SENECA, 10/93

NOx & DRE

(A)

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Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

SENECA LANDFILL, INC.
BUTLER COUNTY, PENNSYLVANIA

Report on

GROUND FLARE EMISSIONS TEST RESULTS
SENECA LANDFILL, INC.
BUTLER COUNTY, PENNSYLVANIA

OCTOBER 1993

CHESTER
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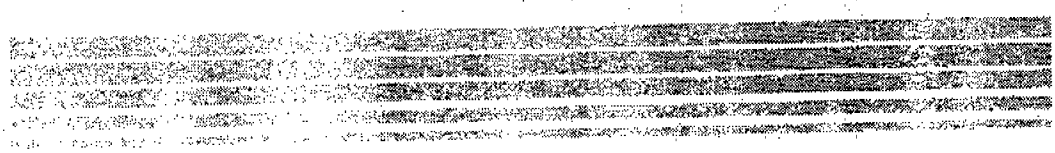

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SENECA LANDFILL, INC.
BUTLER COUNTY, PENNSYLVANIA

Report on

GROUND FLARE EMISSIONS TEST RESULTS
SENECA LANDFILL, INC.
BUTLER COUNTY, PENNSYLVANIA

OCTOBER 1993

Prepared by: Chester Environmental
3000 Tech Center Drive
Monroeville, Pennsylvania 15146

Project No. 398830-01

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1.0 INTRODUCTION

Chester Environmental (Chester) was retained by Seneca Landfill, Inc. (Seneca) to conduct a compliance test program at the landfill located in Butler County, Pennsylvania. The objective of the program was to conduct gas sampling at the inlet and outlet lines of a ground flare operating at the landfill with the intent of demonstrating compliance with the following four permit conditions as listed in Permit No. 10-322-002:

- Destruction/removal efficiency of non-methane hydrocarbons (NMHC) greater than or equal to 99 percent (Conditions 5 and 10b).
- Emission rate of nitrogen oxides (Condition 10c).
- Flare gas temperatures in the combustion box greater than or equal to 1,500°F (Condition 6).
- Residence time of the gas in the flare greater than or equal to 1.1 seconds (Condition 6).

Testing of this source was initially performed by Chester on June 7, 1993. Upon review of the analytical results from this test effort, it was determined that the samples had been contaminated. Testing was then repeated by Chester Environmental on September 8, 1993, using a test crew comprised of Mr. Rich Casselberry and Mr. Tom Morgan. This testing was performed in accordance with the Test Plan dated September 1993, which was approved by the Pennsylvania Department of Environmental Regulation (PADER) prior to project initiation. A copy of the Test Plan is included in this report as Appendix A.

As discussed in the Test Plan for the September effort, sampling included NMHC only. The nitrogen oxides (NOx) concentration results from the preceding test were used to determine the NOx emission rate. Seneca personnel collected the flare gas temperature and combustion chamber volume for inclusion in Chester's final report.

Section 2.0 presents a summary of results for the testing effort. The final section includes the testing methodology and quality assurance procedures used to collect and verify the data.

2.0 SUMMARY OF RESULTS

Table 2-1 presents the summary of results for the testing effort conducted at the Seneca Butler County landfill. This data is an average of the four test runs performed and is organized by permit required test parameters. These results verify that the Seneca flare at the Butler County landfill is in compliance with PADER Permit No. 10-322-002.

Tables 2-2 and 2-3 summarize the detailed results from the flare inlet and outlet, respectively. Supporting field, analytical, and process data are included in Appendices B through D. Example calculations are provided in Appendix E.

TABLE 2-1

SUMMARY OF RESULTS

Parameter	Emission Test Results	Permit Limit
Flare Gas Temperature, °F	1600	≥1500
Non-Methane Hydrocarbons Destruction/Removal Efficiency, %	>99.9	≥99
Nitrogen Oxides Emission Rate, lb/hr	0.33	---
Flare Gas Residence Time, Sec.	3.19	≥1.1

TABLE 2-2

SUMMARY OF RESULTS - FLARE INLET

	Run 1	Run 2	Run 3	Run 4	Average
Sample Information					
Date	9-08-93	9-08-93	9-08-93	9-08-93	---
Time Start	1545	1710	1810	1910	---
Time Finish	1655	1755	1855	1955	---
Inlet Gas Parameters					
O2 Concentration, %	3.3	3.3	3.7	2.5	3.2
CO2 Concentration, %	20.0	21.6	25.7	24.8	23.0
CH4 Concentration, %	18.9	20.8	26.1	25.2	22.7
CO Conc., ppmC	2	2	1	<0.1	<1.3
Calculated Results					
Flue Gas Moisture, %	4.67	4.55	4.55	4.58	4.59
Average Gas Velocity, ft/sec	31.62	31.71	31.65	30.98	31.49
Average Flue Gas Flow, ACFM	6.63E+02	6.65E+02	6.64E+02	6.49E+02	6.60E+02
Average Flue Gas Flow DSCFM	5.98E+02	5.98E+02	5.99E+02	5.88E+02	5.96E+02
NMHC					
Concentration, ppmC	3183	2969	3338	3184	3169
Emission Rate, lb/hr C	3.56	3.32	3.74	3.50	3.53

TABLE 2-3

SUMMARY OF RESULTS - FLARE OUTLET

	Run 1	Run 2	Run 3	Run 4	Average
Sample Information					
Date	9-08-93	9-08-93	9-08-93	9-08-93	---
Time Start	1545	1710	1810	1910	---
Time Finish	1655	1755	1855	1955	---
Stack Gas Parameters					
CO2 Concentration, %	7.8	8.0	8.0	8.1	8.0
CO4 Concentration, ppmC	<0.1	<0.1	<0.1	<0.1	<0.1
CO Concentration, ppmC	62	17	16	11	27
Calculated Results					
Average Flue Gas Flow, DSCFM	2.99E+03	3.20E+03	3.92E+03	3.67E+03	3.44E+03
Average Flue Gas Flow, ACFM	1.20E+04	1.28E+04	1.57E+04	1.47E+04	1.38E+04
Process Operating Conditions					
Combustion Chamber Temp., deg F	1600	1600	1600	1600	1600
Combustion Chamber Volume, ft3	706.8	706.8	706.8	706.8	706.8
Residence Time, Sec.	3.55	3.32	2.70	2.89	3.19
NMHC					
Concentration, ppmC	<0.1	<0.1	<0.1	<0.1	<0.1
Emission Rate, lb/hr C	<5.59E-04	<5.97E-04	<7.33E-04	<6.85E-04	<6.44E-04
Destruction Efficiency	>99.98	>99.98	>99.98	>99.98	>99.98
Nitrogen Oxides					
Concentration, ppmv	13.5[a]	13.5[a]	13.5[a]	13.5[a]	13.5[a]
Emission Rate, lb/hr	0.29	0.31	0.38	0.35	0.33

(a) Average of Three NOx Results from June 7, 1993 Testing Effort.

