EMISSION SURVEY

MONITORING REPORT

(December 2008 Survey)

Prepared for

B.C. Ministry of Agriculture
(Rodear Meats)
Abbotsford, B.C.

Prepared by

A. LANFRANCO & ASSOCIATES INC.

Surrey, B.C.

December 2008

TABLE OF CONTENTS

SUMMARY

The results of single, duplicate and triplicate emission results for particulate from the Incinerator at Rodear Meats on December 9 to 11, 2008 are as follows:

PARAMETER		**Incinerator Results**	
Date	Test	Particulate (mg/Sm^3 @ 11% O_2)	Opacity (%)
Dec. 9/08	Fuel only (test 1)	31.8	
Dec. 9/08	Fuel only (test 1)	26.9	
Dec. 10/08	200 kg load (test1)	36.9	not done
Dec. 10/08	400 kg load (test 1)	105	<5*
Dec. 10/08	400 kg load (test 2)	71.3	<5
Dec. 10/08	400 kg load (test 3)	27.9	<5
Dec. 11/08	400 kg load (test 1)	103	20*
Dec. 11/08	400 kg load (test 2)	33.2	<5
Dec. 11/08	400 kg load (test 1)**	64.7	<5
Dec. 11/08	400 kg load (test 2)**	15.4	<5

* opacity at the beginning of these tests was > 50% for more than six minutes

** Secondary burner was operating continuously during tests.

All results are at standard conditions of 25^{o}C and 101.3 KPa (dry).

1.0 INTRODUCTION

B.C. Ministry of Agriculture of Abbotsford, B.C. retained A. Lanfranco and Associates Inc. of Surrey, B.C., to conduct an emission survey on the exhaust of an animal waste combustor unit located at Rodear Meats near Williams Lake, B.C.

The purpose of the survey was to measure and report emission parameters from the stack associated with the animal waste incinerator. The testing was conducted to provide emission information in support or in anticipation of a MOE emission permit application. The data was also gathered to compare to the incinerator manufacturer's performance specifications guarantee.

In addition to the waste incineration tests, a pre-survey test where diesel only was fired, was conducted to see the emission characteristics when no animal waste was combusted.

This report documents the methods used and results found for single, duplicate and triplicate emission tests conducted on the incinerator exhaust on December 9 and 11, 2008.

2.0 PROCESS DESCRIPTION

The Incinerator unit monitored in this survey utilized diesel as the primary combustion fuel. The incinerator off gases were passed through a diesel fired secondary combustion unit prior to exhaust to the atmosphere via a 12 inch diameter smokestack.

Loads of slaughterhouse waste, varying from 200 to 400 kg, were incinerated during the test program.

3.0 METHODOLOGY

The sampling and analytical methods used throughout this survey conform, in principle to the procedures outlined in the B.C. "Source Testing Code for the Measurement of Emissions of Particulates from Stationery Sources" 1982 Edition, and the B.C. air analytical manual, or EPA Reference Methods (RM).

3.1 Sampling Techniques

The incinerator stack test ports were about six diameters downstream and greater than two diameters upstream of the nearest disturbances. From this criteria, a 16 point sampling regime was calculated. (Fig. A). The 16 points were sampled for four minutes each for a total of 64 minutes resulting in final sample volumes of about 1.7 to 1.9 Sm^3. A special test with no waste combustion (ie diesel firing only) was conducted for 50 minutes, resulting in sample volumes of 0.8 and 1.1 Sm^3 for paired trains.

Train 1 – Particulate

Sampling of particulate (EPA Method 5) from the incinerator stack was conducted using Napp (now Baldwin) sampling trains equipped with heated filter assemblies and a three foot quartz probe and nozzle. (Fig. 1). The impinger sections of the sampling trains were charged with D.I. water for moisture collection. Cyclones were not used as part of the sampling apparatus.

Opacity

Visual opacity readings were conducted manually with EPA Method 9.

3.2 Analytical Techniques

Sample clean-up of the probe and front half glassware from the particulate trains was conducted with sequential rinses of deionized H_2O and acetone. Impingers 1 and 2 were measured from each test for moisture determination.

The particulate sampling filter was removed from the filter holder (after cooling) with tweezers and placed in a labelled petri dish for transportation to the laboratory. Any filter material adhering to the silicone gasket was removed and added to the filter.

Gravimetric analysis of the particulate samples was conducted by A. Lanfranco and Associates Inc. at their Surrey laboratory. Following 105^{o}C drying and desiccation, the filters and probe washings particulate were determined by the difference in initial and final weights, adjusted for blank values.

