N&V

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NOISE REPORT

Prepared For: Nurendale Ltd (Panda Waste)

Phase 4 Recycling Facility

Report Prepared by: Brendan O'Reilly, Noise & Vibration Consultants Ltd (August 2009)

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1 Noise

1.1 Introduction

This report deals with the potential noise emission impacts associated with a proposed extension to the existing materials recycling facility at Rathdrinagh, Beauparc, Navan, Co. Meath. The development consists of the construction of phase 4 facility building, air treatment biofilter and CHP unit. Two steel and two concrete storage tanks will also be constructed which will house a waste anaerobic digestion and composting system. The purpose of this study is to:

- establish existing noise levels in the environs surrounding the proposed development prior to any activity
- project the noise levels generated by construction and completed development
- specify mitigating measures where deemed necessary

Acoustic Terminology

Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment and is normally localised. Environmental noise is normally assessed in terms of A-weighted decibels, dB(A), where the A weighted filter in the measuring device elicits a response which provides a good correlation with the human ear. The criteria for environmental noise control are of annoyance or nuisance rather than damage. In general a noise level is liable to provoke a complaint whenever its level exceeds by a certain margin the pre-existing noise level or when it attains an absolute level. A change in noise level of 2 dB(A) is 'barely perceptible', while an increase in noise level of 10 dB(A) is perceived as a twofold increase in loudness.

Historically road traffic noise has been assessed using the L_{10} dB(A) parameter, the levels expressed as the arithmetic mean hourly value over specified time. Recent draft guidelines by the National Roads Authority recommend the use of the equivalent continuous levels, $L_{(Aeq)}$. For construction or industrial noise sources the assessment is usually expressed in equivalent continuous levels, $L_{(Aeq)}$. The acoustic terminology used in this report is more fully explained in the Appendix.

2.0 The Receiving Environment

2.1 Baseline Noise Survey

A baseline noise survey was carried out at a key location nearest residents in the environs of the proposed development. Continuous monitoring was undertaken over a period from 13th to 16th August 2009. Weather was mainly dry during the survey with average wind speeds less than 5m/s. The following conditions were adhered to in undertaking the survey:

- Measurement of ambient noise levels was undertaken during varied weather conditions using instruments of Type 1 specification.
- Monitoring locations were selected to coincide with local residences.
- Measurements were undertaken during weekday and weekend periods.
- The survey was carried out in accordance with ISO 1996 Part 1 (Description and Measurement of Environmental Noise - Part 1: Basic Quantities and Procedures)

Instrumentation Used

The following instrumentation was used in the baseline survey:

- Two Larson Davis 870 Precision Integrating Sound Level Analyser/Data logger with 900B Pre-amplifier and 1/2" Condenser Microphone Type 2541.
- Wind Shields Type: Larson Davis 2120 Windscreen.
- Calibration Type: Larson Davis Precision Acoustic Calibrator Model CA 250. (Serial No 1087).

Measurement Procedure

Monitoring was carried out at two locations (see noise prediction figure in Appendix) using environmental noise analysers with data logging facilities set on real time, the logged data was downloaded via a personal computer using computer software. The measurement location was as follows;

N1: Located at 35m from road edge, in garden along side of house facing existing facility

N2: Located in back garden of house facing existing facility

At monitoring location the microphone was located at 1.5m above ground level and away from reflecting surfaces. All acoustic instrumentation was calibrated before and after each survey and no drift of calibration was observed (calibration level 114 dB at 250 Hz).

2.2 Results of Noise Survey

The existing noise levels were established during a period of continuous monitoring at a location along the boundary of the proposed development area. The result of this survey, which contains the total noise is typical of a environment which is located alongside an existing industrial site and busy National Primary Route (N2). Road traffic and industrial noise dominates the local environment. The complete dataset from the baseline study is given in the Appendix. A summary of the hourly intervals (mean values) measurements are given in Table 2.1 below.

Table 2.1 Baseline noise levels mean values – 1 hour interval data

Location	Date	Day-Time			Night-Time		
		Leq	L10	L90	Leq	L10	L90
N2	13th – 16th Aug'09	55.3	57.4	49.0	44.1	47.2	35.3
N1	13th – 16th Aug'09	52.1	54.2	46.8	47.9	50.9	42.3

Note Levels quoted are for mean (arithmetic average) for specified periods
Day-time is 08.00 to 20.00 hrs, night-time is 20.00 to 08.00 hrs

3.0 Characteristics of Proposal

The proposed development consists of a number of noise sources (anaerobic digestion and composition system, CHP unit, air treatment biofilter system, shredder and trommel screen and front-end loaders) which will be contained inside the main building. The noise levels associated with this development would be from construction and the operation of completed facility. There will be no increased in traffic flow generated on the local road network from the completed development.

4.0 Potential Impacts of the Proposal

The proposed development consists of:

- construction of the main building and holding tanks
- the operation of the completed facility

Noise Criteria

Noise level measurement are made and assessed based on *ISO 1996 Description and Measurement of Environmental noise (3 Parts).* This standard does not use a criterion of differentials, however, an increase in noise level of 5 dB(A) is considered as one of only

marginal significance. In general a noise is liable to provoke a complaint whenever its level exceeds by a certain margin the pre-existing noise level or when it attains an absolute level. The method of deriving a criterion is related to the existing ambient noise level taking into account the various features of the existing noise environment at the nearer noise sensitive residences.

