APPENDIX B.2

Enclosed Flares

9-200

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ACOUSTICAL REPORT

ON THE

PROPOSED LANDFILL GAS FLARE

CANADIAN WASTE SERVICES INC.
WEST CARLETON LANDFILL
CARP, ONTARIO

Prepared for

Water and Earth Science Associates Ltd.

By

Hugh Williamson Associates Inc.

26 November 1999

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ACOUSTICAL REPORT ON THE PROPOSED LANDFILL GAS FLARE

CANADIAN WASTE SERVICES INC. WEST CARLETON LANDFILL CARP, ONTARIO

Executive Summary

This report contains the results of an acoustical study of the proposed landfill gas flare at the West Carleton Landfill, Township of West Carleton in the Regional Municipality of Ottawa-Carleton. This site is owned and operated by Canadian Waste Services Inc. The proposed gas collection and flaring system is currently undergoing various environmental reviews as part of an application for a Certificate of Approval (Air) from the Ontario Ministry of Environment, MoE. The purpose of the study was to assess the potential impact of noise from the proposed landfill flare on residences in the vicinity, in accordance with MoE noise guidelines.

Assessment has been based on noise measurements of a similar landfill gas flare at Vienna Junction, Erie Michigan, U. S. A. The following conclusions have been reached.

- The estimated sound pressure level from the proposed West Carleton landfill gas flare at the nearest point of reception is 31.1 dBA.
- This sound level meets the MoE noise level limits since it is well below the nighttime exclusion limit, 45 dB(A) for a Class 2 Area (Urban).
- Additional mitigation measures are not required.

ACOUSTICAL REPORT ON THE PROPOSED LANDFILL GAS FLARE

CANADIAN WASTE SERVICES INC. WEST CARLETON LANDFILL CARP, ONTARIO

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ACOUSTICAL REPORT ON THE PROPOSED LANDFILL GAS FLARE

CANADIAN WASTE SERVICES INC. WEST CARLETON LANDFILL CARP, ONTARIO

1.0 Introduction

Canadian Waste Services Inc., CWS, proposes to install and operate a permanent landfill gas collection and flaring system for odour control purposes at the West Carleton Landfill in Carp Ontario. CWS have retained Comcor Environmental Limited to design and build the proposed gas collection and flaring system. Water and Earth Science Associates Ltd., WESA, have been engaged to carry out various environmental studies in relation to this project as part of an application for a Certificate of Approval (Air) from the Ontario Ministry of Environment, MoE. This report describes one of these reviews, an acoustical investigation of the proposed collection and flaring system carried out by Hugh Williamson Associates Inc. under contract to WESA. The primary aim of this report is to assess the potential impact of noise from the proposed flare on residences in the vicinity in accordance with MoE guidelines[1-4] for Certificates of Approval (Air): Noise and Vibration.

The existing West Carleton Landfill is located in Part of Lots 2 and 3 Concession III, Town of West Carleton in the Regional Municipality of Ottawa-Carleton as shown in Figures 1 and 2. (Note that Figures 1 to 9 are contained in Appendix 2. The source of these Figures is the Comcor Emission Summary and Dispersion Modelling Report[5] for the proposed flare.) The existing West Carleton Landfill is owned and operated by CWS under certificate of Approval A461002 issued on 17 August 1994.

The West Carleton Landfill is located adjacent Highway 417. It is bounded by Carp Road on the East and William Mooney Road on the west. An active quarry is situated immediately east of the site across Carp Road. Up-to-date zoning information for the lands surrounding the West Carleton Landfill, which was obtained from the Township of West Carleton, is contained in Appendix 3. The land within 1 km of the landfill is largely industrial. There is no land which is zoned residential within 1 km of the landfill.

The location of the proposed landfill gas flare is shown in Figures 4 and 8. The closest residence to the proposed flare, designated R1, is located just off Carp Road at coordinates (1340,820), see Figure 9.

The landfill gas collection and flaring system can be divided into three main components as shown in Figure 3. These are as follows.

1. Landfill Gas Collection System
2. Landfill Gas Mechanical System
3. Landfill Gas Flare System

The landfill gas collection system will be comprised initially of 24 landfill gas extraction wells installed in the fill. A typical well is shown in Figure 5. Gas from the wells is brought to the landfill gas mechanical system via a piping network as shown in Figure 4. It is anticipated that no significant noise will be generated by the landfill gas collection system.

The landfill gas mechanical system will be housed in a permanent masonry structure which is shown in Figure 8. The ultimate landfill gas mechanical system will be comprised of two (2) Gardner Denver Lamson Turbotron rotary vacuum blowers, complete with a 15 kW (20 HP) three phase, air cooled, totally enclosed, electric motors, see Figure 6. The blowers will be set to initially deliver between 0.28 m^3/s (600 SCFM) and 0.38 m^3/s (800 SCFM) of inlet gas at a maximum vacuum of 127 cm (50 inches) of water column. Typical operating vacuum will range from 50 to 76 cm (20 to 30 inches) of water column. Initially, only one blower will be installed with provision to add the second blower in the future.

The flow rate will be controlled either by an inlet valve or a Variable Frequency Drive (VFD) connected to the motor. With minor adjustments, the Turbotron vacuum blowers will be able to provide the anticipated maximum extraction flow rate of 0.57 m^3/s (1200 SCFM).

The landfill gas flare system, see Figure 7, will be manufactured by John Zink Company of Tulsa Oklahoma, U. S. A., or equivalent. The flare will be a totally enclosed high temperature type, made from carbon steel. The flare will measure 2.1 m (7') in diameter and the top will be approximately 12.2 m (40') above ground surface.

The flare system includes numerous safety features and system control features which are outlined below.

- Air purge blower which evacuates the flare enclosure prior to ignition sequence
- Propane fuelled pilot ignition system

- Flame scanner which automatically controls the safety shut-off valve and shuts down the entire system if no flame is detected
- Thermocouples which continually monitor the flare operating temperature
- Two air dampers which can be adjusted manually and automatically to control the flare temperature
- Continuous in-line methane and oxygen analysers which will shut down the system if pre-set limits are exceeded
- Flame arrestor to protect the collection and mechanical system from flash backs
- Chart recorder for continuous documentation of operating conditions.

The operating conditions for the proposed flare are set out in Table 1.

Stack Size:	Flare Diameter of 2.1 m (7') Height 12.2 m (40') above surrounding grade
Operating Temperature:	875 to 950 °C depending on atmospheric conditions
Landfill Gas Flow Rate:	maximum rate of 0.57 m^3/s (1200 SCFM)
Gas Composition:	40 to 55 % methane gas by volume
Heat release rate*:	10.7 MW (607 MBTU/min)
Exit velocity*:	9.0 m/s (29.5 ft/s)

* Based on 0.57 m^3/s (1200 SCFM) landfill gas flow at 50% methane content and data from John Zink Company, see Appendix 1 for details of calculation procedure.

Table 1 Operating Conditions for Proposed Flare

2.0 Applicable MoE Sound Level Limits

In the MoE guidelines[3,4], sound level limits for stationary sources, such as landfill gas flares, depend on the classification of the area as Class 1, 2 or 3.

Class 1 Area (Urban) 'an area with an acoustical environment typical of a major urban area, where the background noise is dominated by urban hum (primarily road traffic noise)'

Class 2 Area (Urban) 'an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas, and in which a low ambient sound level, normally occurring between 2300 and 0700 hours in Class 1 areas, will typically be realised as early as 1900 hours.

Class 3 Area (Rural) 'acoustical environment that is dominated by natural sounds having little or no road traffic ....'

The West Carleton Landfill is located in a largely industrial area and adjacent to Highway 417. Due to this location the site is subject to high levels of traffic noise throughout the day and night. The nearest residence, R1, is located on Carp Road, approximately 1.3 km from highway 417. Assuming that traffic noise at R1 is considerably reduced at night, this residence can be conservatively assumed to be in a Class 2 Area (Urban) from a noise perspective.

For sound from a stationary source in a Class 2 Area (Urban), including quasi-steady impulsive sound, the sound level limit expressed in terms of the one hour equivalent sound level, L_{AEQ}, is the background one hour equivalent sound level, L_{AEQ}, which is typically caused by road traffic.

In a Class 2 Area (Urban) no restrictions apply to a stationary sound source resulting in a one hour equivalent sound level (L_{AEQ}) lower than the minimum L_{AEQ} value for that time period as specified in Table 2. These lower levels are known as the **exclusion limits.**

Time of Day	One Hour L_{AEQ} (dBA)
0700 - 1900	50
1900 - 2300	45
2300 - 0700	45

Table 2 **Minimum Values (Exclusion Limits) for One Hour L_{AEQ} by Time of Day for a Class 2(Urban) Area[3]**

Since flares generally make a relatively steady sound and the proposed flare is intended to operate the proposed flare on a 24 hour basis, the one hour equivalent sound level, L_{AEQ}, from the flare system at the closest point of reception should be less than 45 dBA.

The nearest residences to the flare system are shown in Figure 9 as R1. For a residences, noise is to be assessed at the closest point of reception to the noise source which is on the resident's property and up to 30 m from the residence. For the nearest residence, R1 in Figure 9, the closest point of reception is on the property line, 360 m from the flare.

3.0 Impact Assessment at the Neighbouring Residences

Prediction of the noise received at the nearest point of reception will be based on noise measurements made of a similar landfill gas flare at the Vienna Junction Landfill, Erie, Michigan, U. S. A. The Vienna Junction landfill flare is larger than the proposed flare at the West Carleton Landfill, however the design parameters of the two flares are very similar as set out in Table 3.

Details of the sound measurements and analysis of the Vienna Junction flare are contained in Appendix 1. Appendix 1 also contains a description of the Vienna Junction flare as a noise source and measured noise spectra. In summary the Vienna Junction landfill flare produced a steady noise with a relatively smooth spectrum, i.e. no significant tonality.

According to published data[6], gas flare noise can be expected to increases with flow rate. Since all other parameters are very similar, it can be expected that sound power of the proposed West Carleton landfill flare, operating at 0.57 m^3/s (1200 SCFM), will be less than the sound power of the Vienna Junction landfill flare operating at 1.13 m^3/s (1200 SCFM). It is also anticipated that the proposed West Carleton landfill flare will have noise characteristics and noise spectra which are similar to the Vienna Junction landfill flare.

Design Parameters	Proposed West Carleton Landfill Flare	Vienna Junction Landfill Flare
Type	fully enclosed	fully enclosed
Height	12.2 m (40')	12.2 m (40')
Diameter	2.1 m (7')	3.05 m (10')
Compressors	two (2) rotary vacuum type	single rotary vacuum type
Compressor Drive	Two (2) 15 kW (20 HP) electric motor, variable speed	37 kW (50 HP) electric motor
Burners	4	6
Operating Temperature	875 to 950 °C	800 to 900 °C
Landfill Gas Flow Rate	Variable, up to 0.57 m^3/s (1200 SCFM)	Variable, tested at 1.13 m^3/s (1200 SCFM)
Gas Composition by volume	40 to 55 % methane	40 to 55 % methane
Heat release rate	10.7 MW (607 MBTU/min)*	21.3 MW (1214 MBTU/min)**
Exit velocity	9.0 m/s (29.5 ft/s)*	8.56 m/s (28.1 ft/s)**

* Based on a landfill gas flow of 0.57 m^3/s (1200 SCFM) and 50% methane content

** Corresponds to a test flow rate of 1.13 m^3/s (2400 SCFM) and 50% methane content, see Appendix 1

Table 3 Comparison of Design Features

A conservative prediction for the sound pressure level, L_P, from the proposed West Carleton landfill flare at the nearest point of reception, based on a sound pressure of 52.7 dBA for the Vienna Junction landfill flare operating at 1.13 m^3/s (2400 SCFM) and on geometric spreading is as follows.

$$\begin{aligned} L_P(\text{at } 360 \text{ m}) &= L_P(\text{Vienna Junction, flare at } 30 \text{ m}) - 20 \log(360/30) \\ &= 52.7 - 20 \log(360/30) \\ &= 31.1 \text{ dBA} \end{aligned}$$

This sound level is well below the nighttime exclusion limit of 45 dBA for Class 2 (Urban) areas.

The above predicted sound pressure level at the nearest point of reception is conservative in the following ways.

- Additional attenuation due to ground absorption has been ignored.
- The proposed flare for the West Carleton Landfill has a considerably lower flow rate and is likely to have a lower sound power.

Another approach is to consider the minimum separation distance between the flare and the point of reception which is required for the sound pressure level from the flare to be below the limit of 45 dBA. In Appendix 1 it has been shown by measurement and calculation that 75m is the minimum separation distance for a flare with the same sound characteristics as the Vienna Junction flare when the sound limit to be reached is 45 dBA. Since the nearest point of reception for the proposed West Carleton landfill flare is 360 m, 4.8 times the minimum separation distance, the noise requirements have been amply satisfied.

In light of the above, additional mitigation measures are not recommended for the proposed West Carleton landfill flare.

4.0 Conclusions and Recommendations

Noise impact assessment of the proposed West Carleton landfill gas flare has been carried out according to MoE guidelines[1-4]. Assessment has been based on noise measurements of a similar landfill gas flare at Vienna Junction, Erie Michigan, U. S. A. The following conclusions have been reached.

- The estimated sound pressure level from the proposed West Carleton landfill gas flare at the nearest point of reception is 31.1 dBA.
- This sound level meets the MoE noise level limits since it is well below the nighttime exclusion limit, 45 dB(A) for a Class 2 Area (Urban).
- Additional mitigation measures are not required.

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Member, Canadian Acoustical Society

References

1. Ministry of Environment, Guide to Applying for Approval (Air): Noise and Vibration, November 1995.

2. Ministry of Environment Publication NPC-233, Information to be Submitted for Approval of Stationary Sources of Sound, October 1995.

3. Ministry of Environment Publication NPC-205, Sound Limits for Stationary Noise Sources in Class 1 & 2 Areas (Urban), October 1995.

4. Ministry of Environment Publication NPC-232, Sound Limits for Stationary Noise Sources in Class 3 Areas (Rural), October 1995.

5. Comcor Environmental Limited, Emission Summary and Dispersion Modelling Report, West Carleton Landfill, Carp, Ontario, 25 June 1999.

6. J. Swithenbank, 'Ecological Aspects of Combustion Devices with Reference to Hydrocarbon Flaring', A.I. Ch. E. Journal, Vol. 18, No. 3, 1972, p. 533 - 560.

Appendix 1

Noise Measurements of Gas Flare at Vienna Junction Landfill

A1.1 Introduction

The results of noise measurements made at the landfill gas flare at Vienna Junction Landfill are presented in this appendix. The purpose of these measurements is to provide noise source data which can be used as a basis for predicting noise emissions from similar flares of this type.

The Vienna Junction Landfill is located at Erie Michigan, just north of Toledo, Ohio, U.S.A. Landfill gases are collected via a collection header from a series of wells across the landfill surface. Under normal operation, this gas is compressed, then pumped to a nearby automotive plant where it is used for process heat. Alternatively, the gas can be burned in the flare, as was the case during these measurements.

The layout of the flaring and associated facilities is shown in Figure A1.1. A Roots blower, located in the Blower Building, pumps landfill gas to the flare through an above ground pipe. The Blower Building is constructed with sheet metal walls.