Analysis of gaseous components was done on-site by a portable continuous analyser system. Additionally, combustion gas analysis for O_2 and CO_2 was conducted on site by grab sample Fyrite analysis.

3.3 Quality Assurance / Quality Control (QA/QC)

QA/QC of this survey was accomplished by the following mechanisms.

1. Pre and Post test leak checks.
2. Calibration of all volume measuring and monitoring instrumentation.
3. Analysis of all blank solutions and filters
4. Isokinetic sample extraction (100 +/- 10%)

4.0 RESULTS

The results of the particulate and stack parameters were calculated using a computer program consistent with reporting requirements of the GVRD and MOE. The computer outputs were checked by hand calculation. Some of the computer output results were converted by hand calculations to appropriate units for presentation in Tables1 to 5.

In the following table, particulate and flowrate are shown in actual, standard or corrected standard terms. The "std" particulate results are mg/m^3 at standard conditions of 25^oC and 101.3 KPa (dry) while the "corrected" results are "std" corrected to 11% O_2 by the formula

$$\frac{9.9}{20.9 - \%\ O_2}$$

The "actual" flowrate results are volumetric flowrate at stack conditions while the standard flowrates are flowrates corrected to 25^oC and 101.3 KPa (dry).

Point by point isokinetic rates are presented in Appendix 1.

Detailed test results are presented in Tables 1, 2, 3 and 4. Supporting data is presented in the Appendices.

Cyclonic flow was checked for and was <u>not</u> present in the stack and all points were sampled isokinetically (100+/- 10%).

TABLE 1 INCINERATOR EMISSIONS RESULTS

(200 kg charge)

Parameter		Test 1
Test Date		Dec. 10/08
Test Time		09:53 - 11:00
Duration	(minutes)	64
Particulate	(mg/Sm^3)	45.6
Particulate	(mg/Sm^3 @11% O_2)	36.9
Particulate	(Kg/hr)	0.0
Particulate	(Kg/day)	1
Flowrate	(Sm^3/min)	15
Flowrate	(Am^3/min)	65
Opacity*	(%)	>50
Temperature	(oC)	772
O_2	(vol % dry)	8.7
CO_2	(vol % dry)	8.7
H_2O	(vol %)	13.1
Isokinetic Variation	(%)	93.5

standard conditions of 25 deg C and 101.3kPa

*Opacity was >50% from the time the incinerator was charged to about thirty minutes later.

TABLE 2 INCINERATOR EMISSIONS RESULTS

(400 kg charge)

Parameter		Test 1	Test 2	Test 3	Average
Test Date		Dec. 10/08	Dec. 10/08	Dec. 10/08	
Test Time		11:32 - 12:39	12:58 - 14:17	14:34 - 15:40	
Duration	(minutes)	64	64	64	64
Particulate	(mg/Sm^3)	138.3	66.8	26.0	77.0
Particulate	(mg/Sm^3 @ 11% O_2)	104.8	71.3	27.9	68.0
Particulate	(Kg/hr)	0.1	0.1	0.0	0.1
Particulate	(Kg/day)	3	1	1	2
Flowrate	(Sm^3/min)	16	15	15	15
Flowrate	(Am^3/min)	69	59	60	63
Opacity*	(%)	<5	<5	<5	<5
Temperature	(oC)	801	694	743	746
O_2	(vol % dry)	7.8	11.6	11.7	10.4
CO_2	(vol % dry)	9.8	6.0	5.7	7.2
H_2O	(vol %)	12.7	9.9	8.9	10.5
Isokinetic Variation	(%)	93.6	103.9	96.4	98.0

standard conditions of 25 deg C and 101.3kPa

*Opacity was >50% from the time the incinerator was charged to about thirty minutes later.