For outdoor noise at residential properties the basic criterion for night-time is normally less than 45 dB(A), while the day-time criterion is normally less than 55 dB(A). Local Authorities throughout Ireland and the EPA through their Licensing apply the aforementioned limits. The existing facility has a waste licence and limits are set under conditions by the EPA. For this proposed development existing limits will apply and these are: for night time (20.00 to 08.00 hrs) 30 minute Leq limit of 45 dB(A) will apply at all residences with a day time (08.00 to 20.00 hrs) 30 minute Leq limit of 55 dB(A). There should be no clearly audible tonal component or impulsive noise emission from activity at any noise sensitive location at night time.

4.1 Typical Construction Noise Sources and Noise Levels

Leq measurements were taken of construction noise sources at other sites within the country at 20m from the geometric centre of activity when the equipment was in continuous operating mode. Noise levels of these noise sources are given in Table 4.1 and were as follows:

Table 4.1 Noise levels from construction activity at 20m

Noise Source	Noise Level Leq 1 hour
Readymix truck	70 dB(A)
Large Excavator	73 dB(A)
Vibratory Roller	68 dB(A)
Dump truck	71 dB(A)

4.2 Calculation and Prediction of Construction Noise

Methodology

The predicted noise levels generated by construction activity (or indeed any noise source) at a particular location can be calculated according to the following formula:

$$Lp2 = Lp1 + \Delta L\psi - \Sigma\Delta L \text{ where,}$$

Lp2 = Sound Pressure level in decibels at Residence.

Lp1 = Sound pressure level in decibels at 20 metres.

$\Delta L\psi$ = correction for direction effects in a horizontal plane,

$\Sigma\Delta L = \Delta Ld + \Delta La + \Delta Lr + \Delta Ls + \Delta Lv + \Delta Lg + \Delta Lw$, and where,

ΔLd = geometric spreading (spherical radiation) and is calculated according to:

$\Delta Ld = 20 \log_{10} (d1/d2)$, where, d1 is the residence distance in metres, while d2 is 20 metres.

ΔLa = air absorption

ΔLr = reflection and diffraction

ΔLs = screening

ΔLv = vegetation

ΔLg = ground absorption

ΔLw = wind gradients

The attenuation effects due to air absorption, reflection, refraction and vegetation is small within distances of 100m and in the predictive calculation the attenuation from these factors is assumed to be zero at such distance. The other attenuating factors have been taken accounted for in the proposed development. The predicted levels are given in Table 4.2

Table 4.2 Predicted noise levels at key locations from construction activity

Receiver Position	Predicted Maximum Levels L_{AeqT} - 1 hour dB(A)	Predicted Typical Levels L_{AeqT} - 1 hour dB(A)
N1	54.5	<45
N2	52.8	<45
N3	50.5	<45
N4	49.2	<45

Note: A 4m high acoustic berm constructed on the boundary of the site using topsoil will reduce the noise emissions at house locations by more than of 8 dBA. The maximum Leq noise levels will pertain for short periods (less than one-week equivalent at any location for the entire project), while typical noise levels are for a period in excess of 50% of the total construction period.

Commentary

All construction will be carried out in accordance with BS 5228: Part 1: 2009[1]. All construction traffic to be used on site should have effective well-maintained silencers. Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery and limiting the hours of site activities that are likely to give high noise level

[1] Noise and Vibration Control on Construction and Open Sites BS5228- Part 1: 2009 *Code of Practice for Basic Information and Procedures for Noise Control*)

emissions. Where possible the contractor will be instructed to use the least noisy equipment. With efficient use of well maintained mobile equipment considerably lower noise levels (3-6 dB(A)) than those predicted can be attained. The Project Engineer will closely supervise all construction activity. Construction activity due to its nature is a temporary activity and thus any impacts will be short term. All construction works will be carried out during daytime periods.

4.3 Noise Impacts from Operation of Completed Phase 4 Facility

The main noise sources associated with the operation of the phase 4 facility are housed inside a building structure. Table 4.3 gives the main noise sources and associated noise levels.

Table 4.3 Main noise sources and associated noise levels

Item of Plant	Noise Level (dBA) @ 1m	Comment
CHP unit- JMC 316 GS-B.L (rating 1400kva) inside	87	Unit housed inside an acoustically insulated container which will be located inside superstructure
Anaerobic digester and composition system	80	All fans will be housed inside acoustic housing structure (fan room) which will be located inside the superstructure
Output fans x 8 each rated at 11kw	83	
Input fans x 8 each rated at 22kw		
Stack Fan	75	At stack exit
Air treatment biofilter system Fans x 3 each at 55kw	80	Free-field having passed through acoustic ducting- Fans to be located inside fan room
Shredder	96+	Measurement inside building
Trommel screen	95+	Measurement inside building
Transfer conveyor	80+	Measurement inside building
Front-end loader x 3	98+	Measurement inside building
Telescopic loader	95+	Measurement inside building
Biofilter pump	75	Free-field
Scrubber pump	78	Free-field
Dosing pump	80	Free-field

NB The main building is referred to as superstructure

+ Operating during day time only. All other equipment will operate at night time 24/7

Prediction of Operational noise

The predicted noise levels are given in Table 4.4. In the calculations the transmission loss of 30 dBA provided by the superstructure (main building) was taken into consideration. The superstructure will be constructed of a base wall of minimum height of 3m with the finished height and roof of Kingspan double skinned cladding or equivalent. As a conservative measure no allowance was made for the attenuation provided by a 4.5m high acoustic earth berm.

Table 4.4 Predicted noise levels from operation of stage 4 facility

Receiver Position	Day time L_{AeqT} - 1 hour dB(A)	Night time L_{AeqT} - 1 hour dB(A)
N2	42.0	<35
N3	40.8	<35
N4	42.5	<35
N5	38.5	<35
N6	37.2	<35

NB The predicted Leq 1 hour level will be similar to a Leq 30 minute level

House N1 is owned by the developer

5.0 Road Traffic Impacts

There will be no increase in road traffic generated by this development and accordingly there will be no increase in road traffic noise at any residence.