3.0 SAMPLING AND ANALYSIS PROCEDURES

This section describes the stack sampling and analysis protocols that were used to determine emissions from the Seneca Butler County landfill. Sampling methods and analytical parameters are presented in Table 3-1.

3.1 Sampling Procedures

Specifics of the individual procedures used to obtain representative samples for accurate determination of concentrations and emissions are detailed in the following sections.

3.1.1 Volumetric Flow Rate - Inlet

Determination of the volumetric flow rate from the landfill gas inlet line was performed in accordance with EPA Reference Methods 1 through 4 before and after each test run. Sampling on the 8-inch line was performed through two sampling ports in the same horizontal plane separated by 90 degrees.

Twelve traverse points per diameter (each port) for a total of 24 points per cross-sectional plane were utilized. The velocity head pressures from each traverse point was measured with a standard type pitot. Temperature measurements were performed concurrently with the velocity measurements using a type K thermocouple.

Molecular weight of the inlet gas was determined using the oxygen, carbon dioxide and methane, nitrogen, and moisture concentrations. The oxygen concentration was determined using "Fyrite" apparatus after the Teledyne oxygen monitor failed to operate within specifications. Three oxygen concentration measurements were performed during each test run. The carbon dioxide and methane concentrations were determined from the NMHC canister analysis. Moisture content was determined gravimetrically using an impinger train in accordance with EPA Reference Method 4. Nitrogen was assumed to be the remaining gas constituent.

TABLE 3-1

TEST SAMPLING MATRIX

Location	Parameter	Sampling Method	Sampling Frequency Per Test Period	Analytical Method
Flare Inlet	Velocity/Volumetric Flow	EPA Methods 1 & 2	Before and After Each Test Run	--
	Oxygen	EPA Method 3	3 Measurements Per Test	Fyrite
	Moisture	EPA Method 4	Once Per Test Run	Gravimetric
	NMHC	EPA Method 25C	Once Per Test Run	Gas Chromatography with Oxidation/Reduction
Flare Outlet	Volumetric Flow	EPA Method 2B	--	--
	NMHC	EPA Method 25C	Once Per Test Run	Gas Chromatography with Oxidation/Reduction
	NOx	EPA Method 7D	Once Per Test Run	Ion Chromatography

CHESTER ENVIRONMENTAL

3.1.2 Volumetric Flow Rate - Outlet

The volumetric flow rate at the flare outlet was determined by performing a carbon balance across the flare. This method is provided in EPA Reference Method 2B. The inlet gas flow was multiplied by a ratio of the inlet carbon content divided by the outlet carbon content. The carbon content was provided through the NMHC canister analysis for methane, non-methane hydrocarbons, carbon monoxide, and carbon dioxide.

3.1.3 Non-methane Hydrocarbons

The NMHC sampling was performed using stainless steel canisters in accordance with EPA Reference Method 25C. This sampling was integrated over an approximate one-hour sampling period.

The apparatus consisted of an evacuated canister (at approximately 30-inch Hg vacuum), pressure gauge, metering valve, and 1/4-inch stainless steel sampling probe.

Prior to sampling, the sampling system was flushed with source gas to remove possible contaminants. The canister was connected to the sampling system, valve opened, and the initial pressure of the canister recorded. Sampling was performed at the rate of approximately 100 milliliters per minute until 3-5-inches Hg vacuum remained in the canister. The canister valve was then closed and the final pressure recorded.

3.1.4 Nitrogen Oxides

The concentrations and emission rates of nitrogen oxides (NO_x) from the stack were determined in accordance with EPA Method 7D. Three tests, each of one-hour duration, were performed during the June 7, 1993 testing effort. The average NO_x concentration then used with the September 8, 1993 volumetric flow results to determine the NO_x emission rate.

3.2 Analytical Procedures

Descriptions of the individual procedures used to accurately quantify specific constituents are detailed in the following sections.

3.2.1 Volumetric Flow Rate - Inlet

The flare inlet volumetric flow rate was calculated using stack velocity traverses, dry gas molecular weights, and moistures in accordance with EPA Reference Method 2 and reported in terms of actual cubic feet per minute (ACFM) and dry standard cubic feet per minute (DSCFM).

3.2.2 Volumetric Flow Rate - Outlet

The flare outlet volumetric flow rate was calculated using the flare inlet volumetric flow rate and the methane, non-methane hydrocarbons, carbon monoxide, and carbon dioxide concentrations from the flare inlet and outlet. The result of the carbon balance provided the volumetric flow rate reported in terms of dry standard cubic feet per minute (DSCFM).

3.2.3 Non-methane Hydrocarbons

The analysis of the samples collected was performed through a series of oxidation, reduction, and measurement procedures. The carbon dioxide, carbon monoxide, and methane concentrations were determined by injecting a portion of the sample into a gas chromatographic column. The column also served to separate the NMHC from the other constituents in the sample. The NMHC was then oxidized to carbon dioxide, reduced to methane, and analyzed using a flame ionization detector.

3.2.4 Nitrogen Oxides

Analyses of the EPA Method 7D NO_X samples were performed by ion chromatography in accordance with the test method.

3.3 Quality Assurance

The quality of the data was assured by the adherence to the quality control criteria outlined in the applicable reference methods. All field measurements were completed on pre-prepared data sheets and were input into computer programs to aid in accurate data reduction. Reported results have been reviewed by a second independent person prior to submittal.

3.3.1 Volumetric Flow Rate

All pitot tubes, thermocouples, differential pressure gauges and scales used in the test program are calibrated on a routine basis and inspected prior to their use. Pitot tubes, connecting tubing, and differential pressure gauges were leak checked on-site before and after each velocity traverse. Impinger weight measurements were performed with a calibrated balance. This balance was checked periodically using standard weights. Following completion of the program, a calibration check of the equipment used in the test effort was performed in accordance with EPA Method 2. Chain-of-custody forms were completed for all samples collected.

