AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

November 10, 2009

Mr. Ray Pilapil
Illinois Environmental Protection Agency
Compliance Section #40
P.O. Box 19276
Springfield, Illinois 62794-9276

Re: Annual Compliance Test Report
Flare Performance Testing
Cottonwood Hills Recycling and Disposal Facility

Dear Mr. Pilapil:

Aquaterra Environmental Solutions, Inc. (Aquaterra) on behalf of our client, Waste Management, Inc., has enclosed two copies of the *Annual Compliance Test Report, Heating Value, Velocity, and Visible Emissions of an Open Flare, Cottonwood Hills Recycling and Disposal Facility, Marissa, Illinois* dated November 2009. Please feel free to contact us at (618) 628-2001 with any questions or comments regarding this report.

Sincerely,
Aquaterra Environmental Solutions, Inc.

Andy Limmer, P.G.
Senior Project Manager

Matt Ballance, P.E.
Senior Project Manager

cc: Ernest Dennison, P.E. - Waste Management of Illinois, Inc.
Kevin Mattison – IEPA Bureau of Air, Des Plaines Office
John Justice – IEPA Bureau of Air, Collinsville Office

ANNUAL COMPLIANCE TEST REPORT
HEATING VALUE, VELOCITY, AND VISIBLE EMISSIONS
OF AN OPEN FLARE
COTTONWOOD HILLS RECYCLING AND DISPOSAL FACILITY
MARISSA, ILLINOIS

Aquaterra Project Number 3523.10
November 2009

Prepared For:

Waste Management of Illinois, Inc.
601 Madison Avenue
East St. Louis, Illinois 62201

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

ANNUAL COMPLIANCE TEST REPORT
HEATING VALUE, VELOCITY, AND VISIBLE EMISSIONS
OF AN OPEN FLARE
COTTONWOOD HILLS RECYCLING AND DISPOSAL FACILITY
MARISSA, ILLINOIS
NOVEMBER 2009

REPORT INDEX

Part No.	Part Title	Number of Pages
1.0	Introduction	1
2.0	Process Overview	1
3.0	Test Methodologies and Results	3

WM00338

TABLE OF CONTENTS

Page No.

REPORT INDEX ii

1.0 INTRODUCTION 1

2.0 PROCESS OVERVIEW 2

3.0 TEST METHODOLOGIES AND RESULTS 3

3.1 Visible Emissions 3

3.2 Fuel Heating Value 4

3.3 Cottonwood Hills RDF Flare Flow Rate Determination 4

LIST OF APPENDICES

Appendix A

Open Flare Diagram

Appendix B

Field Logs

Appendix C

Laboratory Analytical Results

Appendix D

Calculations

Net Heating Value

Exit Velocity

Maximum Permitted Exit Velocity

ANNUAL COMPLIANCE TEST REPORT
HEATING VALUE, VELOCITY, AND VISIBLE EMISSIONS
OF AN OPEN FLARE
COTTONWOOD HILLS RECYCLING AND DISPOSAL FACILITY
MARISSA, ILLINOIS
NOVEMBER 2009

1.0 INTRODUCTION

Aquaterra Environmental Solutions, Inc. (Aquaterra) was retained by Waste Management of Illinois, Inc., to perform the 2009 annual performance testing of the open flare at the Cottonwood Hills Recycling and Disposal Facility (Cottonwood Hills RDF) located in Marissa, Illinois. The flare testing was performed in accordance with the requirements of the Illinois Environmental Protection Agency (IEPA), 40 CFR 60.18 and the New Source Performance Standards found in 40 CFR 60, Subpart WWW. Alex Stewart of Aquaterra performed the Cottonwood Hills RDF flare testing on June 25, 2009 and October 14, 2009.

2.0 PROCESS OVERVIEW

The Cottonwood Hills RDF landfill gas collection and control system is routed to a landfill gas open flare. The open flare is used for the destruction of landfill gas and the control of landfill gas emissions. The flare began operation on February 5, 2008. The flare inlet pipe is 12 inches in diameter and composed of high density polyethylene (SDR-17) piping. The flare exit pipe is 10 inches in diameter. The flare was continually operated on a full-time basis with a flame present at all times during the test period. A diagram of the Cottonwood Hills RDF flare system is provided in Appendix A.

3.0 TEST METHODOLOGIES AND RESULTS

The Cottonwood Hills RDF flare testing was performed in accordance with the guidelines of the following USEPA test methods outlined in 40 CFR 60, Appendix A:

- Fuel Heating Value by ASTM Methods D1946 and D3588,
- Method 2D – Determination of Gas Volumetric Flow Rate in Small Pipes or Ducts, and
- Method 22 – Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares.

Two test events were conducted on the open flare. The test events were completed in June and October of 2009. The visual test of the open flare emissions was conducted during the June 2009 test event. Samples of landfill gas were collected for laboratory analyses during each test event. Copies of the Cottonwood Hills RDF flare testing field logs are presented in Appendix B. Field testing information including sampling times and flare system performance data, including gas and flare temperatures and gas pressure readings, are recorded on the field logs.

Samples Cottonwood-1, Cottonwood-2, and Cottonwood-3 were collected on June 25, 2009, and samples CW-4, CW-5, and CW-6 were collected on October 14, 2009. The landfill gas samples were collected during three consecutive sample runs for laboratory analysis. The landfill gas samples were collected under vacuum at the Cottonwood Hills RDF flare inlet using evacuated stainless steel tanks (summa canisters). A calibrated flow control regulator was used to regulate the flow of landfill gas at the approximate flow rate of 100 cc/min into each evacuated summa canister. The landfill gas sample canisters were delivered to Test America Laboratories (Test America) in Santa Ana, California for laboratory analysis. Test America subcontracted out some of the analysis to Air Technology Laboratories. Copies of the landfill gas sample analytical results are presented in Appendix C.

3.1 Visible Emissions

Visible emissions (opacity) testing of the Cottonwood Hills RDF flare was performed on June 25, 2009, in accordance with USEPA Method 22, *Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares.* The visual emissions from the open flare were continuously monitored for a 2-hour timeframe and documented at 5-minute intervals. A 5-minute rest period occurred after each 20-minute observation period. The Method 22 test results for the Cottonwood Hills RDF flare are summarized on the Method 22 Testing Field Log presented in Appendix B. The results of the visible emissions testing were

below the maximum allowable emissions per the permit. A summary of the acceptable Cottonwood Hills RDF flare visible emissions testing results is presented as follows.

Cottonwood Hills RDF Flare Visible Emission Summary

Visible Elapsed Emission Time per 2 hours	Allowable Visible Emission Time per 2 hours
0 seconds	5 minutes

3.2 Fuel Heating Value

A total of six samples of the landfill gas were analyzed for net heating value by ASTM Methods D1946 and D3588. The heating value results for the Cottonwood Hills RDF flare test events were calculated in accordance with 40 CFR 60.18(f)(3) and are in compliance with the minimum requirements as described in 40 CFR 60.18(b)(3)(ii). The Cottonwood Hills RDF flare heating value results are presented in Appendix D. The heating values of the samples were above the permit minimum allowable heating values. A summary of the calculated and minimum allowable heating values for the Cottonwood Hills RDF flare test events are presented below.

Cottonwood Hills RDF Flare Fuel Heating Value Summary

Date	Run No.	Calculated Heating Value (MJ/scm)	Minimum Allowable Heating Value (MJ/scm)
6/25/09	Cottonwood - 1	12.5	7.45
6/25/09	Cottonwood - 2	12.3	7.45
6/25/09	Cottonwood - 3	13.0	7.45
10/14/09	CW - 4	11.7	7.45
10/14/09	CW - 5	11.9	7.45
10/14/09	CW - 6	12.3	7.45

3.3 Cottonwood Hills RDF Flare Flow Rate Determination

The inlet landfill gas velocity was determined from a pitot tube located in the 10-inch nominal diameter pipe between the blower and the open flare. The pressure in the pipe was

measured with an electronic pressure meter, a Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577. The thermocouple provided a direct reading of the inlet gas temperature. The landfill gas sample mass flow rate was determined using the calculated velocity and results from the landfill gas fuel heating value laboratory analytical results.

The Cottonwood Hills RDF flare exit velocity was determined from the calculated gas mass flow rate and the cross sectional area of the 12-inch diameter flare tip. The maximum permitted exit velocity was determined by the calculations found in 40 CFR 60, 60.18(f)(5). The corresponding gas flow rate calculations are presented in Appendix D. The on-site calculated exit velocities are less than the maximum permitted exit velocities. The calculated exit velocities of the samples did not exceed maximum permitted velocities. A summary of the calculated and maximum permitted velocities for the Cottonwood Hills RDF flare test events is presented below.

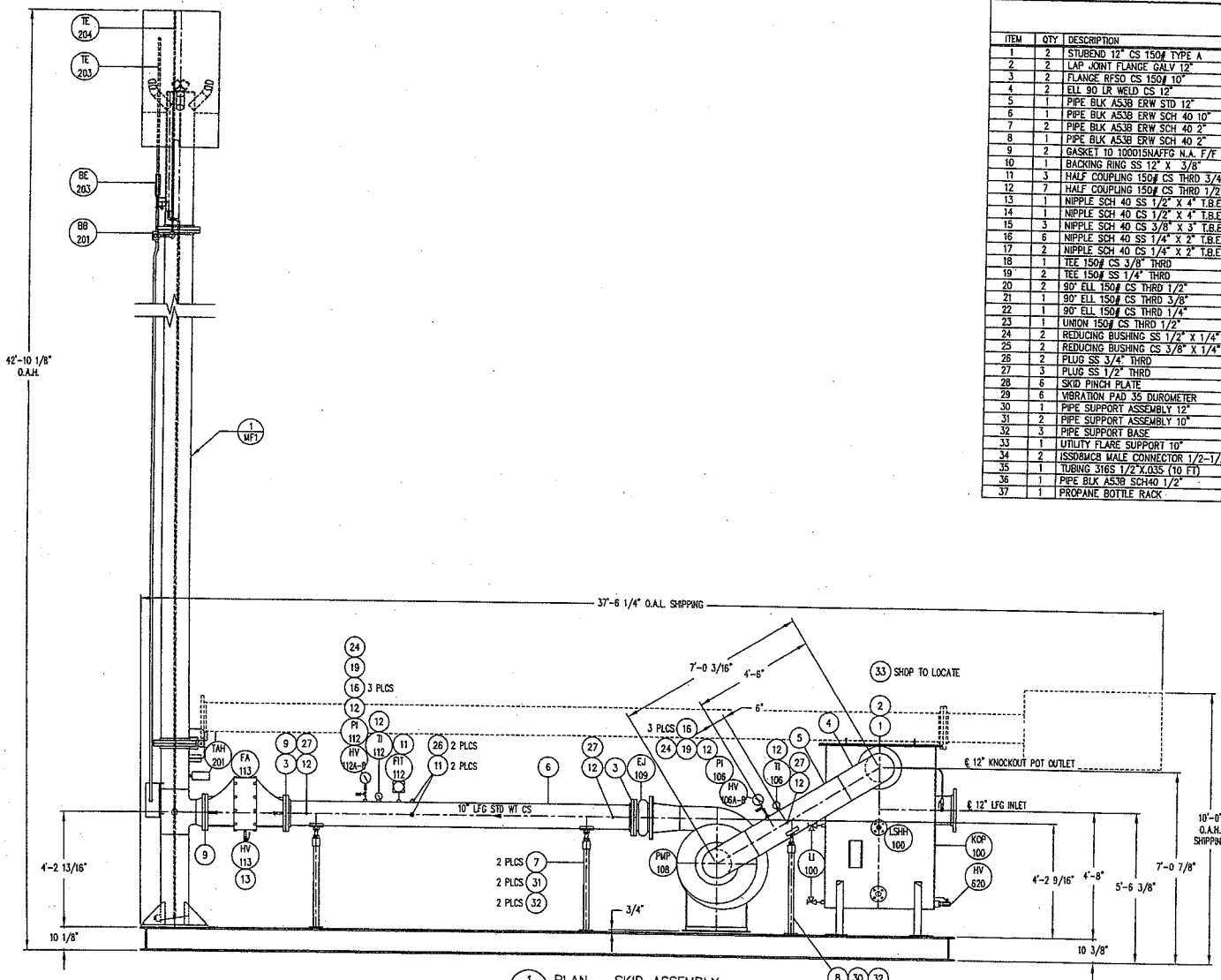
Cottonwood Hills RDF Flare Exit Velocity Summary

Date	Run No.	Calculated Exit Velocity (m/s)	Maximum Permitted Velocity (m/s)
6/25/09	Cottonwood - 1	15.1	20.1
6/25/09	Cottonwood - 2	15.0	19.8
6/25/09	Cottonwood - 3	15.1	20.8
10/14/09	CW - 4	13.7	18.9
10/14/09	CW - 5	13.4	19.2
10/14/09	CW - 6	13.4	19.8

APPENDIX A

OPEN FLARE DIAGRAM

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.