6.0 Ground Vibration

Ground vibration can be generated from construction traffic, light vehicles on the roadway and by construction activity. The level of ground vibration generated by the development will be below the threshold of perception (0.2-0.3mm/sec).

7.0 Mitigating Measures for Noise Control

The following mitigating measures will be put in place:

- A 4m high acoustic berm will be constructed on the perimeter of the facility using topsoil excavated from the site.

- Operators of all mobile equipment will be instructed to avoid unnecessary revving of machinery, turn off equipment / plant when not in use and limit the hours of site activities that are likely to give high noise level emissions.

- All extraction fans, openings for cooling units/vents to the outside of the main building (superstructure) will be acoustically treated (by acoustic louvers or alternative) so that noise emissions at the complex boundary will be less than 45 dB(A) and less than 35 dBA at all residences (with no clearly audible tonal component).

- The housing envelope of main building (superstructure) will have a concrete base wall with a minimum height of 3m with the remaining height to finished height and roof, of Kingspan double skinned cladding with insulation, or equivalent. (a concrete wall of mass per unit area of 300kg/m^2 will give an average transmission loss of 50 dB^2 while a double skinned cladding of Kingspan type equivalent will give a sound transmission loss of 30 dB).

- All doors (including the roller shutter doors) to the main building will be kept shut during operations.

- Any openings for cooling or forced ventilation will have acoustic louvers or equivalent fitted.
- All fans will be housed inside the main building inside a fan room.

- The CHP container unit acoustically treated will be hosed inside the main building (superstructure).

8.0 Assessment and Conclusion

The maximum noise levels predicted will occur during the construction phase of the development and will pertain for short periods only. The noise impact from the operation of the completed phase 4 recycling facility will have a negligible noise impact by day and by night at all residences. Furthermore the noise levels at night time should be inaudible at all residences. As there is no increase in traffic being generated there should be no increase in road traffic noise at any residence

[2] Encyclopedia of Acoustics, Vol 3, Architectual Acouistics, M. J. Crocker (1997)