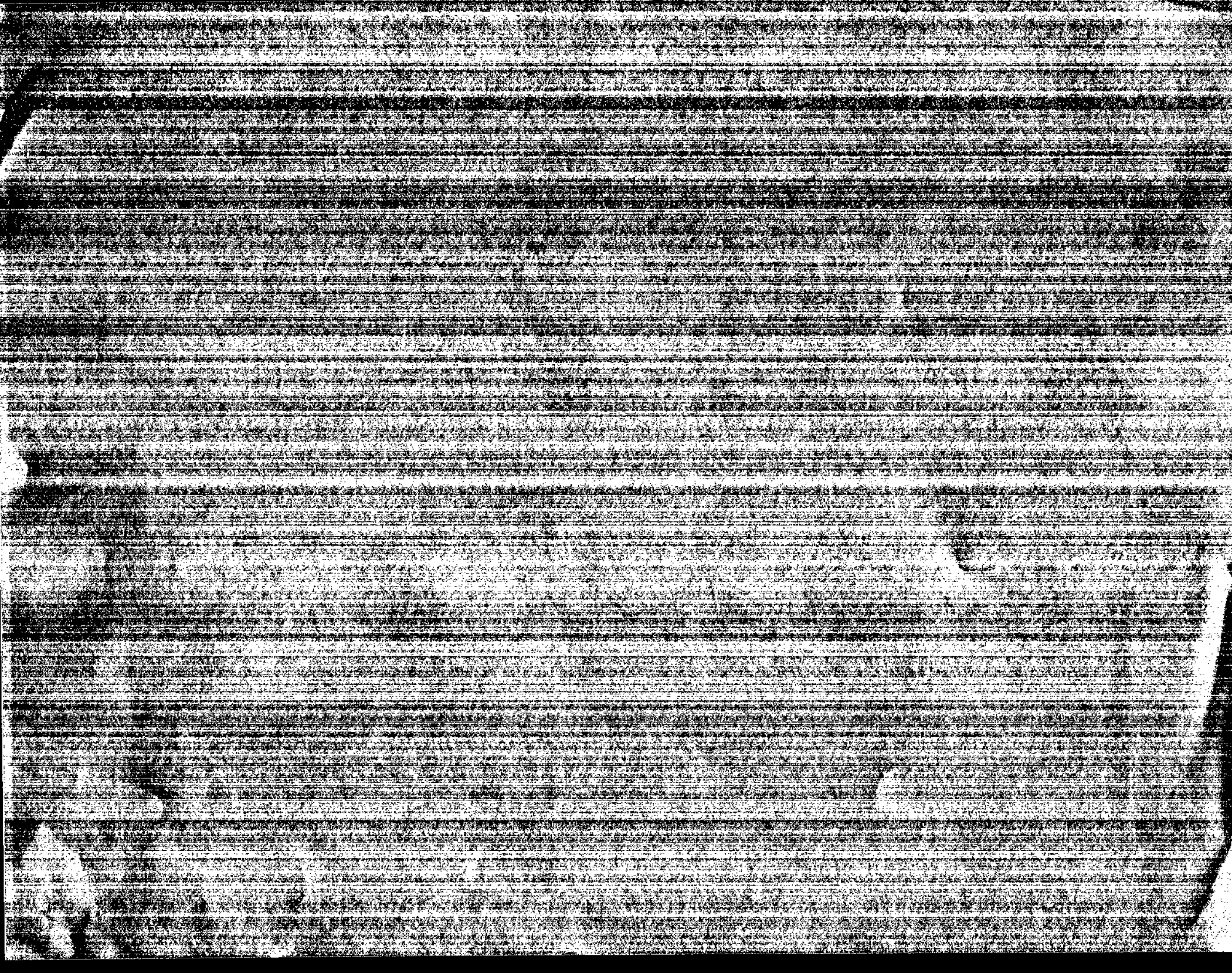
3.3.2 Canister Sampling

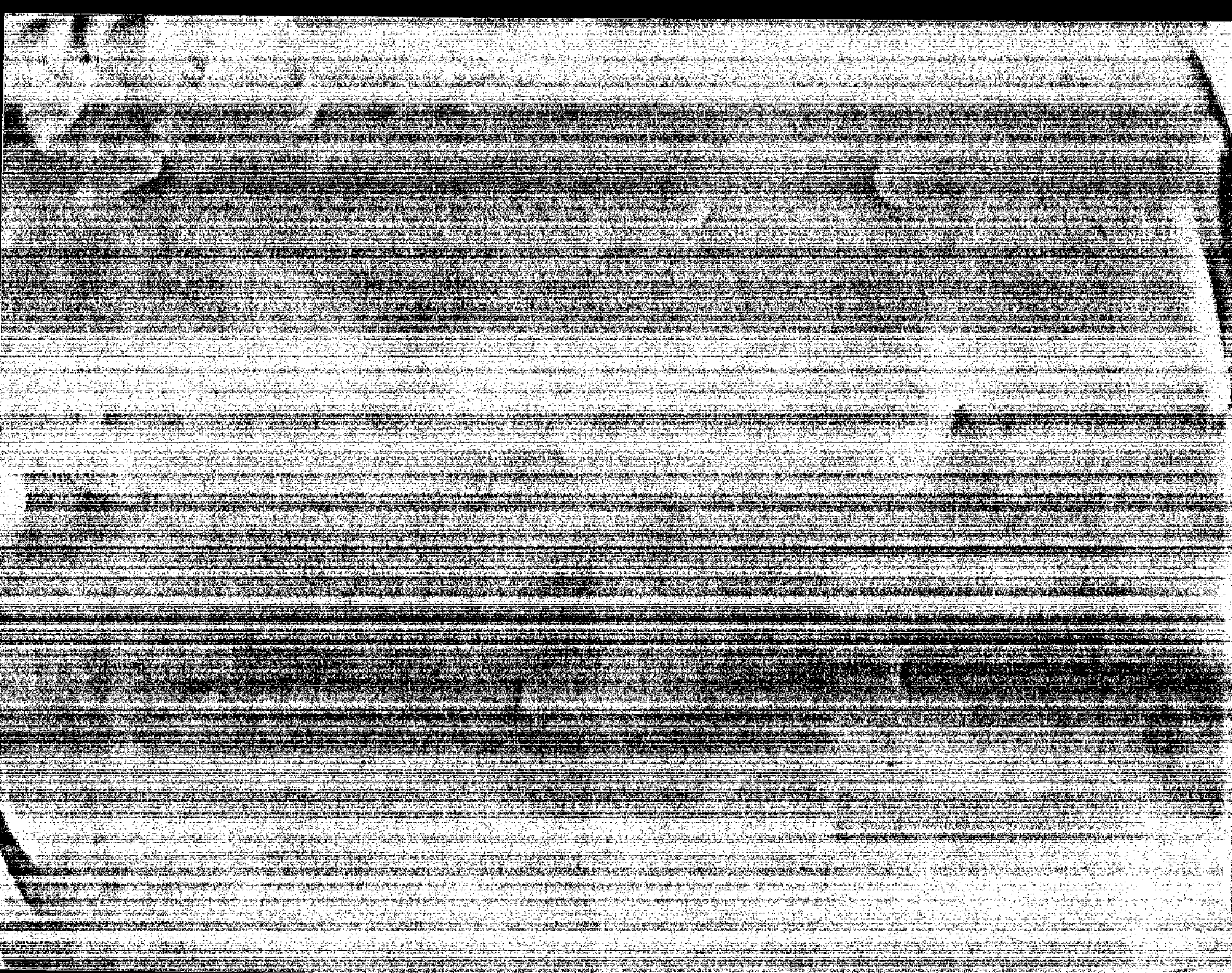
Pressure in the canisters was checked before and after sampling. The post-test pressure was again checked upon receipt by the laboratory to verify that no leakage occurred. This leak check procedure eliminated the need for a nitrogen analysis of the NMHC samples prior to analysis.

