Aberdeen Recycling and Energy

ABERDEEN CITY COUNCIL

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The Moray Council

East Tullos Energy From Waste Environmental Statement

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Sound Terminology

Appendix 10.A Sound Terminology

The ratio between the quietest audible sound and the loudest tolerable sound is a million to one in terms of the change in sound pressure. Due to this wide range, a scale based on logarithms is used in noise level measurement. The scale used is the decibel (dB) scale which extends from 0 to 140 dB, corresponding to the intensity of the sound pressure level.

The ear has the ability to recognise a particular sound depending on the pitch or frequencies found at the source. Microphones cannot differentiate sound in the same way as the ear; and to counter this weakness the sound measuring instrument applies a correction to correspond more closely to the frequency response of the ear. The correction factor is called "A-weighting" and the resulting measurements are written as dB(A). "A-weighting" refers to the noise level that represents the human ear's response to sound.

The dB(A) unit is internationally accepted and has been found to correspond well with people's subjective reaction to sound. Typical dB(A) noise levels for familiar sounds are given in Table A.1:

Table A.1 Typical Sound Levels

Sound Pressure Level, Lp (dB re 20μPa)	Example
0	Threshold of hearing for normal young people
20	Recording studio, ambient level
40	Quiet residential neighbourhood, ambient level
60	Department store, restaurant , speech levels
80	Next to busy highway, shouting
100	Textile mill; press room with presses running; punch press and wood planers, at operator's position
120	Ship's engine room; rock concert; in front and close to speakers
140	Moon launch at 100m; artillery fire; gunner's position Threshold of pain

Source: Engineering Noise Control – Theory and Practice, Third Edition, Bies and Hanson, 2003

The sound levels given in Table A.1 are sound pressure levels (L_p) and describe the sound level at a point in space. Sound power levels (L_w) are used to describe the sound output of a sound source. Sound levels vary over time depending on noise generating activities. The following indices are used to take account of these variations:

- $L_{Aeq,T}$ is the equivalent continuous sound level over a determined time period, T, and is the sound level of a steady sound having the same energy as a fluctuating sound over the same period. It is possible to consider this level as the ambient noise encompassing all noise at a given time. $L_{Aeq,T}$ is considered the best general purpose index for environmental sound;
- $L_{A90,T}$ index represents the noise level exceeded for 90 percent of the measurement period, T, and is used to indicate quieter times during the measurement period. It is usually referred to as the background sound level;

- $L_{A10,T}$ refers to the level exceeded for 10% of the measurement period, *T*. L_{A10} is widely used as a descriptor of traffic noise; and
- $L_{Amax,T}$ is maximum recorded noise level during the measurement period, *T*.

In addition, the following definitions may be helpful when reading this report:

- Ambient Sound: Totally encompassing sound in a given situation at a given time usually composed of sound from many sources near and far;
- Background Sound Level: (See $L_{A90,T}$). The A-weighted sound pressure level of the residual sound at the assessment position that is exceeded for 90% of a given time interval, *T*, measured using the fast time weighting;
- Fast Time Weighting: A sound pressure level measurement using a 125ms moving average time weighting period is said to have been determined using 'fast weighting';
- Free Field: Signifies that a sound measurement has been undertaken in 'free field' conditions i.e. away from any reflecting facades e.g. building facades, close boarded fencing etc;
- Façade Level: Addition of 3 dB(A) façade correction to free field levels to reach sound level at the façade of a building (1 m or less) as advised in BS 4142:2014 and BS 5228:2009+A1:2014;
- Specific Sound Level, $L_{Aeq,Tr}$: The equivalent continuous A-weighted sound pressure level at the assessment position produced by an industrial noise source over a given reference time interval, *T;* and
- Rating Sound Level, $L_{Ar,Tr}$: The specific sound level plus any adjustment for the characteristic features of the sound.

Appendix 10.B Modelling Assumptions

Table B.1 Sound Levels in Spaces

	Sound Level								
	63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Lp Tipping Hall	83	82	75	74	74	73	72	69	80
Lp Waste Bunker Hall	94	93	84	82	81	81	80	77	88
Lp Boiler Hall	79	78	78	79	79	76	71	69	83
Lp Turbine Room	85	91	92	90	94	96	93	87	100

Table B.2 Sound Power Level in Spaces

	Sound Power Level dB(A)
Lp FGT Room	70
Lp CHP (side walls)	90
Lp CHP (roof and ends)	84
Lp IBA Room	96

Table B.3 Sound Power of Equipment

	Sound Level								
	63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	**dB(A)**
Lw Stack (with silencers)	108	98	70	60	58	53	50	52	85
Lw ACC Unit per Fan (assumed 3 fans)	107.9	107.6	103.6	101.7	97.8	90	85.7	81.8	90

Table B.4 Vehicle Movements

	Sound Level, Lw (dB)	**Speed (km/h)**
Waste Vehicles (assumed 8/hr daytime and 1/hr night-time)	108	16
IBA or other HGV (assumed 1/hr daytime)	108	16

Table B.5 Attenuation of constructive elements

	Attenuation of Constructive Elements								
	63 Hz	**125 Hz**	**250 Hz**	**500 Hz**	**1 kHz**	**2 kHz**	**4 kHz**	**8 kHz**	
16m2 louvre on north facing wall of tipping hall	3	3	4	9	14	17	13	13	
9m2 west facing wall of boiler hall	3	3	4	9	14	17	13	13	
6m2 roof vents in boiler hall	3	3	4	9	14	17	13	13	
Roller Shutter Door (all doors assumed closed)	3	3	4	9	14	17	13	13	
Walls and roofs assume double-coated cladding arval CN 125	13	16	25	33	41	43	48		Rw 35
CHP walls and roof	-	-	-	-	-	-	-	-	Rw 24

Table B.6 Building Dimensions

Building	Height (m)	Length (m)	Width (m)
Tipping Hall	20	45	30
Bunker	35	45	28
Boiler	45	50	33.4
FGT	35	30	33.4
ACC	20	40	20
Turbine	15	15	30
IBA	12.3	34	18
Administration / Amenity Block	20	43.5	10.2
Stack	80	3.5 diameter	
Fire Tank	12	15 diameter	
Pump House	5	5	4
Substation	7	15	10
District Heating (CHP)	12	26	20
Fuel oil tank	10	3.6 diameter	
Ammonia tank	9.6	8.6	7.1

Appendix 10.C Equipment Calibration Details

Table C.1 Equipment Details

Item	Manufacturer	Model	Serial Number	Calibration Due Date
LT1:				
Sound level meter	RION	NL - 52	01443533	19/03/2016
Pre-Amplifier	RION	NH – 25	43550	19/03/2016
Microphone	RION	UC - 59	07393	19/03/2016
LT2:				
Sound level meter	RION	NA - 28	01291242	18/12/2016
Pre-Amplifier	RION	NH – 23	81274	18/12/2016
Microphone	RION	UC - 59	01684	18/12/2016

Appendix 10.D Time History and Meteorological Data