DOCUMENT C

Noise Assessment of Mobile Plant at a Household Waste Facility in Crowborough

For Veolia Environmental Services

Final Report

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Scott Wilson Ltd

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Crowborough

Final Report

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1. EXECUTIVE SUMMARY

1.1 Methodology

1.1.1 Scott Wilson has been instructed by Veolia Environmental Services to undertake a noise assessment of waste container servicing operations at its household waste facility in Crowborough, East Sussex. The purpose of the assessment was to compare the noise levels associated with the use of a 'Minimyza' (mobile waste compactor) used to maximise the payloads of waste containers against the noise associated with additional waste container movements arising from non-compaction of the container payloads.

1.1.2 The noise from each item of plant was measured both in close proximity to the plant and at the site boundary near to noise sensitive receptors.

1.2 Findings

1.2.1 The monitoring results show that the predicted sound power level of the Minimyza (mobile compactor) is less than that of the container operations (103 dB(A) versus 105 dB(A)).

1.2.2 The predicted one hour sound pressure level at the closest residential receptor for both Minimyza and container operations is 46 dB $L_{Aeq,1hr}$.

1.3 Conclusions

1.3.1 Predicted noise levels at closest residential receptors for both items of plant are below the 55 dB, L_{Aeq} limit set by MPS 2, based on the measured sound pressure levels.

1.3.2 The overall sound power level (L_{WA}) of the container operations is 2 dB higher than that for the Minimyza.

1.3.3 The predicted worst-case one hour L_{Aeq} level for the Minimyza is equal to that for container movements. Therefore, the Minimyza should be used, as it would increase the daytime capability of handling the total recycling volume, reducing the noise level from lorry movements, which is required for transportation of the containers at site and on surrounding roads. In addition, lorries are an established environmental problem incurring environmental costs such as localised air and noise pollution, road accidents and land take.

2. INTRODUCTION

2.1.1 Scott Wilson has been instructed by Veolia Environmental Services to undertake a noise assessment of waste container servicing operations at its household waste facility in Crowborough, East Sussex. The purpose of the assessment was to compare the noise levels associated with the use of a 'Minimyza' (mobile waste compactor) used to maximise the payloads of waste containers against the noise associated with additional waste container movements arising from non-compaction of the container payloads.

2.1.2 The noise from each item of plant was measured both in close proximity to the plant and at the site boundary near to noise sensitive receptors.

2.1.3 This report presents the findings of the noise assessment. The reporting includes a discussion of the following:

a) Introduction;

b) Site description;

c) Theory and legislation;

d) Noise measurements on plant;

e) Noise impact assessment; and

f) Conclusions.

2.1.4 Measurements were made on Friday 4th May 2007, between 11:00 - 14:00 hours. The findings, investigation and conclusions from these measurements and the site visit are discussed in this report.

2.1.5 Noise terminology and perception relevant to this report are shown in Appendix A.

3. ASSESSMENT METHODOLOGY

3.1 Assessment Guidelines

3.1.1 Minerals Policy Statement 2 (MPS 2) was used as reference for this assessment.

3.1.2 The assessment approach taken in the guidelines is discussed below.

3.2 Minerals Policy Statement 2 (MPS 2) (2005)

3.2.1 The guidance note MPS 2 sets out the current government policies and considerations that should be followed with regard to noise and dust arising from surface mineral workings and associated waste operations. With regard to waste disposal operations it is stated within paragraph 2.4 of Annex 2: that whilst the guidance is not framed with direct reference to other types of waste disposal and recycling (other than those that form an integral part of the mineral operation) "Since these share many operational features with surface mineral operations, waste management operators and waste planning authorities should take account of this Annex" alongside other relevant guidance including PPG 10.

3.2.2 The document presents a variable limit at noise sensitive property during normal operational daytime hours of between 07:00 to 19:00 hours "that does not exceed the background level by more than 10 dB(A)" subject to a maximum nominal limit of 55 dB(A) free field. However it is recognised within the guidance document that "this will under many circumstances be difficult to achieve". It is further stated that "In such cases, the limit set should be as near that level as practicable during normal working hours (07:00 to 19:00 hours) and should not exceed 55 dB $L_{Aeq,1hr}$ free field.".

3.2.3 Within the document MPS 2 sensitive receptors are detailed as including "dwellings, gardens, places of worship, educational establishments, hospitals or similar institutions, livestock farms, some factories or any other property likely to be adversely affected by an increase in noise levels".