3.3.3 Nitrogen Oxides

Nitrogen oxides sampling trains were leak checked on-site before and after each test run. Following completion of the program, a calibration check of the equipment used in the test effort was performed and determined to be acceptable.

A NO_X blank was collected during sampling and the results were acceptable. The blank results were not subtracted from the test results.





APPENDIX A

TEST PLAN

SENECA LANDFILL, INC.
BUTLER COUNTY, PENNSYLVANIA

GROUND FLARE EMISSIONS TEST PLAN
BUTLER COUNTY, PENNSYLVANIA

September 1993

Prepared by: CHESTER ENVIRONMENTAL
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Project No.: 398830-01

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1.0 INTRODUCTION

This test protocol outlines specific test procedures and guidelines to be employed by Chester Environmental (Chester) in performing emission measurements from the Seneca Landfill, Inc. ground flare operated in Butler County, Pennsylvania.

The test program will incorporate emission testing to provide results to be used in determining compliance with PADER Permit Number 10-322-002. The specific conditions required by this permit are as follows:

- Destruction/removal efficiency of nonmethane hydrocarbons (NMHC) greater than or equal to 99 percent (Conditions 5 and 10b);
- Emission rate of nitrogen oxides (Condition 10c);
- Flare gas temperatures greater than or equal to 1500°F (Condition 6); and
- Residence time of the gas in the flare greater than or equal to 1.1 seconds (Condition 6).

Testing of this source was initially performed on June 7, 1993. Upon review of the analytical results from this test effort, it was determined that the samples had been contaminated.

The testing of the flare, as required by the Pennsylvania Department of Environmental Resources (PADER), is tentatively scheduled for September 8, 1993. This testing will include the NMHC testing only. The nitrogen oxides (NO_X) concentration results from the preceding test will be used to determine the NO_X emission rate. Seneca Landfill, Inc. personnel will collect flare gas temperature and combustion chamber volume data for inclusion in Chester's final report.

Testing will only be performed during periods of normal process operation. In the event of a nonrepresentative process operation or equipment malfunction, testing will be temporarily suspended until operating parameters are similar to those preceding the delay. Records will be maintained explaining any such interruption.

2.0 TEST METHODOLOGIES

The execution of the test program will require the use of several promulgated procedures. This section outlines the sampling and analytical procedures to be utilized. Methodologies are summarized in the following table:

Parameter	Methodology
Location of Traverse Points	1
Gas Velocity/Volumetric Flow Rate	2
Carbon Balance	2B
Oxygen	3A
Gas Moisture	4
Non-Methane Hydrocarbons	25C

2.1 Sampling Procedures

Specifics of the individual procedures used to obtain representative samples for accurate determination of concentrations and emissions are detailed in the following sections.

2.1.1 Volumetric Flow Rate - Inlet

Determination of the volumetric flow rate from the landfill gas inlet line will be performed in accordance with EPA Reference Methods 1 through 4 before and after each test run. Sampling on the eight-inch line will be performed through two sampling ports in the same horizontal plane separated by 90 degrees.

Twelve traverse points per diameter (each port) for a total of 24 points per cross-sectional plane will be utilized. The velocity head pressures from each traverse point will be measured with a standard type pitot. Temperature measurements will be performed concurrently with the velocity measurements using a type K thermocouple.

Molecular weight of the inlet gas will be determined using the oxygen, carbon dioxide and methane concentrations. The oxygen concentration will be determined using a Teledyne Oxygen Monitor. Three oxygen concentration measurements will be performed during each test run. The carbon dioxide and methane concentrations will be determined from the NMHC canister analysis. Nitrogen will be assumed to be the remaining gas constituent. Moisture content will be determined gravimetrically using an impinger train in accordance with EPA Reference Method 4.

2.1.2 Volumetric Flow Rate - Outlet

The volumetric flow rate of the flare outlet cannot be measured in a similar manner as the inlet due to the high temperatures and the low velocity head pressures. Therefore, an alternate method must be performed.

The method that will be employed for this test effort will be a carbon balance across the flare. This method is provided in EPA Reference Method 2B. The inlet gas flow will be multiplied by a ratio of the inlet carbon content divided by the outlet carbon content. The carbon content will be provided through the NMHC canister analysis for methane, non-methane hydrocarbons, carbon monoxide and carbon dioxide.

2.1.3 Non-Methane Hydrocarbons

The NMHC sampling will be performed using stainless steel canisters in accordance with EPA Reference Method 25C. This sampling will be integrated over an approximate one-hour sampling period.

The apparatus will consist of an evacuated canister (at approximately 30" Hg vacuum), pressure gauge, metering valve, and 1/4" stainless steel sampling probe.

Prior to sampling, the sampling system will be flushed with source gas to remove possible contaminants. The canister will then be connected to the sampling system, valve opened and the initial pressure of the canister recorded. Sampling will be performed at the rate of approximately 100 millimeters per minute until 3-5" Hg vacuum remain in the canister. The canister valve will then be closed and the final pressure recorded.

2.2 Analytical Procedures

Descriptions of the individual procedures used to accurately quantify specific constituents are detailed in the following sections.

2.2.1 Volumetric Flow Rate - Inlet

The flare inlet volumetric flow rate will be calculated using stack velocity traverses, dry gas molecular weights and moistures in accordance with EPA Reference Method 2 and reported in terms of actual cubic feet per minute (ACFM) and dry standard cubic feet per minute (DSCFM).

2.2.2 Volumetric Flow Rate - Outlet

The flare outlet volumetric flow rate will be calculated using the flare inlet volumetric flow rate and the methane, non-methane hydrocarbon, carbon monoxide and carbon dioxide concentrations from the flare inlet and outlet. The result of the carbon balance will provide the volumetric flow rate reported in terms of dry standard cubic feet per minute (DSCFM).

2.2.3 Non-Methane Hydrocarbons

The analysis of the samples collected will be performed through a series of oxidation, reduction and measurement procedures. The carbon dioxide, carbon monoxide and methane concentrations will be determined by injecting a portion of the sample into a gas chromatographic column. The column will also serve to separate the NMHC from the other constituents in the sample. The NMHC will then be oxidized to carbon dioxide, reduced to methane and analyzed using a flame ionization detector. The results of this method will be reported as methane.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance (QA) and quality control (QC) practices and procedures will be incorporated in the test program to ensure the reliability of the test results. A brief summary of the program QA/QC is provided in the following sections:

3.1 Organization and Responsibilities

Chester's project manager, Mr. John Shimshock, is ultimately responsible to the client for the quality of the test program. This includes review of the specific tasks involved and assurance of adherence to standards necessary for confidence in the final product. Quality issues at the test site are the responsibility of the test team leader, Mr. Richard Casselberry. Testing quality issues include conformance to testing protocol, knowledge of methodology, and the experience necessary to detect possible problems.