The flare is of the enclosed type as shown in Figure A1.2. Incoming landfill gas is distributed to 6 burners located inside the combustion chamber. The combustion chamber is a cylindrical steel stack, 3.0 m (10') diameter by 12 m (40') high, which is lined with a fibrous refractory material. Additional combustion air is provided to the combustion chamber at the base of stack through four openings. Louver dampers control air flow through these openings. Two of the dampers are controlled manually, while the opening of the other two dampers is automatically controlled according to the temperature of gases leaving the top of the stack. The design details of the flare are summarized in Table A1.1.

The landfill gas flow rate was varied during the test in order to assess the operating noise at different flow rates.

Flare Type:	**Enclosed**
Combustion Chamber (Stack):	**3.05 m (10') diameter** **12.2 m (40') high** **steel with fibrous refractory lining**
Burners:	**Six**
Combustion Air:	**Controlled by dampers on four openings at the base of the stack**
Input Capacity:	**1.42 m^3/s (3000 SCFM) landfill gas** **26.6 MW (1520 MBTU/min)**
Landfill Gas Compressor:	**Roots Blower, enclosed** **Xx Watts (xx HP)**

SCFM = standard cubic feet per minute

Table A1.1 Design Parameters, Vienna Junction Gas Flare

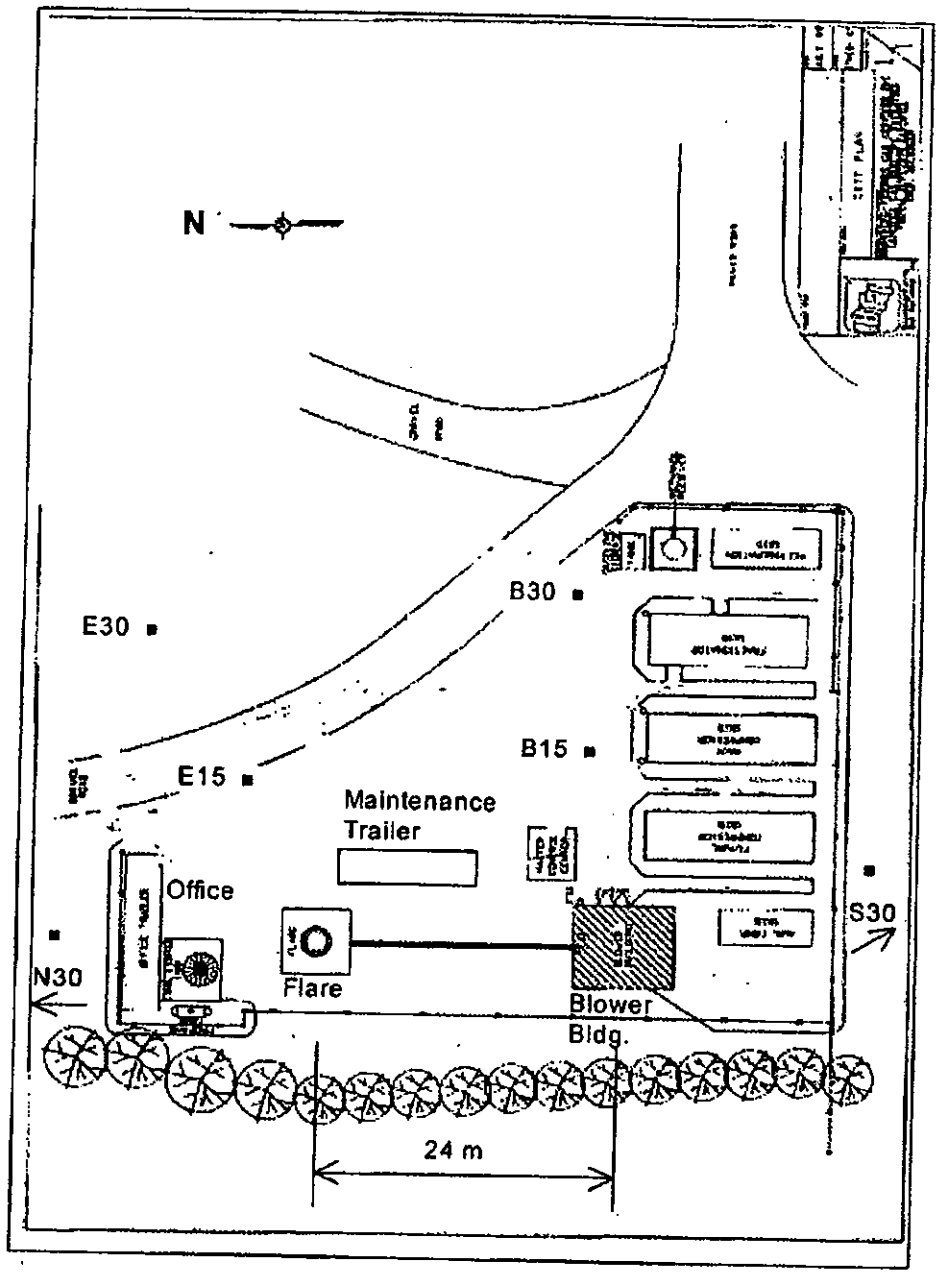


Figure A1.1 Site Plan, Vienna Junction Flare (scaling approximate)

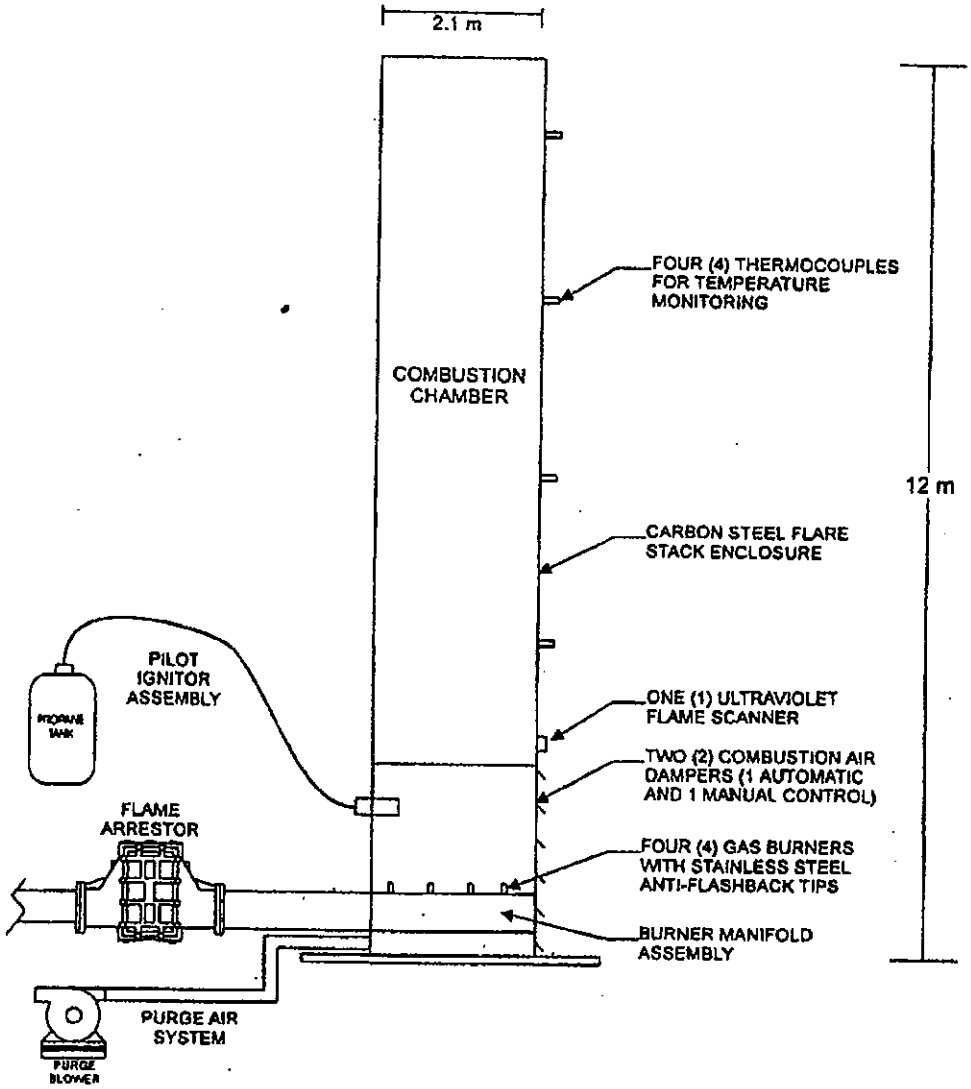


Figure A1.2 Schematic of Enclosed Flare of the Type Installed at Vienna Junction

Note: The Vienna Junction Flare has the following characteristics: 3.05 m diameter, 12.2 m high, four combustion air dampers (2 automatic and two controlled), 6 gas burners.

A1.2 Operating Conditions During Noise Measurements

The landfill gas collected from the Vienna Junction Landfill has the following typical composition by volume.

Methane	50 %
Nitrogen	30 %
Oxygen	1.5 %
Carbon dioxide	balance (18.5 %)

A summary of the two operating conditions used during the noise testing of the Vienna Junction Flare is given in Table A1.2. Sample calculations of these parameters follow.

Landfill Gas Flow Rate	Heat Release Rate	Flue Gas Exit Velocity
1.13 m^3/s (2400 SCFM)	21.3 MW (1214 MBTU/min)	8.56 m/s (28.1 ft/s)
0.57 m^3/s (1200 SCFM)	10.7 MW (607 MBTU/min)	4.28 m/s (14.1 ft/s)

Table A1.2 Operating Conditions During Noise Testing, Vienna Junction Flare, 16 November 1999

The heat release rate of the flare has been based on the higher heating rate of methane, 37.7 MJ/m^3 or 1012 BTU per SCF. A sample calculation for the heat released during burning follows.

Landfill gas flow: 1.13 m^3/s (2400 SCFM)

Methane flow (50% of gas): 0.566 m^3/s (1200 SCFM)

Heat release rate: 37.7 * 0.566 = 21.3 MW (1214 MBTU/min)

An important parameter in determining noise from a flare of this type is the velocity of the flue gasses as they exit the top of the flare stack. This velocity has been estimated using a factor supplied by the John Zink Company, manufacturer of the flare stacks. The

factor depends on the exit temperature of the flue gases at the top of the stack. For the range of temperatures typically used in these flares, 800 to 950 °C, a representative value of the factor is

1.84 actual cubic feet per second of flue gasses per SCFM of methane

A sample calculation of the flue gas exit velocity follows.

Landfill gas flow:	1.13 m^3/s (2400 SCFM)
Methane flow (50% of gas):	0.566 m^3/s (1200 SCFM)
Flue gas flow rate:	62.52 m^3/s (2208 ft^3/s)
Stack cross-section area:	$\pi * (3.05/2)^2 = 7.306\ m^3$ (78.5 ft^2)
Flue gas exit velocity:	62.52/7.306 = 8.56 m/s (28.1 ft/s)

A1.3 Noise Measurement Procedures and Results

On 16 November 1999, sound measurements were taken at various distances and in various directions from the flare as shown in Figure A1.1. In general, directions were chosen which minimised obstructions which might reduce the noise. Noise measurements were not made to the west of the flare as the land in that direction is wooded and drops sharply down to a creek.

In most instances, A-weighted equivalent sound level, L_{AEQ}, was determined at each position and flaring condition by averaging for 5 or more minutes. Due to a limited time available for testing, this averaging time was reduced to between 1 and 5 minutes for measurements at the lower landfill gas flow rate, 0.57 m^3/s (1200 SCFM). Noise from the flare was generally quite steady, so that equivalent sound levels determined over less than 5 minutes are still considered to be reasonably accurate.

Sound measurement instrumentation used is set out below.

a) Brüel & Kjær Modular Precision Sound Analyser, Type 2260B, Serial No. 1772180
b) Brüel & Kjær Prepolarized Free-field ½" Microphone, Type 4189, Serial No.1783705
c) Brüel & Kjær Enhanced Sound Analysis Software, Type BZ7202
d) Brüel & Kjær Sound Level Calibrator, Type 4231, Serial No. 2122785
e) Brüel & Kjær 90 mm Windscreen, Type UA0237
f) Tripod

Items a, b, and d above were calibrated by Brüel & Kjær on 16 August 1999.

All measurements were taken with the analyser mounted on the tripod, at least 1 m above the ground and no closer than 3 m from any other sound reflective surfaces. Unless otherwise noted, extraneous noise events, e.g. aircraft flyovers, passing vehicles, etc., were eliminated by pausing measurement and back erasing where necessary. Calibration and battery checks which were carried out before, after and on several occasions during the measurements. In no case did the calibration vary by more than 0.1 dB over the series of measurements.

Weather conditions were suitable for noise measurements: clear skies, low wind speeds, low humidity and mild temperatures. The following data on weather conditions over the time of period of the measurements was obtained from the U.S. National Weather Service for the nearby weather station at Metcalf Field, Toledo, Ohio.

Temperature:	5 to 6 °C
Due Point:	-6 to -9 °C
Wind:	19 to 24 km/h NNW

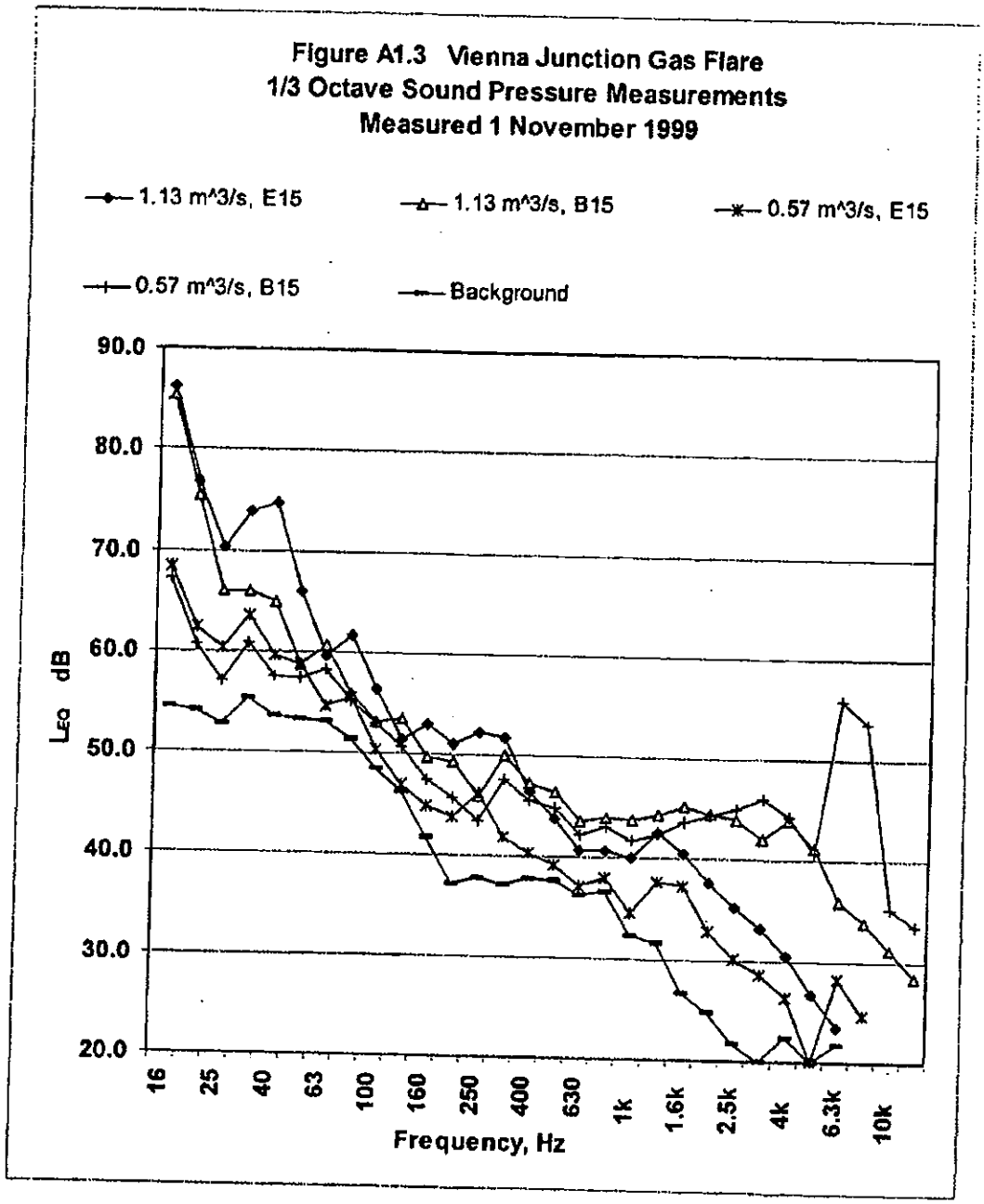
A summary of the noise measurement results is given in Table A1.3.