APPENDIX 1

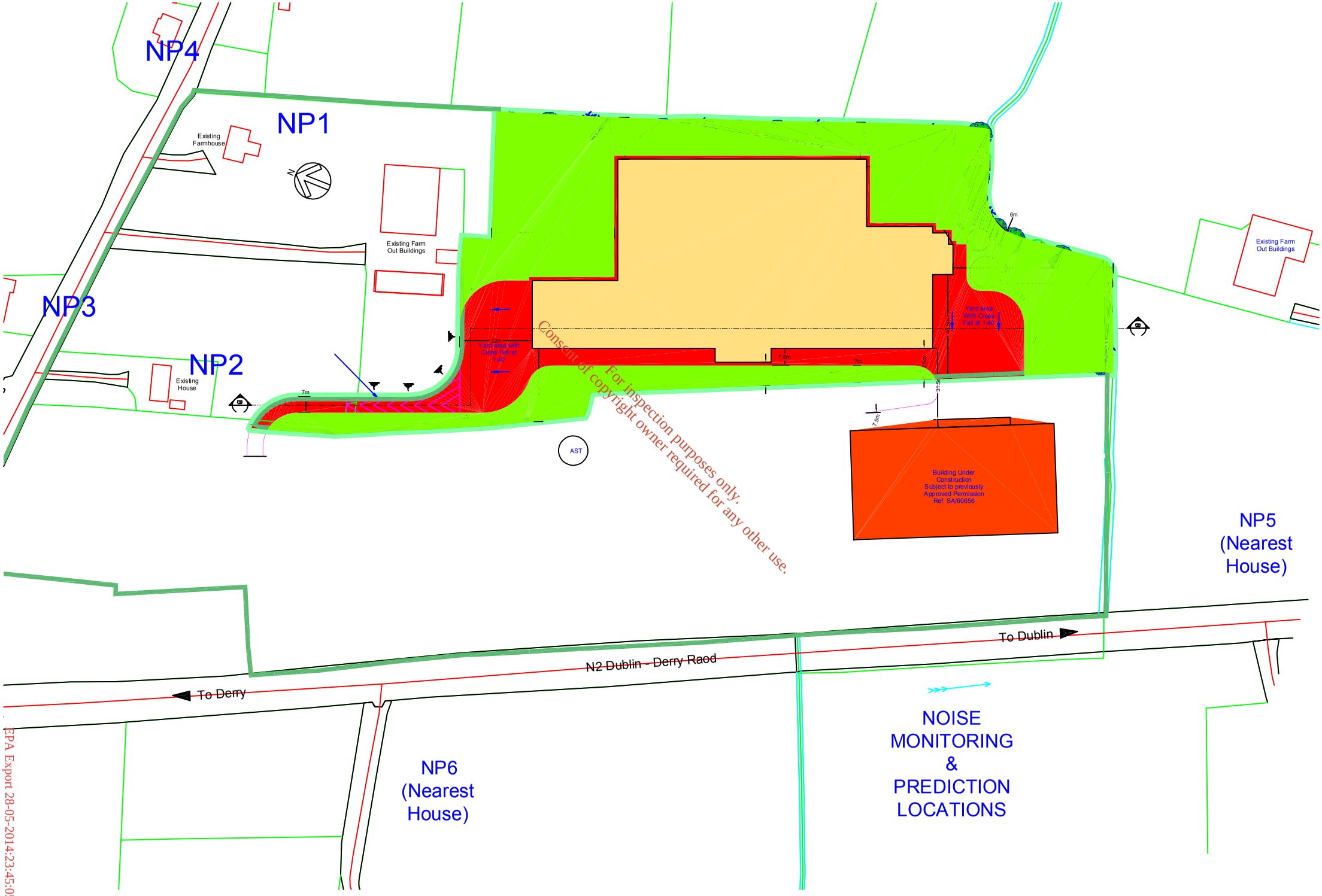

Table 1.0 **Location N1**

Model 870 Interval Report

From File: PANDA1.870

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Date	Time	Duration	Leq dBA	Lmax dBA	L5 dBA	L10 dBA	L50 dBA	L90 dBA
12Aug2009	12:55:16	04:43.9	59.3	85.2	62.2	58.6	53.7	47.1
12Aug2009	13:00:00	1:00:00	52.7	72	57.1	54	49.6	47
12Aug2009	14:00:00	1:00:00	50.8	68.7	54.6	52.5	48.6	46.3
12Aug2009	15:00:00	1:00:00	53.5	68.7	56.8	55.8	52.5	48.1
12Aug2009	16:00:00	1:00:00	60.2	80.2	64.2	61	55.1	51
12Aug2009	17:00:00	1:00:00	75.2	96	79.9	75	56.8	48.6
12Aug2009	18:00:00	1:00:00	52.3	72.2	57.2	54.1	49	45.8
12Aug2009	19:00:00	1:00:00	50.7	72.5	55.3	52.3	47.7	44.2
12Aug2009	20:00:00	1:00:00	49.8	73.7	53.3	50.1	45	41.2
12Aug2009	21:00:00	1:00:00	45.8	66.2	49.7	48	43.3	39.3
12Aug2009	22:00:00	1:00:00	44.6	62.2	48.8	47.2	42.2	37.2
12Aug2009	23:00:00	1:00:00	43.7	64.2	48.6	47.1	40.8	34.5
13Aug2009	00:00:00	1:00:00	41.6	60.8	46.3	44.6	38.6	34.2
13Aug2009	01:00:00	1:00:00	39.2	56.7	45.1	43.2	34.8	31.6
13Aug2009	02:00:00	1:00:00	38.6	52.8	43.8	42.2	35.7	31.6
13Aug2009	03:00:00	1:00:00	38	60	43.7	41.7	33.2	30.3
13Aug2009	04:00:00	1:00:00	40.1	56.8	45.7	43.8	36.7	31.1
13Aug2009	05:00:00	1:00:00	45.6	64.7	51.1	48.1	41.8	37.1
13Aug2009	06:00:00	1:00:00	48.8	72.5	52.7	51.3	46.5	41.7
13Aug2009	07:00:00	1:00:00	51.2	76.5	54.7	51.7	47.6	44.8
13Aug2009	08:00:00	1:00:00	50.5	68.5	54.5	51.8	48.3	46.2
13Aug2009	09:00:00	1:00:00	58.8	86.5	57.2	53.7	48	46
13Aug2009	10:00:00	1:00:00	50.7	74	55.9	52	47.2	44.5
13Aug2009	11:00:00	1:00:00	52.7	71	56.8	54.1	49.8	44.7
13Aug2009	12:00:00	1:00:00	53.6	72.9	58.5	55.6	50.2	46.8
13Aug2009	13:00:00	1:00:00	53.2	94.2	55.6	52.6	46.3	43.6
13Aug2009	14:00:00	1:00:00	54.1	75.4	58.2	55.7	51.7	46.2
13Aug2009	15:00:00	1:00:00	58.2	77	62.5	61.2	57.3	51.5
13Aug2009	16:00:00	1:00:00	53.6	73.2	57.3	55.6	51.2	47.6
13Aug2009	17:00:00	1:00:00	49.8	69	54	52	48.1	45.6
13Aug2009	18:00:00	1:00:00	53.7	72.2	57.2	55.5	50.7	47.2
13Aug2009	19:00:00	1:00:00	52.2	69.9	56.2	54.7	51	47.6
13Aug2009	20:00:00	1:00:00	50.7	69	55.3	53.8	48.7	44.2
13Aug2009	21:00:00	1:00:00	50	67.5	54.8	53.2	47.6	42.2
13Aug2009	22:00:00	1:00:00	47.7	65	52.7	51.1	45	37.7
13Aug2009	23:00:00	1:00:00	45.2	63.2	51	49	41.2	32.2
14Aug2009	00:00:00	1:00:00	46.5	66.9	52	48.7	39.2	30.5
14Aug2009	01:00:00	1:00:00	42.3	61.3	49.2	46.8	33.5	29
14Aug2009	02:00:00	1:00:00	42.2	59.1	49.1	46.2	35.2	29.3
14Aug2009	03:00:00	1:00:00	39.7	60.6	46.3	43	31.6	28.1
14Aug2009	04:00:00	1:00:00	41.7	61.2	47.7	45.2	35.8	31.3
14Aug2009	05:00:00	1:00:00	45.8	60.6	51.2	49.3	43.3	38.7
14Aug2009	06:00:00	1:00:00	52.7	75.2	55.7	53.7	48.8	44.2
14Aug2009	07:00:00	1:00:00	55.5	84.7	58.2	56.7	52.6	48.7
14Aug2009	08:00:00	1:00:00	55.1	69.7	58.3	57.5	53.7	50.6
14Aug2009	09:00:00	1:00:00	57.7	73.5	60.2	59.3	56.8	54.7
14Aug2009	10:00:00	1:00:00	60.2	89.4	62.2	61	57.2	52.7
14Aug2009	11:00:00	1:00:00	58.5	70.5	61.5	60.6	58	55.3
14Aug2009	12:00:00	1:00:00	58.1	71.2	61.5	60.6	57.6	53.8