4. SITE DESCRIPTION

4.1 Location

4.1.1 The Recycling Facility site is located off Farningham Road, Crowborough, East Sussex TN6 2NF.

4.1.2 The site is bounded on all sides by wooden fencing (except the entrance) to a height of up to 6 m. In the immediate surroundings to the site lies: an industrial unit to the east, Farningham Road to the south, and vegetation to the west and north. Nearest sensitive receptors lie further north west at a distance of approximately 30 m (Grey walls).

4.1.3 The site and the surrounding area are shown in Appendix B, Figure B1.

4.1.4 Sensitive receptors in the area include:

- 1-4 Grey Walls, Mount Pleasant (30 m); and
- Hill Cottage (80 m).

4.2 Description of Works

4.2.1 The site is a Household Waste Recycling Facility, which was in use by the public during monitoring. The background noise during monitoring consisted of Minimyza plant, container movements, and public vehicles entering and leaving the site, disposing of household waste. Despite being located on an industrial estate there were no noted significant noise sources impacting upon the site.

4.2.2 Works undertaken on site during the site monitoring exercises included:

- use of a Minimyza – a lorry mounted 360 degree waste compactor; and
- container servicing operation – involves moving a container (on metal rollers) along the ground using a specially adapted lorry, which it is then mounted on for offsite removal. To complete one container movement assuming that they are back loaded, It would take four container movements – See Appendix B, Figure B2, (5 minutes per container totalling 20 minutes):

    1. remove front existing empty container;
    2. remove rear full container;
    3. replace new container; and
    4. return existing empty container.

4.2.3 Photographs of the site and plant are shown in Appendix C.

4.2.4 Work hours Monday to Friday are 09:00 – 17:00 hours and Saturday and Sunday are 09:00 – 13:00 hours, as defined in the planning permission.

4.2.5 The volume of a typical container is approximately 52 m^3; by using the Minimyza twice as much waste can be placed in the container thereby maximising payloads and reducing container movements on and off the site.

5. MEASUREMENT METHODOLOGY

5.1 General

5.1.1 Noise measurements were carried out on Friday 4th May 2007. The site plan and location for ambient monitoring is shown in Figure B1, Appendix B.

5.1.2 Measurements were made in close proximity to the plant to determine the sound power of the plant. The sound power, L_w was determined by monitoring the sound pressure, L_p at equal distances surrounding the plant, logarithmically averaging the results and then using the following equation (based on a point source with geometric spreading):

$$L_w = L_p + 20\log r + 8 \qquad \text{Equation 1}$$

Where: r = the distance from source to receiver in metres.

5.2 Instrumentation

5.2.1 Noise monitoring was undertaken using the following equipment:

- Brüel and Kjær 2238 (x2) Type 1 integrating sound level meter;
- Brüel and Kjær 2260 Type 1 integrating sound level meter; and
- Brüel and Kjær 4231 acoustic calibrator;

5.2.2 The equipment was set to measure various parameters, including L_{Aeq} values, logging at contiguous periods of one second for mobile plant and one minute for ambient monitoring near the site boundary. The equipment was calibrated prior to, and checked after the monitoring periods – no significant changes (±1dB) were noted.

5.2.3 Calibration certificates for the noise instrumentation are available on request.

5.2.4 Serial numbers for the monitoring equipment used are given in Appendix D.

5.3 Meteorological Conditions

5.3.1 Weather conditions during the monitoring period were dry with sunny spells, average temperatures of around 15 °C, and no discernible wind.

6. MEASUREMENT RESULTS

6.1 Mobile Plant

6.1.1 Sound pressure level measurements were recorded for each of the activities.

6.1.2 Baseline measurements were recorded in the absence of the specific noise to ensure the measurements were not biased or corrupted.

6.1.3 From the measured data, the Sound Power Level (L_{wA}) of each activity was calculated and is summarised in Table 6.1.

Table 6.1: Sound Power Level (L_w) of Mobile Plant

Activity	Sound Power Level (L_{wA}) (dB)
Minimyza - household waste	103
Minimyza - cardboard	103
Container operations	105

6.1.4 Individual measured data of the plant are shown in Appendix E.

6.1.5 Sample octave band spectra of the plant on site are presented in Appendix F.

6.2 Site Boundary

6.2.1 Noise measurements were made approximately 12 m outside of the site boundary (as shown in Appendix B) between the hours of 11:00 and 14:00 hours, Friday 4th May 2007. The results are summarised in Table 6.2 and shown graphically in Appendix G.