Measurement Position	Distance from Flare Stack m	Distance from Blower Bldg. m	Measured Noise Level (L_{AEQ} in dBA) Landfill Gas Flow	
			1.13 m^3/s (2400 SCFM)	0.57 m^3/s (1200 SCFM)
E15 (Shielded from Blower bldg.)	15	33	53.3	47.6
E30 (Shielded from Blower bldg.)	30	44	49.2	45.8
B15 (Shielded from air inlets at flare base)	28	15	55.7	59.6
B30 (Shielded from air inlets at flare base)	38	30	50.2	50.6
N30 (Shielded by Office)	30	54	45.1	44.9
S30 (Shielded from air inlets at flare base)	54	30	50.1	51.6
Background			44.0	

Table A1.3 Sound Measurement Results, Vienna Junction Flare, 16 November 1999

Measured noise spectra for several of the above locations and operating conditions are contained in Figure A1.3. The only spectrum which shows tonal characteristics is the noise at B15 for the lower flow conditions, 0.57 m^3/s (1200 SCFM). Subjectively this corresponded to a hissing sound which originated in the flow control valve which was throttled back to give the lower flow rate.

Figure A1.3 Vienna Junction Gas Flare
1/3 Octave Sound Pressure Measurements
Measured 1 November 1999



A1.4 Discussion of Noise Measurement Results

The major points of noise emission were observed to be the flare stack and the blower building. A considerable portion of the flare stack noise was observed to be coming from the air inlets at the base of the flare stack. Sources of noise within the blower building were observed to be the Roots blower and flow noise produced at a flow control valve.

Note in Figure A1.12, that a Trailer, used to store equipment, was situated such that it acted as a barrier to either the flare or the blower building. A discussion of the various measuring positions follows.

- For positions E15 and E30 the flare is unobstructed but noise from the blower building is obstructed by the trailer
- For positions B15 and B30, the blower building is unobstructed, but the trailer obstructs noise from the lower portion of the flare, i.e. the air inlet region.
- For position N30, the Office building blocks noise from the lower part of the flare and from the blower building. It can be seen in Table A1.3 that this results in low noise levels at N30, levels which are barely above the background level.
- For Position S30, the lower part of the flare is partially blocked by the blower building, hence noise at S30 is mainly due to noise from the blower building. Note that the results at S30 are very similar to the results at B30.

Note that noise measurements at B15 and B30, primarily noise from the blower building, are higher at the lower landfill gas flow rate. Noise from the flow control valve in the blower building was higher at lower flow rates.

From the above it is concluded that noise measurements at E15 and E30 can be taken as representative of noise from the flare alone, and that noise measurements at B15 and B30 can be taken as representative of noise from the blower building alone. This approximation is conservative in the sense that the measured levels are likely to be higher than those which are actually due to the flare or blower building alone. For example, the noise measured at B30 probably includes noise from the lower part of the flare which reflects from the office building.

In order to estimate the sound source strength of the flare system in total, it will be assumed that the sound source strengths of the flare and the blower building are additive for a given distance. For example, with the flare system operating at 1.13 m^3/s (2400 SCFM), the system sound source strength at a distance of 30 m will be calculated by adding logarithmically the flare noise from E30, 49.2 dBA, and the blower building noise at B30, 50.2 dBA.

Flare system sound pressure level = 49.2 dBA + 50.2 dBA = 52.7 dBA
(at 30 m & 1.13 m^3/s (2400 SCFM))

Similarly, for the flare system operating at 0.57 m^3/s (1200 SCFM), the system sound source strength at a distance of 30 m is estimated as follows.

Flare system sound pressure level = 45.8 dBA + 50.6 dBA = 51.8 dBA
(at 30 m & 0.57 m^3/s (1200 SCFM))

Note that no corrections have been made for background noise levels, a further conservatism in the estimate.

In order to estimate the noise impact of a similar flare noise at various distances can be estimated by assuming that sound is attenuated by geometric spreading alone, attenuation = 20 $Log(d/d_0)$. This ignores additional attenuation which usually occurs due to ground absorption. Sound pressure levels, estimated on this basis, for various distances from the Vienna Junction flare system, are given in Table A1.4.

Operating Condition (Landfill gas* flow rate)	Sound Pressure Level, L_{AEQ}, dBA			
	30 m	60 m	75 m	150 m
1.13 m^3/s (2400 SCFM)	52.7	46.7	44.7	38.7
0.57 m^3/s (1200 SCFM)	51.8	45.8	43.8	37.8

* Landfill gas containing 50 % methane

Table A1.4 Estimates of Sound Pressure Levels, L_{AEQ}, at Various Distances from the Vienna Junction Flare System

A1.5 Conclusions for Similar Flares Operating in Ontario

Ontario Ministry of Environment, MoE, has published the following noise guidelines for stationary sources of sound, such as gas flares.

- Ministry of Environment Publication NPC-205, Sound Limits for Stationary Noise Sources in Class 1 & 2 Areas (Urban), October 1995.
- Ministry of Environment Publication NPC-232, Sound Limits for Stationary Noise Sources in Class 3 Areas (Rural), October 1995.

Since landfill gas flares typically operate on a 24 hour basis, the lower nighttime limits would be the most relevant. The sound level limits in terms of hourly equivalent sound levels, L_{AEQ}, at the nearest point of reception are the minimum background sound levels. (A point of reception is a point on the property of a residence, school, hospital place of worship, etc., see guidelines for details.) However, exclusion limits have also been established, below which no noise restrictions apply to sound sources. For nighttime operation of a sound source, these limits are 45 dBA for Class 1 & 2 Areas (Urban) and 40 dBA for Class 3 Areas (Rural).

If a flare with similar noise characteristics to the Vienna Junction Gas Flare were located in Ontario and operated at under the above conditions, then minimum separation distances required by the MoE between the flare and the nearest point of reception would be as set out in Table A1.5.

Point of Reception Location	Time of Flare Operation*	Minimum Separation Distance (m)
Class 1 & 2 Areas (Urban)	24 hour operation	75 (criterion < 45 dBA)
Class 3 Areas (Rural)	24 hour operation	150 (criterion < 40 dBA)

* Landfill gas flow up to 1.13 m^3/s (2400 SCFM)) at 50 % methane

Table A1.5 Minimum Separation Distances Applicable to a Flare Similar to the Vienna Junction Flare operating in Ontario

A1.6 Comparison with Published Data

Swithenbank has published a paper discussing theoretical aspects of flare noise as well as some results [J. Swithenbank, 'Ecological Aspects of Combustion Devices with Reference to Hydrocarbon Flaring', A.I. Ch. E. Journal, Vol. 18, No. 3, 1972, p. 533 - 560]. Experimental results from this paper suggest that the acoustic efficiency, η, varies between 10^{-7} to 10^{-10}, depending on flare design parameters and flow rate. Acoustic efficiency is defined as follows.

η = acoustic efficiency = W/W_F

W = sound power output of the flare, Watts

W_F = heat release rate of the flare, Watts

The sound power output of a flare can be calculated from a measured sound pressure level at a distance, assuming uniform hemispherical sound radiation over a non-absorbing ground. In decibel terms this relationship is as follows.

$$L_W = L_P + 10 \text{ Log}(2\pi r^2)$$

$L_W = 10 \text{ Log}(W/W_0)$, where $W_0 = 10^{-12}$ Watts is a reference power output.

L_P = unweighted sound pressure level, L_{EQ}, in dB at r (metres) from the flare.

In Table A1.6 contains calculated acoustic efficiencies of the Vienna Junction Flare at the two flow rates tested. These efficiencies are based on the measured unweighted sound pressure levels at E15, 15 m from the flare. (Similar calculations of acoustic efficiency based on unweighted sound pressure measurements at E30, 30 m from the flare, resulted in acoustic efficiencies of 1.29×10^{-7} and 2.1×10^{-8} respectively.)

These calculated acoustic efficiencies are well within the range of values, 10^{-7} to 10^{-10}, given by Swithenbank. The marked increase in acoustic efficiency with flow rate is also similar to the results given by Swithenbank. These comparisons show that the measured sound outputs of the Vienna Junction Flare are in broad agreement with the data published by Swithenbank.

Landfill Gas* Flow Rate & Heat Release Rate	Measured Sound Pressure Level at E15 L_{EQ} (dB - unweighted)	Calculated Sound Power (Watts)	Acoustic Efficiency η
1.13 m^3/s (2400 SCFM) 21.3 MW	89.2	1.18	5.5×10^{-8}
0.57 m^3/s (1200 SCFM) 10.7 MW	78.0	0.089	0.83×10^{-8}

* Landfill gas containing 50 % methane

Table A1.6 Calculated Acoustic Efficiency of the Vienna Junction Flare

A1.7 Summary of Analysis and Results

Sound measurements of a landfill gas flare have been carried out at the Vienna Junction Landfill in Erie, Michigan. The flare was tested at two landfill gas flow rates: 1.13 m^3/s (2400 SCFM) and 0.57 m^3/s (1200 SCFM). The purpose of these measurements was to provide noise source data which can be used as a basis for predicting noise emissions from similar flares of this type. Below is a summary of the analysis and results.

- Indicative sound pressure levels at 30 m form the flare system were 52.7 dBA and 51.8 dBA respectively for the two flow rates, 1.13 m^3/s (2400 SCFM) and 0.57 m^3/s (1200 SCFM). Both the flare and the blower building were found to be significant sources of noise. Note that noise level did not vary significantly with landfill gas flow rate.

- The measured sound output of the flare has been found to be in broad agreement with published data.

- If a flare similar to the Vienna Junction Flare were located in Ontario and operated on a 24 hour basis, then to meet MoE Nose Limits minimum separation distances between the flare and the nearest point of reception have been found to be 75 m in Class 1 & 2 Areas (Urban), criterion < 45 dBA, and 150 m in Class 3 Areas (Rural), criterion < 40 dBA. (Note that smaller separation distances could be applicable in areas with high background sound levels.)

Appendix 2

Figures

Contents:

Appendix 3

Zoning Information from the Township of West Carleton

Contents:

- **Zoning map from Township of West Carleton, obtained 19 November 1999**

APPENDIX B.3

Candlestick Flare and Blower

FINAL REPORT
ENVIRONMENTAL NOISE AUDIT
BLACKWELL ROAD LANDFILL SITE
SARNIA, ONTARIO

Project Number: 02-1156

Date: November 29, 2001

Submitted By: Rowan Williams Davies & Irwin Inc.

Project Director - David S. Chadder, Hon. B.Sc., Q.E.P.

Project Manager - Greg Conley, M.Eng., P.Eng.

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Project Coordinator - Sarah Crothers, B.Eng.

Submitted to: Ontario Ministry of the Environment

Canadian Waste Services Inc.

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TABLE OF CONTENTS

1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Canadian Waste Services Inc. to conduct a noise audit of their Blackwell Road Landfill Site, located in Sarnia, Ontario. This work has been conducted in accordance with the terms of reference outlined in RWDI Proposal No. 02-0293P, dated October 30, 2001. This environmental noise audit is required by the Ministry of the Environment (MOE) as indicated by Conditions 1 and 2 of the site Certificate of Approval (Air) No. 8688-4JYPTY. To our knowledge there have been no noise complaints filed with the MOE.

The Blackwell Road Landfill Site incorporates two significant noise sources. The first is the flaring system for the removal of methane and the second is the blower housing which maintains compressed air in 51 wells located around the perimeter of the site to minimize methane migration through the soil. Both the flaring system and the blower housing are located at the south end of the site. Noise impacts from the operation of these units are of concern at residences located along Tawny Road and Pullen Drive, which back onto the site. The purposes of this study are:

a) to determine ambient noise levels (without contribution from the landfill sources) at the residences of concern, through measurement of ambient sound exposures;
b) to measure the sound emission characteristics of the flaring system and the blower system; and
c) to measure and predict sound levels resulting from landfill operations, including the flaring system and the blower house, at the receptors of concern, and compare these levels with the MOE noise criteria.

1.1 Key Findings

The key findings of this study are that the worst-case sound exposures resulting from Blackwell Road Landfill Operations, including that of the flaring system and the blower house, are in accordance with MOE NPC-205 noise criteria at the receptors of concern.

1.2 Study Area

The Blackwell Road Landfill is surrounded by a residential area, bordered by the Howard Watson Nature Trail and Blackwell Road. The residential receptors along Tawny Road / Errol Road East back onto the nature trail adjacent to the landfill. The residential receptors along Pullen Drive back onto the landfill site. The south end of the landfill site (the location of the flare and the blower) is approximately 1,430 m from Highway 402.

Figure 1 is a 1:8,000 map showing the location of the facility and receptors of concern. Figure 2 is a site plan (not to scale) showing the location of the flaring system, the blower house, and the nearest receptors of concern.

The noise environment consists of many natural sounds (e.g., birds, neighbourhood dogs, geese), minimal road traffic noise from Highway 402, Michigan Avenue, and small aircraft approaching and departing from the nearby Sarnia Airport.

2. GUIDELINES

Appendix A contains a glossary of commonly used noise terminology.

The applicable guidelines used for this installation are the MOE "Stationary Source" guidelines for Class 1 (urban) areas, set out in Publication NPC-205. These guidelines state that one-hour sound exposures ($L_{eq}(1)$) from stationary noise sources in Class 1 areas shall not exceed that of the background, where the background is typically considered to be:

a) the higher of 50 dBA or background noise typically caused by road traffic, during daytime hours (0700 - 1900h);

b) the higher of 47 dBA, or background noise typically caused by road traffic, during the early evening (1900 - 2300h); and

c) the higher of 45 dBA, or background noise typically caused by road traffic, during nighttime hours (2300 - 0700h).