3.2 Quality Objectives

The objective of the test program is to provide reliable emissions data to be used for compliance determinations. The program will be conducted according to prescribed methodology that has been demonstrated to deliver results with a high degree of confidence.

3.3 QA/QC Procedures

A series of measures designed to provide adequate control of the variables involved in emissions testing will be implemented in the test program. The measures include:

- All field sampling data will be recorded on pre-printed forms.
- A field log will be maintained by the team leader documenting the test program field activities and noting any problems or abnormalities that could have an effect on the results.

- All calculations and data reduction will be subjected to review for data validation purposes.

The following sections summarize the specific procedures to be followed:

3.3.1 Volumetric Flow Rate

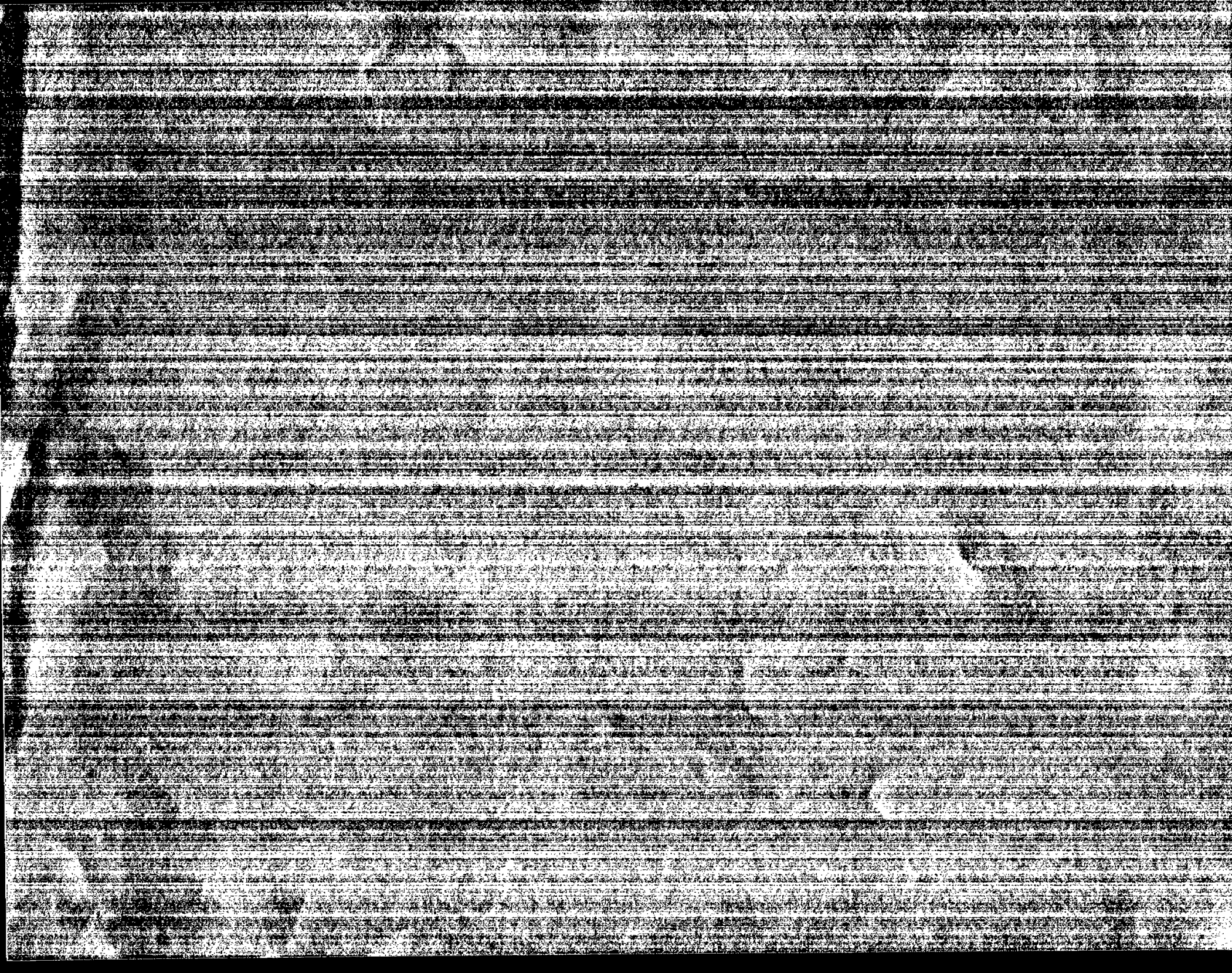
All pitot tubes, thermocouples, differential pressure gauges and scales used in the test program are calibrated on a routine basis and inspected prior to their use. Pitot tubes, connecting tubing and differential pressure gauges will be leak checked on-site before and after each velocity traverse. Impinger weight measurements will be performed with a calibrated balance. This balance will be checked periodically using standard weights. Following completion of the program, a calibration check of the equipment actually used in the testing will be performed. Calibrations will be performed according to EPA Method 2.