Table 1.0 Cont'd **Location N1**

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14Aug2009	14:00:00	1:00:00	60.2	68.5	63.2	62.3	59.5	57.2
14Aug2009	15:00:00	1:00:00	60	71.5	62.8	62	59.2	56.8
14Aug2009	16:00:00	1:00:00	58.2	68.4	61.6	60.6	57.5	54
14Aug2009	17:00:00	1:00:00	57.2	75	60.8	59.7	56.2	53
14Aug2009	18:00:00	1:00:00	56.3	75.9	60.3	59.1	54.7	51.1
14Aug2009	19:00:00	1:00:00	53.7	66	59	57.2	51.2	46.7
14Aug2009	20:00:00	1:00:00	51.2	74.7	54.8	53	48.7	44.5
14Aug2009	21:00:00	1:00:00	53.7	95	54.5	53.1	48.2	43.3
14Aug2009	22:00:00	1:00:00	51.8	68.4	56.7	55.1	49.8	44.8
14Aug2009	23:00:00	1:00:00	52.2	66.7	57.3	55.8	50.2	44.7
15Aug2009	00:00:00	1:00:00	55.2	68.7	60.3	58.7	52.7	47
15Aug2009	01:00:00	1:00:00	54.2	69.5	59.2	57.5	52	46.7
15Aug2009	02:00:00	1:00:00	53.6	72.4	58.7	57	50.8	45.2
15Aug2009	03:00:00	1:00:00	52	66.4	57.2	55.6	49.7	44.2
15Aug2009	04:00:00	1:00:00	51.8	65.2	56.2	55	50.3	45.6
15Aug2009	05:00:00	1:00:00	50.3	65.5	55.3	53.7	47.7	43.1
15Aug2009	06:00:00	1:00:00	54.1	67.2	58.3	57.1	52.8	47
15Aug2009	07:00:00	1:00:00	55	71	58.8	57.3	53.3	50.6
15Aug2009	08:00:00	1:00:00	53.8	69	58	56.7	52.7	49.5
15Aug2009	09:00:00	1:00:00	54.3	67.5	58.8	57.1	52.6	49.2
15Aug2009	10:00:00	1:00:00	53.2	67.2	57.2	55.6	52.1	49
15Aug2009	11:00:00	1:00:00	52.1	68.2	56.3	54.6	50.7	48
15Aug2009	12:00:00	1:00:00	54.7	69.7	59.1	57.7	53.3	49.7
15Aug2009	13:00:00	1:00:00	57	85	60.2	58.7	53.8	49.7
15Aug2009	14:00:00	1:00:00	55.3	70.7	59.7	58.3	53.8	49.8
15Aug2009	15:00:00	1:00:00	54.2	69.4	59	57.5	52.3	48
15Aug2009	16:00:00	1:00:00	55.6	74.9	60.6	58.7	53.2	49.1
15Aug2009	17:00:00	1:00:00	54.2	67.7	58.7	57.2	52.3	48.7
15Aug2009	18:00:00	1:00:00	56.3	78.4	60.6	59.1	54.7	51
15Aug2009	19:00:00	1:00:00	53.6	68.7	58.2	56.7	52	48.2
15Aug2009	20:00:00	1:00:00	50.2	70.2	54.8	53.1	48	43.2
15Aug2009	21:00:00	1:00:00	49	67.4	53.8	51.7	46.2	41.7
15Aug2009	22:00:00	1:00:00	47.2	67	52.2	50.2	44.3	39.6
15Aug2009	23:00:00	1:00:00	46.1	65.2	51	49.3	43.5	38.2
16Aug2009	00:00:00	1:00:00	44.7	66.5	49.6	47.8	41.7	37
16Aug2009	01:00:00	1:00:00	44.2	60.5	49.2	47.3	41.6	36.8
16Aug2009	02:00:00	1:00:00	48	63.5	53.6	51.5	45	39.3
16Aug2009	03:00:00	1:00:00	49.2	63.3	55	52.8	46.1	40.5
16Aug2009	04:00:00	1:00:00	49.6	66.4	54.7	53	47	41.7
16Aug2009	05:00:00	1:00:00	50.8	68	56.2	54.2	47.8	42.7
16Aug2009	06:00:00	1:00:00	51.2	66.2	56.2	54.7	49.2	44
16Aug2009	07:00:00	1:00:00	53	67.7	57.7	56.2	51.1	46.7
16Aug2009	08:00:00	1:00:00	54	72.7	58.8	57.1	51.7	47.2
16Aug2009	09:00:00	1:00:00	53.6	72	58.2	56.7	51.7	47.2
16Aug2009	10:00:00	1:00:00	54.1	68.2	58.7	57.3	52.3	47.8
16Aug2009	11:00:00	1:00:00	55.1	68.5	59.6	58.2	53.5	49.2
16Aug2009	12:00:00	1:00:00	55.2	68.4	60.1	58.6	53.2	48.6
16Aug2009	13:00:00	1:00:00	54.5	67.5	59.1	57.7	52.8	48.5
16Aug2009	14:00:00	1:00:00	54.6	70.4	59	57.7	52.7	48.5
16Aug2009	15:00:00	1:00:00	54.8	79.2	59	57.6	52.5	48.1
16Aug2009	16:00:00	1:00:00	55.2	71.7	59.7	58.2	53.5	49.5