3. MEASUREMENT DATA

3.1 Measurement Equipment

All measurements were conducted using either:

a) A Larson-Davis Model 800B Precision Integrating Sound Level Meter (SLM). The Model 800B uses a Larson-Davis Model 826-10 preamplifier and a Larson-Davis Model 2559 precision air-condenser microphone, which have been factory calibrated with the SLM unit. Calibration was checked before and after measurements with a Larson-Davis Model CA250 precision acoustic calibrator;

b) A Larson-Davis Model 820 Precision Integrating SLM. The Model 820 uses a Larson-Davis Model 828 preamplifier and a Larson-Davis Model 2560 precision air-condenser microphone, which have been factory calibrated with the SLM unit. Calibration was checked before and after measurements with a Larson-Davis Model CA250 precision acoustic calibrator; and,

c) A Larson-Davis System 824 Real-Time Frequency Analyzer (RTA) and SLM. The System 824 uses a Larson-Davis Model 902 preamplifier and a Larson-Davis Model 2559 precision air-condenser microphone, which have been factory calibrated with the SLM / RTA unit. Calibration was checked before and after measurements with a Larson-Davis Model CA250 precision acoustic calibrator.

3.2 Meteorological Conditions at the Time of Measurements

Ambient and near-field noise measurements were collected from November 1 to November 7, 2001. In general, all meteorological conditions complied with MOE NPC-103 criteria during the measurement period.

3.3 Methodology

3.3.1 Ambient Sound Exposures

Ambient measurements (1-hour) including road traffic noise from Michigan Avenue, Tawny/ Errol Road and Highway 402 in the form of L_{eq} (1) values and other noise statistics were obtained using the LD820 SLM. The measurement site is shown in Figure 1. The setback distance and layout of the backyard with respect to the nature trail, landfill and roadway are similar to those of the receptors of concern, and therefore, the acoustical environment is also representative of that of the residences.

The flaring system operates 24 hours a day, 7 days a week, and was in normal operating mode during the ambient monitoring period. Similarly, the blower operates 24 hours a day, 7 days a week, and was also in normal operating mode during the ambient period. Noise from both the flare and the blower were inaudible at the ambient noise monitoring site.

3.3.2 Blackwell Road Landfill Sound Levels

Near-field noise levels from both the flare and the blower (air injection system) were obtained. The locations of the blower and flaring systems are shown in Figure 2. All noise measurements were conducted in compliance with MOE NPC-103 noise measurement protocols. Measurements were conducted at the property line for R1 with both the flare and the blower on.

Noise levels from the flare and the blower were measured at 5 m (near-field) in four perpendicular directions, corresponding approximately to the compass headings north, south, east and west. Thus, there were 4 measurement locations in the near field for each of the blower and the flare. The most noticeable on-site noise source was determined to be the blower. The flare measurements were conducted with the blower off. The blower was deemed to be the dominant noise source during blower measurements so the flare remained in operation.

3.4 Results

3.4.1 Ambient Sound Exposures

The lowest measured ambient sound level during the nighttime period (2300 - 0700h) was 33 dBA. The lowest measured level during daytime hours (0700 - 1900h) was 39 dBA, and the lowest measured level during evening hours (1900 - 2300h) was 38 dBA. Measured ambient sound levels (L_{eq} (1)) over the measurement period from November 1 to November 7, 2001, are included in Appendix B.

3.4.2 Blackwell Road Landfill Sound Levels

Table 1 summarizes the results of the near-field and property line measurements:

Table 1: Summary of Near-Field and Property Line Measurement Results

Source	Direction From Source	Distance From Source (m)	Measured SPL[1] (dBA)
Flaring System	North	5	62
	East	5	57
	South	5	61
	West	5	65
Blower System	North	5	67
	East	5	62
	South	5	51
	West	5	54
Flare + Blower [2] (at R1)	West	71 (from flare) 47 (from blower)	44

Notes:
[1] Sound pressure level
[2] Flare + Blower measurement obtained at R1 property line. Measurement location shown in Figure 2.

4. ASSESSMENT OF COMPLIANCE

4.1 Ambient Sound Exposures

The measured ambient sound levels are summarized in Table 2.

Table 2: Lowest Measured Ambient Sound Exposures & Corresponding NPC-205 Guideline Limits

Time Period	Lowest Measured ($L_{eq}(1)$) (dBA)	NPC-205 Guideline Limit (dBA)
Day (0700-1900h)	39	50
Evening (1900-2300h)	38	47
Night (2300-0700h)	33	45

In accordance with NPC-205 guidelines, the noise impact from Blackwell Road Landfill facilities can not exceed the 50 dBA during daytime hours, 47 dBA during evening hours and 45 dBA during nighttime hours. Since the flaring system and the blower building operate 24 hours a day, the strictest 45 dBA limit has been used in this assessment.

4.2 Blackwell Road Landfill Flaring and Blower Systems – Combined Impacts

As shown in Table 3, the worst-case measured sound level from the combination of the flare and blower noise measured at the property line of R1 is 44 dBA. This meets all NPC-205 guidelines. Receptor R1 is the residence closest to the blower (the dominant noise source), and therefore, is expected to receive the greatest noise impact. Therefore, based on direct measurement, the Blackwell Landfill is in compliance with NPC-205 noise guidelines.

For verification, sound exposures resulting from the operation of the flaring system and the blower house were modelled at the selected worst-case receptor R1, as well as receptor R2, extrapolated from near-field measurement data. Atmospheric and ground attenuation effects were neglected. Because of similarities of ambient sound environments and proximity to the flare and

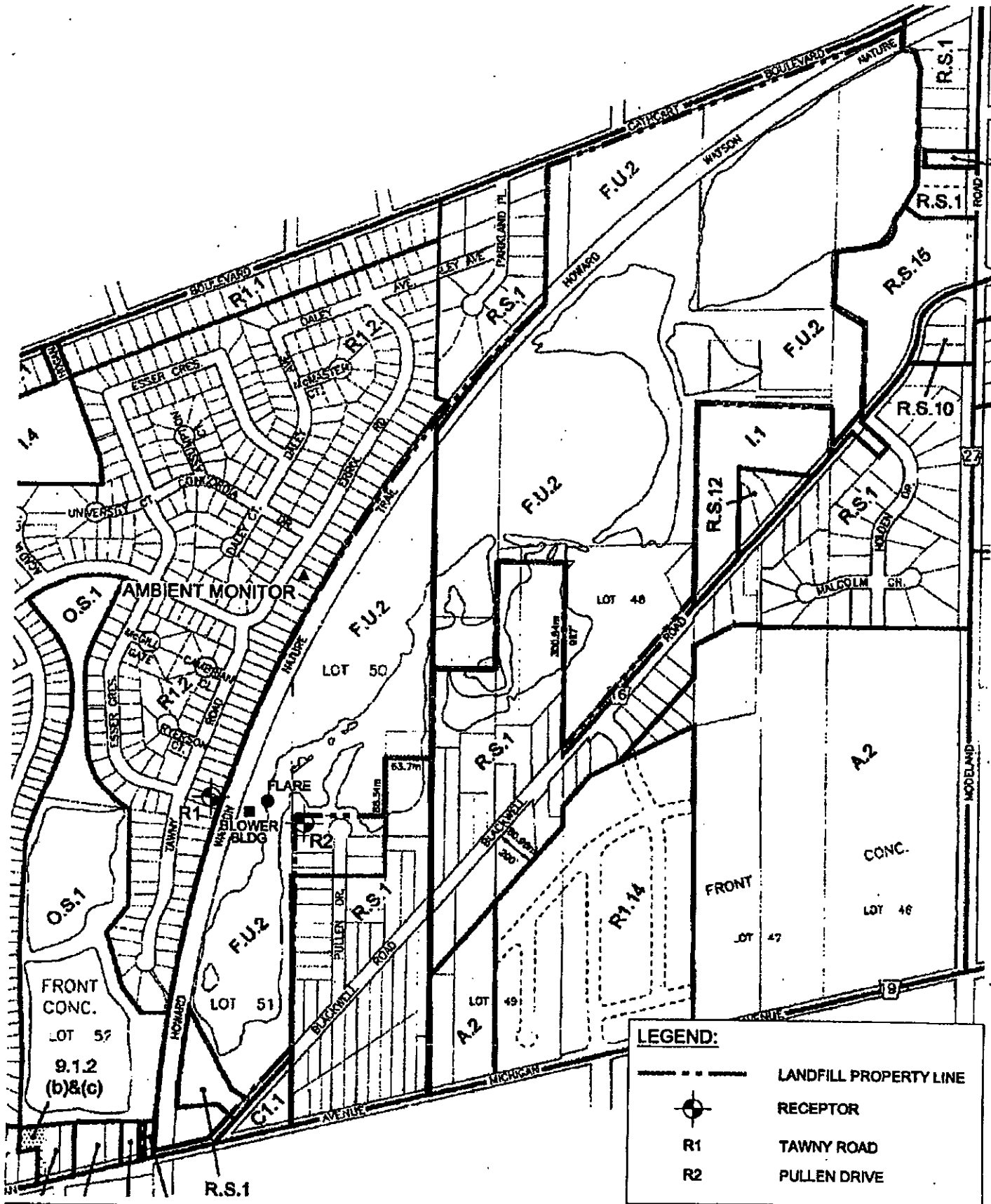
the blower house, R2 is considered to be acoustically equivalent to R1, and therefore, the measured ambient level is valid for both locations.

Table 3: Extrapolated Sound Levels at Modelled Receptors of Concern – Combined Impacts

Descriptor	Levels at Receptor (dBA) [1]	
	R1	R2
Measured Total	44	--
Predicted Flare	40	40
Predicted Blower	45	37
Predicted Total	46	41
Meets NPC-205?	Yes	Yes

Notes:
[1] Based on extrapolating the near-field data, excluding ground and atmospheric attenuation effects.
-- not measured

The measured and predicted noise impacts agree within 2 dBA at the worst-case receptor (R1). The predictions presented above are considered to be conservative due to the omission of ground and atmospheric attenuation effects, and therefore, serve as verification of the actual measured results. Modelled noise impacts were predicted to be within NPC-205 guidelines. In summary, the Blackwell Road Landfill facility is expected to be in compliance with MOE noise requirements.



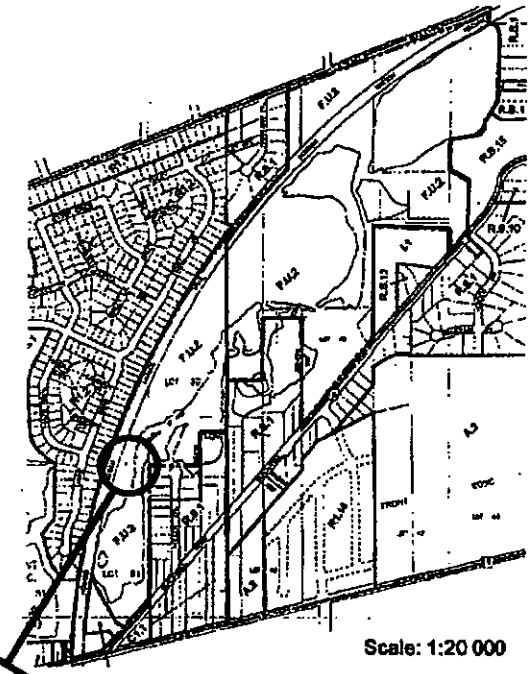
Site Plan, Location of Receptors and Ambient Monitor

True North

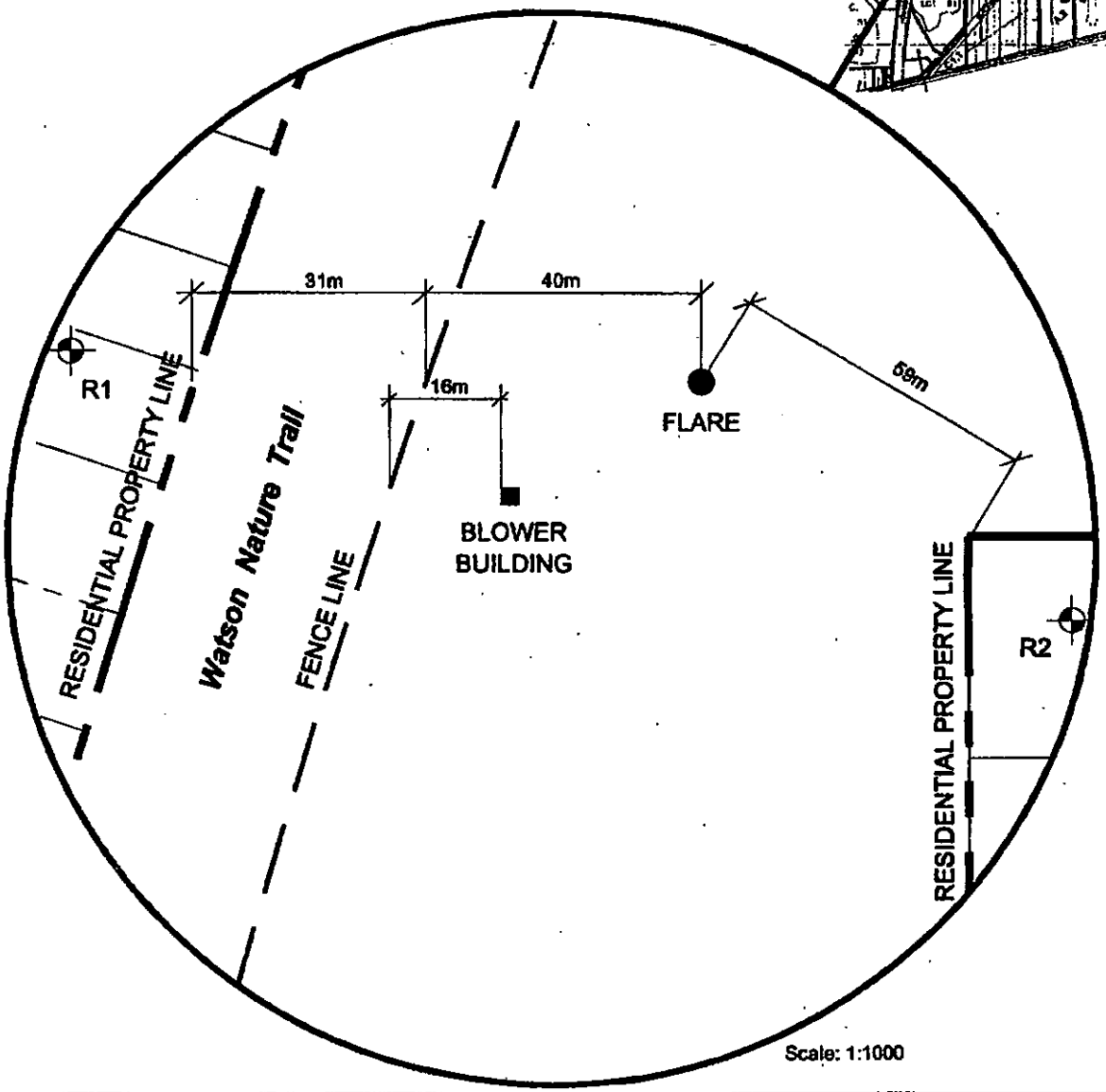
Drawn by: SWJ	Figure: 1	RWDI
Approx. Scale:	1:8000	
Date Revised: Nov 20, 2001		

Blackwell Road Landfill Flare Acoustic Audit - Sarnia, Ontario — Project #02-1156

0001952



Scale: 1:20 000



Scale: 1:1000

Location of Flare and Blower Building	True North	Drawn by: SWJ Figure: 2	RWDI
		Approx. Scale: As Shown	
Blackwell Road Landfill Flare Acoustic Audit - Sarnia, Ontario	Project #02-1156	Date Revised: Nov 20, 2001	

APPENDIX A

APPENDIX A

ENVIRONMENTAL NOISE DESCRIPTORS AND TERMINOLOGY

Ambient Background Noise
Noise from all sources other than a particular sound that is of interest (e.g. other than the sound being measured).

dB - Decibel
The "unit" of sound pressure level. See sound level.

dBA - A-weighted Decibel
A nationally and internationally standardized frequency weighting applied to the sound level spectrum to approximate the sensitivity of the human hearing mechanism as a function of frequency (pitch).