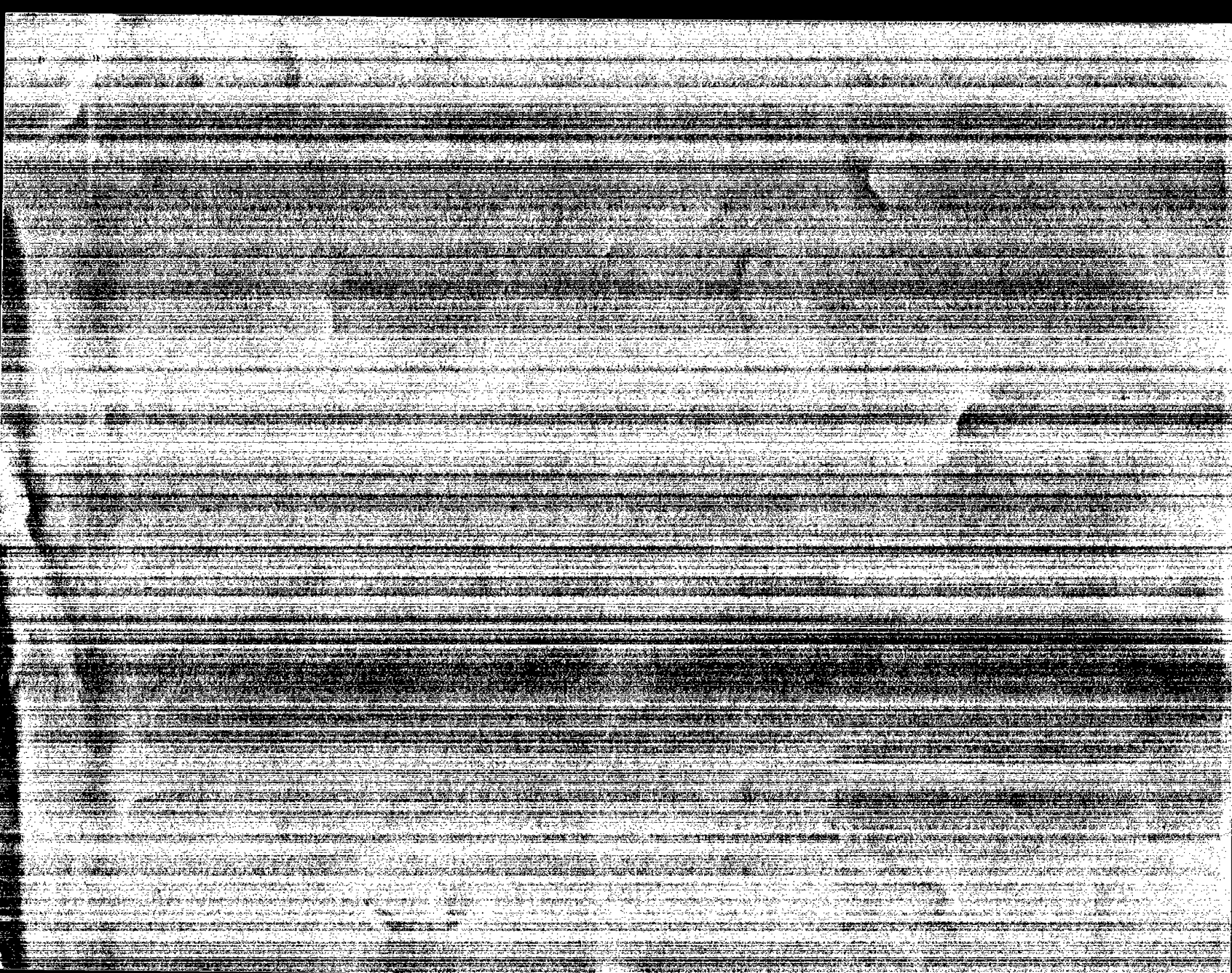
3.3.2 Canister Sampling

Pressure in the canisters will be checked before and after sampling. The post-test pressure will again be checked upon receipt by the laboratory to verify that no leakage occurred. This leak check procedure will eliminate the need for a nitrogen analysis of the NMHC samples prior to analysis.

4.0 TEST PROGRAM REPORT

Results of the test program will be issued in a report covering the program. The report will include an overview of the test program conducted, personnel conducting the tests, the analytical results, the concentrations and emission rates of the constituents of concern, allowable emissions, and any occurrence that could have an effect on the test results. Also contained in the report will be field data sheets, pre and post-test calibration information, process description, process production information, and emission calculations.





APPENDIX B

FIELD DATA SHEETS

METHOD 25 SAMPLE DATA
Triangle Environmental Services, Inc.

Company Name: SENECA LANDFILL			Date: 09-08-93
Units of measure:	o mm Hg	o in Hg	o Fahrenheit	o Celsius

Run # SL-GF-IN-#1	Tank ID # #425		Trap ID # ———	
Description (20)	SENECA LANDFILL GROUND FLARE INLET TEST #1			
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	16:55 / 27.5 " Hg	16:00 - O2 = 5.0% 16:30 - O2 = 2.0%	80° F
Post-Test Data	29.20	16:55 / 2.5 " Hg	16:45 - O2 = 2.0%	80° F

Run # SL-GF-IN #2	Tank ID # #128		Trap ID # ———	
Description (20)	SENECA LANDFILL GROUNDFLARE INLET TEST #2			
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	17:10 / 25.5 " Hg	17:15 O2 = 2.5% 17:30 O2 = 5.0%	77° F
Post-Test Data	29.20	17:55 / 2.5 " Hg	17:40 O2 = 2.5%	76° F

Run # SL-GF-IN #3	Tank ID # #345		Trap ID # ———	
Description (20)	SENECA LANDFILL GROUND FLARE INLET TEST #3			
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	18:10 / 26.0 " Hg	18:15 O2 = 2.5% 18:30 O2 = 4.5%	75° F
Post-Test Data	29.20	18:55 / 3.0 " Hg	18:45 O2 = 4.0%	75° F

Run # SL-GF-IN-#4	Tank ID # #94		Trap ID # ———	
Description (20)	SENECA LANDFILL GROUND FLARE INLET TEST #4			
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	19:10 / 26.5 " Hg	19:15 O2 3.5% 19:30 O2 3.0%	70° F
Post-Test Data	29.20	19:55 / 3.0 " Hg	19:45 O2 2.0%	69° F

Run #	Tank ID #		Trap ID # ———	
Description (20)				
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data				
Post-Test Data				

METHOD 25 SAMPLE DATA
Triangle Environmental Services, Inc.

Company Name:	Seneca Land Fill		Date: 9-8-23
Units of measure:	o mm Hg	o in Hg	o Fahrenheit	o Celsius

Run # SL-GF-OUT-1	Tank ID # 42		~~Trap ID~~ # Time Start 13:55 Time Stop 16:55
Description (20)	Ground Flare outlet stack		
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	28.0" Hg	None	80 °F
Post-Test Data	29.20	2.5" Hg	—	80 °F

Run # SL-GF-OUT-2	Tank ID # 43		~~Trap ID~~ # Start 17:10 Stop 17:55
Description (20)	Ground Flare outlet stack		
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	28.0" Hg	None	~~77~~ °F
Post-Test Data	29.20	2.5" Hg	—	~~77~~ °F

Run # SL-GF-OUT-3	Tank ID # 422		~~Trap ID~~ # Start 18:10 Stop 18:55
Description (20)	Ground Flare outlet stack		
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	28.0" Hg	None	75 °F
Post-Test Data	29.20	2.5" Hg	—	75 °F

Run # SL-GF-OUT-4	Tank ID #		~~Trap ID~~ # Start 19:10 Stop 19:55
Description (20)	Ground Flare outlet stack		
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data	29.20	27.0" Hg	None	70 °F
Post-Test Data	29.20	2.5" Hg	—	70 °F

Run #	Tank ID #		Trap ID #
Description (20)			
	Barometric Pr	Tank Vacuum	Absolute Press	Temperature
Pre-Test Data				
Post-Test Data				