1 / M1 PLAN – SKID ASSEMBLY

BILL OF MATERIAL

ITEM	QTY	DESCRIPTION	SUPPLIER	PART NO.	INVENTORY AMOUNT
1	2	STUBEND 12" CS 150# TYPE A	LFG	WFE12B40	
2	2	LAP JOINT FLANGE GALV 12"	LFG	WFLJ12GALV	
3	2	FLANGE RFSO CS 150# 10"	LFG	WFF10B3	
4	2	ELL 90 LR WELD CS 12"	LFG	WFL1200B4	
5	1	PIPE BLK A53B ERW STD 12"	LFG	PW12BSTD	4
6	1	PIPE BLK A53B ERW SCH 40 10"	LFG	PW10B40	12.8
7	2	PIPE BLK A53B ERW SCH 40 2"	LFG	PW2B40	3.3
8	1	PIPE BLK A53B ERW SCH 40 2"	LFG	PW2B40	3.2
9	2	GASKET 10 100015NAFFG N.A. F/F	LFG	WFG10NA	
10	1	BACKING RING SS 12" X 3/8"	LFG	VFJBR1238S	
11	3	HALF COUPLING 150# CS THRD 3/4"	LFG	FLOOR STOCK	
12	7	HALF COUPLING 150# CS THRD 1/2"	LFG	FLOOR STOCK	
13	1	NIPPLE SCH 40 SS 1/2" X 4" T.B.E.	LFG	FLOOR STOCK	
14	1	NIPPLE SCH 40 CS 1/2" X 4" T.B.E.	LFG	FLOOR STOCK	
15	3	NIPPLE SCH 40 CS 3/8" X 3" T.B.E.	LFG	FLOOR STOCK	
16	6	NIPPLE SCH 40 SS 1/4" X 2" T.B.E.	LFG	FLOOR STOCK	
17	2	NIPPLE SCH 40 CS 1/4" X 2" T.B.E.	LFG	FLOOR STOCK	
18	1	TEE 150# CS 3/8" THRD	LFG	FLOOR STOCK	
19	2	TEE 150# SS 1/4" THRD	LFG	FLOOR STOCK	
20	2	90° ELL 150# CS THRD 1/2"	LFG	FLOOR STOCK	
21	1	90° ELL 150# CS THRD 3/8"	LFG	FLOOR STOCK	
22	1	90° ELL 150# CS THRD 1/4"	LFG	FLOOR STOCK	
23	1	UNION 150# CS THRD 1/2"	LFG	FLOOR STOCK	
24	2	REDUCING BUSHING SS 1/2" X 1/4" THRD	LFG	FLOOR STOCK	
25	2	REDUCING BUSHING CS 3/8" X 1/4" THRD	LFG	FLOOR STOCK	
26	2	PLUG SS 3/4" THRD	LFG	FLOOR STOCK	
27	3	PLUG SS 1/2" THRD	LFG	FLOOR STOCK	
28	6	SKID PINCH PLATE	LFG	PINCHPLATE	
29	6	VIBRATION PAD 35 DUROMETER	LFG	VP35DUROMETER	
30	1	PIPE SUPPORT ASSEMBLY 12"	LFG	PIPESUPPORT12	
31	2	PIPE SUPPORT ASSEMBLY 10"	LFG	PIPESUPPORT10	
32	3	PIPE SUPPORT BASE	LFG	PIPESUPPORTBASE	
33	1	UTILITY FLARE SUPPORT 10"	LFG	LFGSD00750	
34	2	ISS08MC8 MALE CONNECTOR 1/2-1/2	LFG	PFK1212MC	
35	1	TUBING 316S 1/2"X.035 (10 FT)	LFG	PT12X35S	
36	1	PIPE BLK A53B SCH40 1/2"	LFG	PW012B40	10
37	1	PROPANE BOTTLE RACK	LFG	PRORACK	

NOTES:

1. ALL BOLTS, CAP SCREWS AND NUTS WILL BE SAE GRADE 8 WITH YELLOW ZINC DICHROMATE PLATING. THREADED RODS WILL BE STAINLESS STEEL. ALL THREADS WILL BE UNIFIED NATIONAL COARSE.
2. ALL 1/8"-1 1/2" PIPES WILL BE STANDARD BLACK PIPE ASTM A53 OR ASTM A106. ALL 1/8"-1 1/2" PIPE NIPPLES WILL BE STANDARD BLACK PIPE ASTM A733.
3. ALL 1/8"-1 1/2" PIPE FITTINGS (ELBOWS, TEES, BUSHINGS, ETC.) WILL BE STANDARD (CLASS 150) WITH A BLACK FINISH – UNLESS OTHERWISE SPECIFIED.
4. EXTERNAL PIPE SURFACES TO BE BLASTED TO SP-7 SPECIFICATIONS, APPLIES TO CARBON STEEL PIPING ONLY.
5. ALL CARBON STEEL VESSELS AND PIPE EXTERNALS TO BE COATED WITH RUST PROHIBITING SHERWIN WILLIAMS B67R5 RED OXIDE RECOATABLE PRIMER AND FINISHED WITH A 3 MIL COAT OF SLATE GREY COLORED INDUSTRIAL ACRYLIC POLYURETHANE, SHERWIN WILLIAMS ACROLON 218 HS.
6. INSTALL GAUGES TO FACE CONTROL RACK SIDE.
7. ALL PIPE BUTT WELD JOINTS WILL HAVE A 1/8" ROOT OPENING.

Shaw® LFG Specialties, L.L.C.

REV	DESCRIPTION / ISSUE	DATE	BY
0	ISSUED FOR PURCHASING	06/28/07	BKD

THIS DRAWING REPRESENTS INTELLECTUAL PROPERTY OF LFG SPECIALTIES, L.L.C. ANY MODIFICATION TO THE ORIGINAL BY OTHER THAN LFG SPECIALTIES, L.L.C. PERSONNEL VIOLATES ITS ORIGINAL PURPOSE AND AS SUCH IS RENDERED VOID. LFG SPECIALTIES, L.L.C. WILL NOT BE HELD LIABLE FOR ANY CHANGES MADE TO THIS DOCUMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF THE ORIGINATOR.

UTILITY FLARE
SKID ASSEMBLY

DRAWN BY:	DIMENSION:	APPROVED BY:	SIZE:
BKD	LZ	LZ	D
SCALE: 1/2" = 1'-0"	DATE: 06/22/07	PROJECT NO: 127337	

PROJECT NAME: LANDFILL GAS UTILITY FLARE #PCF1242010
COTTONWOOD HILLS LANDFILL
MARISSA, IL

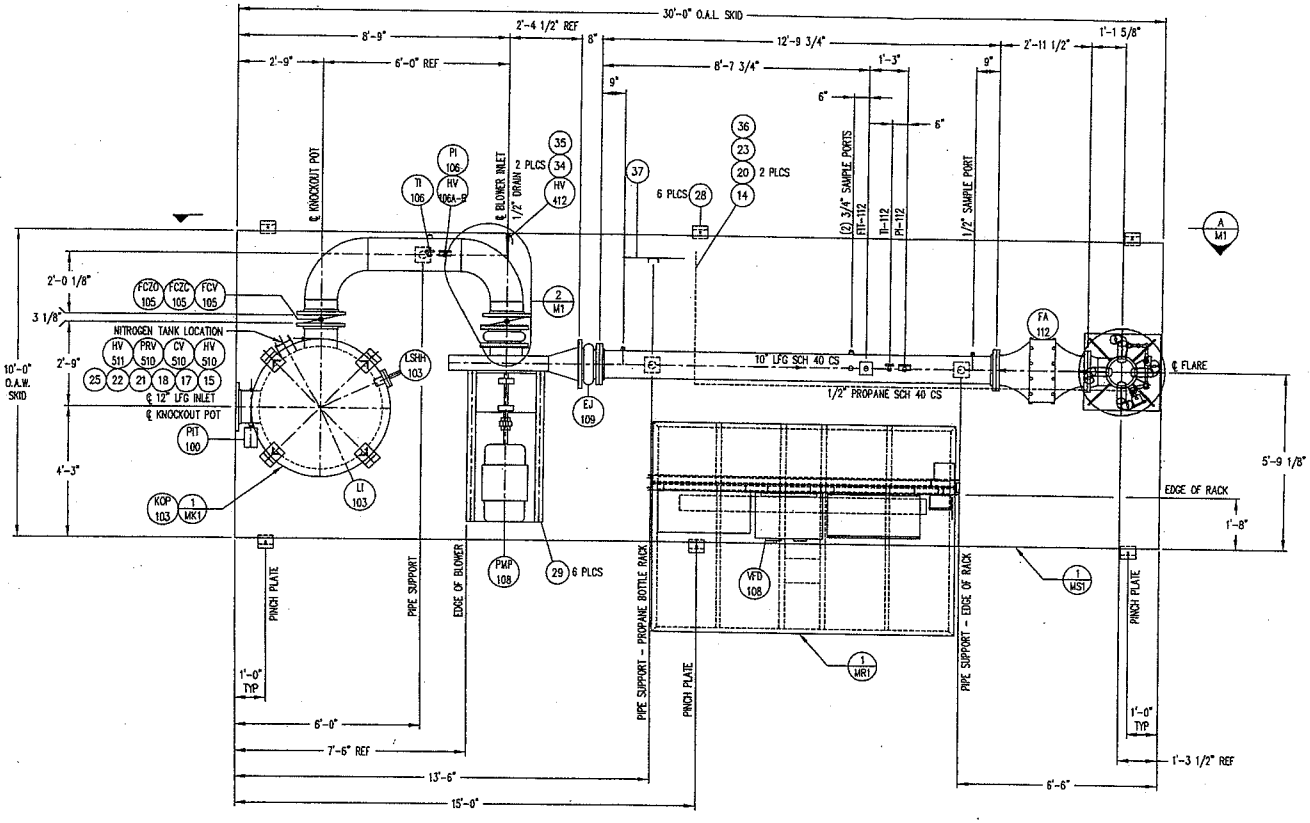
CUSTOMER: WASTE MANAGEMENT

SERIAL NO.	DWG NO.	SHT.
2093	M1	1

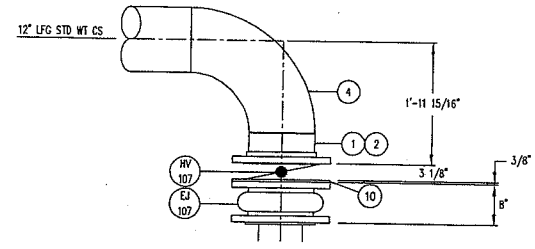
File: f:\LFS\2000 DRAWINGS\2093\MECHANICAL\2093-M1-SHT2.dwg Layout: Model User: chrkeling Aug 15, 2007 – 2:21pm

WM00346

SYSTEM TO BE ORIENTED WITH THE FLARE CONTROL PANEL FACING NORTH



1 / M1 PLAN - SKID ASSEMBLY



2 / M1 DETAIL - BLOWER INLET
SCALE: 2X

FOR B.O.M. SEE DRAWING 2093-M1-SHT2

NOTES:

1. ALL BOLTS, CAP SCREWS AND NUTS WILL BE SAE GRADE 8 WITH YELLOW ZINC DICHROMATE PLATING. THREAEDED RODS WILL BE STAINLESS STEEL. ALL THREADS WILL BE UNIFIED NATIONAL COARSE.
2. ALL 1/8"-1 1/2" PIPES WILL BE STANDARD BLACK PIPE ASTM A53 OR ASTM A106. ALL 1/8"-1 1/2" PIPE NIPPLES WILL BE STANDARD BLACK PIPE ASTM A733.
3. ALL 1/8"-1 1/2" PIPE FITTINGS (ELBOWS, TEES, BUSHINGS, ETC.) WILL BE STANDARD (CLASS 150) WITH A BLACK FINISH - UNLESS OTHERWISE SPECIFIED.
4. EXTERNAL PIPE SURFACES TO BE BLASTED TO SP-7 SPECIFICATIONS, APPLIES TO CARBON STEEL PIPING ONLY.
5. ALL CARBON STEEL VESSELS AND PIPE EXTERNALS TO BE COATED WITH RUST PROHIBITING SHERWIN WILLIAMS B67R5 RED OXIDE RECOATABLE PRIMER AND FINISHED WITH A 3 MIL COAT OF SLATE GREY COLORED INDUSTRIAL ACRYLIC POLYURETHANE, SHERWIN WILLIAMS ACROLON 218 HS.
6. INSTALL GAUGES TO FACE CONTROL RACK SIDE.
7. ALL PIPE BUTT WELD JOINTS WILL HAVE A 1/8" ROOT OPENING.
8. A MINIMUM DISTANCE FROM POWER LINES AND STRUCTURES OF 4 TIMES THE STACK HEIGHT MUST BE MAINTAINED AROUND THE FLARE. IF THIS DISTANCE IS NOT FEASIBLE, PLEASE CONTACT LFG SPECIALTIES ENGINEERING.

Shaw® LFG Specialties, L.L.C.

REV	DESCRIPTION / ISSUE	DATE	BY
0	ISSUED FOR PURCHASING	06/28/07	BKD

THIS DRAWING REPRESENTS INTELLECTUAL PROPERTY OF LFG SPECIALTIES, L.L.C. ANY MODIFICATION TO THE ORIGINAL BY OTHER THAN LFG SPECIALTIES, L.L.C. PERSONNEL VIOLATES ITS ORIGINAL PURPOSE AND AS SUCH IS RENDERED VOID. LFG SPECIALTIES, L.L.C. WILL NOT BE HELD LIABLE FOR ANY CHANGES MADE TO THIS DOCUMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF THE ORIGINATOR.

UTILITY FLARE SKID ASSEMBLY

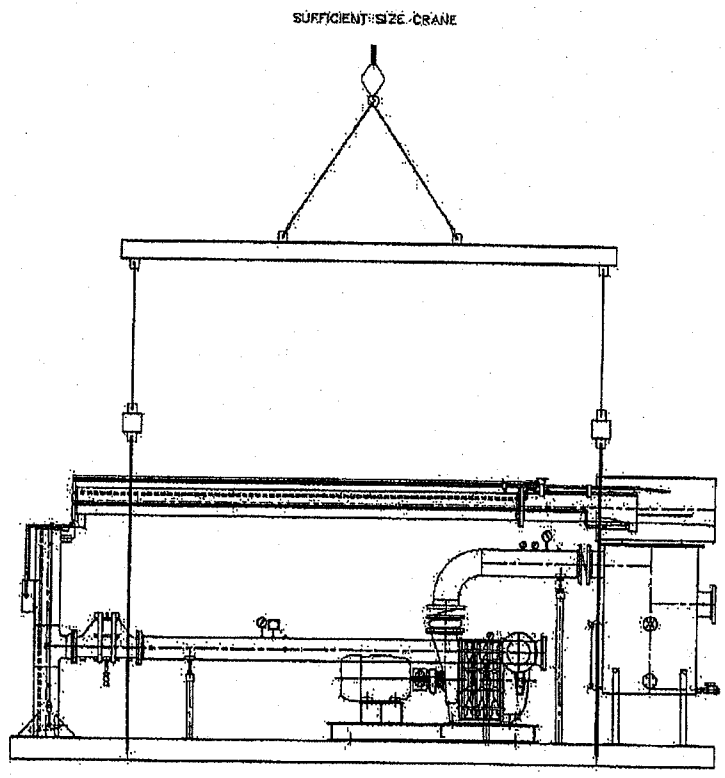
DRAWN BY:	ENGINEER:	APPROVED BY:	SIZE:
BKD	LZ	LZ	D
SCALE: 1/2" = 1'-0"	DATE: 06/22/07	PROJECT NO: 127337	

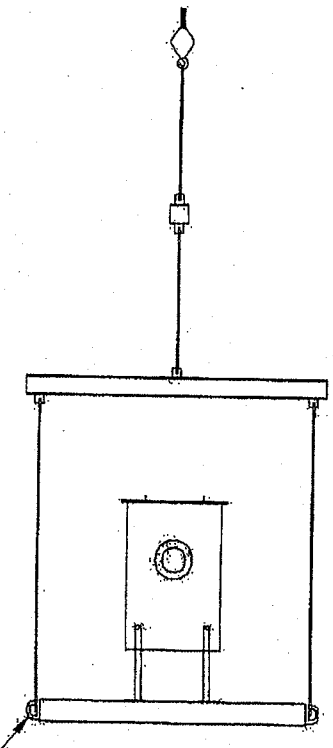
PROJECT NAME: LANDFILL GAS UTILITY FLARE #PCF1242110 COTTONWOOD HILLS LANDFILL MARISSA, IL