Sound
A dynamic (fluctuating) pressure.

Sound Level
The A-weighted Sound Pressure Level expressed in dBA.

Human Perception of Sound
The human perception of noise impact is an important consideration in the quantification of the noise effects caused by projects. The following table is a rough guideline.

Increase in Noise Level (dBA)	Perception
1 to 3	insignificant due to imperceptibility
4 to 5	just-noticeable difference
6 to 9	marginally significant
10 or more	significant, perceived as a doubling of sound exposure

The Energy Equivalent Continuous Sound Level (L_{eq})
The constant sound level over the time period in question, that results in the same total sound energy as the actually varying sound. Must be associated with a time period. Usually in dBA.

Sound (Pressure) Level
Measured in decibels (dB) it is the logarithmic ratio of the instantaneous energy of a sound to the energy at the threshold of hearing. Mathematically:

$$SPL\ (dB) = 20\ LOG\ (P/P_0)$$

where P is the pressure due to the sound and P_0 is the pressure at the threshold of hearing, taken as 20 micro Pascals.

Sound Exposure Level (SEL)
A time integrated measure (Leq) referenced to a one second duration.

Noise
Unwanted sound.

Noise Level
Same as Sound Level, except applied to unwanted sounds.

Exceedance Noise Level (L_N)
The noise level exceeded N% of the time. It is a statistical measure of the noise level. For highly varying sounds, the L90 represents the background noise level, L50 represents the median or typical noise level, and L10 represents the short term peak noise levels, such as due to occasiaonal traffic or a barking dog.

APPENDIX B

C:\FLARE\01NOV_12.bin Summary Data

Site: 0 Model: 820
Location: 1371 Errol Road East, Blackwell Landfill
Date: 01Nov 01 12:14:46

	Overall	Current
Run Time	148:32:29.5	00:00:00.0
Start Time	01Nov 01 12:14:46	08Nov 01 08:46:30
Leq	43.4	Leq 0.0
SEL	100.7	0.0
Lmax	84.7	0.0
Lmax Time	03Nov 01 09:57:15	31Jan 00 00:00:00
Lmin	28.3	0.0
Lmin Time	07Nov 01 03:13:20	31Jan 00 00:00:00
Peak	107.5	0.0
Peak Time	03Nov 01 11:02:25	31Jan 00 00:00:00
Unweighted Peak	118.1	0.0
Uwpk Time	04Nov 01 21:48:14	31Jan 00 00:00:00
Dose	0.0	0.0
Projected Dose	0.0	0.0
Threshold	80	80
Criterion	90	90

Ln values

L 1 =	57.4	L 5 =	50.3	L10 =	48.3
L50 =	41.6	L90 =	36.1	L99 =	31.1

Ldn	52.5	Event Leq	70.8
Cnel	52.7	Event Time	01:04:12.9
Sound Exposure	0.0	Background Leq	46.4
Overloads	0	Background Time	147:28:16.6
Pause Time	00:00:00.0		

Records:

Run/Stop	2	Daily	7
Event	0	Calibration	9
Interval	149	Time History	0

000198

C:\FLARE\01NOV_12.bin Daily Data

Site	Location	Meas Number	Date	Run Time (secs)	Leq	Lmax	Lmin	Peak	Uwpk	Ldn	CNEL
	L(n1) L(n2) L(n3) L(n4) L(n5) L(n6)										
0	1371 Errol Road East	0	01Nov 01	42313.1	49.5	75.7	39.1	102.4	113.7	51.5	52.3
0	1371 Errol Road East	0	02Nov 01	86400.0	46.3	77.5	35.0	95.3	106.0	51.2	51.3
0	1371 Errol Road East	0	03Nov 01	86400.0	57.5	84.7	29.6	107.4	110.1	57.6	57.7
0	1371 Errol Road East	0	04Nov 01	86400.0	45.3	76.3	31.7	95.4	118.1	49.9	50.6
0	1371 Errol Road East	0	05Nov 01	86400.0	46.1	77.7	32.6	100.1	107.2	49.6	49.7
0	1371 Errol Road East	0	06Nov 01	86400.0	47.7	75.0	33.6	94.5	105.4	50.2	50.6
0	1371 Errol Road East	0	07Nov 01	60436.4	43.9	74.5	28.3	94.8	100.2	46.0	46.0

C:\FLARE\01NOV_12.bin Calibration Data

Site	Location	Meas Number	Date	Time	Level	Mode	Offset	Status
0	1371 Errol Road East	0	01Nov 01	12:08:06	114.1	Manual	7.5	Ok
0	1371 Errol Road East	0	01Nov 01	12:08:21	114.0	Manual	7.5	Ok
0	1371 Errol Road East	0	01Nov 01	12:08:35	114.0	Manual	7.5	Ok
0	1371 Errol Road East	0	01Nov 01	12:08:48	114.0	Manual	7.5	Ok
0	1371 Errol Road East	0	01Nov 01	12:09:01	114.0	Manual	7.5	Ok
0	1371 Errol Road East	0	07Nov 01	16:47:59	113.2	Manual	7.5	Ok
0	1371 Errol Road East	0	07Nov 01	16:48:12	113.8	Manual	7.5	Ok
0	1371 Errol Road East	0	07Nov 01	16:48:25	113.8	Manual	7.5	Ok
0	1371 Errol Road East	0	07Nov 01	16:49:50	113.8	Manual	7.5	Ok

C:\FLARE\01NOV_12.bin Run/Stop Data

Site	Location	Meas Number	Date	Time	Type	Cause
0	1371 Errol Road East	0	01Nov 01	12:14:46	Run	Key
0	1371 Errol Road East	0	07Nov 01	16:47:16	Stop	Key

000201

C:\FLARE\01NOV_12.bin Setup Data
Site: 0 Date: 01Nov 01 12:14:45 Model: 820

#	Description	Value
2	Name	(R.W.D.I.1 820)
3	Name	(.....)
4	Name	(.....)
5	Title	(BLACKWELL.AMBIENT)
9	Com1 Baud Rate	[9600]
10	Com1 Address	(0)
14	Output 1 Logic	[Off]
15	Output 1 Hold Time	(10)
20	Power save options	[Auto Off]
21	Timer Run Mode	[Off]
22	Timer Run Date	(01/01/100)
23	Timer Stop Date	(12/31/199)
24	Timer Run Time 1	(08:00)
25	Timer Stop Time 1	(17:00)
26	Timer Run Time 2	(00:00)
27	Timer Stop Time 2	(00:00)
28	Lock combination	(11111111)
29	Lock R/S Key	[No]
30	Lock Setup	[No]
31	Lock Function	[No]
32	Lock Reset	[No]
33	Lock ON Key	[No]
34	Lock I/O	[No]
35	Cal level	(114.00)
36	Calibrator S/N	(2472)
39	Detector	[Slow]
40	Frequency Weighting	[A]
43	Mic polarization	[200]
44	Reference Level	(114.00)
45	Current Exchange rate	[3dB]
46	Current Threshold	(80)
47	Current Criterion	(90)
48	Overall Exchange rate	[3dB]
49	Overall Threshold	(80)
50	Overall Criterion	(90)
51	Dose period	(8)
52	LDL Exchange	[3dB]
53	LDL Threshold	(80)
54	LDL Criterion	(90)
55	Lnn 1 Percent	(1)
56	Lnn 2 Percent	(5)
57	Lnn 3 Percent	(10)
58	Lnn 4 Percent	(50)
59	Lnn 5 Percent	(90)
60	Lnn 6 Percent	(99)
61	RMS Excd Level 1	(115.00)
62	RMS Excd Level 2	(120)
63	Peak Excd Level	(70)
64	Uwpk Excd Level	(140)
65	Excd Hysteresis	(2)
66	Enable Excd History	[No]
67	Excd Exchange rate	[3dB]
68	Excd Minimum Duration	(6)
69	Excd Time-Hist Enable	[No]
70	Excd Time-Hist Period	(32)
72	Enable Intv History	[Yes]
73	Intv Exchange rate	[3dB]
74	Intv Threshold	(0)
75	Intv period	(01:00)
76	Intv Time Sync	[Yes]
77	Intv Save Ln'S	[Yes]
79	Intv Auto Stop	[No]
80	Enable Time History	[No]
81	Time History Resolution	[0.1dB]

82	Hist Save Peak	[No]
83	Hist Period	(60)
84	Hist Period units	[1.0s]
87	Histogram Resolution	[1.0]
88	Enable Daily History	[Yes]
153	Heater Line ON	[No]
154	Modem Mode	[No]
155	Modem Dial Out Mode	[None]
156	Phone Num	(----------)
157	Monitor Number	(0)
158	Modem Init	(X4 E0 Q0 V0 T M1 S0=5 &D)
159	Power Mode	[Normal]
161	Timed Excd Period	(01:00)
162	EXCD Trigger	[Level]
210	Aux Control Reg	(0)

000203

:\FLARE\01NOV_12.bin Interval Data

Site	Location	Meas Number	Date	Time	Duration	Leq	SEL	Lmax	Lmin	Peak	Uwpk	L(1)	L(5)	L(10)	L(50)	L(90)	L(99)	Over loads
0	1371 Errol Road East	0	01Nov 01	12:14:46	2713.0	54.8	89.2	75.7	45.5	102.4	113.7	62.9	58.6	56.9	51.6	47.7	46.1	0
0	1371 Errol Road East	0	01Nov 01	13:00:00	3600.0	50.8	86.4	66.6	44.8	82.8	110.4	58.3	54.7	53.2	49.1	46.9	45.5	0
0	1371 Errol Road East	0	01Nov 01	14:00:00	3600.0	52.1	87.7	75.5	45.2	97.5	105.1	63.1	55.3	52.2	48.7	46.9	45.9	0
0	1371 Errol Road East	0	01Nov 01	15:00:00	3600.0	48.3	83.9	60.0	44.2	78.8	105.1	53.2	51.1	50.3	47.8	45.8	44.6	0
0	1371 Errol Road East	0	01Nov 01	16:00:00	3600.0	50.0	85.5	61.9	45.4	83.7	106.4	55.7	53.0	51.9	49.2	47.4	46.2	0
0	1371 Errol Road East	0	01Nov 01	17:00:00	3600.0	49.9	85.4	68.9	45.4	83.1	113.1	56.3	52.9	51.6	48.7	46.9	45.9	0
0	1371 Errol Road East	0	01Nov 01	18:00:00	3600.0	47.1	82.7	59.2	43.4	76.0	104.8	53.0	50.1	49.0	46.4	45.0	44.0	0
0	1371 Errol Road East	0	01Nov 01	19:00:00	3600.0	46.7	82.3	57.3	43.2	77.3	104.2	51.9	49.8	48.8	46.0	44.3	43.3	0
0	1371 Errol Road East	0	01Nov 01	20:00:00	3600.0	46.7	82.3	59.8	41.5	76.3	106.3	52.6	50.2	48.9	45.7	44.0	42.6	0
0	1371 Errol Road East	0	01Nov 01	21:00:00	3600.0	47.7	83.3	67.5	42.7	87.4	107.2	54.5	51.4	50.0	46.2	44.0	43.1	0
0	1371 Errol Road East	0	01Nov 01	22:00:00	3600.0	46.3	81.8	59.9	40.3	78.9	105.1	53.1	49.9	48.6	45.1	42.6	41.2	0
0	1371 Errol Road East	0	01Nov 01	23:00:00	3600.0	44.3	79.9	53.8	39.1	70.4	102.1	49.2	47.5	46.6	43.6	41.7	40.5	0
0	1371 Errol Road East	0	02Nov 01	00:00:00	3600.0	43.1	78.6	54.5	37.6	75.7	102.1	48.8	46.1	45.0	42.3	40.0	38.4	0
0	1371 Errol Road East	0	02Nov 01	01:00:00	3600.0	41.6	77.1	57.4	36.9	74.2	97.2	46.8	44.1	43.3	40.9	39.0	37.6	0
0	1371 Errol Road East	0	02Nov 01	02:00:00	3600.0	41.6	77.1	65.5	36.4	80.6	96.4	45.6	43.8	43.0	40.7	38.7	37.1	0
0	1371 Errol Road East	0	02Nov 01	03:00:00	3600.0	41.9	77.4	52.7	36.9	80.0	96.8	48.8	45.1	43.8	40.9	38.9	38.0	0
0	1371 Errol Road East	0	02Nov 01	04:00:00	3600.0	44.2	79.8	51.9	38.0	83.3	94.7	50.7	49.1	47.7	42.6	40.5	39.2	0
0	1371 Errol Road East	0	02Nov 01	05:00:00	3600.0	48.8	84.4	56.9	42.6	83.6	97.2	54.9	52.8	51.5	47.8	45.0	43.4	0
0	1371 Errol Road East	0	02Nov 01	06:00:00	3600.0	46.5	82.1	54.7	39.7	83.3	101.6	52.6	51.5	50.6	43.7	41.8	40.8	0
0	1371 Errol Road East	0	02Nov 01	07:00:00	3600.0	49.7	85.2	58.7	44.1	83.8	103.9	54.8	53.7	52.7	48.4	46.4	45.2	0
0	1371 Errol Road East	0	02Nov 01	08:00:00	3600.0	48.5	84.1	61.4	43.5	81.1	106.0	52.9	51.2	50.4	47.9	45.9	44.4	0
0	1371 Errol Road East	0	02Nov 01	09:00:00	3600.0	47.1	82.7	58.5	41.5	81.2	100.7	51.9	50.1	49.5	46.3	43.8	42.5	0

