

APPENDIX 11.1

BASIC ACOUSTIC TERMINOLOGY

Sound is produced by mechanical vibration of a surface, which sets up rapid pressure fluctuations in the surrounding air.

Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure level. It is because of this wide range that a noise level scale based on logarithms is used in noise measurement. This is the decibel or dB scale.

Audibility of sound covers a range of about 0 to 140 decibels (dB) corresponding to the intensity of the sound pressure level. The ability to recognise a particular sound is dependent on the pitch or frequencies present in the source. Sound pressure measurements taken with a microphone cannot differentiate in the same way as the ear, consequently a correction is applied by the noise measuring instrument in order to correspond more closely to the frequency response of the ear which responds to sounds from 20 Hz to 20000 Hz. This is known as 'A weighting' and written as dB(A).

The use of this unit is internationally accepted and correlates well with subjective annoyance to noise.

The logarithmic basis of noise measurements means that when considering more than one noise source their addition must be undertaken in terms of logarithmic arithmetic. Thus, two noise sources each of 40 dB(A) acting together would not give rise to $40 + 40 = 80$ dB(A) but rather $40 + 40 = 43$ dB(A). This 3 dB(A) increase represents a doubling in sound energy but would be only just perceptible to a human ear.

The attached chart gives typical noise levels in terms of dB(A) for common situations.

Noise levels can vary with time according to source activity and indices have been developed in order to be able to assign a value to represent a period of noise level variations and to correspond with subjective response.

The definition in layman's terms is given below for terminology used in the measurement and results obtained during the survey work.

A-weighting: Normal hearing covers the frequency (pitch) range from about 20Hz to 20,000 Hz but sensitivity of the ear is greatest between about 500Hz and 5000Hz. The "A-weighting" is an electrical circuit built into noise meters to mimic this characteristic of the human ear.

Ambient noise: The totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far.

Attenuation: Noise reduction

Background noise: The general quiet periods of ambient noise when the noise source under investigation is not there.

Decibel (dB): The unit of measurement for sound based on a logarithmic scale. 0dB is the threshold of normal hearing; 140dB is the threshold of pain. A change of 1dB is only detectable under controlled laboratory conditions.

dB(A) [decibel A weighted]: Decibels measured on a sound level meter incorporating a frequency weighting (A weighting) serves to distinguish sounds of different frequency (or pitch) in a similar way to how the human ear responds. Measurements in dB(A) broadly agrees with an individual's assessment of loudness. A change of 3dB(A) is the minimum perceptible under normal everyday conditions, and a change of 10dB(A) corresponds roughly to doubling or halving the loudness of sound.

dB(C): [decibel C weighted]: Frequency weighting which does not alter low frequency octave band levels by very much compared to 'A' weighting. Similar to linear reading (i.e. linear does not alter frequency spectra at all)

Frequency (Hz): The number of sound waves to pass a point in one second.

L_{Aeq}: This is a noise index used to describe the "average" level of a noise that varies with time (T). It allows for the different sensitivities of the human ear to different frequencies (pitch), and averages fluctuating noise levels in a manner, which correlates well with human perceptions of loudness.

L_{A10,T}: This noise index gives an indication of the upper limit or peak levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 10 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A10} reading was say 60dB, then this means that for 1 hour out of 10 the level went above 60dB.

L_{A90,T}: This noise index gives an indication of the lower limit or levels of the fluctuating noise. It is the "A weighted" noise level exceeded for 90 per cent of the specified measurement period (T). e.g. If the measurement period was over 10 hours and the L_{A90} reading was say 50dB, then this means that for 9 hours out of 10 the level went above 50dB.

L_{Amax}: This is the highest A weighted noise level recorded during a noise measurement period.

Residual noise: The ambient noise remaining at a given position in a given situation when the noise source under investigation is not there.

Specific noise: The noise source under investigation for assessing the likelihood of complaints

Examples of typical noise levels

Source/Activity	Indicative noise level [dB(A)]
Threshold of hearing	0
Rural night-time background	20-40
Quiet bedroom	35
Wind farm at 350m	35-45
Busy road at 5km	35-45
Car at 65km/h at 100m	55
Busy general office	60
Conversation	60
Truck at 50km/h at 100m	65
City Traffic at 5m	75-85
Pneumatic drill at 7m	95
Jet aircraft at 250m	105
Threshold of pain	140

APPENDIX 11.2

NOISE SURVEY DETAILS

Instrumentation

The following instrumentation was used for all noise measurements:

<i>Manufacturer</i>	<i>Description</i>	<i>Type</i>	<i>Calibration Due date</i>	<i>Serial No.</i>
Cirrus	Integrating Sound Level Meter	CR: 704B	September 2008	B15733F
Cirrus	Integrating Sound Level Meter	CR: 831A	September 2008	B15227FF
Cirrus	Integrating Sound Level Meter	CR:831A	August 2008	B12787FF
Pulsar	Precision Integrating SLM	Model 63	October 2008	B17260F
Norsonic	Real time Analyser	118	February 2009	31992
Cirrus	Electronic Calibrator	CR: 513A	August 2007	031462

The following set-up parameters were used on the sound level meters during noise measurement:

Static Noise Monitoring:

Time Weighting: Fast
Frequency Weighting: 'A'
Measurement Period: 30 minutes

Calibration

Calibration setting: 94dB

The noise meters were calibrated with the electronic calibrator prior to commencement and on completion of the survey. No significant drift in calibration was observed.

Survey Dates and Personnel

Static noise measurements positions (shown on figure 11.1) were chosen in liaison with North Lincolnshire Council to carry out noise monitoring around the site to establish typical ambient noise data (see Appendix 11.3 for detailed information). Mr. D.R. Kettlewell of Noise & Vibration Consultants Limited undertook these measurements on Sunday 13th April to Tuesday 15th April 2008.

An additional noise survey was carried out at an existing REP site in Cambridgeshire during a night-time period from 2300 to midnight at various distances from the relevant buildings to establish typical noise levels and frequency content of the noise source (see Appendix 11.4 for detailed information). Mr. D.R. Kettlewell of Noise & Vibration Consultants Limited undertook these measurements on Thursday 31st May 2007.

Monitoring Period and Test Details

Sleaford Baseline Survey

Measurements were recorded over a period of at approximately 48 hours. Data logging of L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} were recorded at 30-minute intervals for information on the variation of typical boundary noise levels.

Additional noise monitoring on a spot roaming basis was undertaken at receptor positions to obtain sample one third octave band frequency spectra for additional information.

The noise meters were mounted on a tripod at a height of between 1.2 to 1.5 metres above ground level and fitted with a wind and rain shield.

Existing REP Site Survey

Measurements were recorded over a period of at approximately 1 hour. Data logging of L_{Aeq} , L_{A10} , L_{A90} and L_{Amax} were recorded at 1-minute intervals at different distances from the site for information on typical site noise levels.

Noise monitoring of sample third octave band frequency analysis was recorded for information.

The noise meters were mounted on a tripod at a height of between 1.2 to 1.5 metres above ground level and fitted with a wind and rain shield.

Meteorological Conditions

Weather details were recorded by the NVC engineer during the period of the surveys, and appear below:

Sunday 13th April 2008

During the daytime it was dry, variable cloud cover and a light south westerly wind (1-2 m/sec) with a temperature of 5-9deg C. During the night-time period the skies were generally clear and it remained dry with winds light changing from west to north at 1-2 m/sec. Temperature falling to 3deg C.

Monday 14th April 2008

During the morning and afternoon period it was dry with variable cloud cover and a light westerly to northerly wind (1-2m/s), temperature 3 to 8deg C.

Tuesday 15th April 2008

Dry monitoring period, clear skies and a light south west wind (1-2m/s), temperature 1-3deg C.

Thursday 31st May 2007

Dry, overcast, wind light from the west (0-1m/s), temperature 10-12deg C.

The above climatic conditions were suitable for monitoring environmental noise levels in accordance with advice given in BS 7445:1991 'Description and measurement of environmental noise'.