CUSTOMER: WASTE MANAGEMENT | SERIAL NO: 2093 | DWG NO: M1 | SHT: 1

File: F:\LFG\2003 DRAWINGS\2093\MECHANICAL\2093-M1-SHT1.dwg Layout: Model User: chris.king Aug 15, 2007 - 2:20pm

WM00347





Maximum Skid Weights

Length / Width	16 ft	20 ft	26 ft	30 ft	32 ft	36 ft	38 ft	40 ft
8 ft	9,240 lbs	11,271 lbs	15,890 lbs	20,050 lbs	25,480 lbs	31,490 lbs	30,920 lbs	42,100 lbs
9 ft	9,770 lbs	11,921 lbs	16,720 lbs	21,000 lbs	26,490 lbs	32,620 lbs	36,610 lbs	43,350 lbs
10 ft	10,300 lbs	12,571 lbs	17,550 lbs	21,950 lbs	27,500 lbs	33,750 lbs	37,800 lbs	44,600 lbs

RECOMMENDED RIGGING FOR SKID

Shaw LFG Specialties, LLC

XREF Files: IMAGE Files:
File: N:\LFG Time Charges 2004\SKIDDWG.dwg Layout: Model User: tom.seagro Dec 03, 2004 – 4:22pm

APPENDIX B

FIELD LOGS

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler: Alex Stewart

Date: 6/25/2009
Sample I.D.: Cottonwood 1
Vessel I.D.: DL829
Vessel Vol.: 6.0 liter

Temperature Measurements
Flare Temp.*: 1118 Deg. F
Gas Temp.**: 106 Deg. F
* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting
** Measured with in-line thermometer

Orifice Plate Measurements
Static Pressure*: 0.60 Inches Hg
* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Summa Canister Vacuum Readings
Initial Vacuum: -30 Inches Hg
Final Vacuum: -5 Inches Hg

The flow regulator was calibrated at 100 cc/min and the canister was allowed to fill for 45 min.
Start Time: 0735
End Time: 0840

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler: Alex Stewart

Date: 6/25/2009
Sample I.D.: Cottonwood 2
Vessel I.D.: 0092
Vessel Vol.: 6.0 liter

Temperature Measurements
Flare Temp.*: 1230 Deg. F
Gas Temp.**: 110 Deg. F
* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting
** Measured with in-line thermometer

Orifice Plate Measurements
Static Pressure*: 0.58 Inches Hg
* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Summa Canister Vacuum Readings
Initial Vacuum: -30 Inches Hg
Final Vacuum: -5 Inches Hg

The flow regulator was calibrated at 100 cc/min and the canister was allowed to fill for 50 min.
Start Time: 0845
End Time: 0950

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler: Alex Stewart

Date: 6/25/2009
Sample I.D.: Cottonwood 3
Vessel I.D.: 0082
Vessel Vol.: 6.0 liter

Temperature Measurements

Flare Temp.*: 1156 Deg. F
Gas Temp.**: 113 Deg. F

* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting
** Measured with in-line thermometer

Pito Tube Measurements

Static Pressure*: 0.59 Inches Hg

* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Summa Canister Vacuum Readings

Initial Vacuum: -30 Inches Hg
Final Vacuum: -6 Inches Hg

The flow regulator was calibrated at 100 cc/min and the canister was allowed to fill for 50 min.

Start Time: 0955
End Time: 1100

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
VISIBLE EMISSIONS INSPECTION - METHOD 22

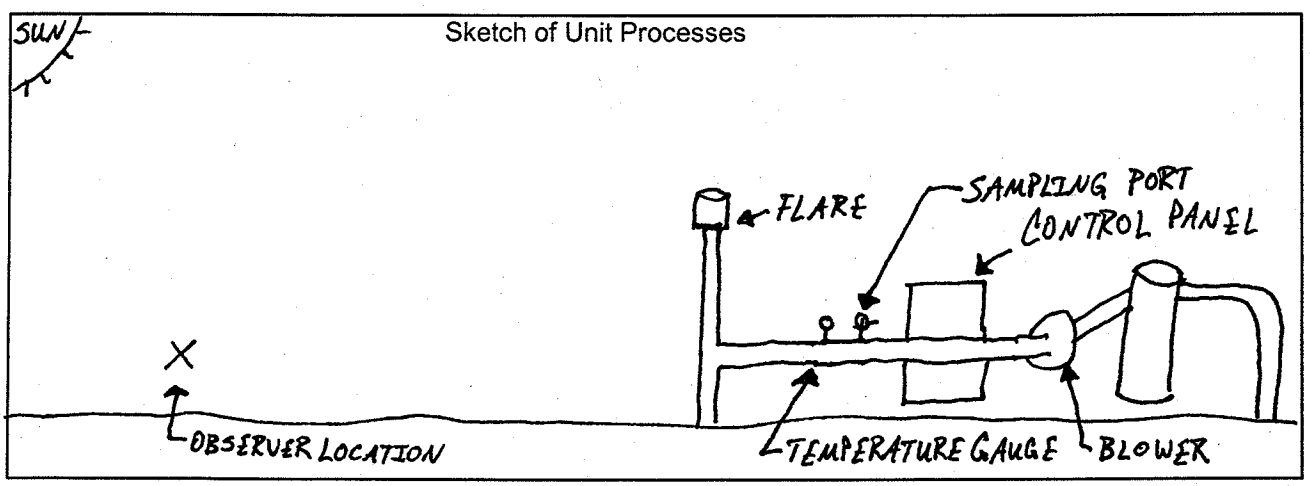
Cottonwood Hills Recycling and DisposalFacility
Marissa, Illinois

Tester Alex Stewart Date 6/25/2009

Time (Hour:Min.)	Elapsed Time (Minutes)	Accumulate Emissions (Min.:Sec.)	Time (Hour:Min.)	Elapsed Time (Minutes)	Accumulate Emissions (Min.:Sec.)
7:35	0		8:50	60	
7:40	5	0:00	8:55	65	0:00
7:45	10	0:00	9:00	70	0:00
7:50	15	0:00	9:05	75	0:00
7:55	20	0:00	9:10	80	0:00
8:00	20		9:15	80	
8:05	25	0:00	9:20	85	0:00
8:10	30	0:00	9:25	90	0:00
8:15	35	0:00	9:30	95	0:00
8:20	40	0:00	9:35	100	0:00
8:25	40		9:40	100	
8:30	45	0:00	9:45	105	0:00
8:35	50	0:00	9:50	110	0:00
8:40	55	0:00	9:55	115	0:00
8:45	60	0:00	10:00	120	0:00
First Hour Subtotal:		0:0	Second Hour Subtotal:		0:00
Total Visible Emissions:				0:00	

Notes:

Sketch of Unit Processes



AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler: Brady Stewart

Date: 10/14/2009
Sample I.D.: CW-4
Vessel I.D.: 12258
Vessel Vol.: 6.0 liter

Temperature Measurements
Flare Temp.*: 966 Deg. F
Gas Temp.**: 87 Deg. F
* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting
** Measured with in-line thermometer

Pito Tube Measurements
Static Pressure*: 0.5 Inches Hg
* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Summa Canister Vacuum Readings
Initial Vacuum: -25 Inches Hg
Final Vacuum: -4 Inches Hg

The flow regulator was calibrated at 100 cc/min and the canister was allowed to fill for 50 min.
Start Time: 0730
End Time: 820

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler: Brady Stewart

Date: 10/14/2009
Sample I.D.: CW-5
Vessel I.D.: 92048
Vessel Vol.: 6.0 liter

Temperature Measurements
Flare Temp.*: 964 Deg. F
Gas Temp.**: 88 Deg. F
* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting
** Measured with in-line thermometer

Pito Tube Measurements
Static Pressure*: 0.48 Inches Hg
* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Summa Canister Vacuum Readings
Initial Vacuum: -27 Inches Hg
Final Vacuum: -4 Inches Hg

The flow regulator was calibrated at 100 cc/min and the canister was allowed to fill for 50 min.
Start Time: 0825
End Time: 915

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Sampler: Brady Stewart

Date: 10/14/2009
Sample I.D.: CW-6
Vessel I.D.: 12156
Vessel Vol.: 6.0 liter

Temperature Measurements
Flare Temp.*: 988 Deg. F
Gas Temp.**: 88 Deg. F
* Measured with CAT 123-6700 Infrared Thermometer II with Laser Sighting
** Measured with in-line thermometer

Pito Tube Measurements
Static Pressure*: 0.48 Inches Hg
* Measured with Shortridge Instruments, Inc. Airdata Multimeter ADM 860 #M00577

Summa Canister Vacuum Readings
Initial Vacuum: -29 Inches Hg
Final Vacuum: -4 Inches Hg

The flow regulator was calibrated at 100 cc/min and the canister was allowed to fill for 50 min.
Start Time: 0920
End Time: 1020

APPENDIX C

LABORATORY ANALYTICAL RESULTS

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

July 27, 2009

LABORATORY REPORT

Client:
Aquaterra Environmental Solution Fairview Heights
13 Executive drive, Suite 1
Fairview Heights, IL 62208
Attn: Andy Limmer

Work Order:	LSG0022
Project Name:	IL31 Cottonwood Hills RDF
Project Number:	Flare Testing
Date Received:	07/01/09

TestAmerica Los Angeles certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the Corrective Action Report. NELAC Certification Number for TestAmerica Los Angeles is E87652. The test results listed within this Laboratory Report pertain only to the samples tested in the laboratory. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica.

The Chain of Custody, 1 page, is included and is an integral part of this report. This entire report was reviewed and approved for release.

If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 714-258-8610.

Analyses included in this report were performed by the laboratory shown at the top of this report unless otherwise indicated.

CASE NARRATIVE:

Methods EPA 25C and EPA 3C were performed at Air Technology Laboratories, Inc. See attached Subcontract Reports.

Approved By:

Marisol Tabirara
Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSG0022 Project: IL31 Cottonwood Hills RDF Project Number: Flare Testing	Received: 07/01/09 10:30 Reported: 07/27/09 15:31	

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION	MATRIX	CONTAINER TYPE
COTTONWOOD 1	LSG0022-01	06/25/09 07:35	Air	Passivated Canister
COTTONWOOD 2	LSG0022-02	06/25/09 08:45	Air	Passivated Canister
COTTONWOOD 3	LSG0022-03	06/25/09 09:55	Air	Passivated Canister

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSG0022 Project: IL31 Cottonwood Hills RDF Project Number: Flare Testing	Received: 07/01/09 10:30 Reported: 07/27/09 15:31	

ANALYTICAL REPORT

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
ample ID: LSG0022-01 (COTTONWOOD 1 - Air)						**Sampled: 06/25/09 07:35**			
STM D3588 - Heat of Combustion & Specific Gravity									
Heat of Combustion	**580**		BTU/ft3	0.19	1.9	07/14/09 05:23	GC7	EI	9G22001

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSG0022 Project: IL31 Cottonwood Hills RDF Project Number: Flare Testing	Received: 07/01/09 10:30 Reported: 07/27/09 15:31	

ANALYTICAL REPORT

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
ample ID: LSG0022-02 (COTTONWOOD 2 - Air)						**Sampled: 06/25/09 08:45**			
STM D3588 - Heat of Combustion & Specific Gravity									
Heat of Combustion	**580**		BTU/ft3	0.20	2.0	07/14/09 06:41	GC7	EI	9G22001

WM00361

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSG0022 Project: IL31 Cottonwood Hills RDF Project Number: Flare Testing	Received: 07/01/09 10:30 Reported: 07/27/09 15:31	

ANALYTICAL REPORT

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
ample ID: LSG0022-03 (COTTONWOOD 3 - Air)						**Sampled: 06/25/09 09:55**			
STM D3588 - Heat of Combustion & Specific Gravity									
Heat of Combustion	**580**		BTU/ft3	0.19	1.9	07/14/09 07:59	GC7	EI	9G22001

WM00362

3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: Project: Project Number:	LSG0022 IL31 Cottonwood Hills RDF Flare Testing	Received: Reported:	07/01/09 10:30 07/27/09 15:31

DATA QUALIFIERS AND DEFINITIONS

ND Not detected at the reporting limit (or method detection limit if shown)

TestAmerica Los Angeles
3585 Cadillac Ave., Suite A
Costa Mesa, CA 92626
Phone 714-258-8610 Fax 714-258-0921

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information		
Company: Aquaterra	Project Manager: Nathan Higgerson	LSG0022 — 2 of 2 COCs
Address: 13 Executive Dr. Suite 1	Phone: (618) 628-2001	Samples Collected By: Alex Stewart
City/State/Zip Fairview Heights, IL 62208	Email: nhiggerson@aquaterra-env.com	
Phone: (618) 628-2001	Site Contact:	
FAX: (618) 628-2002	LAB Contact: Sonye Tabarin	
Project Name: 2009 Flare Testing	Analysis Turnaround Time	
Site: Cottonwood Hills	Standard (Specify)	
PO # 3523.10	Rush (Specify)	

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	TO-3	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
Cottonwood 1	6-25-09	7:35	8:40	-30	-5	HF095	DL829				X	X		X						
Cottonwood 2	6-25-09	8:45	9:50	-30	-5	HF095	0092				X	X		X						
Cottonwood 3	6-25-09	9:55	11:00	-30	-6	HF095	0082				X	X		X						

Temperature (Fahrenheit)	Interior	Ambient
Start		86
Stop		94

Pressure (inches of Hg)	Interior	Ambient
Start		29.86
Stop		29.86

Other is BTU Content

Special Instructions/QC Requirements & Comments:

Samples Shipped by: Alex Stewart	Date/Time: 6-25-09 / 2:00pm	Samples Received by:
Samples Relinquished by:	Date/Time: 7/1/09 1030	Received by:
Relinquished by:	Date/Time:	Received by:

Lab Use Only — Shipper Name: — Opened by: — Condition:

LSG0022

WM00364

TestAmerica

CANISTER FIELD DATA RECORD

CLIENT: WMI

CANISTER SERIAL #: DL829

DATE CLEANED: 061209A

CLIENT SAMPLE #:

SITE LOCATION:

VFR ID:

Duration of comp. : Hrs. / mins.