Table 6.2: Typical Recorded Noise Levels at Site Boundary Including Minimyza and Container Movements

Location	Start	End	Noise Level (dB) $L_{Aeq,T}$
12m from Site Boundary	11:00	12:00	57
	12:00	13:00	54
	13:00	14:00	53
	Average		55

6.2.2 During the first hour (11:00 to 12:00), Minimyza compacting cardboard and container operations took place; this is consistently reflected from the two peaks at 11:27 and 11:47 in the data plot in Appendix G, and therefore the higher noise level compared to the overall average value of 55 dB(A).

6.2.3 Minimyza compacting household waste was undertaken from around 13:40, which correlates with the peak at 13:42 in the plot in Appendix G.

6.2.4 Container movements were undertaken between 11:47 and 11:57, which correlates with the elevated levels in the plot in Appendix G.

7. IMPACT ASSESSMENT

7.1 Site Boundary Measurements

7.1.1 The overall measured level at the monitoring position (approximately 12 m from the site boundary) is within the limit set by MPS 2 (55 dB L_{Aeq}). Since the nearest receptor is located a further 18m from this location it is considered the limit is unlikely to be exceeded, based on current site activities.

7.2 Plant Noise Calculations

7.2.1 The predicted sound power level of the Minimyza (mobile compactor) is lower than that of the container operations (103 dB(A) versus 105 dB(A)).

7.2.2 Based on the calculated Sound Power Levels (L_w), the resultant predicted sound pressure levels for one hour operation $L_{Aeq,1hr}$ are shown in Table 7.1. The calculations are based on the following assumptions:

- Container movements take approximately 20 minutes, with one movement per hour;
- Minimyza compaction of waste takes 10 minutes per container (an hour for four containers with a five-minute set up interval between containers); and
- Barrier attenuation A_B was computed using octave band power spectra calculated from the measured data (see Appendix E, Table E3).

Table 7.1: Predicted Sound Pressure Levels at the Nearest Receptor

Operation	Sound Pressure Level ($L_{Aeq,1hr}$) dB
Minimyza Compaction (40 Minute Duration)	46
Container Operation (20 Minute Duration)	46

7.2.3 Data used in compiling Table 7.1 is shown in Table E2, Appendix E.

7.2.4 The noise levels of both the operations are below the limit in MPS 2. Employment of the Minimyza will provide the following advantages for site operation without breaking the MPS2 daytime noise limits:

- increasing the capability of handling the total recycling volume;
- reducing the noise due to lorry movement for container transportation; and
- reducing the need to close the facility due to insufficient container volume.

8. CONCLUSION

8.1.1 The noise from each item of plant was measured both in close proximity to the plant and at the site boundary near to noise sensitive receptors.

8.1.2 Specific measurements were undertaken close to the noise source. These data were then used to calculate the Sound Power Levels of the Minimyza and the container operation, which are 103 dB(A) and 105 dB(A) respectively.

8.1.3 Noise level at the nearest receptor were predicted and are found to be well below the 55 dB ($L_{Aeq,1hr}$) limit stated in MPS 2. Noise levels for the container operations was higher than the Minimyza.

8.1.4 The predicted worst-case one hour L_{Aeq} level for the Minimyza is equal to that for container movements. Therefore, the Minimyza should be used, as it would increase the daytime capability of handling the total recycling volume, reducing the noise level from lorry movements, which is required for transportation of the containers at site and on surrounding roads. In addition, lorries are an established environmental problem incurring environmental costs such as localised air and noise pollution, road accidents and land take.

APPENDIX A: NOISE TERMINOLOGY AND PERCEPTION

A.1 Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal, Pa). Because of this wide range a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB.

A.2 Sound pressure level (SPL) or sound level L_p is a logarithmic measure of the energy of a particular noise relative to a reference noise source.

$$L_p = 20 \log_{10}\left(\frac{p_1}{p_0}\right) = 10 \log_{10}\left(\frac{p_1^2}{p_0^2}\right) \text{ dB SPL}$$

where p_0 is the reference sound pressure and p_1 is the sound pressure being measured.

