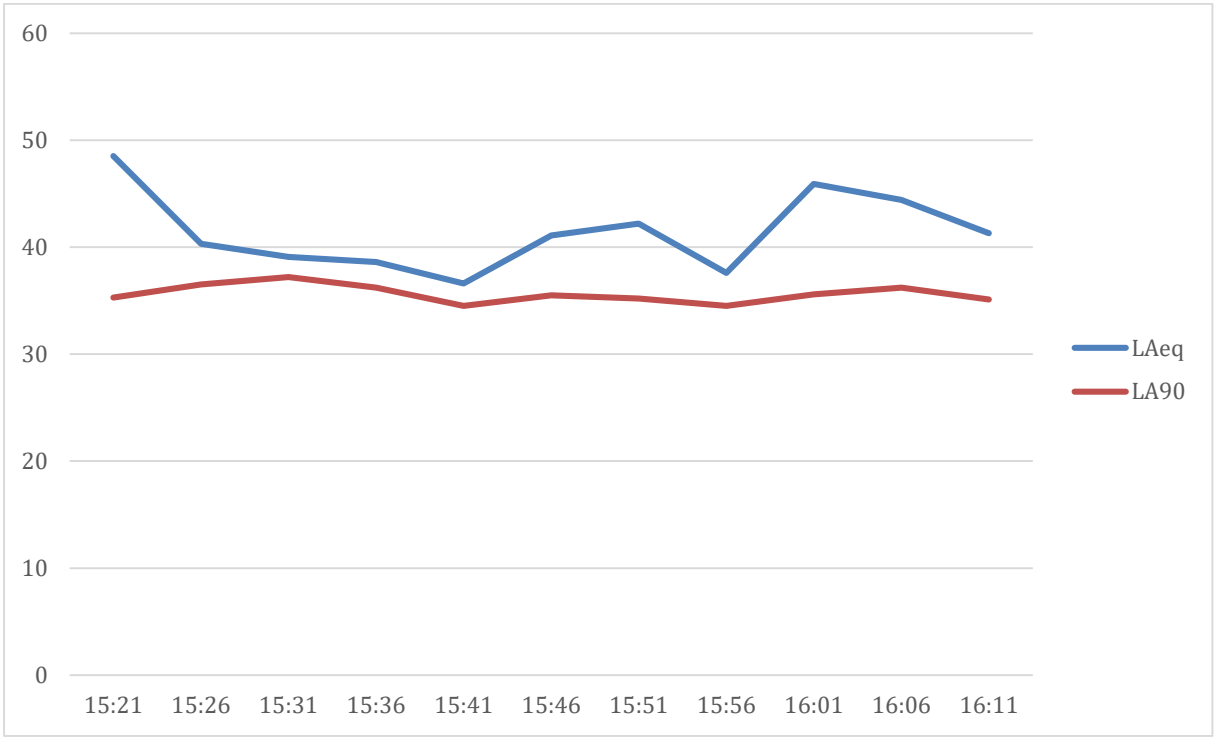
Sawdust Extractor Noise Levels 10th June 2016



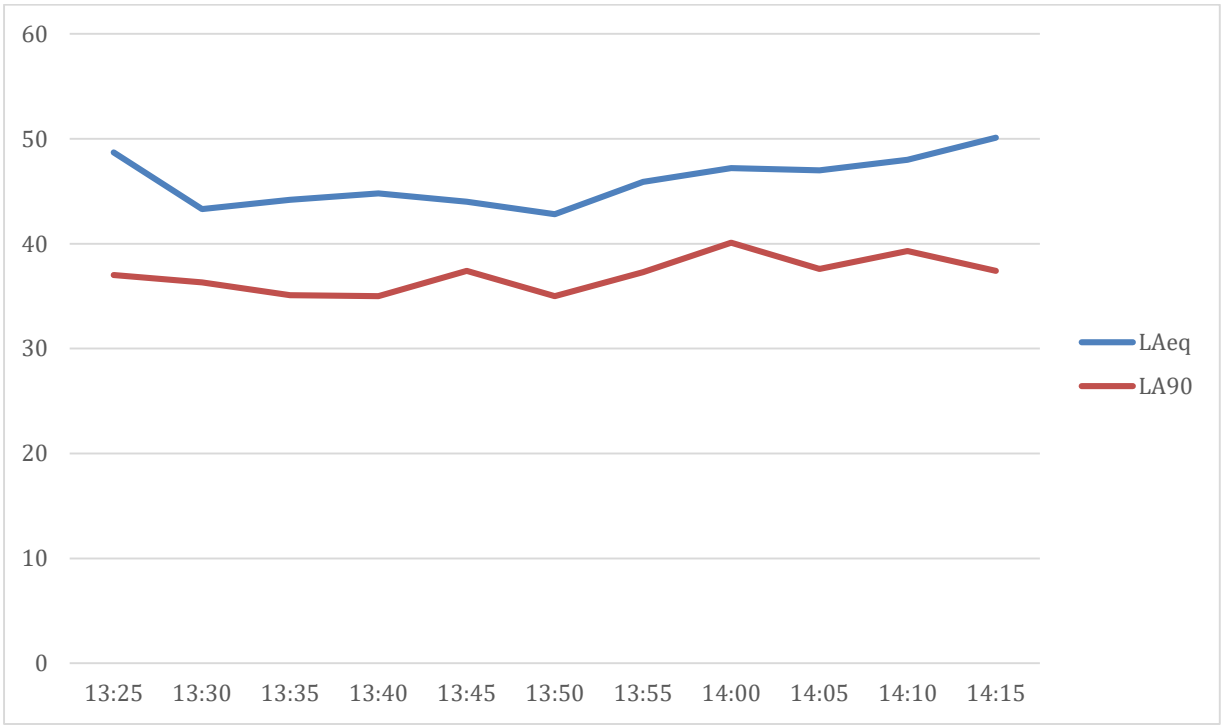
Measured Ambient Noise Levels 10th June 2016, NSR_1