STACK SAMPLING DATA SHEET

CLIENT SENECA LANDFILL | TEST DATE 09-08-93 | ORIFICE CORRECTION (ΔH@) 1.572 | HOT/COLD BOX NO. 7
TEST UNIT GROUND FLARE INLET | TEST NO. SL-GF-IN-#1 | METER CORRECTION (Y) 1.0151 | PROBE NO. —
PROJECT NO. | NOZZLE (SIZE,#) — | CALIBRATION DATE 07-02-93 | FILTER NO. —
TEST CREW RPC TM | STATIC PRESSURE +2.0 | PITOT CORRECTION | STACK DIA. 8.0"
BAROMETRIC PRESSURE 29.00 | PORT DIRECTION Horiz | CONTROL BOX NO. THREE | PORT SIZE 12"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
4.0"	15:46	612.600	—	2.0	2.0	93	89	2.0	88				30 min./point
			—	2.0	2.0	98	89	2.0	88				40 mL/pt
			—	2.0	2.0	105	92	2.0	88				
			—	2.0	2.0	111	93	2.0	85				
			—	2.0	2.0	112	94	2.0	86				
	~~16:46~~		—	2.0	2.0	114	95	2.0	86				
			—	2.0	2.0	118	98	2.0	85				
	16:25	646.225	—	2.0	2.0	119	99	2.0	86				
													Estimates:
		33.625			2.0		101		87				MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	2.001cfm
After	5.0	<.001 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL DI H2O	623.3	603.9	19.4
2.	100 mL DI H2O	559.6	556.3	3.3
3.	MT	452.4	451.4	1.0
4.	SILICA GEL	663.4	654.3	9.1
5.				
6.				
7.				
8.				32.8

CHESTER ENVIRONMENTAL

STACK SAMPLING DATA SHEET

CLIENT SENECA LANDFILL	TEST DATE 09-08-93	ORIFICE CORRECTION (ΔH@) 1.572	HOT/COLD BOX NO. 2
TEST UNIT GROUND FLARE	TEST NO. SL-GF-IN-2	METER CORRECTION (Y) 1.0151	PROBE NO. 2
PROJECT NO.	NOZZLE (SIZE,#)	CALIBRATION DATE 07-02-93	FILTER NO.
TEST CREW RPC, TM	STATIC PRESSURE +2.1	PITOT CORRECTION	STACK DIA. 8.0'
BAROMETRIC PRESSURE 29.20	PORT DIRECTION HORIZ.	CONTROL BOX NO. THREE	PORT SIZE ¼"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
4.0	17:10	649.045	—	2.50	2.50	100	98	4.5	90				30 min./point
			—	2.50	2.50	116	102	4.5	91				
			—	2.50	2.50	121	102	4.5	90				
			—	2.50	2.50	123	103	4.5	89				
			—	2.50	2.50	121	103	4.5	89				
	17:40	678.865	—	2.50	2.50	121	103	4.5	90				
													Estimates:
													MW=
													%H2O=
		29.820			2.5		109		90				

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01CFM.
After	5.5	<0.01CFM

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml DI H2O	490.6	477.6	13.0
2.	100ml DI H2O	577.3	573.9	3.4
3.	ML	448.7	446.9	1.8
4.	Silica Gel	580.8	571.1	9.7
5.				
6.				
7.				
8.				27.9

CHESTER ENVIRONMENTAL

STACK SAMPLING DATA SHEET

CLIENT SCHOLA LANDFILL	TEST DATE 09-08-93	ORIFICE CORRECTION (ΔH@) 1.572	HOT/COLD BOX NO. 7
TEST UNIT GROUND FLARE INLET	TEST NO. SL-GF-IN-#3	METER CORRECTION (Y) 1.0151	PROBE NO. 7
PROJECT NO.	NOZZLE (SIZE,#) —	CALIBRATION DATE 07-02-93	FILTER NO. —
TEST CREW RPC, TM	STATIC PRESSURE +2.1	PITOT CORRECTION	STACK DIA. 8.0"
BAROMETRIC PRESSURE 29.20	PORT DIRECTION HORIZ.	CONTROL BOX NO. TIGER	PORT SIZE 16"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
4.0"	18:10	681.610	—	2.50	2.50	99	97	5.5	88				30 min./point
			—	2.50	2.50	100	97	5.5	87				
			—	2.50	2.50	112	97	5.5	87				
			—	2.50	2.50	114	97	5.5	88				
			—	2.50	2.50	115	97	5.5	88				
	18:40	711.000	—	2.50	2.50	116	96	5.5	89				
													Estimates:
													MW=
		29.390			2.5		103		88				%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.005 CFM
After	6.5	<0.01 CFM

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100ml DI H2O	574.5	557.2	17.3
2.	100ml DI H2O	531.6	529.8	1.8
3.	Empty	430.0	429.7	0.3
4.	Silica Gel	676.6	668.2	8.4
5.				
6.				
7.				
8.				27.8

CHESTER ENVIRONMENTAL

STACK SAMPLING DATA SHEET

CLIENT Seneca Landfill	TEST DATE 09-08-93	ORIFICE CORRECTION (ΔH@) 1.572	HOT/COLD BOX NO. 3
TEST UNIT Ground Flare Tailgt	TEST NO. SL-GF-IN-#4	METER CORRECTION (Y) 1.0151	PROBE NO. 2
PROJECT NO.	NOZZLE (SIZE,#) —	CALIBRATION DATE 07-02-93	FILTER NO. —
TEST CREW RPC, TM	STATIC PRESSURE +2.2	PITOT CORRECTION —	STACK DIA. 8.0"
BAROMETRIC PRESSURE 29.20	PORT DIRECTION Port 2	CONTROL BOX NO. Thermo	PORT SIZE 1/2"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H20)	Orifice ΔH Actual (in. H20)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°F)	Hot Box Temp. (°F)	Comments
4.0	19:10	716.855	—	2.5	2.5	90	90	5.5	85				30 min./point
			—	2.5	2.5	100	90	5.5	86				
			—	2.5	2.5	107	90	5.5	85				
			—	2.5	2.5	110	90	5.5	86				
			—	2.5	2.5	111	91	5.5	85				
	9:40	746210	—	2.5	2.5	110	90	5.5	86				
													Estimates:
													MW=
		29.355			2.5		98		86				%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	<0.01 cfm
After	5.5	<0.01 cfm

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

GAS	1	2
CO2		
O2		
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 ml DI H2O	482.4	464.5	17.9
2.	100 ml DI H2O	565.6	563.6	2.0
3.	empty	458.4	457.8	0.6
4.	Silica Gel.	679.2	671.5	7.7
5.				
6.				
7.				
8.				28.2

CHESTER ENVIRONMENTAL

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT SENECA LANDFILL — TEST DATE 07-08-93 — PAGE 1 of 5
PLANT LOCATION BUTLER COUNTY, PA — TEST NO. SL-GF-IN — STACK DIAMETER (in.) 90"
TEST SITE GROUND FLARE INLET — PROBE TYPE STAINLESS PITOT — STACK LENGTH (in.) ROUND
PROJECT NO. — PROBE NO. 20" — STACK WIDTH (in.) ROUND
TEST CREW LPC, TM — B.P. (in. Hg) 29.20 — COMMENTS