APPENDIX 11.3

BACKGROUND NOISE SURVEY RESULTS

Noise Survey Results

Date: Sunday 13th April 2008

Location: Brigg, Lincolnshire

Client: Eco 2

Project: Biomass Site

Data: **Position 1 - Rear Properties off Brook Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, variable cloud, temp. 5-9deg C, south westerly light winds (1-2m/s)

Calibration: 94dB

TABLE 1

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	30:00	48.9	50.6	37.4	65.7	
07:30	30:00	50.2	51.7	38.9	69.9	
08:00	30:00	51.1	52.5	38.2	70.2	
08:30	30:00	50.9	51.1	39.6	71.2	
09:00	30:00	51.2	47.9	36.8	80.5	
09:30	30:00	52.6	45.3	37.9	79.4	
10:00	30:00	50.8	48.5	38.0	77.4	Distant road traffic noise
10:30	30:00	42.7	44.6	38.0	58.1	and birdsong
11:00	30:00	52.9	45.9	38.5	82.3	
11:30	30:00	53.9	47.9	41.8	83.9	
12:00	30:00	49.7	52.0	45.2	64.3	
12:30	30:00	51.7	52.5	48.4	77.0	
13:00	30:00	52.4	53.2	48.6	78.7	
13:30	30:00	52.9	52.9	48.6	76.2	
14:00	30:00	51.2	52.1	45.8	68.8	Distant road traffic noise
14:30	30:00	48.2	49.8	45.5	68.2	and birdsong
15:00	30:00	50.6	51.6	48.5	67.3	
15:30	30:00	54.5	50.4	46.5	80.7	
16:00	30:00	48.1	49.3	45.7	65.6	
16:30	30:00	50.6	51.5	45.8	74.2	Distant road traffic noise
17:00	30:00	51.8	53.1	49.6	71.3	and birdsong
17:30	30:00	50.6	52.0	48.0	68.5	
18:00	30:00	49.3	50.3	45.8	72.6	
18:30	30:00	50.2	49.8	46.0	75.3	
19:00	30:00	49.5	49.0	45.3	71.8	
19:30	30:00	54.4	50.9	45.6	80.2	
20:00	30:00	48.6	49.9	45.5	69.7	Distant road traffic noise
20:30	30:00	47.7	49.3	44.7	55.3	and birdsong
21:00	30:00	48.3	49.8	45.4	62.1	
21:30	30:00	46.5	48.3	42.7	58.1	
22:00	30:00	45.7	47.8	41.0	52.5	
22:30	30:00	46.5	48.4	42.6	53.4	
Average 0700-2300		50.8	50.0	43.6	70.3	

Noise Survey Results

Date: Sunday 13th-Monday 14th April 2008

Site: Brigg, Lincolnshire

TABLE 2

Client: Eco 2

Project: Biomass Site

Data: **Position 1 - Rear Properties off Brook Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, generally clear skies, light winds west to northerly (1-2m/s), temp. 3-5degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	30:00	46.2	48.2	41.5	56.5	Occasional distant road traffic noise
23:30	30:00	45.2	46.9	40.7	55.6	
00:00	30:00	43.1	44.5	37.4	52.9	
00:30	30:00	43.9	45.7	38.9	56.2	
01:00	30:00	42.9	45.2	37.5	54.3	
01:30	30:00	43.4	45.6	38.5	55.8	
02:00	30:00	44.8	47.1	39.1	53.9	
02:30	30:00	45.7	47.9	40.0	56.5	
03:00	30:00	48.7	51.6	43.4	59.4	
03:30	30:00	47.9	49.9	43.0	55.6	
04:00	30:00	49.8	51.2	44.5	58.0	
04:30	30:00	50.2	51.1	45.7	57.8	
05:00	30:00	50.5	52.3	46.2	58.7	
05:30	30:00	51.0	51.3	46.5	65.3	
06:00	30:00	54.5	55.8	47.6	66.7	
06:30	30:00	55.4	56.7	48.7	64.5	
Average 2300-0700		49.5	49.4	42.5	58.0	

Noise Survey Results

Date: Monday 14th April 2008

Location: Brigg, Lincolnshire

Client: Eco 2

Project: Biomass Site

Data: **Position 1 - Rear Properties off Brook Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, variable cloud cover, temp. 3-8deg C, westerly to northerly light winds (1-2m/s)

Calibration: 94dB

TABLE 3

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
07:00	30:00	58.4	59.6	57.0	70.9	
07:30	30:00	58.6	59.4	56.3	74.5	
08:00	30:00	56.6	57.8	54.8	77.6	Distant road traffic noise
08:30	30:00	55.9	57.5	52.9	77.8	and birdsong
09:00	30:00	53.4	54.8	51.3	66.7	
09:30	30:00	54.0	55.2	51.9	75.7	
10:00	30:00	56.7	55.5	51.6	84.7	
10:30	30:00	51.0	53.2	47.5	67.4	Distant road traffic noise
11:00	30:00	53.4	54.5	50.9	77.5	and birdsong
11:30	30:00	54.3	55.6	52.4	70.4	
12:00	30:00	54.8	55.4	51.6	72.6	
12:30	30:00	52.7	53.9	49.7	71.6	
13:00	30:00	52.3	53.9	49.9	69.2	
13:30	30:00	51.7	53.6	48.4	64.5	
14:00	30:00	53.2	55.4	49.0	65.9	
14:30	30:00	54.7	56.5	52.0	72.0	
15:00	30:00	53.4	54.5	51.6	71.4	
15:30	30:00	54.9	56.2	53.1	69.5	
16:00	30:00	55.1	56.1	53.4	75.0	
16:30	30:00	55.0	56.1	53.5	68.2	
17:00	30:00	54.7	55.7	53.2	75.6	
17:30	30:00	54.1	55.3	52.3	68.8	Distant road traffic noise
18:00	30:00	52.6	53.8	50.6	69.2	and birdsong
18:30	30:00	52.3	53.5	50.5	68.9	
19:00	30:00	52.6	53.4	49.7	74.7	
19:30	30:00	51.5	52.7	49.3	69.6	
20:00	30:00	51.6	53.3	48.5	64.9	
20:30	30:00	50.5	51.7	46.9	64.4	
21:00	30:00	49.6	51.1	47.1	56.2	
21:30	30:00	49.8	51.5	46.8	56.8	Distant road traffic noise
22:00	30:00	49.1	50.9	45.7	56.9	and birdsong
22:30	30:00	48.0	49.9	44.1	59.7	
Average 0700-2300		53.9	54.6	50.7	69.7	

Noise Survey Results

Date: Monday 14th-Tuesday 15th April 2008

Site: Brigg, Lincolnshire

TABLE 4

Client: Eco 2

Project: Biomass Site

Data: **Position 1 - Rear Properties off Brook Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, clear skies overnight, light westerly winds (0-1m/s), temp. 1-2degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	30:00	47.9	50.2	43.2	57.3	
23:30	30:00	48.8	51.2	43.3	59.6	
00:00	30:00	47.7	50.1	41.9	58.2	Occasional distant road traffic noise
00:30	30:00	45.4	47.7	38.5	56.0	
01:00	30:00	44.4	47.0	36.8	56.9	
01:30	30:00	43.9	46.8	36.1	56.4	
02:00	30:00	44.6	47.5	35.7	57.8	
02:30	30:00	45.2	48.2	36.0	58.4	
03:00	30:00	47.3	50.8	36.4	58.6	
03:30	30:00	49.3	52.5	38.8	58.5	
04:00	30:00	50.6	52.7	46.3	59.9	
04:30	30:00	54.2	56.9	49.1	61.4	
05:00	30:00	56.5	58.0	53.3	62.2	
05:30	30:00	56.2	57.7	53.5	66.5	Distant road traffic noise and birdsong
06:00	30:00	58.7	59.7	52.2	60.7	
06:30	30:00	56.3	57.5	53.2	61.9	
Average 2300-0700		52.5	52.2	43.4	59.4	

Noise Survey Results

Date: Sunday 13th April
 Location: Brigg, Lincolnshire
 Client: Eco 2
 Project: Biomass Site