Flow setting: ml/min

Initials:

READING	TIME	Vac. (Inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	6/18/09	[illegible]
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (Inches Hg / PSIA (circle unit used))	12.75	7/6/09	[illegible]
FINAL PRESSURE (PSIA)	24.60	7/6/09	[illegible]

Pressurization Gas: N_2

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\COI\DOCS\TestAmerica DOCs\TestAmerica - CANISTER FIELD DATA RECORD - 20080201.doc

TestAmerica

CANISTER FIELD DATA RECORD

CLIENT: WMI

CANISTER SERIAL #: 0092

DATE CLEANED: 061209A

CLIENT SAMPLE #:

SITE LOCATION:

VFR ID:

Duration of comp. : Hrs. / mins.

Flow setting: ml/min

Initials:

READING	TIME	Vac. (Inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	6/18/09	
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (Inches Hg / PSIA (circle unit used))	12.65	2/6/09	X
FINAL PRESSURE (PSIA)	24.70	2/6/09	X

Pressurization Gas: N2

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\COI\DOCS\TestAmerica DOCs\TestAmerica - CANISTER FIELD DATA RECORD - 20080201.doc

3

TestAmerica

CANISTER FIELD DATA RECORD

CLIENT: WMI

CANISTER SERIAL #: 0082

DATE CLEANED: 061209A

CLIENT SAMPLE #:

SITE LOCATION:

VFR ID:

Duration of comp. : Hrs. / mins.

Flow setting: ml/min

Initials:

READING	TIME	Vac. (inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	6/18/09	[illegible]
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (Inches Hg / PSIA (circle unit used))	12.50	7/6/09	X
.FINAL PRESSURE (PSIA)	24.39	7/6/09	X

Pressurization Gas: N_2

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\CON\DOCS\TestAmerica DOCs\TestAmerica - CANISTER FIELD DATA RECORD - 20080201.doc

CANISTER QC CERTIFICATION

TestAmerica

Certification Type: TO-15 ML

Date Cleaned/Batch: 6-12-09A

Date of QC: 6-16-09 (MSA)

Data File Number: MB06153

CANISTER ID NUMBERS

* A-267	0182
12585	GL0010
✓ 12442	✓ 0103326
✓ 0092	✓ 064678
✓ DL829	02315
✓ 0082	WMI-04

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

AD
Reviewed By:

6/16/09
Date:

N:\CON\DCCS\TestAmerica DCCs\Can QC Cert 20070712.doc

LSG0022

WM00368

TestAmerica Los Angeles

AIR TOXICS - TO-14A/TO-15 MEDIUM LEVEL

Data file : \\LAPC065\MSA_C\CHEM\MSA.I\090615A.B\MB06153.D
Lab Smp Id: BLANK Client Smp ID: A-267
Inj Date : 16-JUN-2009 02:52
Operator : AA Inst ID: MSA.i
Smp Info : BLANK,A-267,,SCREEN BLANK
Misc Info : 1,1,500,500,3,,BLANK,CORP.SUB,0
Comment :
Method : \\LAPC065\MSA_C\CHEM\MSA.I\090615A.B\TO14A.m
Meth Date : 15-Jun-2009 16:17 almagroa Quant Type: ISTD
Cal Date : 12-JUN-2009 04:41 Cal File: IC06128.D
Als bottle: 5 QC Sample: BLANK
Dil Factor: 1.00000
Integrator: HP RTE Compound Sublist: CORP.SUB
Subtraction File: \\LAPC065\MSA_C
Target Version: 4.04
Processing Host: LAPC065

Concentration Formula: Amt * DF * (FinalPres / InitPres)*(CalVol / SmpVol)

Name	Value	Description
DF	1.000	Dilution Factor
FinalPres	1.000	FinalPres
InitPres	1.000	InitPres
CalVol	500.000	CalVol
SmpVol	500.000	SmpVol

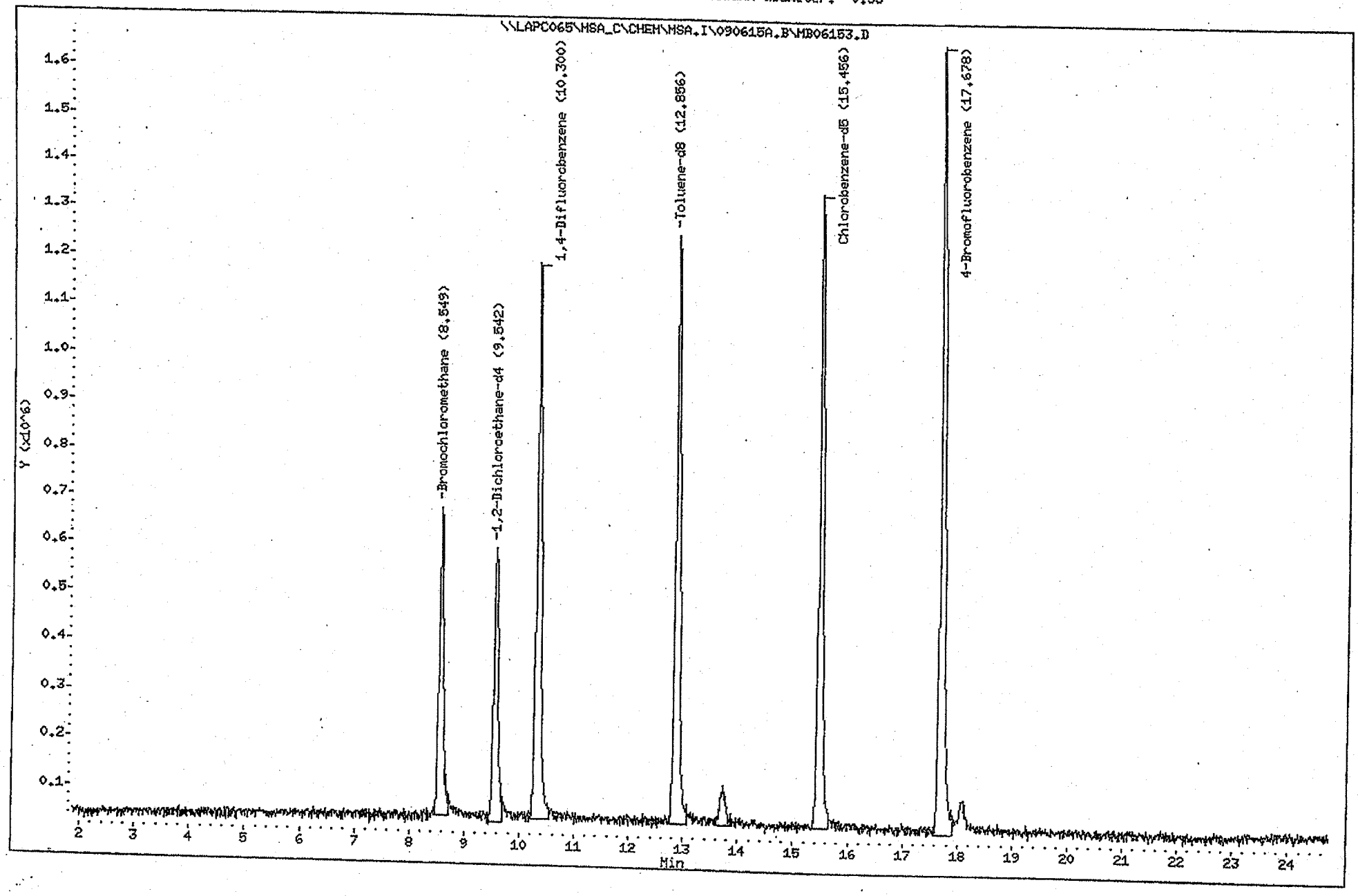
Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ppbv)	FINAL (ppbv)
* 58 Bromochloromethane	49	8.548	8.551	(1.000)	921598	50.0000	
$ 66 1,2-Dichloroethane-d4	65	9.532	9.545	(1.115)	875730	48.3688	48.37
* 75 1,4-Difluorobenzene	114	10.309	10.303	(1.000)	2677639	50.0000	
$ 90 Toluene-d8	100	12.846	12.850	(1.246)	1509170	53.1121	53.11
* 101 Chlorobenzene-d5	117	15.456	15.459	(1.000)	2200450	50.0000	
$ 117 4-Bromofluorobenzene	95	17.677	17.671	(1.144)	2194582	50.2796	50.28

Date File: \\LAPC065\MSA_C\CHEM\MSA.I\090615A.B\MB06153.D
Date : 16-JUN-2009 02:52
Client ID: A-267
Sample Info: BLANK,A-267,,SCREEN BLANK

Column phase: J&W DB-624

Instrument: MSA.i

Operator: AA
Column diameter: 0.53



LSG0022

WM00370

Subcontract Reports

AIR TECHNOLOGY
Laboratories, Inc.

July 24, 2009

nelac
FL Cert #E87847/LA Cert #04140
EPA Methods TO3, TO14A, TO15, 25C/3C
RSK-175
TX Cert #T104704450-09-TX
EPA Methods TO14A,TO15

AZ Dept of Health Services #AZ0737
EPA Methods TO3, TO14A, TO15, 15, 18, 25C

TestAmerica
ATTN: Sonia Tabirara
3585 Cadillac Ave., Suite A
Costa Mesa, CA 92626

LABORATORY TEST RESULTS

Project Reference: LSG0022
Lab Number: A9072112-01/03

Enclosed are results for sample(s) received 7/21/09 by Air Technology Laboratories. Analyses were performed according to specifications on the chain of custody provided with the sample(s).

Report Narrative:

- Sample analyses were performed within method performance criteria and meet all requirements of the NELAC Standards.
- All results are reported without qualifications.

Results were e-mailed to Sonia Tabirara on 7/23/09.

ATL appreciates the opportunity to provide testing services to your company. If you have any questions regarding these results, please call me at (626) 964-4032.

Sincerely,

Mark Johnson
Operations Manager
MJohnson@AirTechLabs.com

Enclosures

Note: The cover letter is an integral part of this analytical report.

Client: TestAmerica - Los Angeles
Attn: Sonia Tabirara

Project Name: LSG0022 (AQUATERRA)
Project Number: LSG0022
Date Received: 7/21/2009
Matrix: Vapor

TNMOC by EPA METHOD 25C
Fixed Gases by EPA METHOD 3C

Lab Number:			A9072112-01		A9072112-02		A9072112-03					
Client Sample ID:			COTTONWOOD 1		COTTONWOOD 2		COTTONWOOD 3					
Date Collected:			6/25/2009		6/25/2009		6/25/2009					
Date Analyzed:			7/22/2009		7/22/2009		7/23/2009					
Analyst Initials:			ZK		ZK		ZK					
QC Batch:			090722GC8A3		090722GC8A3		090722GC8A3					
Dilution Factor:			2.0		2.0		2.1					
ANALYTE	Units	PQL	Result	RL	Result	RL	Result	RL				
TNMOC	ppmv C	10	2,700	20	3,700	20	4,400	21				
TNMOC uncorr*	ppmv C	10	2,600	20	3,500	20	4,100	21				
Nitrogen	% v/v	1.0	ND	2.0	ND	2.0	ND	2.1				
Oxygen	% v/v	0.50	ND	1.0	ND	1.0	ND	1.1				
Carbon Dioxide	% v/v	0.010	40	0.020	39	0.020	42	0.021				
Methane	% v/v	0.0010	57	0.0020	56	0.0020	59	0.0021				
Carbon Monoxide	% v/v	0.0010	0.0025	0.0020	0.0025	0.0020	0.0027	0.0021				

ND = Not detected at or above reporting limit.
PQL = Practical Quantitation Limit.
TNMOC = Total Non-Methane Organic Carbon.
TNMOC uncorr* = TNMOC concentration in sample without nitrogen/moisture correction.
NA = Nitrogen/moisture correction causes division by zero.

Reviewed/Approved By: _____ Date: 7-23-09
Mark Johnson
Operations Manager

The cover letter is an integral part of this analytical report.

A9072112-01/03

Chain of Custody Record

TESTAMERICA -LA

Client: TESTAMERICA-LOS ANGELES	SITE CONTACT:	Date: 7/21/09	
Address: 3585 CADILLAC AVE SUITE A	Telephone Number(Area Code)/Fax Number: 714-258-8610	Lab Number: LSG0022	Page 1 of 1
City: COSTA MESA; State: CA; Zip Code: 92626	Laboratory Contract: SONIA TABIRARA		
Project Name: LSG0022 (AQUATERRA)	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.:			

Analysis (Attach list if more space is needed)

	SAMPLE ID No. And Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Matrix: Sediment	Matrix: Soil	Matrix: Air	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH		EPA 3C	EPA 25C									Special Instructions / Conditions of Receipt
01	COTTONWOOD 1	6/25/09	0735				X	1							X	X									#DL829
02	COTTONWOOD 2	6/25/09	0845				X	1							X	X									#0092
03	COTTONWOOD 3	6/25/09	0955				X	1							X	X									#0082

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal: ☐ Return to Client ☒ Disposal by Lab ☐ Archive for _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: ☐ 24 Hours ☒ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By: [signature]	7/21/09	1320	1. Received By: [signature]	7/21/09	1320
2. Relinquished By: [signature]	7-21-09	1345	2. Received By: [signature]	7/21/09	1345
3. Relinquished By: [signature]	7/21/09	1446	3. Received By: [signature] Jason Guien	7/21/09	1446

Comments:
SUB TO AIR TECHNOLOGY. Call Project Manager with any questions.

WM00374

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

October 27, 2009

LABORATORY REPORT

Client:
Aquaterra Environmental Solution Fairview Heights
13 Executive drive, Suite 1
Fairview Heights, IL 62208
Attn: Andy Limmer

Work Order:	LSJ0174
Project Name:	IL31 Cottonwood Hills RDF
Project Number:	[none]
Date Received:	10/19/09

TestAmerica Los Angeles certifies that the test results provided in this report meet all NELAC requirements for parameters for which accreditation is required or available. Any exceptions to NELAC requirements are noted in the Corrective Action Report. NELAC Certification Number for TestAmerica Los Angeles is E87652. The test results listed within this Laboratory Report pertain only to the samples tested in the laboratory. This Laboratory Report is confidential and is intended for the sole use of TestAmerica and its client. This report shall not be reproduced, except in full, without written permission from TestAmerica.

The Chain of Custody, 1 page, is included and is an integral part of this report. This entire report was reviewed and approved for release.

If you have any questions relating to this analytical report, please contact your Laboratory Project Manager at 714-258-8610.