Table 2.0 **Location N2**

Model 870 Serial Number:A0313 Interval Report

From File: PAND2.870 Mon 17Aug2009 12:27:16

Period = 01:00 (hh:mm)

Date	Time	Duration	Leq dBA	Lmax dBA	L1 dBA	L5 dBA	L10 dBA	L50 dBA	L90 dBA
12Aug2009	11:50:49	09:10.7	52.6	78.7	55.8	54	53.2	51.5	50.1
12Aug2009	12:00:00	1:00:00	50.2	74.7	54.7	52.7	51.7	49.2	47.1
12Aug2009	13:00:00	1:00:00	49.5	64.2	53.8	52.2	51.5	48.8	47
12Aug2009	14:00:00	1:00:00	49.5	62.3	53.6	51.8	51.2	49.1	46.8
12Aug2009	15:00:00	1:00:00	50.5	60.5	54.7	53	52.2	50.1	48.1
12Aug2009	16:00:00	1:00:00	49	59.8	53	51.5	50.7	48.5	46.6
12Aug2009	17:00:00	1:00:00	46.7	65	54	50.7	49.2	45.2	42.2
12Aug2009	18:00:00	1:00:00	44.6	64.5	51.2	48.2	46.8	43.3	39.7
12Aug2009	19:00:00	1:00:00	45.2	76.2	51.1	47.2	45.8	42.1	38.5
12Aug2009	20:00:00	1:00:00	39.7	54	46.2	44	42.7	38.5	35
12Aug2009	21:00:00	1:00:00	39.1	64.7	46.3	43.2	41.7	37.2	32.8
12Aug2009	22:00:00	1:00:00	40.3	73.2	47.7	43.7	42.2	35.8	29.5
12Aug2009	23:00:00	1:00:00	36.3	55.1	45.1	42.1	40.2	33.2	28
13Aug2009	00:00:00	1:00:00	33.8	53.1	44	39.7	37.3	29.8	26.1
13Aug2009	01:00:00	1:00:00	32.8	48.6	42.2	38.2	36.3	30	25.8
13Aug2009	02:00:00	1:00:00	32.2	47.2	41.7	37.8	35.6	29.3	25.1
13Aug2009	03:00:00	1:00:00	37	56.5	45.7	42.2	40.2	33.3	25.6
13Aug2009	04:00:00	1:00:00	41.7	59.6	52.1	46.8	44.7	38.5	32.2
13Aug2009	05:00:00	1:00:00	46.7	69.5	57.6	52.8	50	42	36.5
13Aug2009	06:00:00	1:00:00	50.3	72.7	60.5	54.8	51.6	46.6	43.7
13Aug2009	07:00:00	1:00:00	51.3	77.5	60.2	54.7	52.2	48.8	47
13Aug2009	08:00:00	1:00:00	50.2	76.5	56.8	52.7	51.3	48.6	46.7
13Aug2009	09:00:00	1:00:00	48	71.5	53.5	50.7	49.7	47.2	45.1
13Aug2009	10:00:00	1:00:00	49.6	66.2	55	52.5	51.2	48.7	47.1
13Aug2009	11:00:00	1:00:00	49.8	62.6	55	52.6	51.6	49.3	47.8
13Aug2009	12:00:00	1:00:00	48.7	63.7	55.6	51.8	50.6	47.7	45.3
13Aug2009	13:00:00	1:00:00	51.7	70.5	57.3	55	54	51	48.6
13Aug2009	14:00:00	1:00:00	52.5	64.7	56.7	54.7	54	52.1	50.2
13Aug2009	15:00:00	1:00:00	51.3	66.2	57	54.2	53.2	50.7	47.8
13Aug2009	16:00:00	1:00:00	50.7	73.2	61.3	53	51.5	47.8	45.8
13Aug2009	17:00:00	1:00:00	48.7	65.2	53.7	51.5	50.5	48.1	46.1
13Aug2009	18:00:00	1:00:00	50.2	62.8	56	53.7	52.6	49.5	47.2
13Aug2009	19:00:00	1:00:00	49.2	61.6	55.8	53.3	52	48.1	43.7
13Aug2009	20:00:00	1:00:00	48.3	61.2	55.7	53.1	51.6	46.7	41.5
13Aug2009	21:00:00	1:00:00	47.3	61.8	55.6	52.7	51.2	44.7	36.3
13Aug2009	22:00:00	1:00:00	45.2	63.1	54.6	51	49.1	41.5	32.2
13Aug2009	23:00:00	1:00:00	41.7	57.7	51.2	47.7	45.6	37.7	30.3
14Aug2009	00:00:00	1:00:00	39.2	70	49.3	44.5	42.2	33.6	26.3
14Aug2009	01:00:00	1:00:00	39	57	49.7	45.2	42.8	32.7	26.1
14Aug2009	02:00:00	1:00:00	37.7	57.2	48	44	41.7	31.3	25.3
14Aug2009	03:00:00	1:00:00	41.5	60.2	51.3	47.7	45.2	37.1	28
14Aug2009	04:00:00	1:00:00	44.7	60.6	53.7	50.1	48.2	41.6	34.3
14Aug2009	05:00:00	1:00:00	49.7	62.7	57.2	54.5	53	48	42.8
14Aug2009	06:00:00	1:00:00	52.6	72	58.1	56	55.1	51.7	48.3
14Aug2009	07:00:00	1:00:00	54.2	67.2	59.6	57.7	56.7	53.2	50.5
14Aug2009	08:00:00	1:00:00	56.3	72	60.7	59	58.2	55.8	53.8
14Aug2009	09:00:00	1:00:00	56.7	78.9	63.1	59	58.2	55	50.7
14Aug2009	10:00:00	1:00:00	56.6	70.4	61.3	59.7	58.8	55.8	53.2
14Aug2009	11:00:00	1:00:00	57.3	76	62.6	60.6	59.7	56.7	53.2
14Aug2009	12:00:00	1:00:00	55.3	66.9	61	59	57.8	54.5	51.7