TABLE 5

Data: **Position 2 - End of Silversides Lane**
 Instrumentation: Cirrus 831 Integrating Precision SLM
 Weather Conditions: Dry, variable cloud, temp. 5-9deg C, south westerly light winds (1-2m/s)
 Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	30:00	46.2	48.7	42.2	65.3	
07:30	30:00	48.3	50.2	40.8	68.9	
08:00	30:00	47.5	49.6	41.4	67.8	
08:30	30:00	46.9	49.8	41.5	67.0	
09:00	30:00	47.5	48.0	41.7	67.7	
09:30	30:00	48.9	51.6	42.4	68.6	Birdsong & distant road
10:00	30:00	49.0	50.8	42.3	67.4	traffic noise
10:30	30:00	46.7	48.8	40.3	69.6	Power station just audible
11:00	30:00	50.2	51.8	41.9	69.4	
11:30	30:00	46.6	47.3	42.3	74.7	
12:00	30:00	47.9	49.1	43.2	70.5	
12:30	30:00	50.9	51.8	47.3	70.6	Birdsong & distant road
13:00	30:00	49.8	50.7	47.3	69.1	traffic noise
13:30	30:00	51.8	51.6	47.1	70.9	
14:00	30:00	50.5	51.3	46.3	72.7	
14:30	30:00	49.2	49.2	45.4	75.2	
15:00	30:00	49.6	49.9	46.4	71.5	
15:30	30:00	51.5	50.9	47.0	71.8	Power station just audible
16:00	30:00	48.0	49.3	45.8	65.5	
16:30	30:00	47.6	49.1	45.2	62.3	Birdsong & distant road
17:00	30:00	49.1	50.4	46.0	73.7	traffic noise
17:30	30:00	50.5	51.4	47.7	70.5	
18:00	30:00	51.6	53.3	46.1	71.8	
18:30	30:00	53.9	57.3	45.8	74.0	
19:00	30:00	49.8	49.8	45.1	72.2	
19:30	30:00	54.2	54.2	44.4	79.3	Power station just audible
20:00	30:00	52.5	53.5	44.3	76.8	
20:30	30:00	49.2	47.7	44.0	75.1	Distant road traffic noise
21:00	30:00	46.0	47.5	44.1	51.2	
21:30	30:00	45.9	47.1	43.0	63.8	
22:00	30:00	45.3	47.3	42.3	57.5	
22:30	30:00	45.2	47.2	42.0	54.9	
Average 0700-2300		49.6	50.2	44.1	69.0	

Noise Survey Results

Date: Sunday 13th-Monday 14th April 2008

Site: Brigg, Lincolnshire

TABLE 6

Client: Eco 2

Project: Biomass Site

Data: **Position 2 - End of Silversides Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, generally clear skies, light winds west to northerly (1-2m/s), temp. 3-5degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	30:00	46.5	48.6	43.3	56.2	Distant road traffic noise
23:30	30:00	45.1	47.6	41.1	55.8	
00:00	30:00	45.5	47.8	41.5	52.0	
00:30	30:00	44.5	46.3	41.3	53.2	
01:00	30:00	45.7	47.6	42.2	55.4	
01:30	30:00	44.0	45.7	41.7	52.9	
02:00	30:00	45.4	47.6	42.0	56.1	
02:30	30:00	45.4	47.5	42.0	61.1	
03:00	30:00	48.7	51.1	45.1	55.4	
03:30	30:00	49.0	51.3	45.3	57.6	
04:00	30:00	50.5	52.9	46.5	56.3	
04:30	30:00	52.9	55.0	50.2	63.2	
05:00	30:00	53.1	55.7	49.9	65.3	
05:30	30:00	53.5	56.3	50.1	66.3	
06:00	30:00	54.3	56.7	50.2	67.3	Power station just audible
06:30	30:00	53.9	56.9	50.2	65.8	
Average 2300-0700		50.2	50.9	45.2	58.7	

Noise Survey Results

Date: Monday 14th April 2008

Location: Brigg, Lincolnshire

Client: Eco 2

Project: Biomass Site

Data: **Position 2 - End of Silversides Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, variable cloud cover, temp. 3-8deg C, westerly to northerly light winds (1-2m/s)

Calibration: 94dB

TABLE 7

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	30:00	59.0	60.5	57.6	72.7	
07:30	30:00	60.4	61.6	58.8	73.9	
08:00	30:00	58.8	61.0	55.5	73.1	Birdsong & road traffic noise
08:30	30:00	57.3	58.9	54.9	72.5	
09:00	30:00	54.3	55.8	50.7	75.4	
09:30	30:00	52.7	53.8	50.5	71.2	
10:00	30:00	55.8	54.3	50.6	81.7	Power Station just audible
10:30	30:00	53.1	53.9	49.7	79.2	Birdsong & road traffic noise
11:00	30:00	50.2	51.6	47.5	71.7	
11:30	30:00	52.6	54.1	49.8	72.7	
12:00	30:00	52.6	53.8	50.6	73.2	
12:30	30:00	52.9	52.8	49.8	77.8	
13:00	30:00	51.2	52.4	48.1	76.9	
13:30	30:00	51.3	52.8	48.3	75.8	
14:00	30:00	49.2	51.2	45.6	66.9	Birdsong & road traffic noise
14:30	30:00	53.5	55.7	48.7	71.4	
15:00	30:00	54.0	54.8	51.2	74.3	
15:30	30:00	57.8	60.3	50.7	78.3	
16:00	30:00	54.3	55.6	52.1	72.3	
16:30	30:00	56.0	58.3	52.8	71.2	
17:00	30:00	55.2	57.2	52.8	68.7	
17:30	30:00	54.8	56.7	52.2	67.2	Birdsong & road traffic noise
18:00	30:00	52.6	54.1	50.6	69.3	
18:30	30:00	51.6	53.1	49.6	63.8	
19:00	30:00	51.1	52.2	49.0	67.1	
19:30	30:00	55.6	58.0	48.6	75.3	
20:00	30:00	50.9	51.0	47.4	69.6	Distant road traffic noise
20:30	30:00	58.3	59.1	47.0	79.4	
21:00	30:00	49.7	49.5	45.5	69.0	
21:30	30:00	48.0	49.7	45.7	56.4	
22:00	30:00	47.8	49.5	45.4	55.5	
22:30	30:00	47.5	49.3	44.8	56.2	
Average 0700-2300		54.6	54.8	50.1	71.2	

Noise Survey Results

Date: Monday 14th-Tuesday 15th April 2008

Site: Brigg, Lincolnshire

TABLE 8

Client: Eco 2

Project: Biomass Site

Data: **Position 2 - End of Silversides Lane**

Instrumentation: Cirrus 831 Integrating Precision SLM

Weather Conditions: Dry, clear skies overnight, light westerly winds (0-1m/s), temp. 1-2degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	30:00	46.0	48.1	42.8	53.1	
23:30	30:00	46.4	48.8	42.6	56.5	
00:00	30:00	46.8	49.2	42.8	55.2	Distant road traffic noise
00:30	30:00	47.5	50.0	42.8	60.0	
01:00	30:00	46.4	49.4	40.7	57.1	
01:30	30:00	44.0	47.2	37.2	57.7	
02:00	30:00	42.9	45.8	36.6	56.5	
02:30	30:00	41.7	44.8	35.1	54.2	
03:00	30:00	42.1	45.0	36.1	54.7	
03:30	30:00	46.8	50.1	38.1	60.1	
04:00	30:00	49.7	52.5	44.5	60.7	
04:30	30:00	52.1	54.1	48.9	60.0	
05:00	30:00	58.0	59.2	51.4	76.2	Local and distant road traffic
05:30	30:00	58.3	59.5	53.1	81.1	Power station just audible
06:00	30:00	55.9	56.4	52.0	70.4	
06:30	30:00	56.7	57.9	53.5	71.0	
Average 2300-0700		52.3	51.1	43.6	61.5	

Noise Survey Results

Date: Sunday 13th April 2008

Location: Brigg, Lincolnshire

Client: Eco 2

Project: Biomass Site

Data: **Position 3 - Mill Lane**

Instrumentation: Cirrus 704B Integrating Sound Level Meter

Weather Conditions: Dry, variable cloud, temp. 5-9deg C, south westerly light winds (1-2m/s)