Analyses included in this report were performed by the laboratory shown at the top of this report unless otherwise indicated.

CASE NARRATIVE:
All samples for method 25C have been corrected for nitrogen. Field conditions are used in this calculation. Samples for EPA 25C are analyzed in triplicate and 3C samples are run in duplicate. EPA 3C/25C result summary forms are available.

Approved By:

Marisol Tabirara
Project Manager

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: Project: Project Number:	LSJ0174 IL31 Cottonwood Hills RDF [none]	Received: Reported:	10/19/09 11:30 10/27/09 15:44

SAMPLE IDENTIFICATION	LAB NUMBER	COLLECTION	MATRIX	CONTAINER TYPE
CW-4	LSJ0174-01	10/14/09 07:30	Air	Passivated Canister
CW-5	LSJ0174-02	10/14/09 08:25	Air	Passivated Canister
CW-6	LSJ0174-03	10/14/09 09:20	Air	Passivated Canister

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSJ0174 Project: IL31 Cottonwood Hills RDF Project Number: [none]	Received: 10/19/09 11:30 Reported: 10/27/09 15:44	

ANALYTICAL REPORT

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
ample ID: LSJ0174-01 (CW-4 - Air)						**Sampled: 10/14/09 07:30**			
STM D3588 - Heat of Combustion & Specific Gravity									
Heat of Combustion	**560**		BTU/ft3	0.19	1.9	10/20/09 06:48	GC8	YZ	9J22011
PA 25C - Total Nonmethane Organic Compounds									
Total Non-Methane Hydrocarbons as Methane	**4000**		ppm-C	57	1.9	10/20/09 18:48	GC8	EI	9J21004
PA 3C - Fixed Gases									
Carbon dioxide	**36**		%(v/v)	0.019	1.9	10/20/09 18:48	GC8	EI	9J21004
Carbon monoxide	ND		%(v/v)	0.0019	1.9	10/20/09 18:48	GC8	EI	9J21004
Methane	**55**		%(v/v)	0.00038	1.9	10/20/09 18:48	GC8	EI	9J21004
Nitrogen	**8.8**		%(v/v)	1.9	1.9	10/20/09 18:48	GC8	EI	9J21004
Oxygen	**0.80**		%(v/v)	0.38	1.9	10/20/09 18:48	GC8	EI	9J21004

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSJ0174 Project: IL31 Cottonwood Hills RDF Project Number: [none]	Received: 10/19/09 11:30 Reported: 10/27/09 15:44	

ANALYTICAL REPORT

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
ample ID: LSJ0174-02 (CW-5 - Air)						**Sampled: 10/14/09 08:25**			
STM D3588 - Heat of Combustion & Specific Gravity									
Heat of Combustion	**560**		BTU/ft3	0.19	1.9	10/20/09 09:27	GC8	YZ	9J22011
PA 25C - Total Nonmethane Organic Compounds									
Total Non-Methane Hydrocarbons as Methane	**4900**		ppm-C	57	1.9	10/20/09 21:27	GC8	EI	9J21004
PA 3C - Fixed Gases									
Carbon dioxide	**37**		%(v/v)	0.019	1.9	10/20/09 21:27	GC8	EI	9J21004
Carbon monoxide	ND		%(v/v)	0.0019	1.9	10/20/09 21:27	GC8	EI	9J21004
Methane	**56**		%(v/v)	0.00038	1.9	10/20/09 21:27	GC8	EI	9J21004
Nitrogen	**8.1**		%(v/v)	1.9	1.9	10/20/09 21:27	GC8	EI	9J21004
Oxygen	**0.41**		%(v/v)	0.38	1.9	10/20/09 21:27	GC8	EI	9J21004

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSJ0174 Project: IL31 Cottonwood Hills RDF Project Number: [none]	Received: 10/19/09 11:30 Reported: 10/27/09 15:44	

ANALYTICAL REPORT

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
ample ID: LSJ0174-03 (CW-6 - Air)						**Sampled: 10/14/09 09:20**			
STM D3588 - Heat of Combustion & Specific Gravity									
Heat of Combustion	**570**		BTU/ft3	0.19	1.9	10/20/09 08:08	GC8	YZ	9J22011
PA 25C - Total Nonmethane Organic Compounds									
Total Non-Methane Hydrocarbons as Methane	**5300**		ppm-C	57	1.9	10/20/09 20:08	GC8	EI	9J21004
PA 3C - Fixed Gases									
Carbon dioxide	**37**		%(v/v)	0.019	1.9	10/20/09 20:08	GC8	EI	9J21004
Carbon monoxide	ND		%(v/v)	0.0019	1.9	10/20/09 20:08	GC8	EI	9J21004
Methane	**57**		%(v/v)	0.00038	1.9	10/20/09 20:08	GC8	EI	9J21004
Nitrogen	**7.4**		%(v/v)	1.9	1.9	10/20/09 20:08	GC8	EI	9J21004
Oxygen	ND		%(v/v)	0.38	1.9	10/20/09 20:08	GC8	EI	9J21004

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: Project: Project Number:	LSJ0174 IL31 Cottonwood Hills RDF [none]	Received: 10/19/09 11:30 Reported: 10/27/09 15:44

PROJECT QUALITY CONTROL DATA

Blank

Analyte	Result	Data Qualifier	Units	RL	Dilution	Date Analyzed	Instrument	Analyst	QC Batch
Sample ID: 9J21004-BLK1 (Blank - Air)									
EPA 25C - Total Nonmethane Organic Compounds									
Total Non-Methane Hydrocarbons as Methane	ND		ppm-C	30	1.00	10/20/09 14:17	GC8	EI	9J21004
Sample ID: 9J21004-BLK1 (Blank - Air)									
EPA 3C - Fixed Gases									
Carbon dioxide	ND		%(v/v)	0.010	1.00	10/20/09 14:17	GC8	EI	9J21004
Carbon monoxide	ND		%(v/v)	0.0010	1.00	10/20/09 14:17	GC8	EI	9J21004
Methane	ND		%(v/v)	0.00020	1.00	10/20/09 14:17	GC8	EI	9J21004
Nitrogen	ND		%(v/v)	1.0	1.00	10/20/09 14:17	GC8	EI	9J21004
Oxygen	ND		%(v/v)	0.20	1.00	10/20/09 14:17	GC8	EI	9J21004

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: Project: Project Number:	LSJ0174 IL31 Cottonwood Hills RDF [none]	Received: 10/19/09 11:30 Reported: 10/27/09 15:44

PROJECT QUALITY CONTROL DATA

LCS

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Spike Conc	% Rec	Target Range	Instrument	Date Analyzed	QC Batch
Sample ID: 9J21004-BS2 (LCS - Air)											
EPA 25C - Total Nonmethane Organic Compounds											
Total Non-Methane Hydrocarbons as Methane	56.7		ppm-C	30	1.00	60.0	95%	80 - 120	GC8	10/20/09 13:17	9J21004
Sample ID: 9J21004-BS1 (LCS - Air)											
EPA 3C - Fixed Gases											
Carbon dioxide	1.01		%(v/v)	0.010	1.00	0.998	102%	75 - 125	GC8	10/20/09 10:12	9J21004
Carbon monoxide	0.0487		%(v/v)	0.0010	1.00	0.0455	107%	70 - 130	GC8	10/20/09 10:12	9J21004
Methane	0.0550		%(v/v)	0.00020	1.00	0.0500	110%	75 - 135	GC8	10/20/09 10:12	9J21004
Nitrogen	23.9		%(v/v)	1.0	1.00	21.9	109%	70 - 130	GC8	10/20/09 10:12	9J21004
Oxygen	5.47		%(v/v)	0.20	1.00	4.98	110%	70 - 130	GC8	10/20/09 10:12	9J21004

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: LSJ0174 Project: IL31 Cottonwood Hills RDF Project Number: [none]	Received: 10/19/09 11:30 Reported: 10/27/09 15:44	

PROJECT QUALITY CONTROL DATA

LCS Dup

Analyte	Result	Data Qualifiers	Units	RL	Dilution	Spike Conc	% Rec	Target Range	RPD	Limit	Date Analyzed	QC Batch
Sample ID: 9J21004-BSD2 (LCS Dup - Air)												
EPA 25C - Total Nonmethane Organic Compounds												
Total Non-Methane Hydrocarbons as Methane	56.6		ppm-C	30	1.00	60.0	94%	80 - 120	0.2	20	10/20/09 13:44	9J21004
Sample ID: 9J21004-BSD1 (LCS Dup - Air)												
EPA 3C - Fixed Gases												
Carbon dioxide	1.01		%(v/v)	0.010	1.00	0.998	101%	75 - 125	0.2	20	10/20/09 10:28	9J21004
Carbon monoxide	0.0486		%(v/v)	0.0010	1.00	0.0455	107%	70 - 130	0.2	30	10/20/09 10:28	9J21004
Methane	0.0549		%(v/v)	0.00020	1.00	0.0500	110%	75 - 135	0.2	20	10/20/09 10:28	9J21004
Nitrogen	23.8		%(v/v)	1.0	1.00	21.9	109%	70 - 130	0.3	30	10/20/09 10:28	9J21004
Oxygen	5.45		%(v/v)	0.20	1.00	4.98	109%	70 - 130	0.3	30	10/20/09 10:28	9J21004

3585 Cadillac Avenue, Suite A Costa Mesa, CA 92626 * 714-258-8610 * Fax 714-258-0921

Aquaterra Environmental Solution Fairview Heights 13 Executive drive, Suite 1 Fairview Heights, IL 62208 Andy Limmer	Work Order: Project: Project Number:	LSJ0174 IL31 Cottonwood Hills RDF [none]	Received: Reported:	10/19/09 11:30 10/27/09 15:44

DATA QUALIFIERS AND DEFINITIONS

ND Not detected at the reporting limit (or method detection limit if shown)

TestAmerica Los Angeles
3585 Cadillac Ave., Suite A
Costa Mesa, CA 92626
Phone 714-258-8610 Fax 714-258-0921

Canister Samples Chain of Custody Record

TestAmerica Laboratories, Inc. assumes no liability with respect to the collection and shipment of these samples.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Contact Information	Project Manager: ~~Andy Bimmer~~ BRADY STEWART	LSJ0174	1 of 1 COCs
Company: AQUATERRA	Phone:	Samples Collected By:	
Address: 13 Executive Dr. Suite 1	Email: BSTEWART ~~atimmer~~@aquaterra-env.com		
City/State/Zip: Fairview Heights / IL / 62208	Site Contact:		
Phone: 618-628-2001	LAB Contact: Sonya Tabirara		
FAX: 618-628-2002	Analysis Turnaround Time		
Project Name: 2009 Flare Test	Standard (Specify) X		
Site: Cottonwood Hills RDF	Rush (Specify)		
PO # 3523.10			

Sample Identification	Sample Date(s)	Time Start	Time Stop	Canister Vacuum in Field, "Hg (Start)	Canister Vacuum in Field, "Hg (Stop)	Flow Controller ID	Canister ID	TO-15	TO-14A	TO-3	EPA 3C	EPA 25C	ASTM D-1946	Other (Please specify in notes section)	Sample Type	Indoor Air	Ambient Air	Soil Gas	Landfill Gas	Other (Please specify in notes section)
CW-4	10/14/09	0730	0820	-25*	-4	HF080	12258				X	X		X					X	
CW-5	10/14/09	0825	0915	-27*	-4	HF080	92048				X	X		X					X	
CW-6	10/14/09	0920	1020	-29	-4	HF080	12156				X	X		X					X	

Temperature (Fahrenheit)	Interior	Ambient
Start		50
Stop		48

Pressure (inches of Hg)	Interior	Ambient
Start		30.03
Stop		30.03

Other = Btu content

*The sample was partial collected but problems with the flare valve caused a stoppage. Actual start vacuum was -29.

Special Instructions/QC Requirements & Comments:

*SAMPLER'S NAME: BRADY STEWART
PER CLIENT MDT 10/21/09

Samples Shipped by:	Date/Time: 10/14/09 1600	Samples Received by: FED EX
Samples Relinquished by: FED EX	Date/Time: 10/19/09 1130	Received by:
Relinquished by:	Date/Time:	Received by:

Lab Use Only Shipper Name: Opened by: Condition:

WM00384

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

CLIENT: WMI
CANISTER SERIAL #: 12288
DATE CLEANED: 092309E
CLIENT SAMPLE #:
SITE LOCATION:

VFR ID:
Duration of comp. : Hrs. / mins.
Flow setting: ml/min
Initials:

READING	TIME	Vac. (inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	10/7/09	[illegible]
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (Inches Hg (PSIA) (circle unit used))	12.95	10/20/09	X
FINAL PRESSURE (PSIA)	24.47	10/20/09	X

Pressurization Gas: NV

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\CO\DOCS\TestAmerica DOCs\TestAmerica - CANISTER FIELD DATA RECORD - 20080201.doc

2

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

CLIENT: WMI
CANISTER SERIAL #: 92048
DATE CLEANED: 092309E
CLIENT SAMPLE #:
SITE LOCATION:

VFR ID:
Duration of comp.: Hrs. / mins.
Flow setting: ml/min
Initials:

READING	TIME	Vac. (Inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	10/7/09	[illegible]
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (Inches Hg / PSIA (circle unit used))	12.84	10/20/09	X
FINAL PRESSURE (PSIA)	24.40	10/20/09	X

Pressurization Gas: N2

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\COI\DOCS\TestAmerica DOCs\TestAmerica - CANISTER FIELD DATA RECORD - 20080201.doc

3

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

CANISTER FIELD DATA RECORD

CLIENT: WMI
CANISTER SERIAL #: 12156
DATE CLEANED: 092309E
CLIENT SAMPLE #:
SITE LOCATION:

VFR ID:
Duration of comp. : Hrs. / mins.
Flow setting: ml/min
Initials:

READING	TIME	Vac. (Inches Hg) Or PRESS. (psig)	DATE	INITIALS
INITIAL VACUUM CHECK		30"	10/7/09	[illegible]
INITIAL FIELD VACUUM				
FINAL FIELD READING				

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (Inches Hg / PSIA (circle unit used))	12.90	10/20/09	X
FINAL PRESSURE (PSIA)	24.42	10/20/09	X

Pressurization Gas: N_2

COMMENTS:

COMPOSITE TIME (HOURS)	FLOW RATE RANGE (ml/min)
15 Min.	316 – 333
30 Min.	158 – 166.7
1	79.2 – 83.3
2	39.6 – 41.7
4	19.8 – 20.8
6	13.2 – 13.9
8	9.9 – 10.4
10	7.92 – 8.3
12	6.6 – 6.9
24	3.5 – 4.0

N:\COI\DOCS\TestAmerica DOCs\TestAmerica - CANISTER FIELD DATA RECORD - 20080201.doc

CANISTER QC CERTIFICATION

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Certification Type: TO-15 ML

Date Cleaned/Batch: B092309E

Date of QC: 09-25-09

Data File Number: MB09245 (MSE)

CANISTER ID NUMBERS

* 93203	✓ 12156
9296BB	✓ 92048
11196	✓ 9305BB
✓ 0161	✓ GL0029
✓ 12258	✓ 93290
✓ 93152	✓ 12613

The above canisters were cleaned as a batch. This certifies this batch contains no target analyte concentration greater than or equal to the method criteria for the "*Certification Type*" indicated above.