Table 2.0 Cont'd **Location N2**

Model 870 Interval Report

From File: PAND2.870

Period = 01:00 (hh:mm)

Date	Time	Duration	Leq dBA	Lmax dBA	L1 dBA	L5 dBA	L10 dBA	L50 dBA	L90 dBA
14Aug2009	13:00:00	1:00:00	57.7	66.5	62.3	60.7	59.8	57.2	54.5
14Aug2009	14:00:00	1:00:00	57.5	72	62.1	60.6	59.7	56.8	54.3
14Aug2009	15:00:00	1:00:00	56.6	68.5	61.6	59.7	58.8	56	53.2
14Aug2009	16:00:00	1:00:00	55.2	66	60.5	58.7	57.8	54.6	51.1
14Aug2009	17:00:00	1:00:00	53.8	73.5	60.2	57.8	56.7	52.6	48
14Aug2009	18:00:00	1:00:00	52.2	70	59.8	57.5	55.7	50.2	44.6
14Aug2009	19:00:00	1:00:00	48.5	71.5	55.8	53.2	51.8	46.6	41
14Aug2009	20:00:00	1:00:00	51.8	92.2	56.5	53.3	51.7	45.8	40
14Aug2009	21:00:00	1:00:00	47.7	66.9	56.5	53.3	51.7	44.5	37.8
14Aug2009	22:00:00	1:00:00	46.7	67	56.7	52.7	50.6	42.1	36.6
14Aug2009	23:00:00	1:00:00	46.3	66.7	56.6	52	49.7	42.1	37.6
15Aug2009	00:00:00	1:00:00	46.3	63.7	56.1	52	49.7	42.7	38.2
15Aug2009	01:00:00	1:00:00	44.2	64.2	54.7	49.6	46.8	40.2	35.7
15Aug2009	02:00:00	1:00:00	43.7	62.2	53.8	49.2	46.3	40.1	35.7
15Aug2009	03:00:00	1:00:00	45.2	60.7	54.6	50.3	48.1	42.6	39.2
15Aug2009	04:00:00	1:00:00	44.7	69.4	54.7	50	47.7	40.6	36.6
15Aug2009	05:00:00	1:00:00	48.6	65.7	57.1	53.7	52.1	46.7	38.3
15Aug2009	06:00:00	1:00:00	52.2	64.2	58.5	56	54.7	51.2	48.7
15Aug2009	07:00:00	1:00:00	53.1	68.9	60.8	56.8	55.3	51.5	49.1
15Aug2009	08:00:00	1:00:00	52.7	67.9	58.8	56.3	55.2	51.7	49.3
15Aug2009	09:00:00	1:00:00	51.2	71.9	56.8	54	53	50.2	48.1
15Aug2009	10:00:00	1:00:00	50.5	65	55.7	53.2	52.3	49.7	47.7
15Aug2009	11:00:00	1:00:00	52	70.7	57	55	54	51.2	49
15Aug2009	12:00:00	1:00:00	52.6	79.4	59.2	55.3	54.2	50.5	47.3
15Aug2009	13:00:00	1:00:00	51.3	73.7	59.1	54.8	53.5	49.7	46.2
15Aug2009	14:00:00	1:00:00	50.8	74	58	54.6	53.3	49.2	44.3
15Aug2009	15:00:00	1:00:00	53.7	83	62.3	57	56	50.3	46
15Aug2009	16:00:00	1:00:00	50	67.5	56.7	54.2	53	48.5	44.5
15Aug2009	17:00:00	1:00:00	52	81.2	58.2	55.8	54.6	50.5	46.6
15Aug2009	18:00:00	1:00:00	50	66	57.1	54.5	53.2	48.5	43.7
15Aug2009	19:00:00	1:00:00	47.8	70	55.7	52.7	51.2	45.7	39.7
15Aug2009	20:00:00	1:00:00	46.6	64.5	54.5	51.7	50.2	44.2	38.2
15Aug2009	21:00:00	1:00:00	44.2	59.7	53.2	49.8	48.1	41.3	33.7
15Aug2009	22:00:00	1:00:00	42.3	58.3	51.5	48.2	46.2	38.7	31.1
15Aug2009	23:00:00	1:00:00	42.3	62.3	52.8	48.8	46.2	36.3	29.3
16Aug2009	00:00:00	1:00:00	40.7	59.8	50.8	47	44.7	35	30
16Aug2009	01:00:00	1:00:00	41.3	61	51.8	47.2	44.8	36.3	31.6
16Aug2009	02:00:00	1:00:00	41.5	60.7	52.5	47.1	43.7	37.5	34.1
16Aug2009	03:00:00	1:00:00	43.2	64	54.6	49.1	45.8	38.2	34.2
16Aug2009	04:00:00	1:00:00	41.8	59.1	52.3	47.2	44.3	38.6	34.8
16Aug2009	05:00:00	1:00:00	46.6	72.2	56.7	52.7	50.3	41.1	36.2
16Aug2009	06:00:00	1:00:00	47.7	65.5	57.6	53.7	51.7	43.3	38.5
16Aug2009	07:00:00	1:00:00	47.6	68.5	56.3	52.7	50.8	44.7	40.6
16Aug2009	08:00:00	1:00:00	49.1	66.7	57	54.1	52.5	46.7	41.5
16Aug2009	09:00:00	1:00:00	50.2	64.2	57.8	55	53.5	48.2	42.8
16Aug2009	10:00:00	1:00:00	51.3	66.5	58.6	55.8	54.6	49.7	44.6
16Aug2009	11:00:00	1:00:00	50.7	70.2	57.8	55.1	53.7	49	44.1
16Aug2009	12:00:00	1:00:00	55.8	77.9	68.5	59.3	57.5	50.7	45.3
16Aug2009	13:00:00	1:00:00	60.2	81.5	73	65.7	59.2	51.3	46.3
16Aug2009	14:00:00	1:00:00	51.3	79.5	58.7	55.2	53.7	49	43.8