Calibration: 94dB

TABLE 9

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	30:00	47.8	49.4	40.2	65.3	
07:30	30:00	47.6	48.5	41.3	60.5	
08:00	30:00	48.7	49.2	40.5	63.4	
08:30	30:00	48.1	49.6	41.2	64.7	
09:00	30:00	49.2	50.3	40.4	67.5	
09:30	30:00	48.9	49.7	41.3	68.3	
10:00	30:00	49.8	51.6	40.6	68	Distant road traffic noise
10:30	30:00	48.7	47.6	38.7	66.7	
11:00	30:00	47.1	48.2	42.5	61.6	Distant noise from mobile
11:30	30:00	46.9	47.1	41.8	65.3	plant at end of Mill Lane
12:00	30:00	45.8	47.1	41	62.8	
12:30	30:00	48.1	49.2	44.2	62.2	
13:00	30:00	50.2	53.4	44.2	63	
13:30	30:00	50.1	51.1	43.2	69.8	
14:00	30:00	54.5	53	42.8	77.4	
14:30	30:00	51.4	51.3	44.7	68.1	
15:00	30:00	52.6	51.4	45	70.1	Local road traffic movements
15:30	30:00	50.2	51.5	46.1	64.7	
16:00	30:00	49.9	49.4	44.3	71.7	
16:30	30:00	48.7	48.5	44.2	68.6	
17:00	30:00	50.6	52.9	45.3	63.1	
17:30	30:00	49.8	50.6	46.1	65.3	
18:00	30:00	51.6	51	44.1	69.6	Distant road traffic noise
18:30	30:00	53.3	53.4	44.3	72.7	Local road traffic movements
19:00	30:00	49.8	48.1	42.5	74.5	
19:30	30:00	49.9	50.8	42.5	66.7	
20:00	30:00	50.1	51.6	43	69	Local road traffic movements
20:30	30:00	49.7	51.2	41.2	68.7	
21:00	30:00	49.7	49.5	41.3	67.3	
21:30	30:00	47	46.3	40.5	64	
22:00	30:00	44	44.6	40	62.3	
22:30	30:00	46.4	46.6	40.2	64.2	
Average 0700-2300		49.7	49.8	42.5	66.8	

Noise Survey Results

Date: Sunday 13th-Monday 14th April 2008

Site: Brigg, Lincolnshire

TABLE 10

Client: Eco 2

Project: Biomass Site

Data: **Position 3 - Mill Lane**

Instrumentation: Cirrus 704B Integrating Sound Level Meter

Weather Conditions: Dry, generally clear skies, light winds west to northerly (1-2m/s), temp. 3-5degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations	
23:00	30:00	47.9	48.9	42.8	66.9	Distant road traffic noise	
23:30	30:00	43.9	45.9	40	51.5		
00:00	30:00	43.5	45.9	39.4	51.8		
00:30	30:00	42.5	43.6	37.4	57.8		
01:00	30:00	40	42.2	35.6	50.3		
01:30	30:00	40.2	42.8	35.1	49.9		
02:00	30:00	40.5	43.3	35.3	49.9		
02:30	30:00	40.3	42.7	35.7	47.7		
03:00	30:00	45.2	47.2	40.3	54.4		
03:30	30:00	47	49.4	42.5	53.6		
04:00	30:00	48.1	50.1	44.4	53.9		
04:30	30:00	50.4	52.3	46.3	56		
05:00	30:00	53.4	54.5	52.4	68.2		Local and distant road traffic
05:30	30:00	53.5	55.2	50	64.3		
06:00	30:00	53.2	54.5	50.5	63.1		
06:30	30:00	54.8	56	52.6	63.5		
Average 2300-0700		49.3	48.4	42.5	56.4		

Noise Survey Results

Date: Monday 14th April 2008

Location: Brigg, Lincolnshire

Client: Eco 2

Project: Biomass Site

Data: **Position 3 - Mill Lane**

Instrumentation: Cirrus 704B Integrating Sound Level Meter

Weather Conditions: Dry, variable cloud cover, temp. 3-8deg C, westerly to northerly light winds (1-2m/s)

Calibration: 94dB

TABLE 11

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	30:00	56	56.6	53.8	69.8	
07:30	30:00	57.6	58.4	55.7	65.5	
08:00	30:00	57.2	58.9	53.1	68.9	
08:30	30:00	56.9	56.2	52.3	77.3	Distant noise from mobile plant
09:00	30:00	60	55.4	47.9	90.9	Local and distant road traffic noise
09:30	30:00	51.3	52.9	47.4	64.5	
10:00	30:00	51.4	52.4	46.8	71.4	
10:30	30:00	52.9	53.7	45.6	74.8	
11:00	30:00	49.9	50.3	44.4	66.3	
11:30	30:00	50.6	51.6	46.8	63.7	Local and distant road traffic
12:00	30:00	52.7	54.2	48.3	67.7	
12:30	30:00	49.6	50.6	46.5	61.1	
13:00	30:00	52.6	53.5	45.5	74	
13:30	30:00	52.6	54.4	45.8	73.4	
14:00	30:00	49.3	51.7	43.2	64.5	
14:30	30:00	53.7	56	48.3	66	
15:00	30:00	52.6	54.1	47.9	67.3	
15:30	30:00	52.5	54.2	48.9	64.4	Local and distant road traffic
16:00	30:00	53.8	55.5	50.7	64.9	
16:30	30:00	53.6	54.8	50.7	65.5	
17:00	30:00	53.7	54.1	50.8	67.5	
17:30	30:00	52.8	53.4	49.9	65.1	Local and distant road traffic
18:00	30:00	54.1	54	48.4	71.4	
18:30	30:00	52.8	53.4	48.4	69.6	
19:00	30:00	51.8	53.1	47	70	
19:30	30:00	53.9	56.1	46.7	69.4	
20:00	30:00	52.2	51.9	45	72.6	
20:30	30:00	51.2	52.6	44.6	67.1	Local and distant road traffic
21:00	30:00	52.3	50.5	43.4	70.4	
21:30	30:00	51.8	48.6	43.8	75.1	
22:00	30:00	47.2	47.1	42.7	67	
22:30	30:00	47.3	47.3	42.8	64.6	
Average 0700-2300		53.5	53.4	47.6	69.1	

Noise Survey Results

Date: Monday 14th-Tuesday 15th April 2008

Site: Brigg, Lincolnshire

TABLE 12

Client: Eco 2

Project: Biomass Site

Data: **Position 3 - Mill Lane**

Instrumentation: Cirrus 704B Integrating Sound Level Meter

Weather Conditions: Dry, clear skies overnight, light westerly winds (0-1m/s), temp. 1-2degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations	
23:00	30:00	47.7	47.6	41.3	66.9	Distant road traffic noise	
23:30	30:00	44.3	45.8	41.2	51.7		
00:00	30:00	45.8	47.8	42	52.9		
00:30	30:00	47.6	49.6	43.5	53.7		
01:00	30:00	44.6	47.1	39.3	55		
01:30	30:00	40.5	42.6	36.3	47.3		
02:00	30:00	41.1	43.2	37.3	50.8		
02:30	30:00	42.5	45.3	36.4	50.8		
03:00	30:00	42.6	45.3	36.3	57.1		
03:30	30:00	44.2	47	36	51.9		
04:00	30:00	46.3	49.1	40	57.9		
04:30	30:00	48.4	50.2	44.9	55.6		
05:00	30:00	54.6	56.4	50.5	62.9		Local and distant road traffic noise
05:30	30:00	54	55.2	51.3	59.1		
06:00	30:00	55.9	55.3	51.1	76.4		
06:30	30:00	47.2	49.5	49.1	50		
Average 2300-0700		49.3	48.6	42.3	56.3		

Noise Survey Results

Date: Sunday 13th April
 Location: Brigg, Lincolnshire
 Client: Eco 2
 Project: Biomass Site
 Data: **Position 4 - Off Cadney Road**