"*" INDICATES THE CAN OR CANS WHICH WERE SCREENED.

Reviewed By: [signature]

Date: 09-25-09

N:\CO\DOCS\TestAmerica DOCs\Can QC Cert 20070712.doc

TestAmerica Los Angeles

AIR LOW LEVEL TO-14A / TO-15

Data file : \\LAPC106\D\chem\MSE.i\090924.B\MB0924J.D
Lab Smp Id: BLANK Client Smp ID: 93203
Inj Date : 25-SEP-2009 02:56
Operator : DLK Inst ID: mse.i
Smp Info : BLANK,93203,,SCREEN BLANK
Misc Info : 1,1,500,500,3,,BLANK,TO15CORP.SUB,0,
Comment :
Method : \\LAPC106\D\CHEM\MSE.I\090924.B\TO15.m
Meth Date : 24-Sep-2009 12:47 kammererd Quant Type: ISTD
Cal Date : 09-SEP-2009 14:11 Cal File: IC09097.D
Als bottle: 15 QC Sample: BLANK
Dil Factor: 1.00000
Integrator: HP RTE Compound Sublist: TO15CORP.SUB
Target Version: 4.14
Processing Host: LAPC106

Concentration Formula:
Amt * DF * (FinalPres / InitPres)*(CalVol / SmpVol) * CpndVariable

Name	Value	Description
DF	1.000	Dilution Factor
FinalPres	1.000	Final Pressure
InitPres	1.000	Initial Pressure
CalVol	500.000	Calibration Volume
SmpVol	500.000	Sample Volume
Cpnd Variable		Local Compound Variable

Compounds	QUANT SIG MASS	RT	EXP RT	REL RT	RESPONSE	CONCENTRATIONS ON-COLUMN (ppbv)	FINAL (ppbv)
* 48 Bromochloromethane	49	12.014	12.008	(1.000)	49414	4.00000	
$ 55 1,2-Dichloroethane-d4	65	12.796	12.789	(0.957)	51652	5.25987	5.260(R)
* 61 1,4-Difluorobenzene	114	13.372	13.372	(1.000)	109320	4.00000	
$ 71 Toluene-d8	98	15.499	15.499	(0.884)	105951	4.09290	4.093
* 82 Chlorobenzene-d5	117	17.533	17.533	(1.000)	105309	4.00000	
$ 94 4-Bromofluorobenzene	95	19.152	19.152	(1.092)	71295	3.68146	3.681

QC Flag Legend

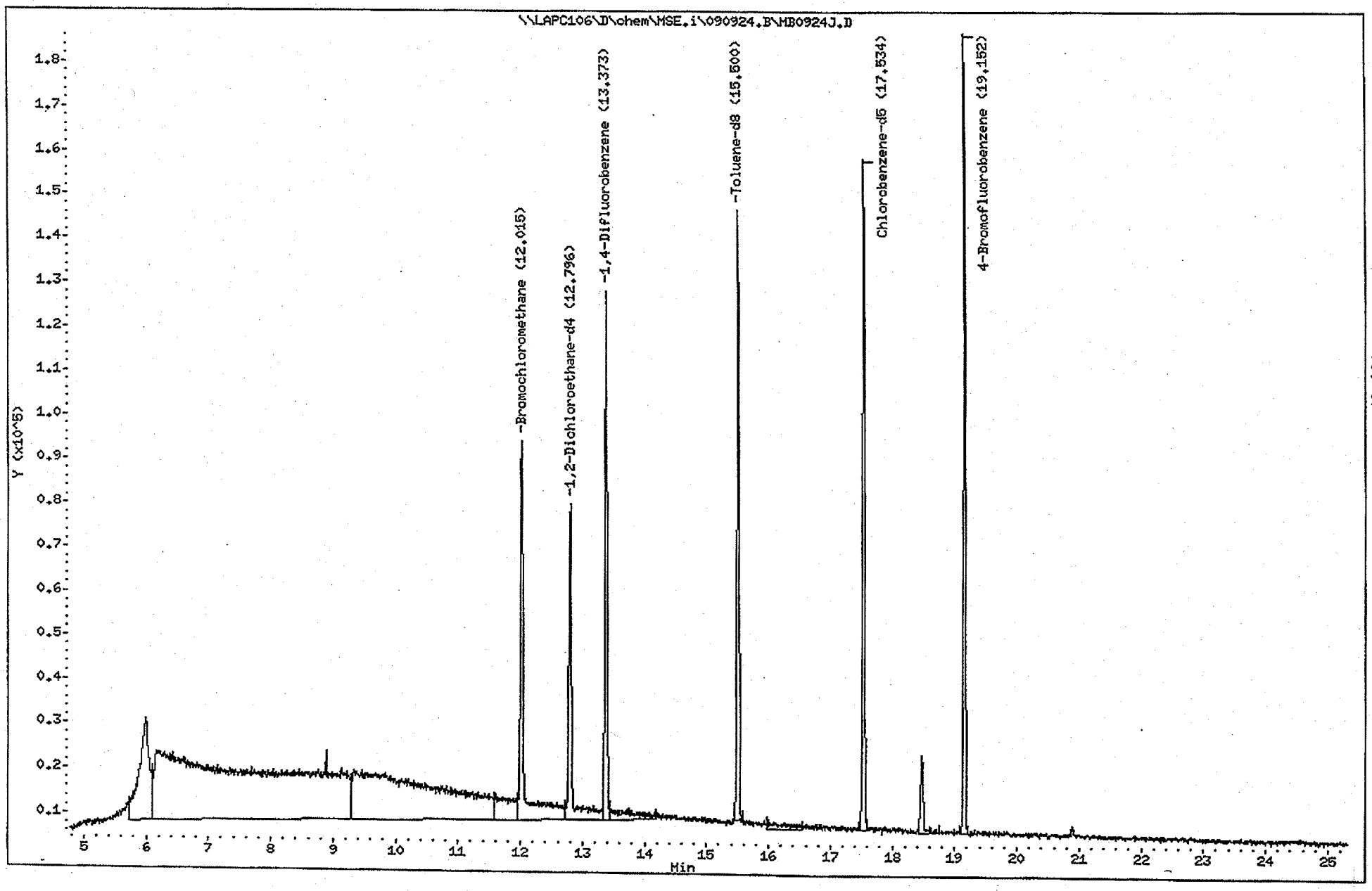
R - Spike/Surrogate failed recovery limits.

Data File: \\LAPC106\D\chem\MSE.i\090924.B\MB0924J.D
Date : 25-SEP-2009 02:56
Client ID: 93203
Sample Info: BLANK,93203,,SCREEN BLANK

Column phase: J&W DB-5ms

Instrument: mse.i

Operator: DLK
Column diameter: 0.32



TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

EPA 25C TRIPLICATE RESULTS

Date Analyzed / QC Batch: 10/20/09 / 9721004

GC8 EPA 25C TNMOC SUMMARY REPORT

LAB SAMPLE ID#: LSJ0174-01

		Date	Time	Dilution Factor
25C RAW DATA FILES Run 1:	J301-1	10/20/09	18:48	1.8896
Run 2:	J301-2	10/20/09	19:14	1.8896
Run 3:	J301-3	10/20/09	19:41	1.8896

EPA 25C DF: 1.8896 Date: 10/20/2009

	Run 1	Run 2	Run 3	Average			BASE RL's
	Results	Results	Results	Results	RSD=15%		
COMPOUND	ppm-c	ppm-c	ppm-c	ppm-c	%RSD	RL	ppm
TNMOC	3882.30	3526.18	4086.24	3984.2708	7.398	56.7	30

	Results	Results	Results	Results	RSD=15%
	%v/v	%v/v	%v/v	%v/v	%RSD
NITROGEN	8.5075	9.1654	8.6997	8.6036	3.848
NO N2 CORRECTION	97.465	98.1229	97.6572		

COMMENTS: CANISTER PRE-PRESSURIZED WITH HELIUM

FINAL PRESSURE 24.47

INITIAL PRESSURE 12.95

Client readings: Temp.=48F; Press.= 30.03"Hg

Lab conversions: Temp.=8.89C; Press.= 762.76 mm Hg

Water Pressure = 8.551

TNMOC as CH4	RAW AMOUNT	ADJUSTED TNMOC RESULTS
RUN1	3419.614	3882.30
RUN2	3076.485	3526.18
RUN3	3589.273	4086.24

NMOC	ETHENE	ETHANE
3419.614	0.000	0.000
3076.485	0.000	0.000
3589.273	0.000	0.000

NOTE: TNMOC RESULTS ADJUSTED PER NITROGEN VALUES AND STP

LEVEL 1 10/22/09 LEVEL2

GC8 EPA 25C TNMOC SUMMARY REPORT

LAB SAMPLE ID#: LSJ0174-02

		Date	Time	Dilution Factor
25C RAW DATA FILES Run 1:	J303-1	10/20/09	21:27	1.9003
Run 2:	J303-2	10/20/09	21:54	1.9003
Run 3:	J303-3	10/20/09	22:20	1.9003

EPA 25C DF: 1.9003 Date: 10/20/2009

	Run 1	Run 2	Run 3	Average			BASE RL's
	Results	Results	Results	Results	RSD=15%		
COMPOUND	ppm-c	ppm-c	ppm-c	ppm-c	%RSD	RL	ppm
TNMOC	4677.26	4295.47	5112.67	4894.9671	8.709	57.0	30

	Results	Results	Results	Results	RSD=15%
	%v/v	%v/v	%v/v	%v/v	%RSD
NITROGEN	8.2244	7.9777	7.4087	7.8166	5.315
NO N2 CORRECTION	98.2556	98.0089	97.4399		

COMMENTS: CANISTER PRE-PRESSURIZED WITH HELIUM

FINAL PRESSURE 24.40

INITIAL PRESSURE 12.84

Client readings: Temp.=48F; Press.= 30.03"Hg

Lab conversions: Temp.=8.89C; Press.= 762.76 mm Hg

Water Pressure = 8.551

TNMOC as CH4	RAW AMOUNT	ADJUSTED TNMOC RESULTS
RUN1	4136.628	4677.26
RUN2	3812.422	4295.47
RUN3	4574.647	5112.67

NMOC	ETHENE	ETHANE
4136.628	0.000	0.000
3812.422	0.000	0.000
4574.647	0.000	0.000

NOTE: TNMOC RESULTS ADJUSTED PER NITROGEN VALUES AND STP

LEVEL 1 EJ 10/22/09 LEVEL2 M 10/23/09

GC8 EPA 25C TNMOC SUMMARY REPORT

LAB SAMPLE ID#: LSJ0174-03

		Date	Time	Dilution Factor
25C RAW DATA FILES Run 1:	J302-1	10/20/09	20:08	1.8930
Run 2:	J302-2	10/20/09	20:34	1.8930
Run 3:	J302-3	10/20/09	21:01	1.8930

EPA 25C DF: 1.8930 Date: 10/20/2009

	Run 1	Run 2	Run 3	Average			
	Results	Results	Results	Results	RSD=15%		BASE RL's
COMPOUND	ppm-c	ppm-c	ppm-c	ppm-c	%RSD	RL	ppm
TNMOC	5641.77	5445.48	4888.60	5265.1850	7.337	56.8	30

	Results	Results	Results	Results	RSD=15%
	%v/v	%v/v	%v/v	%v/v	%RSD
NITROGEN	7.3153	7.5127	7.2064	7.2608	2.114
NO N2 CORRECTION	96.0176	96.815	96.5087		

COMMENTS: CANISTER PRE-PRESSURIZED WITH HELIUM

FINAL PRESSURE 24.42

INITIAL PRESSURE 12.90

Client readings: Temp.=48F; Press.= 30.03"Hg

Lab conversions: Temp.=8.89C; Press.= 762.76 mm Hg

Water Pressure = 8.551

TNMOC as CH4	RAW AMOUNT	ADJUSTED TNMOC RESULTS
RUN1	5054.754	5641.77
RUN2	4865.244	5445.48
RUN3	4386.712	4888.60

NMOC	ETHENE	ETHANE
5054.754	0.000	0.000
4865.244	0.000	0.000
4386.712	0.000	0.000

NOTE: TNMOC RESULTS ADJUSTED PER NITROGEN VALUES AND STP

LEVEL 1 10/22/09 LEVEL2 10-23-09

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

EPA 3C DUPLICATE RESULTS

Date Analyzed / QC Batch: 10/20/09/9721004

TESTAMERICA LOS ANGELES

EPA 3C SAMPLE RESULTS SUMMARY CALCULATION

Lot ID: LSJ0174-01
Data File(s): J301 -1
Date Acquired: 10/20/2009 18:48 ; 19:14
Dilution Factor: 1.89

Final(F) Lab Pressure: 24.47
Sample(S) Receipt Pressure: 12.95
Prepressurized? (He,NO): NO
Lab Pressurized? (N2,NO): N2
Pre-pressure: 0
Serial Dilution: 1

Analyte	RUN1 PPM(v/v)	RUN2 PPM(v/v)	RPD (10%)	AVERAGE PPM(v/v)	AVERAGE %v/v	RL %v/v	BASE RL %v/v
Carbon Dioxide:	357953.58	359402.89	0.40	358678.24	35.867824	0.01890	0.01
Oxygen/Argon:	8006	8034	0.35	8020	0.802030	0.37792	0.2
Nitrogen:	85062	91641	7.45	88352	8.835173	1.88958	1
Methane:	547546.01	550678.93	0.57	549112.47	54.911247	0.00038	0.0002
Ethene:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00189	0.001
Ethane:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00094	0.0005
Hydrogen	0	0	#DIV/0!	0.00	0.000000	0.03779	0.02
Helium	0	0	#DIV/0!	0.00	0.000000	0.03779	0.02
Carbon Monoxide:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00189	0.001
%Total:	99.857	100.976					

	RUN1 PPM(v/v)	RUN2 PPM(v/v)	RUN1 %(v/v)	RUN2 %(v/v)
Nitrogen File Result:	515797	519279	51.5797	51.9279

LEVEL 1 [illegible] 10/22/09 LEVEL2 [illegible]

Note: Calculation for Nitrogen last validated by QA on 6-23-2008.