Acoustic Terminology

Sound is simply the pressure oscillations that reach our ears. These are characterised by their amplitude, measured in decibels (dB), and their frequency, measured in Hertz (Hz). Noise is unwanted or undesirable sound, it does not accumulate in the environment and is normally localised.

Units of Measurement

The units of measurements of noise must reflect our overall response to it. The basic difficulty in measuring noise is the huge range of sensitivity of the ear. Audible sound pressures range between the threshold of hearing ($0.00002 N/m^2$) and the threshold of feeling ($20 N/m^2$) which corresponds to a ratio of 1 to 1,000,000. In order to cover this wide range, a logarithmic unit, the decibel (dB) is used. The dB scale ranges from 0 to 120/140 dB. While the size of the pressure fluctuations is measured in dB, the rate of pressure fluctuations is measured in cycles per seconds or Hertz (Hz).

The human ear has a limited frequency range from about 20 Hz to 20 kHz, the upper end depending on the age of the person and previous exposure to high levels of noise. Within that range the ear can tolerate low frequencies more than middle to high frequencies and we must ensure that any measurement device elicits a numerical value which matches the ear's response. This is achieved by introducing an electronic filter (called an A-weighted filter) into the measuring system. This weighting characteristic provides good correlation with the noise annoyance, and, since it's maximum lies in the frequency region where the ear is most sensitive, it takes into account the hearing damage potential of the noise. For this reason environmental noise levels are generally measured in terms of A weighted decibels, dB(A). A noise level in excess of 85 dB(A) gives a significant risk of hearing damage. A noise level increase of 2 dB(A) is barely perceptible while an increase in noise level of 10 dB(A) is perceived as a twofold increase in ‘loudness’.

Statistical Noise Indices

Where noise levels vary in time, statistical analysis of the variation can be carried out. The results are usually stated in the form L_N (L for level), where N is the percentage of time a level is equalled or exceeded. Hence if L_{90} = 40 dB(A), the noise level exceeds 40 dB(A) for 90% of the time measured period (i.e. background noise level is 40 dB(A). Background noise level could be described as the lowest 10% of noise level over a given period

In addition to the statistical units, the equivalent continuous level is also measured. The equivalent continuous level, L_{eq}, is measured in dB(A) and is a notional steady level that has the same sound energy as the real fluctuating sound over the measurement period. It is measured using an integrating sound level meter.

Noise Criteria

The criterion is one of annoyance or nuisance rather than damage. The relevant standard presently in use is ISO 1996 (3 Parts). This standard does not use the criteria of differentials, however an increase in noise level of 5 dB(A) is considered as one of only marginal significance. In general a noise is liable to provoke a complaint whenever its level exceeds by a certain margin the pre-existing noise level or when it attains an absolute level. The method of deriving a criterion is related to the existing ambient noise level taking into account the various features of the noise environment at the nearest relevant residences to the development**.**

In accordance with International Standard ISO 1996 (3 Parts) and British Standard 4142: 1990, most planning criteria are now stated in terms of L_{Aeq}.

Road traffic noise may cause annoyance and the parameter currently used in the assessment of traffic noise is the L10 dB(A) level. The parameter used in the UK (Ref; Calculation of Road Traffic Noise 1988, Dept of Transport Welsh Office: HMSO) and until recently by Local Authorities in Ireland is the 18 hour L10, this is the arithmetic mean of the hourly L10 levels in the period 06.00 to 24.00 hours. . Recent draft guidelines (Jan'04) by the National Roads Authority recommend the use of the equivalent continuous levels, $L_{(Aeq)}$ and specifying night time as23.00 to 07.00 hrs.

Construction and industrial noise is usually expressed in L_{Aeq}. The daytime criterion for industrial noise is normally between 45 - 55 dB(A) (Ref EPA's Guidance Note in Relation to Scheduled Activities). For construction development noise there are no Irish Standards applicable, however it is normal to apply one of best endeavour, which means keeping the daily Leq values as low as practicable (less than 65 dB(A)).

APPENDIX 2

Noise Impact Assessment: Site Fully Operational

The predicted noise levels at the monitoring locations when all four Buildings are operational are presented in Table 1. The monitoring locations are shown on the Map in the Noise & Vibrations Consultants Ltd Report

Table 1

Receiver Position	Day time L_{AeqT} . 1 hour dB(A)	Night time L_{AeqT} . 1 hour dB(A)
N2 (N2*)	50.0	<35
N3	48	<35
N4 (N2B*)	49	<35
N5	45	<35
N6	46	<35

* Monitoring point specified in the Waste Licence

The existing noise levels on the perimeter of the enlarged site will not be changed substantially due to a number of reasons

(a) all new facilities Buildings 3 and 4 will have noise sources housed
(b) the main noise sources for Building 3 are already on site and will be relocated into Building 3
(c) the wood shredder will be moved from the open yard into Building 3