0	1371	Errol Road East	0	02Nov 01	10:00:00	3600.0	51.1	86.7	77.5	40.9	95.3	99.7	58.0	48.3	46.8	44.3	43.0	42.0	0
0	1371	Errol Road East	0	02Nov 01	11:00:00	3600.0	49.3	84.9	64.3	41.3	81.5	99.1	57.6	55.4	53.7	45.2	43.1	42.1	0
0	1371	Errol Road East	0	02Nov 01	12:00:00	3600.0	47.6	83.2	71.2	40.2	88.1	100.2	55.4	52.3	50.1	43.8	41.9	41.0	0
0	1371	Errol Road East	0	02Nov 01	13:00:00	3600.0	50.6	86.2	73.1	38.4	92.8	93.7	63.8	51.4	47.5	42.8	40.8	39.1	0
0	1371	Errol Road East	0	02Nov 01	14:00:00	3600.0	44.6	80.1	58.3	37.1	78.7	98.5	53.8	49.5	47.7	42.1	39.2	38.0	0
0	1371	Errol Road East	0	02Nov 01	15:00:00	3600.0	45.7	81.3	60.7	36.8	74.1	93.7	55.9	50.6	48.2	42.7	39.6	37.5	0
0	1371	Errol Road East	0	02Nov 01	16:00:00	3600.0	43.5	79.0	58.3	37.3	75.8	99.7	50.6	47.8	46.4	41.8	39.3	38.1	0
0	1371	Errol Road East	0	02Nov 01	17:00:00	3600.0	46.1	81.7	65.7	37.6	85.4	87.6	57.2	50.7	47.9	41.8	39.3	38.1	0
0	1371	Errol Road East	0	02Nov 01	18:00:00	3600.0	42.5	78.1	54.3	38.6	71.6	87.6	49.4	46.4	44.6	41.4	40.1	39.1	0
0	1371	Errol Road East	0	02Nov 01	19:00:00	3600.0	43.2	78.8	68.0	37.1	85.6	87.6	48.3	45.0	43.3	40.5	39.1	38.1	0
0	1371	Errol Road East	0	02Nov 01	20:00:00	3600.0	41.2	76.8	55.7	36.6	67.3	85.1	48.5	44.9	43.2	39.9	38.2	37.1	0
0	1371	Errol Road East	0	02Nov 01	21:00:00	3600.0	41.2	76.8	66.1	36.2	90.3	89.6	48.3	44.3	42.2	39.8	38.2	37.1	0
0	1371	Errol Road East	0	02Nov 01	22:00:00	3600.0	41.1	76.7	53.0	37.0	73.1	85.1	47.5	44.3	42.9	40.3	38.7	37.8	0
0	1371	Errol Road East	0	02Nov 01	23:00:00	3600.0	39.5	75.1	51.8	35.0	65.0	0.0	46.0	43.0	41.4	38.5	36.9	35.7	0
0	1371	Errol Road East	0	03Nov 01	00:00:00	3600.0	38.1	73.7	50.5	32.6	65.1	0.0	46.8	41.1	39.7	37.0	34.7	33.2	0
0	1371	Errol Road East	0	03Nov 01	01:00:00	3600.0	35.1	70.7	50.6	29.8	63.7	87.6	44.3	37.9	36.6	33.3	31.2	30.1	0
0	1371	Errol Road East	0	03Nov 01	02:00:00	3600.0	34.1	69.7	50.5	30.1	63.1	0.0	40.9	36.0	35.7	32.8	31.3	30.3	0
0	1371	Errol Road East	0	03Nov 01	03:00:00	3600.0	33.2	68.8	39.5	30.1	59.4	85.1	36.9	36.4	35.8	32.5	31.2	30.3	0
0	1371	Errol Road East	0	03Nov 01	04:00:00	3600.0	34.8	70.4	53.1	29.6	67.8	85.1	42.9	36.9	36.2	32.8	30.6	30.0	0
0	1371	Errol Road East	0	03Nov 01	05:00:00	3600.0	33.1	68.7	41.4	29.8	59.4	0.0	37.2	35.8	35.2	32.4	30.8	30.1	0
0	1371	Errol Road East	0	03Nov 01	06:00:00	3600.0	37.4	73.0	58.0	32.4	72.1	0.0	44.3	38.7	37.9	36.0	34.3	33.2	0
0	1371	Errol Road East	0	03Nov 01	07:00:00	3600.0	46.3	81.9	72.6	34.0	90.9	92.5	59.1	48.7	45.3	39.2	36.3	35.0	0
0	1371	Errol Road East	0	03Nov 01	08:00:00	3600.0	45.4	81.0	70.8	33.9	88.6	98.5	54.7	49.1	46.7	39.0	35.5	34.3	0
0	1371	Errol Road East	0	03Nov 01	09:00:00	3600.0	64.9	100.5	84.7	33.9	104.5	107.2	78.7	69.2	56.8	43.6	36.4	34.9	0
0	1371	Errol Road East	0	03Nov 01	10:00:00	3600.0	67.5	103.0	84.5	37.0	105.8	109.1	79.5	74.1	71.6	51.7	44.4	40.8	0
0	1371	Errol Road East	0	03Nov 01	11:00:00	3600.0	65.1	100.7	82.1	33.7	107.4	110.1	77.9	72.9	68.9	42.9	36.5	35.0	0
0	1371	Errol Road East	0	03Nov 01	12:00:00	3600.0	51.4	87.0	75.4	32.9	92.8	94.7	63.6	51.6	48.7	40.5	36.6	34.5	0

0	1371 Errol Road East	0	03Nov 01 13:00:00	3600.0	47.4	83.0	62.0	33.5	80.6	95.6	56.3	52.3	50.8	44.7	37.8	35.4	0
0	1371 Errol Road East	0	03Nov 01 14:00:00	3600.0	49.7	85.2	75.2	36.2	92.0	95.6	58.8	52.5	49.6	42.9	39.4	37.2	0
0	1371 Errol Road East	0	03Nov 01 15:00:00	3600.0	59.3	94.9	74.4	34.9	93.4	101.6	72.7	68.4	55.4	41.0	37.3	36.1	0
0	1371 Errol Road East	0	03Nov 01 16:00:00	3600.0	48.1	83.6	74.5	34.0	92.4	94.7	58.8	46.8	44.6	39.2	36.1	34.4	0
0	1371 Errol Road East	0	03Nov 01 17:00:00	3600.0	47.3	82.9	64.3	38.4	81.0	91.2	59.6	51.8	48.4	42.6	40.3	39.2	0
0	1371 Errol Road East	0	03Nov 01 18:00:00	3600.0	44.8	80.4	63.3	38.8	78.0	87.6	51.6	47.8	46.2	43.1	41.1	39.6	0
0	1371 Errol Road East	0	03Nov 01 19:00:00	3600.0	46.2	81.8	69.8	40.0	88.9	89.6	50.8	47.0	45.8	43.5	42.0	40.5	0
0	1371 Errol Road East	0	03Nov 01 20:00:00	3600.0	42.8	78.3	55.8	38.8	71.6	0.0	49.2	45.0	43.9	42.1	40.5	39.3	0
0	1371 Errol Road East	0	03Nov 01 21:00:00	3600.0	41.4	76.9	56.1	36.8	67.9	0.0	48.4	43.9	42.8	40.6	38.7	37.3	0
0	1371 Errol Road East	0	03Nov 01 22:00:00	3600.0	42.3	77.9	61.6	36.0	75.8	87.6	52.0	46.5	43.6	39.6	37.9	36.6	0
0	1371 Errol Road East	0	03Nov 01 23:00:00	3600.0	40.3	75.9	53.5	35.6	66.6	85.1	48.0	44.2	41.9	39.0	37.4	36.2	0
0	1371 Errol Road East	0	04Nov 01 00:00:00	3600.0	39.8	75.4	55.6	34.7	69.4	89.6	48.4	42.7	40.9	38.4	36.7	35.3	0
0	1371 Errol Road East	0	04Nov 01 01:00:00	3600.0	37.7	73.2	52.8	32.8	66.5	0.0	45.6	39.9	38.8	36.7	35.0	33.6	0
0	1371 Errol Road East	0	04Nov 01 02:00:00	3600.0	38.0	73.5	51.4	33.1	64.0	0.0	44.6	40.3	39.4	37.2	35.3	34.0	0
0	1371 Errol Road East	0	04Nov 01 03:00:00	3600.0	37.1	72.6	51.8	33.2	64.8	0.0	41.1	39.6	38.9	36.5	34.5	33.7	0
0	1371 Errol Road East	0	04Nov 01 04:00:00	3600.0	35.9	71.4	44.8	31.7	65.8	0.0	39.8	37.9	37.4	35.6	33.8	32.3	0
0	1371 Errol Road East	0	04Nov 01 05:00:00	3600.0	36.7	72.3	44.4	33.3	61.0	0.0	39.8	38.7	38.1	36.5	34.9	34.0	0
0	1371 Errol Road East	0	04Nov 01 06:00:00	3600.0	37.9	73.5	49.9	34.5	69.1	0.0	41.8	40.0	39.5	37.5	35.8	34.8	0
0	1371 Errol Road East	0	04Nov 01 07:00:00	3600.0	43.3	78.9	60.2	37.2	78.9	86.5	50.1	47.3	45.9	41.6	39.1	37.9	0
0	1371 Errol Road East	0	04Nov 01 08:00:00	3600.0	51.3	86.9	76.3	36.5	91.9	97.2	61.3	48.9	46.0	40.6	38.5	37.2	0
0	1371 Errol Road East	0	04Nov 01 09:00:00	3600.0	45.2	80.8	63.4	36.1	81.0	100.7	55.4	49.5	47.3	41.5	38.3	36.9	0
0	1371 Errol Road East	0	04Nov 01 10:00:00	3600.0	43.7	79.3	58.8	35.7	75.6	101.6	53.3	48.5	46.3	41.1	38.3	36.8	0
0	1371 Errol Road East	0	04Nov 01 11:00:00	3600.0	43.2	78.8	67.3	34.5	83.3	101.2	54.7	47.5	44.9	39.3	36.6	35.0	0
0	1371 Errol Road East	0	04Nov 01 12:00:00	3600.0	43.3	78.9	56.5	36.1	75.1	100.7	51.0	48.0	46.4	41.4	38.4	37.1	0
0	1371 Errol Road East	0	04Nov 01 13:00:00	3600.0	46.9	82.5	67.3	37.8	89.1	102.4	55.2	51.2	49.0	43.3	40.3	38.5	0
0	1371 Errol Road East	0	04Nov 01 14:00:00	3600.0	46.1	81.7	65.8	36.5	89.6	100.7	55.3	50.6	47.9	42.9	39.3	37.4	0

0 1371 Errol Road East	0	04Nov 01 15:00:00	3600.0	45.4	81.0	68.4	37.1	95.4	105.1	54.3	49.8	48.0	42.5	39.8	37.9	0
0 1371 Errol Road East	0	04Nov 01 16:00:00	3600.0	44.5	80.1	58.7	37.3	74.9	103.9	53.4	48.9	47.2	42.4	39.6	38.2	0
0 1371 Errol Road East	0	04Nov 01 17:00:00	3600.0	42.9	78.5	59.0	36.0	74.0	101.2	52.0	47.3	45.4	40.6	37.8	36.4	0
0 1371 Errol Road East	0	04Nov 01 18:00:00	3600.0	42.7	78.3	60.1	35.2	89.4	102.8	50.8	47.5	45.5	40.6	38.1	36.3	0
0 1371 Errol Road East	0	04Nov 01 19:00:00	3600.0	45.8	81.3	72.0	35.8	91.7	107.6	54.0	49.4	47.6	41.9	37.9	36.7	0
0 1371 Errol Road East	0	04Nov 01 20:00:00	3600.0	43.5	79.1	59.8	36.3	80.4	102.4	51.4	48.0	46.4	41.3	38.5	36.9	0
0 1371 Errol Road East	0	04Nov 01 21:00:00	3600.0	51.3	86.9	70.3	38.9	90.3	118.1	61.0	56.5	54.6	46.9	41.8	40.0	0
0 1371 Errol Road East	0	04Nov 01 22:00:00	3600.0	49.4	85.0	65.6	41.6	84.0	109.0	58.1	54.3	52.2	47.1	43.6	42.1	0
0 1371 Errol Road East	0	04Nov 01 23:00:00	3600.0	46.3	81.9	63.3	39.2	82.2	106.3	53.8	50.1	48.7	44.6	41.8	40.3	0
0 1371 Errol Road East	0	05Nov 01 00:00:00	3600.0	44.9	80.5	60.5	37.6	81.4	106.0	52.6	49.6	47.7	43.0	40.3	38.6	0
0 1371 Errol Road East	0	05Nov 01 01:00:00	3600.0	43.2	78.8	59.2	37.1	79.1	105.1	51.0	47.4	45.7	41.3	39.2	38.0	0
0 1371 Errol Road East	0	05Nov 01 02:00:00	3600.0	41.2	76.8	53.9	36.2	76.0	102.8	47.9	44.5	43.0	40.2	38.3	36.6	0
0 1371 Errol Road East	0	05Nov 01 03:00:00	3600.0	40.2	75.7	53.6	35.7	75.1	103.2	45.5	42.7	41.6	39.5	38.1	37.0	0
0 1371 Errol Road East	0	05Nov 01 04:00:00	3600.0	39.6	75.2	51.2	35.7	66.7	98.5	45.4	42.5	41.5	38.9	37.2	36.1	0
0 1371 Errol Road East	0	05Nov 01 05:00:00	3600.0	40.2	75.7	52.8	36.1	67.6	99.1	45.9	42.6	41.5	39.5	38.1	37.0	0
0 1371 Errol Road East	0	05Nov 01 06:00:00	3600.0	41.8	77.3	57.8	37.2	74.2	99.1	49.3	45.4	43.4	40.2	38.8	37.9	0
0 1371 Errol Road East	0	05Nov 01 07:00:00	3600.0	45.4	80.9	71.8	37.2	88.6	107.2	51.8	47.5	45.8	41.8	39.6	38.3	0
0 1371 Errol Road East	0	05Nov 01 08:00:00	3600.0	44.1	79.7	58.6	37.9	79.1	102.4	52.8	48.7	46.9	41.9	39.7	38.4	0
0 1371 Errol Road East	0	05Nov 01 09:00:00	3600.0	44.2	79.8	65.9	37.5	89.1	100.5	54.3	48.2	46.0	41.7	39.2	38.1	0
0 1371 Errol Road East	0	05Nov 01 10:00:00	3600.0	45.2	80.8	71.0	38.1	87.0	95.6	53.4	48.1	46.1	41.5	39.5	38.3	0
0 1371 Errol Road East	0	05Nov 01 11:00:00	3600.0	46.7	82.3	69.1	36.6	86.8	103.5	55.5	50.9	48.8	42.8	40.1	38.2	0
0 1371 Errol Road East	0	05Nov 01 12:00:00	3600.0	43.9	79.5	53.9	37.6	73.8	95.6	50.4	47.8	46.5	42.7	40.3	38.4	0
0 1371 Errol Road East	0	05Nov 01 13:00:00	3600.0	47.1	82.6	74.2	37.8	90.7	95.6	57.0	49.9	48.0	42.3	39.5	38.2	0
0 1371 Errol Road East	0	05Nov 01 14:00:00	3600.0	47.9	83.5	71.5	37.3	100.1	101.6	57.7	52.3	49.9	43.7	39.4	38.1	0
0 1371 Errol Road East	0	05Nov 01 15:00:00	3600.0	54.6	90.2	76.3	36.3	97.9	102.1	67.6	58.3	56.1	42.4	38.5	36.8	0
0 1371 Errol Road East	0	05Nov 01 16:00:00	3600.0	53.0	88.6	77.7	36.3	94.4	95.6	64.8	49.5	46.9	40.5	38.3	37.1	0
0 1371 Errol Road East	0	05Nov 01 17:00:00	3600.0	41.4	77.0	55.0	35.5	74.7	85.1	49.4	46.1	44.1	39.4	37.4	36.2	0