A.3 Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in pascals, Pa). Because of this wide range, a noise level scale based on logarithms is used in noise measurement called the decibel (dB) scale. Audibility of sound covers a range of approximately 0 to 140 dB. The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure noise is weighted to represent the performance of the ear. This is known as the 'A weighting' and annotated as dB(A). Table A1.1 lists the sound pressure level in dB(A) for common situations.

Table A1.1: Noise Levels for Common Situations

Typical Noise Level dB(A)	Example
0	Threshold of hearing
30	Rural area at night, still air
40	Public library Refrigerator humming at 2m
50	Quiet office, no machinery Boiling kettle at 0.5m
60	Normal conversation
70	Telephone ringing at 2m, Vacuum cleaner at 3m
80	General factory noise level
90	Heavy goods vehicle from pavement Powered lawnmower, operator's ear
100	Pneumatic drill at 5m
120	Discotheque - 1m in front of loudspeaker
140	Threshold of pain

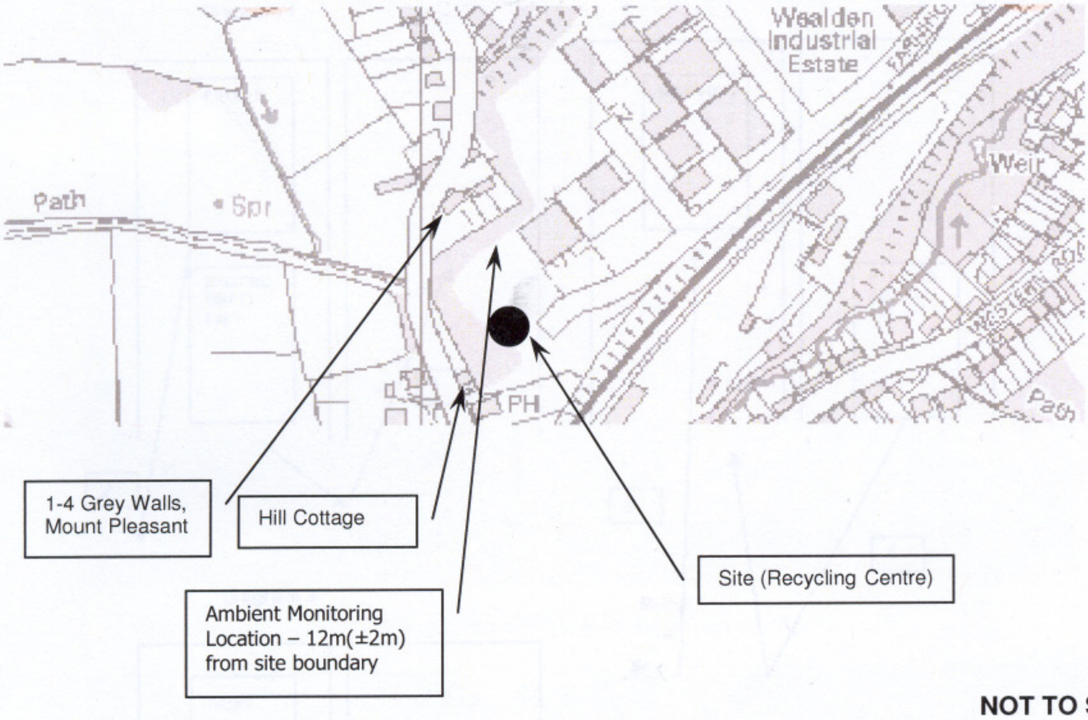
A.4 The noise level at a measurement point is rarely steady, even in rural areas, and varies over a range dependent upon the effects of local noise sources. Close to a busy motorway, the noise level may vary over a range of 5 dB(A), whereas in a suburban area this variation may be up to 40 dB(A) and more due to the multitude of noise sources in such areas (cars, dogs, aircraft etc.) and their variable operation. Furthermore, the range of night-time noise levels will often be smaller and the levels significantly reduced compared to daytime levels. When considering environmental noise, it is necessary to consider how to quantify the existing noise (the ambient noise) to account for these second to second variations.

A.5 A parameter that is widely accepted as reflecting human perception of the ambient noise is the background noise level, L_{A90}. This is the noise level exceeded for 90% of the measurement period and generally reflects the noise level in the lulls between individual noise events. Over a one hour period, the L_{A90} will be the noise level exceeded for 54 minutes.