TABLE 13

Instrumentation: Pulsar Model 63 Integrating Sound Level Meter
 Weather Conditions: Dry, variable cloud, temp. 5-9deg C, south westerly light winds (1-2m/s)
 Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
07:00	30:00	44.2	47.2	42.1	57.3	
07:30	30:00	47.3	48.9	40.4	60.9	Birdsong, occasional local traffic
08:00	30:00	47.0	49.6	40.9	58.8	
08:30	30:00	46.7	49.6	40.9	57.0	
09:00	30:00	47.6	48.1	41.5	56.7	
09:30	30:00	49.2	51.9	42.3	56.6	Power station just audible
10:00	30:00	49.5	51.3	42.3	53.4	
10:30	30:00	46.7	48.8	40.4	59.6	
11:00	30:00	47.8	50.4	42.1	60.4	
11:30	30:00	46.8	47.5	42.7	66.7	
12:00	30:00	47.5	48.7	43.1	61.5	Power station just audible
12:30	30:00	50.1	51.0	46.9	60.6	
13:00	30:00	48.8	49.7	46.7	61.1	
13:30	30:00	49.7	49.5	46.4	62.9	Birdsong, occasional local road traffic
14:00	30:00	48.2	49.0	45.8	63.7	
14:30	30:00	48.9	48.9	45.2	65.2	
15:00	30:00	48.5	48.8	47.4	60.5	
15:30	30:00	50.2	49.6	48.2	59.8	
16:00	30:00	48.1	49.4	45.4	51.5	
16:30	30:00	47.6	49.1	44.9	52.3	
17:00	30:00	46.7	48.4	45.2	64.7	
17:30	30:00	50.7	51.6	46.9	62.5	Power station just audible
18:00	30:00	51.2	52.9	45.1	62.8	
18:30	30:00	51.9	52.0	45.8	64.0	
19:00	30:00	48.8	48.8	45.0	64.2	
19:30	30:00	52.1	52.1	44.2	71.3	Birdsong
20:00	30:00	50.2	51.2	43.8	67.8	
20:30	30:00	48.9	47.4	43.8	65.1	
21:00	30:00	44.9	47.0	44.1	40.2	
21:30	30:00	44.6	45.8	42.9	51.8	
22:00	30:00	45.4	47.4	42.1	43.5	
22:30	30:00	44.2	46.2	41.9	44.9	
Average 0700-2300		48.6	49.3	44.0	59.0	

Noise Survey Results

Date: Sunday13th-Monday14th April 2008

Site: Brigg, Lincolnshire

TABLE 14

Client: Eco 2

Project: Biomass Site

Data: **Position 4 - Off Cadney Road**

Instrumentation: Pulsar Model 63 Integrating Sound Level Meter

Weather Conditions: Dry, generally clear skies, light winds west to northerly (1-2m/s), temp. 3-5degC

Calibration: 94dB

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
23:00	30:00	44.5	47.1	40.3	48.2	Power Station just audible
23:30	30:00	44.1	46.3	38.6	47.8	
00:00	30:00	45.0	47.8	38.5	43.0	
00:30	30:00	44.3	46.1	37.8	43.2	
01:00	30:00	45.8	47.7	38.2	44.4	
01:30	30:00	44.3	46.0	37.7	40.9	
02:00	30:00	45.9	48.1	37.8	42.1	
02:30	30:00	45.4	47.5	38.3	51.1	
03:00	30:00	44.7	46.6	41.6	46.4	
03:30	30:00	44.0	46.4	41.8	49.6	
04:00	30:00	44.5	46.8	40.5	47.3	
04:30	30:00	45.9	47.8	39.2	53.2	
05:00	30:00	49.2	51.9	36.9	62.6	
05:30	30:00	49.9	53.2	38.6	64.1	
06:00	30:00	48.9	49.5	40.5	64.1	
06:30	30:00	48.7	49.9	41.6	60.9	
Average 2300-0700		46.4	48.0	39.2	50.6	

Noise Survey Results

Date: Monday 14th April 2008

Location: Brigg, Lincolnshire

Client: Eco 2

Project: Biomass Site

Data: **Position 4 - Off Cadney Road**

Instrumentation: Pulsar Model 63 Integrating Sound Level Meter

Weather Conditions: Dry, variable cloud cover, temp. 3-8deg C, westerly to northerly light winds (1-2m/s)

Calibration: 94dB

TABLE 15

Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmx (dB)	Observations
07:00	30:00	48.2	50.7	42.2	57.4	
07:30	30:00	51.5	52.9	40.9	63.2	
08:00	30:00	50.1	52.6	41.5	60.3	Birdsong & occasional local road traffic
08:30	30:00	50.2	52.8	41.9	58.0	
09:00	30:00	50.6	51.2	42.5	58.0	
09:30	30:00	51.2	54.1	43.3	57.6	
10:00	30:00	51.0	52.3	42.5	54.6	
10:30	30:00	50.1	52.6	40.9	60.7	
11:00	30:00	50.1	52.9	42.8	62.1	
11:30	30:00	48.4	49.1	43.7	68.0	
12:00	30:00	49.3	50.5	44.2	62.6	
12:30	30:00	49.3	52.0	48.1	61.8	
13:00	30:00	49.9	51.1	47.4	61.8	
13:30	30:00	51.4	51.4	47.3	64.3	
14:00	30:00	50.2	51.1	46.8	64.7	
14:30	30:00	50.0	50.3	45.7	66.2	
15:00	30:00	49.6	50.3	48.7	61.8	
15:30	30:00	51.4	50.9	49.6	61.2	Power station just audible
16:00	30:00	49.1	49.3	46.4	52.5	
16:30	30:00	49.2	50.8	45.3	52.7	
17:00	30:00	48.1	49.6	45.9	65.7	
17:30	30:00	50.9	51.6	47.8	64.5	
18:00	30:00	50.8	52.9	46.2	64.4	
18:30	30:00	50.9	53.1	47.3	65.5	
19:00	30:00	48.8	49.1	45.7	65.4	
19:30	30:00	50.0	50.1	44.6	65.3	
20:00	30:00	51.3	52.2	44.8	68.4	Power station just audible
20:30	30:00	49.9	48.5	44.8	66.1	
21:00	30:00	48.9	50.5	44.5	45.2	
21:30	30:00	48.6	49.5	43.6	53.8	
22:00	30:00	49.4	51.2	43.0	46.5	
22:30	30:00	48.2	50.3	42.9	50.9	
Average 0700-2300		49.8	51.2	44.8	60.4	

Noise Survey Results

Date: Monday 14th-Tuesday 15th April 2008

Site: Brigg, Lincolnshire

TABLE 16

Client: Eco 2

Project: Biomass Site

Data: **Position 4 - Off Cadney Road**

Instrumentation: Pulsar Model 63 Integrating Sound Level Meter

Weather Conditions: Dry, clear skies overnight, light westerly winds (0-1m/s), temp. 1-2degC

Calibration: 94dB

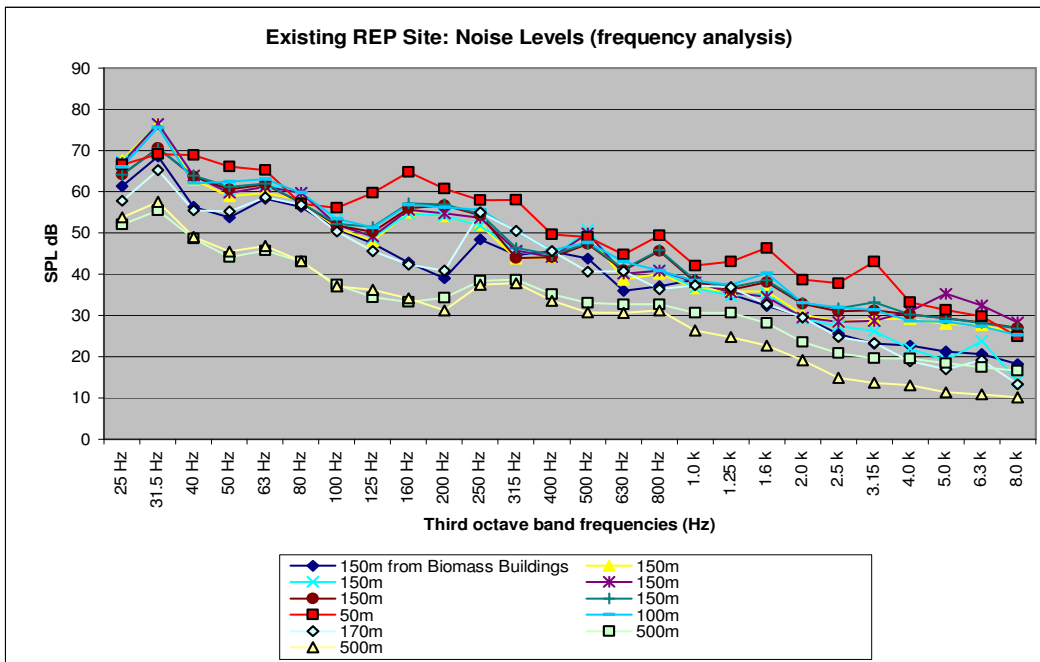
Start Time	Run Time (mins.)	LAeq (dB)	LA10 (dB)	LA90 (dB)	LAmix (dB)	Observations
23:00	30:00	44.6	46.9	40.0	49.2	
23:30	30:00	44.0	46.1	37.8	49.8	
00:00	30:00	45.2	48.1	37.7	45.0	
00:30	30:00	43.9	46.1	36.8	47.2	
01:00	30:00	44.8	47.2	38.2	42.4	
01:30	30:00	44.1	45.6	37.6	38.5	
02:00	30:00	47.0	49.5	37.6	39.0	
02:30	30:00	44.8	46.5	37.8	53.1	
03:00	30:00	44.5	46.3	41.4	47.4	
03:30	30:00	44.2	46.6	41.8	51.1	
04:00	30:00	44.9	47.6	40.2	43.3	
04:30	30:00	46.0	47.7	38.4	58.2	
05:00	30:00	49.7	51.7	36.1	59.6	
05:30	30:00	50.2	53.5	37.6	60.1	Power Station just audible
06:00	30:00	49.6	50.0	40.5	66.1	
06:30	30:00	49.7	50.3	41.5	61.9	
Average 2300-0700		46.7	48.1	38.8	50.7	