0	1371	Errol Road East	0	05Nov 01 18:00:00	3600.0	41.8	77.4	60.1	34.7	75.5	89.6	52.8	46.5	43.5	38.4	36.4	35.3	0
0	1371	Errol Road East	0	05Nov 01 19:00:00	3600.0	38.9	74.4	52.6	33.5	74.1	0.0	47.7	44.2	41.2	36.8	35.0	34.1	0
0	1371	Errol Road East	0	05Nov 01 20:00:00	3600.0	40.0	75.6	56.4	32.6	72.5	85.1	49.2	44.6	42.3	37.6	34.9	33.4	0
0	1371	Errol Road East	0	05Nov 01 21:00:00	3600.0	41.7	77.3	51.7	35.0	71.8	0.0	47.4	45.4	44.3	40.9	37.5	36.0	0
0	1371	Errol Road East	0	05Nov 01 22:00:00	3600.0	40.2	75.7	49.4	36.2	72.8	87.6	45.3	42.5	41.8	39.7	38.0	36.4	0
0	1371	Errol Road East	0	05Nov 01 23:00:00	3600.0	41.5	77.1	53.7	36.1	66.2	0.0	47.9	45.2	43.7	40.4	37.8	36.6	0
0	1371	Errol Road East	0	06Nov 01 00:00:00	3600.0	40.1	75.6	50.1	35.2	64.5	0.0	44.2	42.4	41.8	39.7	37.4	36.1	0
0	1371	Errol Road East	0	06Nov 01 01:00:00	3600.0	40.4	76.0	50.2	35.1	62.2	0.0	46.4	43.6	42.5	39.8	37.4	36.2	0
0	1371	Errol Road East	0	06Nov 01 02:00:00	3600.0	40.2	75.8	52.7	35.7	66.7	0.0	44.3	42.7	41.9	39.8	38.0	36.5	0
0	1371	Errol Road East	0	06Nov 01 03:00:00	3600.0	41.4	77.0	47.0	36.4	60.1	0.0	44.6	43.7	43.2	41.2	39.2	37.6	0
0	1371	Errol Road East	0	06Nov 01 04:00:00	3600.0	41.3	76.9	50.2	36.4	61.4	0.0	44.9	43.8	43.2	41.0	38.6	37.2	0
0	1371	Errol Road East	0	06Nov 01 05:00:00	3600.0	41.1	76.7	49.7	37.4	62.8	0.0	45.0	43.4	42.8	40.9	39.2	38.1	0
0	1371	Errol Road East	0	06Nov 01 06:00:00	3600.0	44.2	79.8	60.5	39.9	74.7	0.0	49.4	47.0	46.0	43.5	41.6	40.3	0
0	1371	Errol Road East	0	06Nov 01 07:00:00	3600.0	47.4	83.0	56.4	43.0	74.8	85.1	52.1	50.3	49.5	46.9	45.0	43.7	0
0	1371	Errol Road East	0	06Nov 01 08:00:00	3600.0	47.3	82.9	61.2	42.5	74.7	85.1	54.1	50.3	49.1	46.4	44.3	43.2	0
0	1371	Errol Road East	0	06Nov 01 09:00:00	3600.0	46.4	81.9	66.5	39.6	82.1	92.5	58.6	48.8	46.3	42.3	40.8	40.1	0
0	1371	Errol Road East	0	06Nov 01 10:00:00	3600.0	58.5	94.1	75.0	38.9	94.5	96.4	71.7	66.1	61.9	42.9	40.5	39.3	0
0	1371	Errol Road East	0	06Nov 01 11:00:00	3600.0	44.9	80.4	67.2	37.2	82.7	97.2	52.9	48.5	46.7	42.5	40.3	38.8	0
0	1371	Errol Road East	0	06Nov 01 12:00:00	3600.0	44.1	79.7	61.2	38.3	75.2	96.4	52.4	47.9	46.4	42.3	40.2	39.0	0
0	1371	Errol Road East	0	06Nov 01 13:00:00	3600.0	45.5	81.1	61.8	39.5	83.5	98.5	53.8	49.8	48.0	43.7	41.3	40.1	0
0	1371	Errol Road East	0	06Nov 01 14:00:00	3600.0	46.1	81.7	63.0	40.0	78.1	100.7	55.7	49.6	47.8	44.4	42.1	41.0	0
0	1371	Errol Road East	0	06Nov 01 15:00:00	3600.0	46.3	81.9	71.1	40.1	91.2	95.6	53.7	49.6	48.0	43.9	41.9	40.5	0
0	1371	Errol Road East	0	06Nov 01 16:00:00	3600.0	47.3	82.9	64.0	41.0	81.3	94.7	56.7	50.9	48.9	45.3	43.3	42.0	0
0	1371	Errol Road East	0	06Nov 01 17:00:00	3600.0	46.9	82.5	65.4	44.0	86.0	92.5	51.6	49.1	48.1	46.4	45.2	44.2	0
0	1371	Errol Road East	0	06Nov 01 18:00:00	3600.0	45.9	81.4	52.5	43.1	75.0	91.2	49.8	48.1	47.4	45.5	44.2	43.2	0
0	1371	Errol Road East	0	06Nov 01 19:00:00	3600.0	46.7	82.3	72.6	41.3	89.6	92.5	49.6	46.9	45.9	44.2	43.0	42.0	0

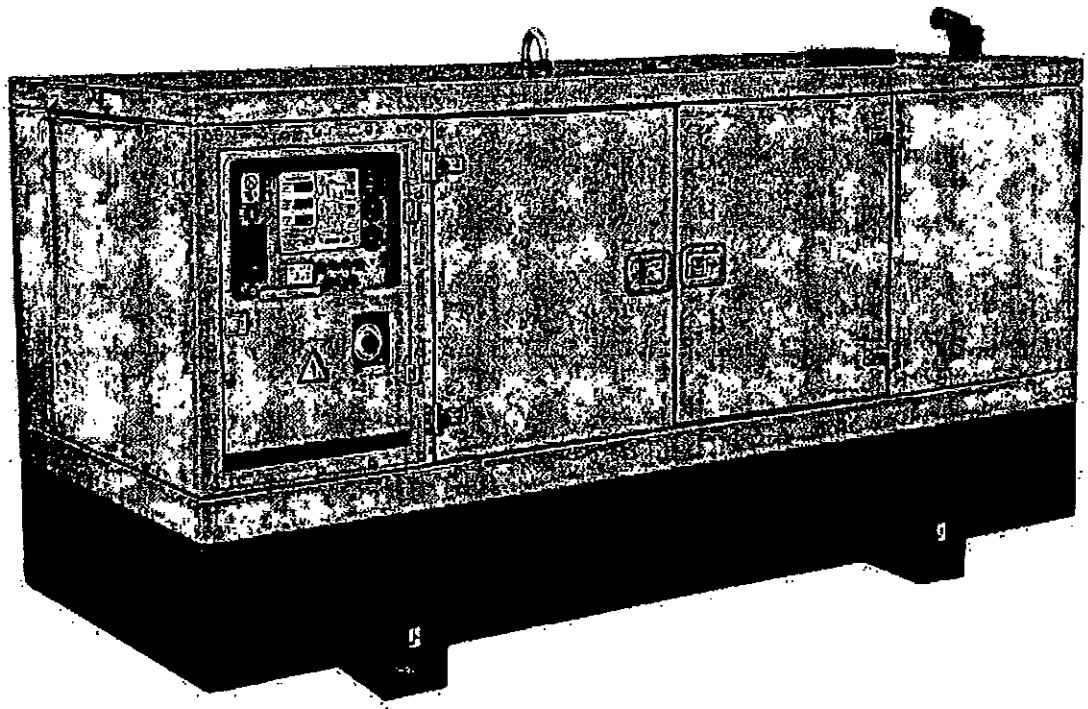
0	1371 Errol Road East	0	06Nov 01 20:00:00	3600.0	46.0	81.6	73.4	40.8	91.3	105.4	51.1	47.8	46.5	44.1	42.5	41.4	0
0	1371 Errol Road East	0	06Nov 01 21:00:00	3600.0	45.1	80.7	56.2	40.9	78.5	104.8	51.2	48.5	47.3	44.2	42.4	41.3	0
0	1371 Errol Road East	0	06Nov 01 22:00:00	3600.0	41.5	77.1	53.8	37.2	71.6	97.9	47.1	44.0	43.1	40.9	38.8	37.8	0
0	1371 Errol Road East	0	06Nov 01 23:00:00	3600.0	38.1	73.6	49.0	33.6	64.3	91.2	42.4	40.3	39.6	37.7	35.7	34.2	0
0	1371 Errol Road East	0	07Nov 01 00:00:00	3600.0	37.7	73.3	50.3	33.2	63.3	94.7	42.4	40.0	39.4	37.2	35.3	34.2	0
0	1371 Errol Road East	0	07Nov 01 01:00:00	3600.0	35.7	71.3	48.8	30.7	75.8	91.2	40.4	38.4	37.6	35.1	32.7	31.2	0
0	1371 Errol Road East	0	07Nov 01 02:00:00	3600.0	33.6	69.1	50.1	28.5	63.6	89.6	37.8	36.7	36.0	32.3	30.0	29.1	0
0	1371 Errol Road East	0	07Nov 01 03:00:00	3600.0	33.4	69.0	54.4	28.3	85.1	96.4	40.0	36.5	35.3	31.7	29.5	28.4	0
0	1371 Errol Road East	0	07Nov 01 04:00:00	3600.0	37.9	73.5	60.7	30.0	76.2	100.2	49.4	39.5	36.6	33.0	31.1	30.1	0
0	1371 Errol Road East	0	07Nov 01 05:00:00	3600.0	34.2	69.7	47.7	30.1	65.5	92.5	39.4	37.1	36.3	33.0	31.1	30.1	0
0	1371 Errol Road East	0	07Nov 01 06:00:00	3600.0	37.5	73.1	55.8	32.3	69.2	91.2	46.7	38.9	37.8	35.2	33.9	33.1	0
0	1371 Errol Road East	0	07Nov 01 07:00:00	3600.0	42.2	77.8	65.5	35.2	82.8	91.2	50.0	46.6	44.6	39.8	37.6	36.1	0
0	1371 Errol Road East	0	07Nov 01 08:00:00	3600.0	46.8	82.3	74.5	33.7	94.8	95.6	58.2	50.1	47.2	38.8	35.7	34.4	0
0	1371 Errol Road East	0	07Nov 01 09:00:00	3600.0	42.1	77.7	61.6	33.9	80.3	85.1	51.6	47.1	45.1	38.1	35.4	34.3	0
0	1371 Errol Road East	0	07Nov 01 10:00:00	3600.0	42.5	78.1	56.0	33.5	72.9	85.1	51.9	48.9	46.1	39.0	36.0	34.4	0
0	1371 Errol Road East	0	07Nov 01 11:00:00	3600.0	47.4	83.0	73.4	34.3	92.5	93.7	58.2	51.1	47.5	39.3	36.3	35.1	0
0	1371 Errol Road East	0	07Nov 01 12:00:00	3600.0	45.7	81.3	73.3	37.1	93.8	95.6	55.0	48.1	45.6	40.9	38.9	37.6	0
0	1371 Errol Road East	0	07Nov 01 13:00:00	3600.0	45.5	81.1	66.1	38.2	90.5	91.2	55.8	49.8	46.7	41.8	40.1	38.7	0
0	1371 Errol Road East	0	07Nov 01 14:00:00	3600.0	44.4	80.0	57.3	39.4	75.9	85.1	51.6	48.4	46.7	43.2	41.1	40.1	0
0	1371 Errol Road East	0	07Nov 01 15:00:00	3600.0	46.7	82.3	60.8	42.9	75.8	87.6	53.9	49.5	48.2	45.6	44.1	43.1	0
0	1371 Errol Road East	0	07Nov 01 16:00:00	2836.4	50.0	84.5	62.7	43.2	90.2	97.2	59.8	55.6	53.4	46.7	44.8	43.8	0

APPENDIX B.4

Diesel Generator

SOUNDPROOFED GENERATING SETS

40 - 150 kVA



PERFORMANCES

GENERATING SET MODEL	Duty	50 Hz		60 Hz		LWA (1)	LPS (2)
		kVA	kW	kVA	kW	dB (A)	dB (A)
GS8041i06	Prime	40	32	47	38	94.1	66.1
	Stand-by	44	35	52	42	94.1	66.1
GS8061i06	Prime	60	48	70	56	92.5	64.5
	Stand-by	67	54	77	62	92.5	64.5
GS8061Si06	Prime	80	64	95	76	95.1	67.1
	Stand-by	88	70	105	84	95.1	67.1
GS8061Si07	Prime	100	80	120	96	94.3	66.3
	Stand-by	115	92	135	108	94.3	66.3
GS8061SRi26	Prime	125	100	145	160	91.9	64.7
	Stand-by	150	120	160	128	91.9	64.7
GS8061SRi27	Prime	150	120	170	136	92.4	67.5
	Stand-by	165	132	185	148	92.4	67.5

Ratings at 0.8 p.f. - Standard reference conditions : 27°C air inlet temperature ; 1000 mbar ; 30% relative humidity.
(1) Sound power measured according to 84/536 CE at 50 Hz.
(2) Sound pressure level measured by a phonometer at a distance of 10 m at 50 Hz.

PRIME POWER

The Prime Power is the maximum power available with varying loads for an unlimited number of hours. The average power output during a 24 h period of operation must not exceed 80% of the declared prime power between the prescribed maintenance intervals and at standard environmental conditions. A 10% overload is permissible for 1 hour every 12 hours of operation.

STAND-BY POWER

This is the maximum power available for a period of 500 hours/year with a mean load factor of 90% of the declared stand-by power. No kind of overload is permissible for this use.

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STANDARD CONFIGURATION

1. ENGINE DRIVE

IVECO heavy duty diesel engine.

1.1 Governor

Mechanical, compliance with ISO 8528, class G2 (till 60 kVA). Electronic, compliance with ISO 8528, class G3 (from 80 kVA).

2. COOLING SYSTEM

The unit is equipped with a radiator and a pusher fan dimensioned for use in tropical climates. The radiator, mounted on the base frame (on specific supports for 40 kVA), is insulated against engine vibrations and is fitted with appropriate accident-prevention devices.

3. FILTRATION SYSTEM

The engine is equipped with: dry air filter complete of security element, cartridge fuel filtes and oil filter.
All filters have replaceable cartridges.

4. EXHAUST SYSTEM

Industrial application exhaust silencers are supplied on request, assembled on the unit.

5. ELECTRICAL SYSTEM

12 Volt system with battery charging alternator. Starter motor. High performance maintenance free lead acid battery (on request).
Battery rack mounted on the generating set base frame.

6. ALTERNATOR

Single bearing synchronous brushless alternator, four poles, mechanical protection degree IP21 and H class insulation. Standard connections: 12 terminals - 9 leads reconnectable. Tropical climates impregnation; on request, humid and corrosive climates treatment. All alternators are equipped with electronic voltage regulator.

7. MOUNTING ARRANGEMENT

7.1 Frame

Casing of sheet steel, bent and welded at the corners to reduce vibrations, and protected against any external agent by a prior phosphating treatment. The unit is installed on a base frame of bent sheet steel covering the entire perimeter of the casing. Engine and alternator are mounted via dampers ensuring vibration-proofing insulation. The interior of the unit can be reached via sound-proofed flap doors covered with fire-proofing fibres.

7.2 Coupling

Engine and alternator are directly coupled. The engine flywheel is coupled to the alternator rotor by means of flexible disks.

7.3 Transport and handling

The casing of the unit is equipped with a towing hook for ease of handling. The unit can be converted from static to movable, since the base frame has been designed to accomodate a handling truck. The truck, of metal plate, has a rudder adjustable for height and is fitted with a brake and springing type-approved for on-road transport.

8. FUEL SYSTEM

The unit is fitted with a thermoplastic fuel tank available in different capacities (see table), which is housed in the base frame and has a visual fuel level indicator. An oversized fuel tank of a capacity of 500 liters is available as option for 40 kVA. Fuel tanks with special type-approval certificates are also available on request.

9. CONTROL PANEL

Manual and Automatic control panels are available in different configurations.

10. OPTIONS

Generating set can be supplied with different options to meet the specific requirements of the customer (see specific brochure).

11. DOCUMENTATION

A full set of operation and maintenance manuals are provided with each unit.

12. FACTORY TESTS

Generating set is subject to a strict load test before delivery. A test certificate can be provided as option.