A.6 The equivalent continuous A-weighted sound pressure level, L_{Aeq} is the single number that represents the total sound energy measured over that period. L_{Aeq} is the sound level of a notionally steady sound having the same energy as a fluctuating sound over a specified measurement period. It is commonly used to express the energy level from individual sources that vary in level over their operational cycle.

A.7 Human subjects, under laboratory conditions, are generally only capable of noticing changes in steady levels of no less than 3 dB(A). It is generally accepted that a change of 10 dB(A) in an overall, steady noise level is perceived to the human ear as a doubling (or halving) of the noise level. (These findings do not necessarily apply to transient or non-steady noise sources such as changes in noise due to changes in road traffic flow, or intermittent noise sources).

APPENDIX B: SITE PLAN AND PROCESSES



NOT TO SCALE

Figure B1: Site Location with Neighbouring Receptors and Ambient Monitoring Location

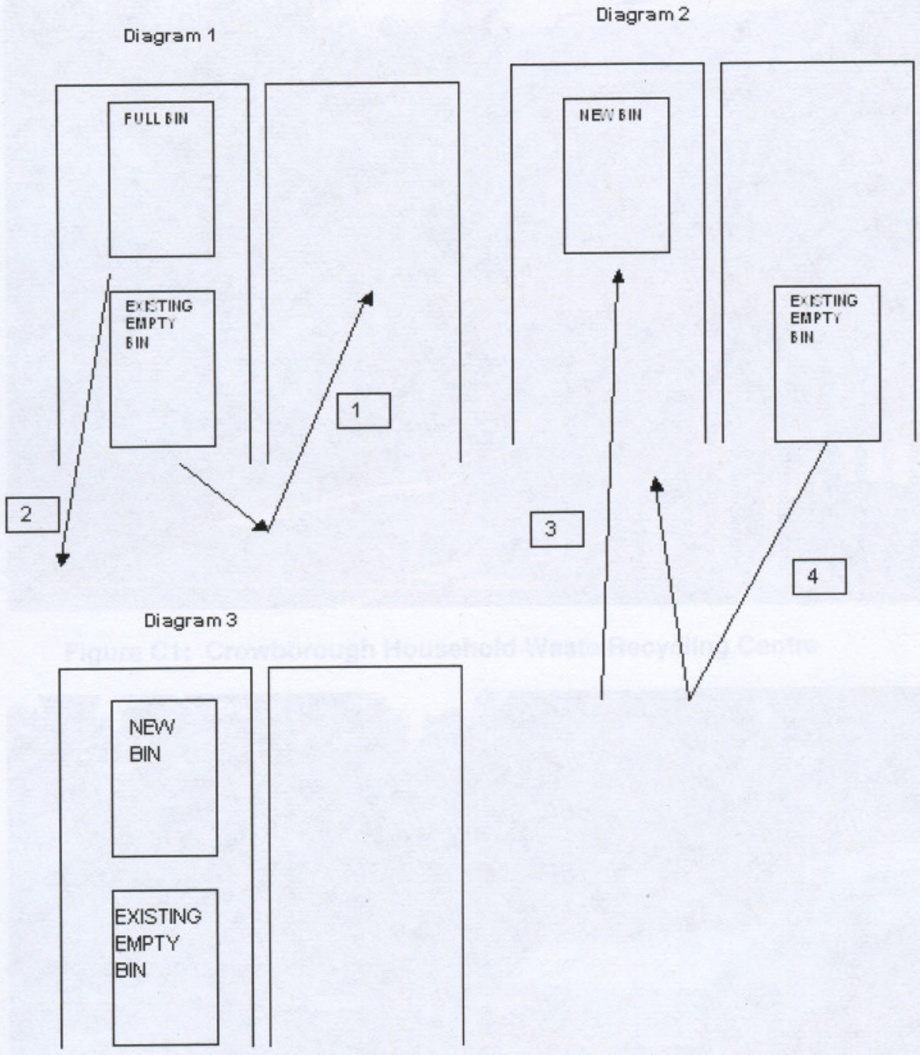


Figure B2: Container Process Operations

APPENDIX C: SITE PHOTOGRAPHS

Figure C1: Crowborough Household Waste Recycling Centre

Figure C2: 'Drop off' Area for Public

Figure C3: Containers for Household Waste

Figure C4: Noise Measurements Adjacent to Waste Transfer Operation

Figure C5: Noise Measurements Adjacent to the Minimyza

Figure C6: Noise Measurements Approximately 12m from Site Boundary

APPENDIX D: INSTRUMENTATION

Details of the equipment used for monitoring are shown below:

Type	Serial Number
Brüel and Kjær 2260 Type 1 Sound Level Meter	2001556
Brüel and Kjær 2238 Type 1 Sound Level Meter	2381585
Brüel and Kjær 2238 Type 1 Sound Level Meter	2201511

APPENDIX E: PLANT MONITORING RESULTS

Table E1: Energy-averaged Sound Levels for Site Activities

Activity	Distance from source (m)	Position 1	2	3	4	5	6	Average
		Energy Average Sound Pressure Levels, L_{Aeq} (dB)						
Minimyza on cardboard	9.1	77	78	77	76	75	72	76
Background	-	54	61	61	58	69	54	63
Minimyza on household waste	4.6	82	82	82	82	82	81	82
Background	-	55	58	56	58	65	51	59
Container operations	4.6	85	81	84	83	83	81	83
Background	-	66	54	48	53	58	55	60

Note: Monitoring duration at each position:

* 30 seconds for Minimyza and baseline; and
* approximately 3 minutes (1 container movement) for container operation.

Table E2: Predicted Sound Pressure Levels at the Monitoring Location

	Activity	Sound Power Level L_w	Distance (m)	Barrier Attenuation A_B (dB)	Predicted Level L_p (dBA)	Measured Level Lp (dBA)
Monitoring Location	Minimyza	103	27	14	52	58
	Container	105	27	13	55	60
Nearest Receptor	Minimyza	103	45	14	48	-
	Container	105	45	13	51	-

Note: * Levels differ based on frequency data input into spreadsheet as shown in Table E3.

1. In Table E2, the Sound Power Levels L_w of Minimyza and Container operation were calculated by Equation 1 (in the report) using the noise levels measured during the corresponding activities. Sound pressure levels were predicted at the monitoring location from these sound power levels, accounting for barrier attenuations which was computed using the measured power spectra.

2. The calculated sound power level for the Minimyza is some 2 dB lower than that of the container operation. The predicted attention for the Minimizer is 1dB greater than the container operation, due to their relative frequency contents. This results in a predicted sound pressure level form the Minimyza some 3 dB below that for container operations.

3. The difference between measured and predicted levels could be due to a number of factors including directivity of the noise sources and over prediction of the barrier effect. The difference between the two sources is consistent between measurements and predictions to within 1 dB.

4. Noise level at the nearest receptor (Paragraph 4.1.4) is predicted using the same equation. On-time corrections were applied according to the assumptions presented in Section 7.2. The predicted $L_{Aeq,1hr}$ values due to Minimyza and container operation are found to be the same. The 3 dB lower noise level for the Minimyza is exactly balanced by the differences in on-time (the Mimimyza is assumed to be operational for twice the duration of container operations).

Table E3: Predicted $L_{Aeq,1hr}$ Sound Pressure Levels at Nearest Receptor

	Activity	Sound Power Level L_w	Distance (m)	Barrier Attenuation A_B (dB)	Sound Pressure Level L_p	On-time Correction (min/hr)	Predicted $L_{Aeq,1hr}$ (dB)
Nearest Receptor	Minimyza	103	45	14	48	40	46
	Container	105	45	13	51	20	46

Table E3: Example Prediction Spreadsheet for Attenuation (Minimyza)

BARRIER CALCULATION IN OCTAVE BANDS (DOES NOT WORK IN ILLUMINATED ZONE)