TESTAMERICA LOS ANGELES

EPA 3C SAMPLE RESULTS SUMMARY CALCULATION

Lot ID: LSJ0174-02
Data File(s): j303 -1
Date Acquired: 10/20/2009 21:27 ; 21:54
Dilution Factor: 1.90

Final(F) Lab Pressure: 24.40
Sample(S) Receipt Pressure: 12.84
Prepressurized? (He,NO): NO
Lab Pressurized? (N2,NO): N2
Pre-pressure: 0
Serial Dilution: 1

Analyte	RUN1 PPM(v/v)	RUN2 PPM(v/v)	RPD (10%)	AVERAGE PPM(v/v)	AVERAGE %v/v	RL %v/v	BASE RL %v/v
Carbon Dioxide:	367256.11	366613.80	0.18	366934.95	36.693495	0.01900	0.01
Oxygen/Argon:	4084	4078	0.14	4081	0.408092	0.38006	0.2
Nitrogen:	82250	79784	3.04	81017	8.101695	1.90031	1
Methane:	562222.37	561365.33	0.15	561793.85	56.179385	0.00038	0.0002
Ethene:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00190	0.001
Ethane:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00095	0.0005
Hydrogen	0	0	#DIV/0!	0.00	0.000000	0.03801	0.02
Helium	0	0	#DIV/0!	0.00	0.000000	0.03801	0.02
Carbon Monoxide:	0.00	6.63	200.00 NA	3.31	0.000331 NA	0.00190	0.001
%Total:	101.581	101.185					

10/22/09 10/22/09

	RUN1 PPM(v/v)	RUN2 PPM(v/v)	RUN1 %(v/v)	RUN2 %(v/v)
Nitrogen File Result:	517053	515755	51.7053	51.5755

LEVEL 1 10/22/09 LEVEL2 10/23/09

Note: Calculation for Nitrogen last validated by QA on 6-23-2008.

TESTAMERICA LOS ANGELES

EPA 3C SAMPLE RESULTS SUMMARY CALCULATION

Lot ID: LSJ0174-03
Data File(s): j302 -1
Date Acquired: 10/20/2009 20:08 ; 20:34
Dilution Factor: 1.89

Final(F) Lab Pressure: 24.42
Sample(S) Receipt Pressure: 12.90
Prepressurized? (He,NO): NO
Lab Pressurized? (N2,NO): N2
Pre-pressure: 0
Serial Dilution: 1

Analyte	RUN1 PPM(v/v)	RUN2 PPM(v/v)	RPD (10%)	AVERAGE PPM(v/v)	AVERAGE %v/v	RL %v/v	BASE RL %v/v
Carbon Dioxide:	369457.56	369875.92	0.11	369666.74	36.966674	0.01893	0.01
Oxygen/Argon:	2688	2677	0.42	2682	0.268241	0.37860	0.2
Nitrogen:	73164	75139	2.66	74152	7.415167	1.89302	1
Methane:	566140.79	566844.99	0.12	566492.89	56.649289	0.00038	0.0002
Ethene:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00189	0.001
Ethane:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00095	0.0005
Hydrogen	0	0	#DIV/0!	0.00	0.000000	0.03786	0.02
Helium	0	0	#DIV/0!	0.00	0.000000	0.03786	0.02
Carbon Monoxide:	0.00	0.00	#DIV/0!	0.00	0.000000	0.00189	0.001
%Total:	101.145	101.454					

	RUN1 PPM(v/v)	RUN2 PPM(v/v)	RUN1 %(v/v)	RUN2 %(v/v)
Nitrogen File Result:	510394	511437	51.0394	51.1437

LEVEL 1 LS 10/22/09 **LEVEL2** 11/02309

Note: Calculation for Nitrogen last validated by QA on 6-23-2008.

APPENDIX D

CALCULATIONS

Included in this Appendix:

- **Net Heating Value**
- **Exit Velocity**
- **Maximum Permitted Exit Velocity**

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	**Cottonwood -1**		
Percent Methane:	57	Percent	
Laboratory Measured Fuel Gas Heating Value:	580	Btu/scf	at 60 deg. F and 760 mm Hg

Net Heating Value calculated using the following equation:

H (T) = K C H

where:
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg
K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)
where (g mole/scm) is at 20 deg. C
C: concentration of component on wet basis in ppm
H: Laboratory measured heat of combustion
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) Btu/scf to Btu/lb-mole
580 x (460+60) x 10.732/14.696 = 220,248.4 Btu/lb-mole (60 deg. F)

B) Btu/lb-mole to kcal/g-mole
220,248.4 x 0.252122/453.5924 = 122.4 kcal/g-mole (60 deg. F)

C) kcal/g-mole (60 deg F) to kcal/g-mole (25 deg C)
122.4 x (77+460) / (60+460) = 126.4 kcal/g-mole (25 deg. C)

Now calculate Net Heating Value

H (T) = K C H

H (T) = 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal) x 570,000 ppm x 126.4 kcal/g-mole

H (T) = 12.5 MJ/scm

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	**Cottonwood-2**		
Percent Methane:	56	Percent	
Laboratory Measured Fuel Gas Heating Value:	580	Btu/scf	at 60 deg. F and 760 mm Hg

Net Heating Value calculated using the following equation:

H (T) = K C H

where:
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg
K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)
where (g mole/scm) is at 20 deg. C
C: concentration of component on wet basis in ppm
H: Laboratory measured heat of combustion
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) Btu/scf to Btu/lb-mole
580 x (460+60) x 10.732/14.696 = 220,248.4 Btu/lb-mole (60 deg. F)

B) Btu/lb-mole to kcal/g-mole
220,248.4 x 0.252122/453.5924 = 122.4 kcal/g-mole (60 deg. F)

C) kcal/g-mole (60 deg F) to kcal/g-mole (25 deg C)
122.4 x (77+460) / (60+460) = 126.4 kcal/g-mole (25 deg. C)

Now calculate Net Heating Value

H (T) = K C H

H (T) = 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal) x 560,000 ppm x 126.4 kcal/g-mole

H (T) = 12.3 MJ/scm

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	**Cottonwood-3**		
Percent Methane:	59	Percent	
Laboratory Measured Fuel Gas Heating Value:	580	Btu/scf	at 60 deg. F and 760 mm Hg

Net Heating Value calculated using the following equation:

H (T) = K C H

where:
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg
K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)
where (g mole/scm) is at 20 deg. C
C: concentration of component on wet basis in ppm
H: Laboratory measured heat of combustion
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) Btu/scf to Btu/lb-mole
580 x (460+60) x 10.732/14.696 = 220,248.4 Btu/lb-mole (60 deg. F)

B) Btu/lb-mole to kcal/g-mole
220,248.4 x 0.252122/453.5924 = 122.4 kcal/g-mole (60 deg. F)

C) kcal/g-mole (60 deg F) to kcal/g-mole (25 deg C)
122.4 x (77+460) / (60+460) = 126.4 kcal/g-mole (25 deg. C)

Now calculate Net Heating Value

H (T) = K C H

H (T) = 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal) x 590,000 ppm x 126.4 kcal/g-mole

H (T) = 13.0 MJ/scm

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **CW-4**

Percent Methane:	55	Percent	
Laboratory Measured Fuel Gas Heating Value:	560	Btu/scf	at 60 deg. F and 760 mm Hg

Net Heating Value calculated using the following equation:

H (T) = K C H

where:
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg
K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)
where (g mole/scm) is at 20 deg. C
C: concentration of component on wet basis in ppm
H: Laboratory measured heat of combustion
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) Btu/scf to Btu/lb-mole
560 x (460+60) x 10.732/14.696 = 212,653.7 Btu/lb-mole (60 deg. F)

B) Btu/lb-mole to kcal/g-mole
212653.7 x 0.252122/453.5924 = 118.2 kcal/g-mole (60 deg. F)

C) kcal/g-mole (60 deg F) to kcal/g-mole (25 deg C)
118.2 x (77+460) / (60+460) = 122.1 kcal/g-mole (25 deg. C)

Now calculate Net Heating Value

H (T) = K C H

H (T) = 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal) x 550,000 ppm x 122.1 kcal/g-mole

H (T) = 11.7 MJ/scm

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No.	**CW-5**		
Percent Methane:	56	Percent	
Laboratory Measured Fuel Gas Heating Value:	560	Btu/scf	at 60 deg. F and 760 mm Hg

Net Heating Value calculated using the following equation:

H (T) = K C H

where:
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg
K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)
where (g mole/scm) is at 20 deg. C
C: concentration of component on wet basis in ppm
H: Laboratory measured heat of combustion
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) Btu/scf to Btu/lb-mole
560 x (460+60) x 10.732/14.696 = 212,653.7 Btu/lb-mole (60 deg. F)

B) Btu/lb-mole to kcal/g-mole
212653.7 x 0.252122/453.5924 = 118.2 kcal/g-mole (60 deg. F)

C) kcal/g-mole (60 deg F) to kcal/g-mole (25 deg C)
118.2 x (77+460) / (60+460) = 122.1 kcal/g-mole (25 deg. C)

Now calculate Net Heating Value

H (T) = K C H

H (T) = 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal) x 560,000 ppm x 122.1 kcal/g-mole

H (T) = 11.9 MJ/scm

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
NET HEATING VALUE CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **CW-6**

Percent Methane:	57	Percent	
Laboratory Measured Fuel Gas Heating Value:	570	Btu/scf	at 60 deg. F and 760 mm Hg

Net Heating Value calculated using the following equation:

H (T) = K C H

where:
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg
K: 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal)
where (g mole/scm) is at 20 deg. C
C: concentration of component on wet basis in ppm
H: Laboratory measured heat of combustion
in (kcal/g mole) at 25 deg. C, 760 mm Hg

Convert Heat of Combustion from Btu/scf to kcal/g mole

A) Btu/scf to Btu/lb-mole
570 x (460+60) x 10.732/14.696 = 216,451.1 Btu/lb-mole (60 deg. F)

B) Btu/lb-mole to kcal/g-mole
216451.1 x 0.252122/453.5924 = 120.3 kcal/g-mole (60 deg. F)

C) kcal/g-mole (60 deg F) to kcal/g-mole (25 deg C)
120.3 x (77+460) / (60+460) = 124.2 kcal/g-mole (25 deg. C)

Now calculate Net Heating Value

H (T) = K C H

H (T) = 1.740×10^{-7} (1/ppm)(g mole/scm)(MJ/kcal) x 570,000 ppm x 124.2 kcal/g-mole

H (T) = 12.3 MJ/scm

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **Cottonwood-1** Date 6/25/2009

Landfill Gas (Dry)

Constitutent	Percentage	Molecular Wt. (lb-Mole)
Methane	57.0%	16
Carbon Dioxide	40.0%	44
Oxygen	0.0%	32
Carbon Monoxide	0.0%	28
Nitrogen*	3.0%	28
Total	100.0%	
Percent Water**	3%	18

Barometric Pressure	29.86	in Hg
Pressure	0.6	in Hg
Gas Temperature	106	deg. F
Inlet Diameter	12	in
Flare Tip Diameter	10	in

* Adjusted if necessary to sum consitutents to 100%
** estimated

Dry Molecular Weight (lb/lb-mole)

MW= (44 x 0.40) + (32 x 0.0) + (28 x 0.03) + (16 x 0.57)
MW= 34.40 lb/lb-mole

Molecular Weight, at Stack Condition (lb/lb-mole)

MW= (34.40 x (1 - 0.03)) + (18 x 0.03)
MW= 33.91 lb/lb-mole

Absolute Flue Gas Pressure, Inches of Mercury

P_s= 29.86 + 0.6 / 13.6 P_{Br} +P_g/13.6
29.90 Inches of Mercury

Dry Desity at STP (68 deg F, 29.92 in Hg), lb/cf

DD_{stp}= (0.1137 x 0.40) + (0.0827 x 0.0) + (0.0724 x 0.03) + (0.0485 x 0.57)
DD_{stp}= 0.0889 lb/cf

Wet Density at STP (68 deg F, 29.92 in Hg), lb/cf

WD_{stp}= 0.0889 x ((1 - 0.03) + (0.0465 x 0.03))
WD_{stp}= 0.0864 lb/cf

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION (CONTINUED)

Sample No. **Cottonwood-1**

Average Stack Gas Velocity (ft/sec)

V_s= 85.49 x 1.0 x SQRT ((460+106) x 0.6/ (29.75 x 33.91))

V_s= 49.60 ft/sec

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

Q_{actual}= (60 x 1.0 x (68 + 460) x 29.86 x 49.6 x 0.8) / (106 + 460) x 29.92)

Q_{actual}= 2216.62

Stack Gas Flowrate (ACFM)

Q_{actual}= 60 x 49.6 x 0.8

Q_{actual}= 2336 ACFM

Average Stack Exit Velocity (ft/sec)

V_{exit}= 2336/ (.785 / 60)

V_{exit}= 49.6 ft/sec

or

15.1 m/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **Cottonwood-2** Date 6/25/2009

Landfill Gas (Dry)

Constitutent	Percentage	Molecular Wt. (lb-Mole)
Methane	56.0%	16
Carbon Dioxide	39.0%	44
Oxygen	0.0%	32
Carbon Monoxide	0.0%	28
Nitrogen*	5.0%	28
Total	100.0%	
Percent Water**	3%	18

* Adjusted if necessary to sum consitutents to 100%
** estimated

Barometric Pressure	29.86	in Hg
Pressure	0.58	in Hg
Gas Temperature	110	deg. F
Inlet Diameter	12	in
Flare Tip Diameter	10	in

Dry Molecular Weight (lb/lb-mole)

MW= (44 x 0.39) + (32 x 0.0) + (28 x 0.05) + (16 x 0.56)
MW= 34.24 lb/lb-mole

Molecular Weight, at Stack Condition (lb/lb-mole)

MW= (34.24 x (1 - 0.03)) + (18 x 0.03)
MW= 33.75 lb/lb-mole

Absolute Flue Gas Pressure, Inches of Mercury

P_s= 29.86 + 0.58 / 13.6 P_{Br} +P_g/13.6
29.90 Inches of Mercury

Dry Desity at STP (68 deg F, 29.92 in Hg), lb/cf

DD_{stp}= (0.1137 x 0.39) + (0.0827 x 0.0) + (0.0724 x 0.05) + (0.0485 x 0.56)
DD_{stp}= 0.0885 lb/cf