APPENDIX 11.4

EXISTING REP SITE NOISE SURVEY RESULTS

31st May 2007

	23:08 150m	23:23 150m	23:25 150m	23:25 150m	23:26 150m	23:27 150m	23:28 50m	23:30 100m	23:34 170m	23:44 500m	23:46 500m
LAeq	48.5	52	52.4	52.8	53.2	53.7	58.9	53.9	50.8	40.9	38.6
LAF(max)	53.8	58	54	57.2	56.6	59.7	61.1	57.5	53.7	53.8	39.7
LA10	49.4	53	53.1	53.2	54	54.3	59.8	54.7	51.9	41.6	39.2
LA90	47.4	45.9	51.5	52.1	52.4	52.4	57.7	53.1	49.9	38.7	37.9
25 Hz	61.4	67.7	67.3	66.9	64.1	64.2	66.6	66	57.8	52.1	53.8
31.5 Hz	68.5	76.6	76.5	76.5	70.6	70.5	69.2	75.6	65.3	55.5	57.6
40 Hz	56.4	62.9	63.8	63.9	63.6	63.9	68.9	62.1	55.5	48.7	49
50 Hz	53.8	58.9	60.5	59.7	60.6	61.2	66.1	62.5	55.3	44.1	45.5
63 Hz	58.3	59.7	61.9	61.2	61.7	62	65.2	63	58.7	45.7	46.8
80 Hz	56.3	57.9	59.6	59.7	57.3	57.3	57.1	59.7	56.8	43	43.2
100 Hz	51	51.2	53.3	52	51.8	52.2	56.1	53.4	50.4	37.5	37.1
125 Hz	47.4	48.1	48.8	49.1	50.2	51.5	59.7	51.3	45.6	34.4	36.2
160 Hz	42.8	55	54.7	55.6	56	57.2	64.7	56.8	42.3	33.3	34.1
200 Hz	39	54	54.2	54.7	56.7	57	60.7	56.2	40.9	34.3	31.2
250 Hz	48.4	51.9	51.8	53.6	54.3	54.6	57.9	55.6	55	38.4	37.4
315 Hz	44.6	43.8	45.6	45.7	43.9	46.4	58.1	50.3	50.5	38.6	37.8
400 Hz	45.5	44.2	44.2	44.2	44.2	44.8	49.6	45.9	45.6	35.1	33.5
500 Hz	43.8	49.9	50.7	49.9	47.3	47.4	49	47.7	40.6	33.1	30.7
630 Hz	36	38.6	40.1	40.1	41	41.2	44.7	43.1	40.7	32.7	30.6
800 Hz	37.1	40.1	41	40.9	45.6	45.9	49.4	40.8	36.3	32.7	31.2
1.0 k	38.6	36.6	36.7	38.1	38.2	38.5	42.1	38.4	37.3	30.6	26.4
1.25 k	35.1	35.8	34.8	35.6	36.2	36.8	43	37.5	36.8	30.6	24.7
1.6 k	32.3	35.9	35.3	34.5	38.1	38.5	46.3	40.2	32.7	28.2	22.7
2.0 k	29.8	30.3	29.2	29.5	32.8	33.1	38.7	33.1	29.5	23.5	19.2
2.5 k	25.5	28.5	27.4	28.4	31	31.7	37.8	31.9	24.8	20.8	14.9
3.15 k	23.2	29.2	26.2	28.7	31.2	33.2	43	31.3	23.3	19.6	13.7
4.0 k	22.7	29.1	21.9	31	30.2	30.2	33.2	28.6	18.9	19.5	13.1
5.0 k	21.2	27.9	19.2	35.3	29.3	29.3	31.3	28.4	16.9	18.4	11.4
6.3 k	20.6	27.7	23.8	32.5	28.3	28.2	29.7	27.3	19.1	17.5	10.9
8.0 k	18.2	25.7	14.1	28.3	27	26.8	24.9	25.2	13.3	16.6	10.1



APPENDIX 11.5

LOW FREQUENCY NOISE

Review of European Legislation and Standards

Authorities in Germany, Denmark, Holland, Sweden and Poland have acknowledged the problems associated with low frequency noise by publishing standards or guidance.

COMPARISON OF EUROPEAN STANDARDS AND GUIDANCE CRITERIA FOR LOW FREQUENCY NOISE

	Poland	Germany	Netherlands	Denmark (night)	Sweden	ISO226
Frequency (Hz)	L_{A10} dB	DIN45680 dB	NSG dB	20dBA	dB	dB
8		103				
10	80.4	95		90.4		
12.5	73.4	87		83.4		
16	66.7	79		76.7		
20	60.5	71	74	70.5		78.5
25	54.7	63	64	64.7		68.8
31.5	49.3	55.5	55	59.4	56	59.5
40	44.6	48	46	54.6	49	51.1
50	40.2	40.5	39	50.2	43	44
63	36.2	33.5	33	46.2	41.5	37.5
80	32.5	28	27	42.5	40	31.5
100	29.1	23.5	22	39.1	38	26.5
125	26.1			36.1	36	22.1
160	23.4			33.4	34	17.9
200	20.9				32	14.4
250	18.6					11.4

Low Frequency Guidance in the UK:

In February 2005, the University of Salford published a research paper which was prepared for Defra (Contract NANR45) entitled 'Proposed criteria for the assessment of low frequency noise disturbance'.

The proposed criteria and procedure for assessing low frequency noise is as follows:

Measurement should be taken with the microphone in an unoccupied room where the complainant says the noise is present. (Note that the person taking the measurements may not be able to hear the sound).

Record L_{eq} , L_{10} , and L_{90} in the third octave bands between 10Hz and 1060Hz.

If the L_{eq} taken over a time when the noise is said to be present, exceeds the values in Table 9 it may indicate a source of LFN that could cause disturbance. The character of the sound should be checked if possible by playing back an audio recording at amplified level.

If the noise occurs only during the day then 5dB relaxation may be applied to all third octave bands.