SOURCE HEIGHT =	1
RECEIVER HEIGHT =	5
BARRIER HEIGHT =	5

SOURCE-BARRIER DISTANCE =	15
BARRIER-RECEIVER DISTANCE =	12

DSR =	27.29469
DSB =	15.52417
DBR =	12

CRITERION: DIRECT SOURCE-RECEIVER LINE ABOVE OR BELOW TOP OF BARRIER
3.222222222 BARRIER

PATH DIFF. =	0.229

LIN INPUT SPECTRUM	F	LAMDA	N	ATTEN.	LIN OUTPUT SPECTRUM	A-WT	A-WT INPUT SPECTRUM	A-WT OUTPUT SPECTRUM
86.1	63	5.460	0.084	6.7	79.4	-26.2	59.9	53.2
76.9	125	2.752	0.167	8.0	68.8	-16.1	60.8	52.7
79.1	250	1.376	0.334	9.9	69.2	-8.6	70.5	60.6
78.7	500	0.688	0.667	12.1	66.5	-3.2	75.5	63.3
76.9	1000	0.344	1.334	14.7	62.1	0.0	76.9	62.1
76.5	2000	0.172	2.668	17.5	59.0	1.2	77.7	60.2
70.6	4000	0.086	5.337	20.4	50.2	1.0	71.6	51.2
62.7	8000	0.043	10.674	23.4	39.3	-1.1	61.6	38.2
						O'ALL A-WT LEVEL	82.3	68.1
						O'ALL A-WT ATTEN.		14.2