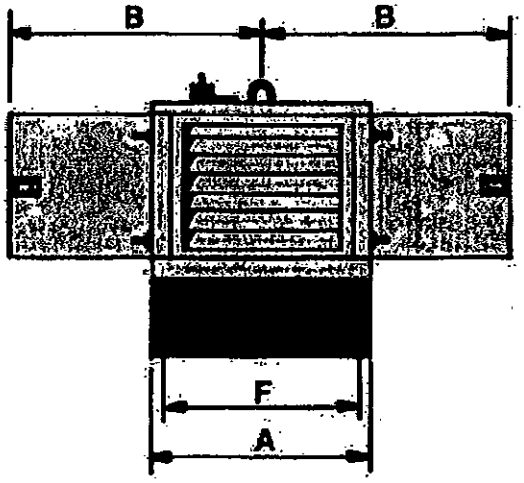
13. QUALITY STANDARDS

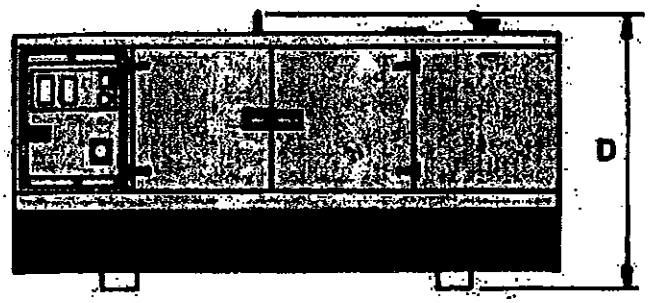
All the generating sets meet the following standards : 73/23/CE, 89/392/EE, 89/336/CE, ISO 8528, IEC 34.1. The generators used in our generating sets meet the following standards: ISO 8528, IEC 34.1, CEI 2.3, VDE 0530, BS 4999-5000, NF 51-100.
All units are sound-proofed according to directive 84/536CE sound power emission.
IVECO and 2HE are fully accredited ISO 9001 companies.

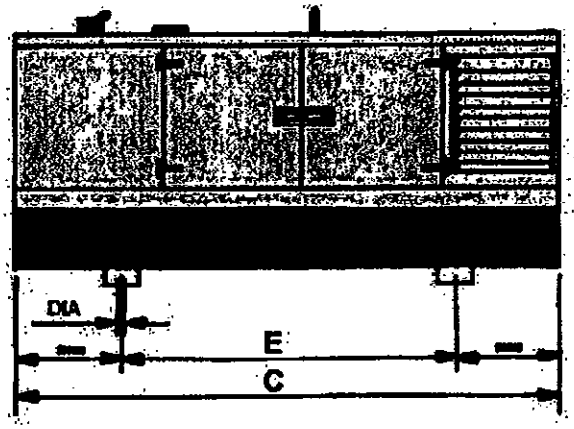
14. WARRANTY

Generating set is guaranteed for a period of 12 months from the start up date or 18 months from date of shipment whichever occurs earlier. Extended warranty is available on request.

OVERALL DIMENSIONS AND WEIGHTS





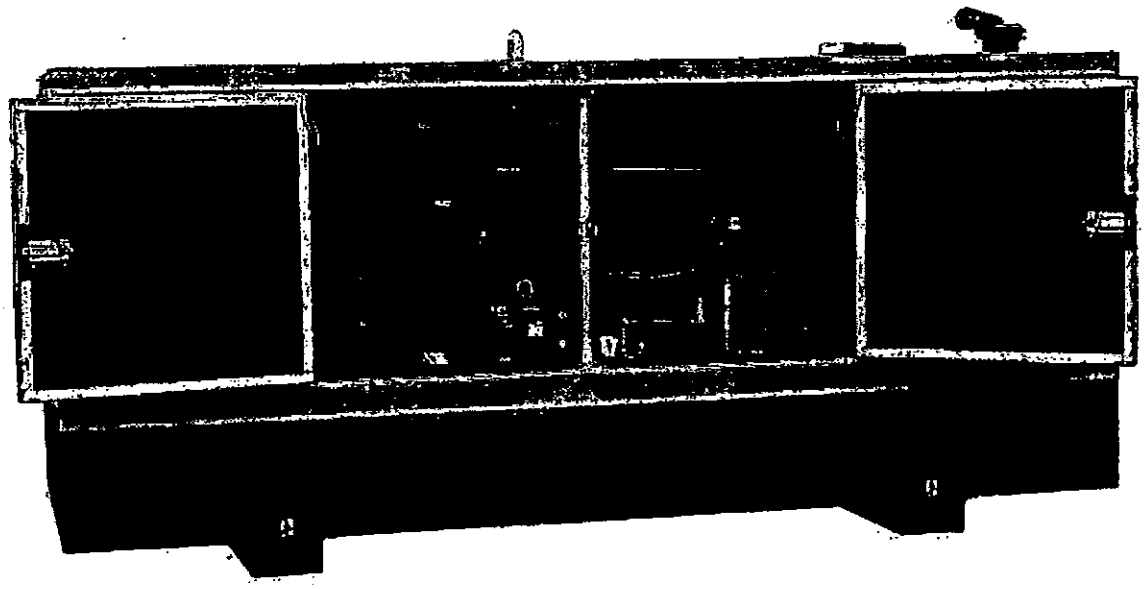


GENERATING SET MODEL	A	B	C	D	E	F	DIA	Fuel tank capacity (liters)	Weight (kg)
GS8041i06	1000	1115	2400	1312 1453*	1240	890	15	110 or 249*	1235
GS8061i06	1200	1375	3000	1465 1667*	1846	1090	15	230 or 492*	1785
GS8061Si06	1200	1375	3000	1465 1667*	1846	1090	15	230 or 492*	1860
GS8061Si07	1200	1375	3000	1465 1739*	1846	1090	15	230 or 794*	1880
GS8061SRi26	1200	1375	3000	1465 1739*	1846	1090	15	230 or 794*	1980
GS8061SRi27	1200	1375	3000	1465 1799*	1846	1090	15	230 or 794*	2095

Dimensions in mm. Dry weight including engine oil and without fuel in the fuel tank.

* 24 hours fuel tank.

SOUNDPROOFED GENERATING SETS 40 - 150 kVA



ENGINE DATA

Model	N° Cyl. Aspir.	Displ. L	Specific Fuel consumption (l/h) - (1)				Lube oil consumption (2)
			50 Hz		60 Hz		
			75 % charge	100 % charge	75 % charge	100 % charge	
804Ii06	4L - NA	3.9	6.5	8.7	7.9	10.4	~ 0.3% of fuel consumption
806Ii06	6L - NA	5.9	9.7	12.9	11.8	15.1	
806ISi06	6L - TC	5.9	12.6	16.4	14.9	19.6	
806ISi07	6L - TC	5.9	15.6	20.1	18.6	24.4	
806ISRi26	6L - TCA	5.9	20.1	25.6	22.3	29.2	
806ISRi27	6L - TCA	5.9	22.6	29.7	25.4	34.9	

(1) Use fuel corresponding to the specifications EN 590.

(2) Use lube oil corresponding to the specifications ACEA E2-96 MIL-L-2104E for naturally aspirated engines and ACEA E3-96 MIL-L-2104E for turbocharged engines.

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Local distributor

IVECO MOTORS

2nd ENERGY IVECO Group

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APPENDIX C

Noise Calculations

Sound Level Prediction Calculations

Project Number:	91712
Project Name:	WM of Canada Corp.
Receptor Name:	POR1
Receptor Xr Co-Ordinate (m)	1284
Receptor Yr Co-Ordinate (m)	910
Ground Elevation at Receptor (m)	121
Receptor Height (m)	1.5
Receptor Zr Co-Ordinate (m)	122.5
Other Data	

Source ID		E1 - E8	F1	F2	TF	B2	D1
Source Name		LFG ENGINES	FLARE #1	FLARE #2	TEMP FLARE	TEMP FLARE BLOWER	DIESEL ENGINE
Consider Source (Y/N)		Y	Y	Y	Y	Y	Y
Source Xr Co-Ordinate (m)		1230	1260	1254	108.44	108	108
Source Yr Co-Ordinate (m)		745	290	290	310.126	310	210
Ground Elevation at Source (m)		126	128	128	128	128	128
Source Height (m)		5.5	12.2	13.7	8.5	8.5	1.5
Source Zr Co-Ordinate (m)		131.5	140.2	141.7	136.5	136.5	129.5
Reference Sound Level (dBA)		77	52.7	52.7	65	67	67
Reference Distance (m)		15	30	30	5	5	10
Source-Receptor Distance (m)		173.84	620.72	621.02	1319.64	1320.29	1368.59
Frequency (Hz)		500	500	500	500	500	500
Geometrical Spreading							
Consider Distance Attenuation (Y/N)		Y	Y	Y	Y	Y	Y
Geometrical Divergence (dBA)		21.28	26.32	26.32	46.43	46.43	42.73
Atmospheric Attenuation							
Consider Atmospheric Attenuation (Y/N)		Y	Y	Y	Y	Y	Y
Atmospheric Attenuation (dBA)		0.49	1.74	1.74	3.70	3.70	3.83
Ground Attenuation							
Consider Ground Attenuation (Y/N)		Y	Y	Y	Y	Y	Y
Ground Attenuation (dBA)		4.18	3.72	3.82	3.06	3.06	5.31
Source Region Ground Factor		0.5	0.5	0.5	0.5	0.5	0.5
Receptor Region Ground Factor		1	1	1	1	1	1
Middle Region Ground Factor		0.5	0.5	0.5	0.5	0.5	0.5
Barrier Attenuation							
Consider Barrier (Y/N)		Y	Y	Y	N	N	N
Barrier Attenuation		9.79	14.78	14.78	0.00	0.00	0.00
Barrier LOS Xr Co-Ordinate (m)		1255	1279	1278			
Barrier LOS Yr Co-Ordinate (m)		822	754	754			
Ground Elevation at Barrier (m)		124.00	124.00	124.00			
Barrier Height (m)		8.00	8.00	8.00			
Barrier Zr Co-Ordinate (m)		132	132	132	0	0	0
Barrier Thickness		3.00	3.00	3.00	3.00	3.00	3.00
Source-Barrier Distance (m)		79.46	462.96	463.22	354.27	354.02	287.82
Receptor-Barrier Distance (m)		91.64	154.87	154.90	1577.09	1577.03	1577.03
Pathlength Difference (m)		0.32	0.13	0.12	632.68	632.00	488.10
Meteorological Correction Factor		0.49	0.00	0.00	0.68	0.68	0.68
Additional Attenuation (dBA)		0.00	0.00	0.00	0.00	0.00	0.00
Total Attenuation (dBA)		35.73	36.55	36.66	55.19	55.19	51.87
Lp at Receptor (dBA)		41.27	16.15	16.04	9.61	11.61	16.13
Leq Time Base (min)		60.00	60.00	60.00	60.00	60.00	60.00
No. of Events in Time Base		1.00	1.00	1.00	1.00	1.00	1.00
Each Event Duration (min)		60.00	60.00	60.00	60.00	60.00	60.00
Duration of All Events (min)		60.00	60.00	60.00	60.00	60.00	60.00
Leq at Receptor (dBA)		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
All Sources Leq (dBA)	41						

Sound Level Prediction Calculations

Project Number:	91712
Project Name:	WM of Canada Corp.
Receptor Name:	POR2
Receptor Xr Co-Ordinate (m)	-33.17
Receptor Yr Co-Ordinate (m)	216.8
Ground Elevation at Receptor (m)	128
Receptor Height (m)	1.5
Receptor Zr Co-Ordinate (m)	129.5
Other Data	

Source ID	E1 - E8	F1	F2	TF	B2	D1
Source Name	LFG ENGINES	FLARE #1	FLARE #2	TEMP FLARE	TEMP FLARE BLOWER	DIESEL ENGINE
Consider Source (Y/N)	Y	Y	Y	Y	Y	Y
Source Xr Co-Ordinate (m)	1230	1260	1254	108.44	108	108
Source Yr Co-Ordinate (m)	745	290	280	310.126	310	210
Ground Elevation at Source (m)	126	128	128	128	128	128
Source Height (m)	5.5	12.2	13.7	8.5	8.5	1.5
Source Zr Co-Ordinate (m)	131.5	140.2	141.7	136.5	136.5	129.5
Reference Sound Level (dBA)	77	52.7	52.7	65	67	67
Reference Distance (m)	15	30	30	5	5	10
Source-Receptor Distance (m)	1369.16	1295.28	1289.31	169.74	169.31	141.33
Frequency (Hz)	500	500	500	500	500	500
Geometrical Spreading						
Consider Distance Attenuation (Y/N)	Y	Y	Y	Y	Y	Y
Geometrical Divergence (dBA)	39.21	32.70	32.66	30.62	30.59	23.00
Atmospheric Attenuation						
Consider Atmospheric Attenuation (Y/N)	Y	Y	Y	Y	Y	Y
Atmospheric Attenuation (dBA)	3.83	3.63	3.61	0.48	0.47	0.40
Ground Attenuation						
Consider Ground Attenuation (Y/N)	Y	Y	Y	Y	Y	Y
Ground Attenuation (dBA)	2.20	2.45	2.50	3.44	3.44	2.87
Source Region Ground Factor	0	0	0	0	0	0
Receptor Region Ground Factor	1	1	1	1	1	1
Middle Region Ground Factor	0.5	0.5	0.5	0.5	0.5	0.5
Source Region Attenuation	-1.50	-1.50	-1.50	-1.50	-1.50	-1.50
Receptor Region Attenuation	4.97	4.97	4.97	4.94	4.94	4.91
Middle Region Attenuation	-1.27	-1.02	-0.97	0.00	0.00	-0.54
Barrier Attenuation						
Consider Barrier (Y/N)	N	N	N	N	N	N
Barrier Attenuation	0.00	0.00	0.00	0.00	0.00	0.00
Barrier LOS Xr Co-Ordinate (m)						
Barrier LOS Yr Co-Ordinate (m)						
Ground Elevation at Barrier (m)						
Barrier Height (m)						
Barrier Zr Co-Ordinate (m)	0	0	0	0	0	0
Barrier Thickness	3.00	3.00	3.00	3.00	3.00	3.00
Source-Barrier Distance (m)	1442.53	1299.02	1293.37	354.27	354.02	267.82
Receptor-Barrier Distance(m)	253.20	253.20	253.20	253.20	253.20	253.20
Pathlength Difference (m)	347.73	280.53	280.94	484.60	484.78	439.68
Meteorological Correction Factor	0.65	0.65	0.65	0.94	0.94	0.95
Additional Attenuation (dBA)	0.00	0.00	0.00	0.00	0.00	0.00
Total Attenuation (dBA)	45.24	38.78	38.78	34.53	34.51	26.27
Lp at Receptor (dBA)	31.76	13.92	13.92	30.47	32.49	40.73
Leq Time Base (min)	60.00	60.00	60.00	60.00	60.00	60.00
No. of Events in Time Base	1.00	1.00	1.00	1.00	1.00	1.00
Each Event Duration (min)	60.00	60.00	60.00	60.00	60.00	60.00
Duration of All Events (min)	60.00	60.00	60.00	60.00	60.00	60.00
Leq at Receptor (dBA)	31.76	13.92	13.92	30.47	32.49	40.73

All Sources Leq (dBA)	42

APPENDIX D

List of Insignificant Noise Sources

Insignificant Noise Sources

Source ID	Description
B1	Biopile Blower #1
B3	GS Blower
B4	Air Injection System

The above sources are/will be located indoors. It has been assumed that the building structure will provide sufficient noise attenuation for these sources.