If the noise is steady then a 5dB relaxation may be applied to all third octave bands. A noise is considered steady if either of the conditions a. or b. below is met:

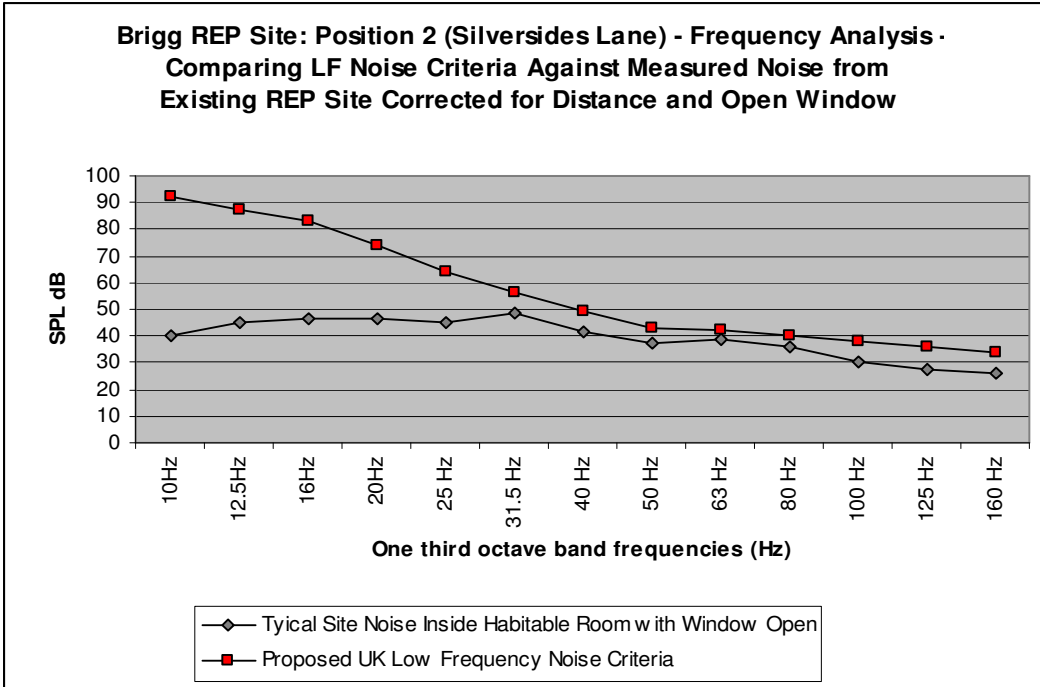
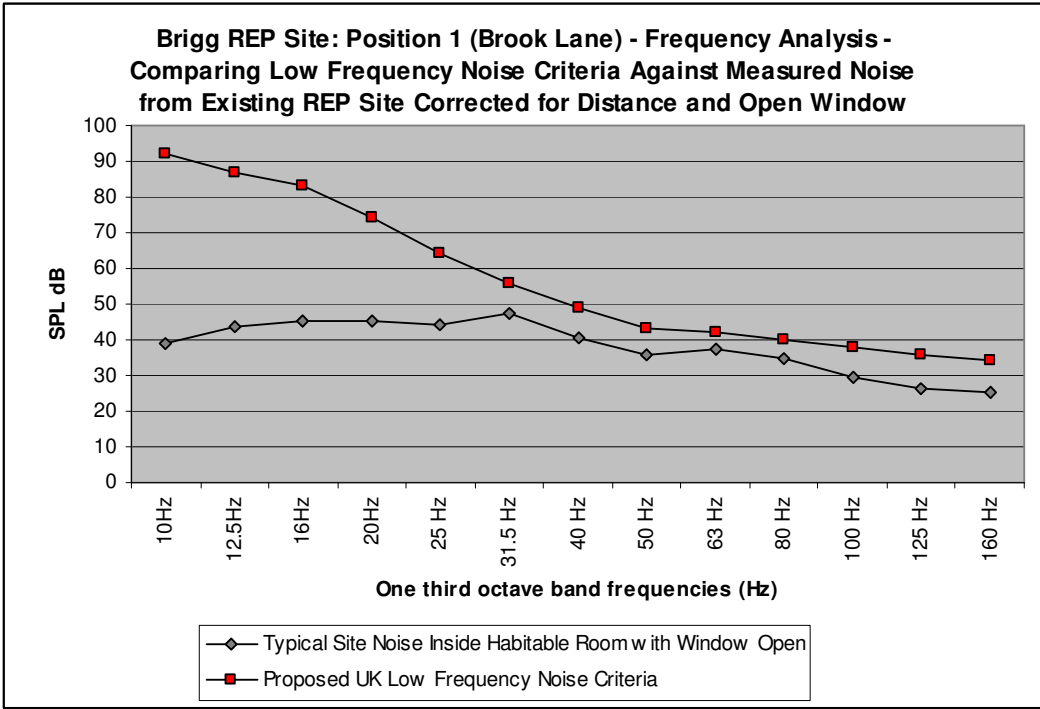
- a. $L_{10} - L_{90} < 5\text{dB}$
- b. The rate of change of sound pressure level (Fast time weighting) is less than 10dB per second.

Where the parameters are evaluated in the third octave band which exceeds the reference curve values (Table 9) by the greatest margin.

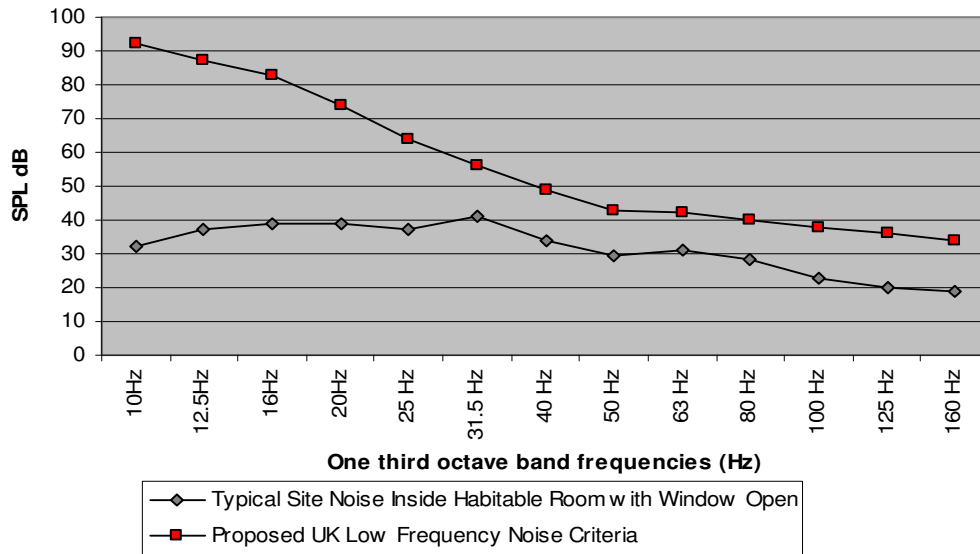
Table 9 Proposed reference curves

Hz	10	12.5	16	20	25	31.5	40	50	63	80	100	125	160
dB, Leq	92	87	83	74	64	56	49	43	42	40	38	36	34

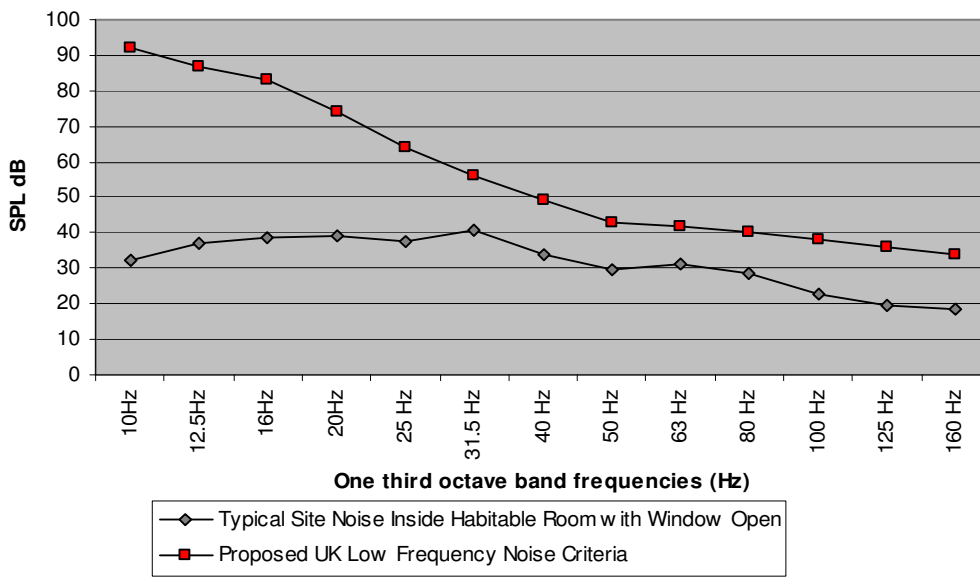
Predicted Internal Noise Measurements Corrected for Distance and Open Window at each receptor