TABLE 3 INCINERATOR EMISSIONS RESULTS

(400 kg charge)

Parameter		Test 1	Test 2	Average
Test Date		Dec. 11/08	Dec. 11/08	
Test Time		10:31 - 11:48	12:04 - 13:08	
Duration	(minutes)	64	64	64
Particulate	(mg/Sm^3)	166.4	38.3	102.4
Particulate	(mg/Sm^3 @ 11% O_2)	102.8	33.2	68.0
Particulate	(Kg/hr)	0.2	0.0	0.1
Particulate	(Kg/day)	4	1	2
Flowrate	(Sm^3/min)	16	15	15
Flowrate	(Am^3/min)	73	63	68
Opacity		20	<5	10
Temperature	(oC)	815	808	812
O_2	(vol % dry)	4.9	9.5	7.2
CO_2	(vol % dry)	10.6	7.6	9.1
H_2O	(vol %)	12.4	10.5	11.5
Isokinetic Variation	(%)	92.3	88.0	90.2

standard conditions of 25 deg C and 101.3kPa

TABLE 4 INCINERATOR EMISSIONS RESULTS

(400 kg charge)

Parameter		Test 1	Test 2	Average
Test Date		Dec. 11/08	Dec. 11/08	
Test Time		14:01 - 15:07	15:34 - 16:40	
Duration	(minutes)	64	64	64
Particulate	(mg/Sm^3)	91.6	15.3	53.5
Particulate	(mg/Sm^3 @ 11 O_2)	64.7	15.4	40.0
Particulate	(Kg/hr)	0.1	0.0	0.0
Particulate	(Kg/day)	2	0	1
Flowrate	(Sm^3/min)	15	14	15
Flowrate	(Am^3/min)	67	61	64
Opacity		<5	<5	<5
Temperature	(oC)	800	778	789
O_2	(vol % dry)	6.9	11.1	9.0
CO_2	(vol % dry)	10.7	6.9	8.8
H_2O	(vol %)	13.0	11.0	12.0
Isokinetic Variation	(%)	94.0	98.3	96.1

standard conditions of 25 deg C and 101.3kPa

TABLE 5 GRAVIMETRIC RESULTS

Test	Date	Filter Particulate (mg)	Probe and Washings (mg)	Total Particulate (mg)
1	Dec. 9/08	12.6	41.3	53.9
1	Dec. 9/08	10.7	22.8	33.5
2	Dec.10/08	19.7	56.1	75.8
1	Dec. 10/08	126.5	112.1	238.6
2	Dec. 10/08	65.8	60.7	126.5
3	Dec. 10/08	5.8	38.5	44.3
1	Dec. 11/08	172.9	120.6	293.5
2	Dec. 11/08	16.3	41.9	58.2
1	Dec. 11/08	44.1	110.2	154.3
2	Dec. 11/08	4.0	21.4	25.4

5.0 DISCUSSION

The emission tests conducted on the Rodear Meats incinerator were conducted under three different loading and operating conditions. The initial operation (Dec. 9) was conducted with only diesel fuel firing. On December 10, a test where 200 kg were incinerated was conducted, followed by three tests during the incineration of a 400 kg batch. On December 11, two four hundred kg batches were monitored.

In general, for test results greater than 60 mg/Sm^3 @ 11% O_2, some of the measured particulate matter found was black, and appeared to be unburned carbon. For tests below 60 mg/Sm^3, the sample catch was mostly "off grey".

The test data clearly shows the decreasing trend of particulate emissions with time of the incineration cycle. Particulate emissions are maximized during the first 90 minutes, with moderate emissions during the second 90 minute period, and low particulate emissions after about three to four hours.

The fuel only test revealed some interesting data, where total particulate was about 30 mg/Sm^3 @ 11% O_2. However, the 30 mg/Sm^3 was comprised of about 25 to 30% material found on the sample filter (ie light density material), with about 70 to 80% of material found in the sample probe (usually higher density material or larger particles).

The particulate emitted during the fuel only tests, may have been residual debris in the Primary chamber that had not been cleaned out prior to the tests. It may also have been refractory particles being entrained in the gas stream, due to slight deterioration of the refractory lining caused by the super-hot and corrosive gases.

The very low result of the final test may indicate that the contribution of particulate matter by materials not related to the waste charge (ie fuel ash or refractory) becomes less with time, probably due to the unit operating at high temperatures for extended periods.

There were periods of opacity at >50%, but most opacity was measured at <5% (six minute observations). Normally, BC MOE air permits allow opacity exceedances for brief periods, which are usually shorter than the "high opacity" durations observed during the start of most of the burn cycles conducted here.

All tests were conducted by certified emission testing technicians using calibrated source sampling equipment. Samples were collected isokinetically at all points (except for one test). The test results, therefore, are considered to be an accurate representation of emission characteristics for the process conditions maintained on the test dates.

APPENDIX 1

COMPUTER OUTPUTS OF MEASURED AND CALCULATED DATA

APPENDIX 2

FIELD DATA SHEETS

APPENDIX 3

CALIBRATION DATA