APPENDIX F: OCTAVE BAND SPECTRA OF PLANT

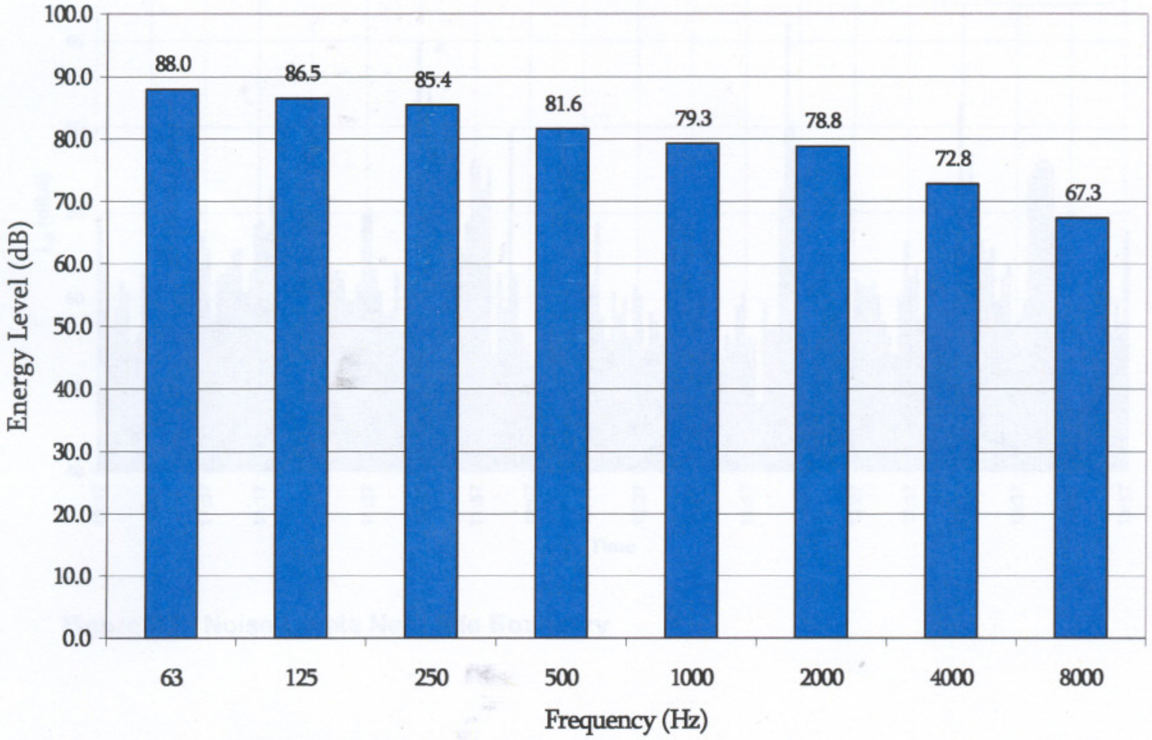


Figure F1: Octave Band Spectrum During Container Operations

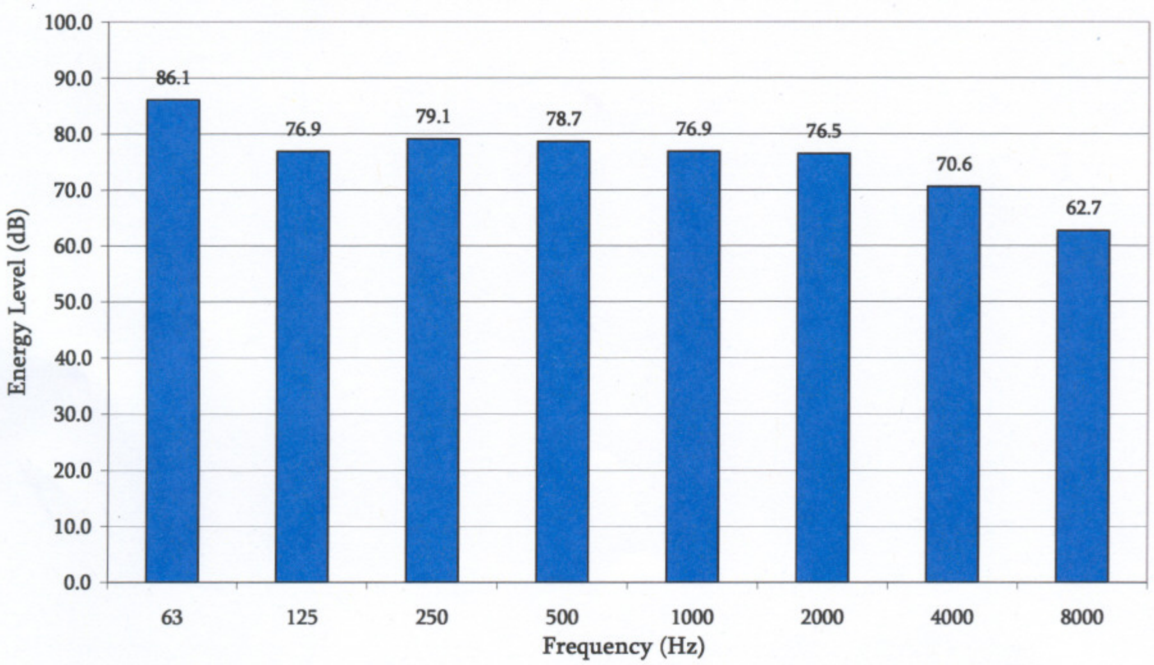


Figure F2: Octave Band Spectrum During Minimyza Compaction of Household Waste

APPENDIX G: NOISE MEASUREMENT PLOT

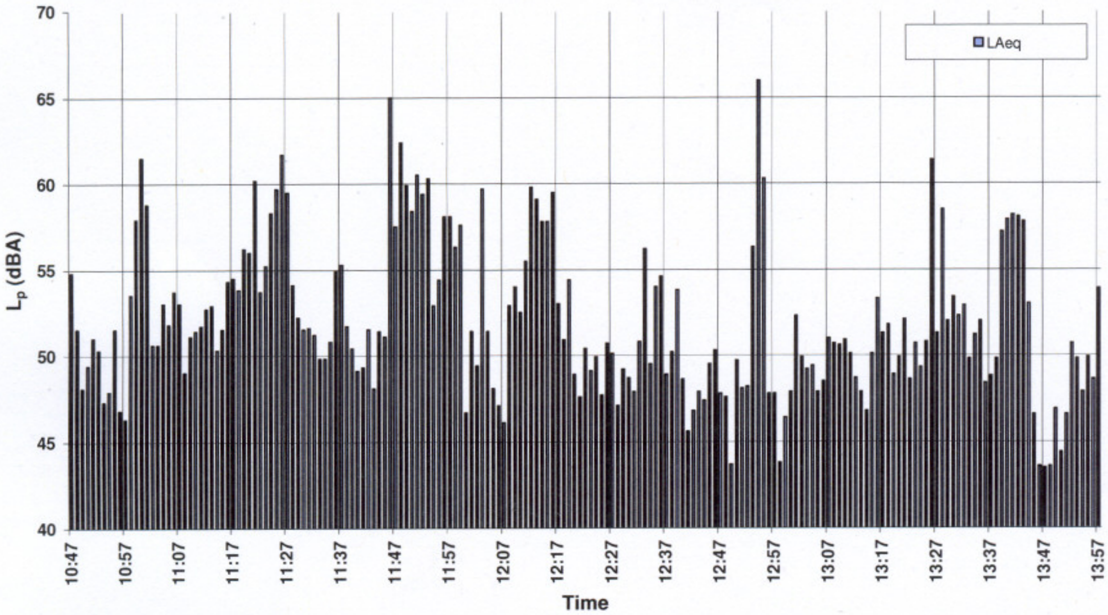


Figure G1: Noise Levels Near Site Boundary