Brigg REP Site: Position 3 (Mill Lane) - Frequency Analysis - Comparing LF Noise Criteria Against Measured Noise from Existing REP Site Corrected for Distance and Open Window



Brigg REP Site: Position 4 (Cadney Road) - Frequency Analysis - Comparing LF Noise Criteria Against Measured Noise from Existing REP Site Corrected for Distance & Open Window



APPENDIX 11.6

Construction Plant Inventory

Soil Movements:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Dozer	110	100	1.0
Excavator/Loader	108	100	1.0
Lorry	110	50	1.0

Piling:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Piling Rig (Auger)	110	100	1.0
Lorry	110	50	1.0

General Site Noisy Activities:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
JCB	108	100	1.0
Dumper	95	100	1.0
Lorry	110	50	1.0
Compressor	98-105	100	1.0
Generator	105	100	1.0

Infrastructure Construction:

Plant Type	Sound Power Level	% Operating Time	Distance Ratio
Asphalt Melter	103	100	1.0
Asphalt Spreader	96	10	1.0
Lorry	110	100	1.0
Truck Mixer	100	100	1.0
Concrete Pump	107-118	100	1.0
Poker Vibrator	112	100	1.0

APPENDIX 11.7

Assumed Noise Levels for Site Plant

Plant Type	Sound Pressure Level LAeq dB @ 1 metre	Assumed % Operating Time	Period of Operation
Radiator Coolers	80	100	Daytime/Night-time
Transformer	70	100	Daytime/Night-time
Grab Cranes (externally)	75	100	Daytime
Straw Barns (externally)	65	100	Daytime/Night-time
Conveyors (enclosed)	73	100	Daytime/Night-time
Fan Stack (top)	75	100	Daytime/Night-time
Flue Gas (top)	75	100	Daytime/Night-time
Air cooled condenser	80	100	Daytime/Night-time
Compressor Room (externally)	70	100	Daytime/Night-time
Silos	72	100	Daytime/Night-time
FGT Plant (externally)	75	100	Daytime/Night-time
Turbine Hall (externally)	76	100	Daytime/Night-time
Boiler House (externally)	66	100	Daytime/Night-time
Bottom Ash Silo	68	100	Daytime/Night-time
HGVs	82	100	Daytime
Fans	80	100	Daytime/Night-time
Pump House (externally)	70	100	Daytime/Night-time
Wood Storage (externally)	68	100	Daytime/Night-time
Ventilation Openings	75	100	Daytime/Night-time

APPENDIX 11.8

Vibration Monitoring Details

Instrumentation

The following instrumentation was used for all vibration measurements:

Manufacturer	Description	Type	Serial No.
Nomis	Portable Field Seismograph	Mini-Supergraph	10708

The following set-up parameters were used on the Seismographs during vibration measurement:

PPV

Mode: Continuous
Range: Up to 2mm/sec
Scan Time: 10 seconds
(Trigger: 0.3mm/sec)

Survey Dates and Personnel

Vibration levels were measured over a two hour period on Thursday 31st May 2007. The survey was conducted by Mr D.R. Kettlewell of Noise & Vibration Consultants Limited.

Meteorological Conditions

Weather conditions were noted during the survey period.

Dry, overcast with a light westerly wind (0-1m/s). Temperature 10-12deg C.

APPENDIX 11.9

VIBRATION TERMINOLOGY

VIBRATION TERMINOLOGY

Ground Borne Vibrations

For any source of vibration on or near the surface of the ground, energy propagates away from the source via:

- a) elastic body (or compression) waves – which radiate energy into the ground in all directions
- b) surface (or shear) waves – which carry energy along the ground surface, caused when body waves are reflected back into the ground at the ground-surface interface

Thus, at any point away from that source, the ground motion is the sum of all the wave motions at that point. When wave motion has been generated, the waves will be attenuated as they travel away from the source. The two main mechanisms for attenuation are:

- a) enlargement of the wave front as the distance from the source increases, and
- b) internal damping of the transmitting medium (the ground)

Ground borne vibration is therefore made up of a combination of different waves, travelling in different directions, at different speeds and at different frequencies. The frequency component of the vibration will affect the rate at which attenuation occurs since the internal damping of the ground is frequency dependent.

Since vibration enters buildings through the foundations, the hard structure of the building is normally affected to a greater degree than by air borne vibration. Often ground borne vibrations are more noticeable when standing or sitting near the middle of suspended wooden floors.

Ground Borne Vibration Measurement Units

Ground borne vibration is caused when the individual particles making up the strata are caused to oscillate by the passage of a pressure wave. The resulting vibration can be summarized in terms of 4 main parameters:

- a) **Velocity** – how fast the particles move when they are oscillating.
Since the velocity of these particles continually change as the pressure wave passes the most useful value that is often reported is the maximum or peak particle velocity (PPV). PPVs are usually expressed in terms of ms^{-1} or mms^{-1} .
- b) **Acceleration** – is the rate at which the particle velocity changes during oscillation. It is usually measured in ms^{-2} mms^{-2} or “g’s”. 1g is that acceleration imparted to an object by the earth’s gravitational pull and is approximately 9.81 ms^{-2} .
- c) **Displacement** – is the distance moved by oscillating particles. This is usually very small and measured in mm or even μm .
- d) **Frequency** – is the number of oscillations per second which a particle undergoes due to the passage of a vibration wave. It is measured in cycles per second or Hertz (Hz).

The movement of particles induced to oscillate by vibration waves are usually measured in three mutually perpendicular directions to fully describe the vibration intensity, as particles will be oscillating in three dimensions. These are:

- a) **Longitudinal** – back and forth particle movement in the same direction that the vibration wave is travelling.
- b) **Vertical** – up and down movement perpendicular to the direction the vibration wave is travelling.
- c) **Transverse** – left and right particle movement perpendicular to the direction the vibration wave is travelling.

APPENDIX 11.10

Consultants Experience & Qualifications

Test Engineer: Dean Robert Kettlewell - MSc MIOA MAE I.Eng

(Director - Principle Acoustic Consultant)

Précis

As Director and Principle Acoustic Consultant with Noise & Vibration Consultants Ltd, Dean has over 24 years background experience in a wide range of issues relating to environmental, industrial and commercial noise and vibration assessment. He currently manages corporate and unit specific contracts for:

- Assessment of Environmental & Industrial Noise
- Environmental Noise Impact Assessments
- Expert Witness representation for Deafness and `Vibration White Finger' Claims
- Integrated Pollution Prevention and Control (IPPC) Applications
- Industrial Noise Assessment and Control
- Planning Issues for Residential and Commercial Development
- Noise at Work Regulations Assessments
- Building Acoustics and Sound Insulation Tests
- Wind Farm Noise Impact Assessments
- Entertainment Noise Assessment and Control
- Architectural Acoustics
- Specialist knowledge in the Design of Noise Control Systems
- Ground borne vibration measurement and assessment
- Project Management of Noise Control Systems
- Hand-arm Vibration Assessments

Relevant Work Experience

Director & Principle Consultant - Noise & Vibration Consultants Ltd	2001- to date
Senior Acoustic Consultant - Vibrock Limited	1998 - 2001
Associate & Principle Acoustic Consultant - John Savidge & Associates	1994 - 1998
Technical Manager – LBJ Limited (Noise Control Division)	1990 - 1994
Technical Engineer/ Technical Manager (1988) - Vibac (Noise Control) Ltd	1982 - 1990

Qualifications and Education

M.Sc. Applied Acoustics (Derby University – Distinction)
HNC Electrical & Electronic Engineering
IOA Diploma in Acoustics & Noise Control
IOA Certificate in Law and Administration
Certificate of Competence in Workplace Noise Assessment
Certificate of Competence in Ground Vibration Monitoring
Post Graduate Certificate in Applied Acoustics

Affiliations: Member of Institute of Acoustics (MIOA)
Member of Academy of Experts (MAE)
Member of Association of Noise Consultants (ANC)
Incorporated Engineer (I.Eng)