Wet Density at STP (68 deg F, 29.92 in Hg), lb/cf

WD_{stp}= 0.0885 x ((1 - 0.03) + (0.0465 x 0.03))
WD_{stp}= 0.0860 lb/cf

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION (CONTINUED)

Sample No. **Cottonwood-2**

Average Stack Gas Velocity (ft/sec)

V_s= 85.49 x 1.0 x SQRT ((460+110) x 0.58 / (29.75 x 33.75))

V_s= 49.05 ft/sec

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

Q_{actual}= (60 x 1.0 x (68 + 460) x 29.86x 49.05 x 0.8) / (110 + 460) x 29.92)

Q_{actual}= 2176.69

Stack Gas Flowrate (ACFM)

Q_{actual}= 60 x 49.05 x 0.8

Q_{actual}= 2310 ACFM

Average Stack Exit Velocity (ft/sec)

V_{exit}= 2310 / (.785 / 60)

V_{exit}= 49.1 ft/sec

or

15.0 m/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **Cottonwood-3** Date 6/25/2009

Landfill Gas (Dry)

Constitutent	Percentage	Molecular Wt. (lb-Mole)
Methane	59.0%	16
Carbon Dioxide	41.0%	44
Oxygen	0.0%	32
Carbon Monoxide	0.0%	28
Nitrogen*	0.0%	28
Total	100.0%	
Percent Water**	3%	18

* Adjusted if necessary to sum consitutents to 100%
** estimated

Barometric Pressure	29.86	in Hg
Pressure	0.59	in Hg
Gas Temperature	113	deg. F
Inlet Diameter	12	in
Flare Tip Diameter	10	in

Dry Molecular Weight (lb/lb-mole)

MW= (44 x 0.41) + (32 x 0.0) + (28 x 0.0) + (16 x 0.59)
MW= 34.56 lb/lb-mole

Molecular Weight, at Stack Condition (lb/lb-mole)

MW= (34.56 x (1 - 0.03)) + (18 x 0.03)
MW= 34.06 lb/lb-mole

Absolute Flue Gas Pressure, Inches of Mercury

P_s= 29.86 + 0.59 / 13.6 $P_{Br}+P_g/13.6$
29.90 Inches of Mercury

Dry Desity at STP (68 deg F, 29.92 in Hg), lb/cf

DD_{stp}= (0.1137 x 0.41) + (0.0827 x 0.0) + (0.0724 x 0.0) + (0.0485 x 0.59)
DD_{stp}= 0.0893 lb/cf

Wet Density at STP (68 deg F, 29.92 in Hg), lb/cf

WD_{stp}= 0.0893 x ((1 - 0.03) + (0.0465 x 0.03))
WD_{stp}= 0.0868 lb/cf

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION (CONTINUED)

Sample No. **Cottonwood-3**

Average Stack Gas Velocity (ft/sec)

V_s= 85.49 x 1.0 x SQRT ((460+113) x 0.59 / (29.75 x 34.06))

V_s= 49.38 ft/sec

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

Q_{actual}= (60 x 1.0 x (68 + 460) x 29.86 x 49.38 x 0.8) / ((113 + 460) x 29.92)

Q_{actual}= 2179.62

Stack Gas Flowrate (ACFM)

Q_{actual}= 60 x 49.38 x 0.8

Q_{actual}= 2326 ACFM

Average Stack Exit Velocity (ft/sec)

V_{exit}= 2326/ (.785 / 60)

V_{exit}= 49.4 ft/sec

or

15.1 m/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **CW-4** Date 10/14/2009

Landfill Gas (Dry)

Constitutent	Percentage	Molecular Wt. (lb-Mole)
Methane	55.0%	16
Carbon Dioxide	36.0%	44
Oxygen	0.8%	32
Carbon Monoxide	0.0%	28
Nitrogen*	8.2%	28
Total	100.0%	
Percent Water**	3%	18

* Adjusted if necessary to sum consitutents to 100%
** estimated

Barometric Pressure	30.12	in Hg
Pressure	0.5	in Hg
Gas Temperature	87	deg. F
Inlet Diameter	12	in
Flare Tip Diameter	10	in

Dry Molecular Weight (lb/lb-mole)

MW= (44 x 0.36) + (32 x 0.008) + (28 x 0.082) + (16 x 0.55)
MW= 33.79 lb/lb-mole

Molecular Weight, at Stack Condition (lb/lb-mole)

MW= (33.79 x (1 - 0.03)) + (18 x 0.03)
MW= 33.32 lb/lb-mole

Absolute Flue Gas Pressure, Inches of Mercury

P_s= 30.12 + 0.50 / 13.6 $P_{Br}+P_g/13.6$
30.16 Inches of Mercury

Dry Desity at STP (68 deg F, 29.92 in Hg), lb/cf

DD_{stp}= (0.1137 x 0.36) + (0.0827 x 0.008) + (0.0724 x 0.082) + (0.0485 x 0.55)
DD_{stp}= 0.0874 lb/cf

Wet Density at STP (68 deg F, 29.92 in Hg), lb/cf

WD_{stp}= 0.0874 x ((1 - 0.03) + (0.0465 x 0.03))
WD_{stp}= 0.0849 lb/cf

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION (CONTINUED)

Sample No. **CW-4**

Average Stack Gas Velocity (ft/sec)

V_s= 85.49 x 1.0 x SQRT ((460+87) x 0.50 / (29.75 x 33.32))

V_s= 44.91 ft/sec

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

Q_{actual}= (60 x 1.0 x (68 + 460) x 30.12 x 44.91 x 0.8) / ((87 + 460) x 29.92)

Q_{actual}= 2094.55

Stack Gas Flowrate (ACFM)

Q_{actual}= 60 x 44.91 x 0.8

Q_{actual}= 2115 ACFM

Average Stack Exit Velocity (ft/sec)

V_{exit}= 2115/ (.785 / 60)

V_{exit}= 44.9 ft/sec

or

13.7 m/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **CW-5** Date 10/14/2009

Landfill Gas (Dry)

Constitutent	Percentage	Molecular Wt. (lb-Mole)
Methane	56.0%	16
Carbon Dioxide	37.0%	44
Oxygen	0.4%	32
Carbon Monoxide	0.0%	28
Nitrogen*	6.6%	28
Total	100.0%	
Percent Water**	3%	18

* Adjusted if necessary to sum consitutents to 100%
** estimated

Barometric Pressure	30.12	in Hg
Pressure	0.48	in Hg
Gas Temperature	88	deg. F
Inlet Diameter	12	in
Flare Tip Diameter	10	in

Dry Molecular Weight (lb/lb-mole)

MW= (44 x 0.37) + (32 x 0.0041) + (28 x 0.0659) + (16 x 0.56)
MW= 33.94 lb/lb-mole

Molecular Weight, at Stack Condition (lb/lb-mole)

MW= (33.94 x (1 - 0.03)) + (18 x 0.03)
MW= 33.46 lb/lb-mole

Absolute Flue Gas Pressure, Inches of Mercury

P_s= 30.12 + 0.48 / 13.6 $P_{Br}+P_g/13.6$
30.16 Inches of Mercury

Dry Desity at STP (68 deg F, 29.92 in Hg), lb/cf

DD_{stp}= (0.1137 x 0.37) + (0.0827 x 0.0041) + (0.0724 x 0.0659) + (0.0485 x 0.56)
DD_{stp}= 0.0877 lb/cf

Wet Density at STP (68 deg F, 29.92 in Hg), lb/cf

WD_{stp}= 0.0877 x ((1 - 0.03) + (0.0465 x 0.03))
WD_{stp}= 0.0852 lb/cf

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION (CONTINUED)

Sample No. **CW-5**

Average Stack Gas Velocity (ft/sec)

V_s= 85.49 x 1.0 x SQRT ((460+88) x 0.48 / (29.75 x 33.46))

V_s= 43.95 ft/sec

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

Q_{actual}= (60 x 1.0 x (68 + 460) x 30.12 x 43.95 x 0.8) / ((88 + 460) x 29.92)

Q_{actual}= 2046.06

Stack Gas Flowrate (ACFM)

Q_{actual}= 60 x 43.95 x 0.8

Q_{actual}= 2070 ACFM

Average Stack Exit Velocity (ft/sec)

V_{exit}= 2070/ (.785 / 60)

V_{exit}= 43.9 ft/sec

or

13.4 m/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Input

Sample No. **CW-6** Date 10/14/2009

Landfill Gas (Dry)

Constitutent	Percentage	Molecular Wt. (lb-Mole)
Methane	57.0%	16
Carbon Dioxide	37.0%	44
Oxygen	0.0%	32
Carbon Monoxide	0.0%	28
Nitrogen*	6.0%	28
Total	100.0%	
Percent Water**	3%	18

* Adjusted if necessary to sum consitutents to 100%
** estimated

Barometric Pressure	30.12	in Hg
Pressure	0.48	in Hg
Gas Temperature	88	deg. F
Inlet Diameter	12	in
Flare Tip Diameter	10	in

Dry Molecular Weight (lb/lb-mole)

MW= (44 x 0.37) + (32 x 0.0) + (28 x 0.06) + (16 x 0.57)
MW= 33.92 lb/lb-mole

Molecular Weight, at Stack Condition (lb/lb-mole)

MW= (33.92 x (1 - 0.03)) + (18 x 0.03)
MW= 33.44 lb/lb-mole

Absolute Flue Gas Pressure, Inches of Mercury

P_s= 30.12 + 0.48 / 13.6 $P_{Br} + P_g/13.6$
30.16 Inches of Mercury

Dry Desity at STP (68 deg F, 29.92 in Hg), lb/cf

DD_{stp}= (0.1137 x 0.37) + (0.0827 x 0.0) + (0.0724 x 0.06) + (0.0485 x 0.57)
DD_{stp}= 0.0877 lb/cf

Wet Density at STP (68 deg F, 29.92 in Hg), lb/cf

WD_{stp}= 0.0877 x ((1 - 0.03) + (0.0465 x 0.03))
WD_{stp}= 0.0852 lb/cf

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
EXIT VELOCITY DETERMINATION (CONTINUED)

Sample No. **CW-6**

Average Stack Gas Velocity (ft/sec)

V_s= 85.49 x 1.0 x SQRT ((460+88) x 0.48 / (29.75 x 33.44))

V_s= 43.96 ft/sec

Dry Volumetric Flue Gas Flow Rate at Standard Conditions, dscfm

Q_{actual}= (60 x 1.0 x (68 + 460) x 30.12 x 43.96 x 0.8) / ((88 + 460) x 29.92)

Q_{actual}= 2046.55

Stack Gas Flowrate (ACFM)

Q_{actual}= 60 x 43.96 x 0.8

Q_{actual}= 2070 ACFM

Average Stack Exit Velocity (ft/sec)

V_{exit}= 2070/ (.785 / 60)

V_{exit}= 44.0 ft/sec

or

13.4 m/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
MAXIMUM PERMITTED EXIT VELOCITY CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Maximum permitted exit velocity calculated using the following equation:

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$

where:
$V_{(max)}$: Maximum permitted exit velocity, m/sec
28.8: Constant
31.7: Constant
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

Sample No. **Cottonwood-1**
Net Heating Value Heating Value, H(T): 12.5 MJ/scm at 25 deg. C and 760 mm Hg

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = (8.7 + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = 1.3$
$V_{(max)} = 20.1$ m/sec
$V_{(max)} = 66.1$ ft/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
MAXIMUM PERMITTED EXIT VELOCITY CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Maximum permitted exit velocity calculated using the following equation:

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$

where:
$V_{(max)}$: Maximum permitted exit velocity, m/sec
28.8: Constant
31.7: Constant
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

Sample No. **Cottonwood-2**
Net Heating Value Heating Value, H(T): 12.3 MJ/scm at 25 deg. C and 760 mm Hg

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = (10.1 + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = 1.3$
$V_{(max)} = 19.8$ m/sec
$V_{(max)} = 65.0$ ft/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
MAXIMUM PERMITTED EXIT VELOCITY CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Maximum permitted exit velocity calculated using the following equation:

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$

where:
$V_{(max)}$: Maximum permitted exit velocity, m/sec
28.8: Constant
31.7: Constant
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

Sample No. **Cottonwood-3**
Net Heating Value Heating Value, H(T): 13.0 MJ/scm at 25 deg. C and 760 mm Hg

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = (10.1 + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = 1.3$
$V_{(max)} = 20.8$ m/sec
$V_{(max)} = 68.3$ ft/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
MAXIMUM PERMITTED EXIT VELOCITY CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Maximum permitted exit velocity calculated using the following equation:

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$

where:
$V_{(max)}$: Maximum permitted exit velocity, m/sec
28.8: Constant
31.7: Constant
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

Sample No. **CW-4**
Net Heating Value Heating Value, H(T): 11.7 MJ/scm at 25 deg. C and 760 mm Hg

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = (10.1 + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = 1.3$
$V_{(max)} = 18.9$ m/sec
$V_{(max)} = 62.2$ ft/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
MAXIMUM PERMITTED EXIT VELOCITY CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Maximum permitted exit velocity calculated using the following equation:

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$

where:
$V_{(max)}$: Maximum permitted exit velocity, m/sec
28.8: Constant
31.7: Constant
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

Sample No. **CW-5**
Net Heating Value Heating Value, H(T): 11.9 MJ/scm at 25 deg. C and 760 mm Hg

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = (10.1 + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = 1.3$
$V_{(max)} = 19.2$ m/sec
$V_{(max)} = 63.1$ ft/sec

AQUATERRA ENVIRONMENTAL SOLUTIONS, INC.
LANDFILL GAS FLARE TESTING LOG
MAXIMUM PERMITTED EXIT VELOCITY CALCULATIONS

Waste Management, Inc.
Cottonwood Hills Recycling and Disposal Facility
Marissa, Illinois

Maximum permitted exit velocity calculated using the following equation:

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$

where:
$V_{(max)}$: Maximum permitted exit velocity, m/sec
28.8: Constant
31.7: Constant
H (T): Net Heating Value in (MJ/scm) at 25 deg. C, 760 mm Hg

Sample No. **CW-6**
Net Heating Value Heating Value, H(T): 12.3 MJ/scm at 25 deg. C and 760 mm Hg

$\text{Log (10)} (V_{(max)}) = (H(T) + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = (10.1 + 28.8)/31.7$
$\text{Log (10)} (V_{(max)}) = 1.3$
$V_{(max)} = 19.8$ m/sec
$V_{(max)} = 64.9$ ft/sec