Measured Background Noise Levels 16th June 2016, NSR_1



Measured Background Noise Levels 16th June 2016, NSR_2



	Noise Level (L_{eq} dB)									
Time	**10Hz**	**12.5Hz**	**16Hz**	**20Hz**	**25Hz**	**31.5Hz**	**40Hz**	**50Hz**	**63Hz**	**80Hz**
14:04	61.1	63	65.2	68.2	74.8	71	74.6	77.6	71	74.5
14:05	60.8	62	64.8	68.7	72.6	72.6	74.4	77.5	71.1	74.1
14:06	57.3	60.2	64.4	67.8	72.6	71.6	73.5	77.3	70.5	74.1
14:07	60.2	61.9	64.1	67.4	71.9	71.7	73.8	77.2	70.7	74
14:08	62.1	62.8	64.8	67.7	72.3	72	73.8	77.1	70.5	73.8
14:09	59	60.9	63.7	68	72	71.9	73.3	77.2	70.2	73.8
14:10	56.9	61.6	64.6	68.3	71.5	70.5	70.6	75.4	70.3	73.7
14:11	56.5	61	64	68.1	71.4	70.4	70.6	75.3	70.6	73.3
14:12	59.4	61.1	64	67.8	71.9	71.1	73.1	76.8	70.1	73.3
14:13	60.6	61.8	63.9	67.5	72	70.7	73.4	76.8	70.4	73.3
14:14	59.4	61.5	63.8	67	72	71.6	73.3	76.6	70.4	73.6

	Noise Level (L_{eq} dB)								
Time	**100Hz**	**125Hz**	**160Hz**	**250Hz**	**500Hz**	**1kHz**	**2kHz**	**4kHz**	**8kHz**
14:04	80.2	83.5	98.7	73.7	72.2	65.4	63.8	68.1	53.2
14:05	80.2	83.2	98.3	73.9	72	64.9	62.8	67.9	52.9
14:06	80	82.8	98.1	73.6	71.4	64.6	62.5	68	53
14:07	79.6	82.7	97.8	73.4	71.4	64.4	62.5	68.2	53.2
14:08	79.5	82.6	97.8	73.3	71.5	64.4	62.5	68.2	53.1
14:09	79.4	82.4	97.7	73.3	71.4	64.4	62.5	68.3	53.4
14:10	79.7	82.3	97.6	73.8	70.1	64.7	62.5	68.2	53.5
14:11	79.6	82.3	97.5	73.6	70.5	64.6	62.4	68.2	53.4
14:12	79.2	82.5	97.6	73.3	71.6	64.2	62.4	68.4	53.7
14:13	78.9	82.4	97.6	73.1	71.5	64.1	62.3	68.4	53.4
14:14	79.4	82.4	97.6	73	71.4	64.3	62.4	68.4	53.6

APPENDIX H – Limitations to this Report

This report requires a physical investigation of the site with an appropriate number of measurements in order to provide quantifiable information concerning the type and magnitude of noise affecting the site. The objectives have been limited to identifying sources of noise in order to carry out a suitable assessment for the proposed development.

The number and duration of noise measurements have been strategically selected to give reasonably representative information on the environment within the agreed time. Also, measurement locations have been limited to the areas unoccupied by any building that are easily accessible without imposing any form of risk to Peak Acoustics staff.

With any sampling, the number of samples and methods of sampling and measuring cannot exclude the existence of 'hotspots' where noise or vibration levels may transpire to be significantly more than those actually measured due to previously unknown or unrecognised sources of noise and vibration. Additionally, sources of noise or vibration may be irregular or fluctuate in intensity to an unpredictable degree and consequently may not be present in full intensity for some of the survey period or the entire survey period.

The report does not consider the effects of long-distance meteorological effects such as refraction (due to temperature inversions, wind propagation). All measurements taken on site are subject to a margin of uncertainty of ±1dB due to manufacturer's specification of equipment.