TIME: 15:32

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
VERT	0.17	.20	88	+2.0
	0.54	.20		
	0.94	.22		
	1.42	.24		
	2.00	.25		
	2.85	.28		
	5.15	.24		
	6.00	.20		
	6.58	.19		
	7.06	.15		
	7.46	.15		
	7.83	.20		
		0.4564	88	+2.0

TIME: 15:32

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
HORIZ.	0.17	.20	88	+2.0
	0.54	.21		
	0.94	.22		
	1.42	.24		
	2.00	.28		
	2.85	.28		
	5.15	.24		
	6.00	.22		
	6.58	.17		
	7.06	.15		
	7.46	.15		
	7.83	.15		
		0.4547	88	+2.0

A. Barometric Pressure		in. Hg	15:30
B. Static Pressure		in. H2O	O_2 = 15%
C. Average ΔP		in. H2O	CO_2 = OFF SCALE
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight		lb./lb. mol	FYRITE CHECK a_2 = 20.5%
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity		fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate		acfm	(I*J*60)
L. Standard Flow Rate		scfm	[K*(528/E)*(G/29.92)]

5/92

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

PAGE 2 of 5

CLIENT SOUSA LANDFILL | TEST DATE 09-08-93 | STACK DIAMETER (in.) 80"
PLANT LOCATION BUTLER COUNTY, PA | TEST NO. S1-GF-IN | STACK LENGTH (in.) ROUND
TEST SITE GROUND FLARE INLET | PROBE TYPE STANDARD PITOT | STACK WIDTH (in.) ROUND
PROJECT NO. | PROBE NO. 20" | COMMENTS
TEST CREW RPC TM | B.P. (in. Hg) 29.20

TIME: 1700

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
VERT	0.17	0.15	90	+2.1
	0.54	0.20		
	094	0.25		
	1.42	0.25		
	2.00	0.28		
	2.85	.28		
	5.15	22		
	6.00	22		
	6.58	.20		
	7.06	.20		
	7.46	.19		
	7.83	18		
		0.4655	90	+2.1

TIME: 1700

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
Horiz	0.17	.21	90	+2.1
	0.54	.23		
	094	.20		
	1.42	.24		
	2.00	.28		
	2.85	.28		
	5.15	23		
	6.00	.20		
	6.58	.19		
	7.06	.15		
	7.46	.14		
	7.83	.14		
		0.4544	90	+2.1

17:00
O_2 = 4.5%
CO_2 = ONE SOURCE
FINITE CHECK = 20%

A. Barometric Pressure		in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight		lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity		fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate		acfm	(I*J*60)
L. Standard Flow Rate		scfm	[K*(528/E)*(G/29.92)]

AVG. RUN 1
$\sqrt{\Delta P}$ = .4579
T_s = 84
STATIC = 2.05

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT SENECA LANDFILL
PLANT LOCATION BUTLER COUNTY PA
TEST SITE GROUND FLARE INLET
PROJECT NO.
TEST CREW RPC, TM

TEST DATE 09-08-93
TEST NO. SL-GF-IN
PROBE TYPE STANDARD PITOT
PROBE NO. 20.0"
B.P. (in. Hg) 29.20

PAGE 3 of 5
STACK DIAMETER (in.) 8.0
STACK LENGTH (in.) ROUND
STACK WIDTH (in.) ROUND
COMMENTS

TIME: 18:00

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
VERT	0.17	.19	88	+2.2
	0.54	.18		
	0.94	.19		
	1.42	.22		
	2.00	.25		
	2.85	.28		
	5.15	.22		
	6.00	.22		
	6.58	.20		
	7.06	.20		
	7.46	.19		
	7.83	.19		
		0.4582	88	+2.2

TIME: 18:00

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
HORIZ	0.17	.19	88	+2.2
	0.54	.20		
	0.94	.19		
	1.42	.23		
	2.00	.25		
	2.85	.27		
	5.15	.23		
	6.00	.23		
	6.58	.25		
	7.06	.19		
	7.46	.16		
	7.83	.12		
		0.4550	88	+2.2

FYRITE CHECK O_2 = 20% RPC
18:00 O_2 = ~~[illegible]~~ 15%
CO_2 = OFF SCALE

A. Barometric Pressure		in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight		lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity		fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate		acfm	(I*J*60)
L. Standard Flow Rate		scfm	[K*(528/E)*(G/29.92)]

AVG. RUN 2
$\sqrt{\Delta P}$ = .4583
T_s = 89
STATIC = 2.15

5/92

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT SENECA LANDFILL | TEST DATE 09-08-93 | PAGE 4 of 5
PLANT LOCATION BUTLER COUNTY PA | TEST NO. SL-GF-IN | STACK DIAMETER (in.) 8.0
TEST SITE GROUND FLARE INLET | PROBE TYPE STD/MAN PITOT | STACK LENGTH (in.) ROUND
PROJECT NO. | PROBE NO. 200" | STACK WIDTH (in.) ROUND
TEST CREW LPC, TM | B.P. (in. Hg) 27.20 | COMMENTS

TIME: 1900

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
VERT	0.17	.18	85°F	+2.2
	0.54	.18		
	0.94	.20		
	1.42	.22		
	2.00	.28		
	2.85	.29		
	5.15	.26		
	6.00	.24		
	6.58	.24		
	7.06	.12		
	7.46	.16		
	7.83	.16		
		0.4567	85	+2.2

TIME: 1900

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
HORIZ	0.17	.18	85°F	+2.2
	0.54	.20		
	0.94	.23		
	1.42	.26		
	2.00	.26		
	2.85	.28		
	5.15	.27		
	6.00	.25		
	6.58	.19		
	7.06	.19		
	7.46	.14		
	7.83	.16		
		0.4638	85	+2.2

1900 FYRITE CHECK 20%
CO_2 = OFF SCALE
O_2 = 4.5%

A. Barometric Pressure		in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight		lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity		fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate		acfm	(I*J*60)
L. Standard Flow Rate		scfm	[K*(528/E)*(G/29.92)]

AVG. RUN 3
$\sqrt{\Delta P}$ = .4564
T_s = 87
STATIC = 2.2

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

STACK GAS SAMPLING
GAS VELOCITY AND VOLUMETRIC FLOW CALCULATION SHEET

CLIENT SENECA LANDFILL | TEST DATE 04-08-97 | PAGE 5 of 5
PLANT LOCATION BUTLER COUNTY, PA | TEST NO. SL-GF-IN | STACK DIAMETER (in.) 8.0
TEST SITE GROUND FLARE INLET | PROBE TYPE STANDARD PITOT | STACK LENGTH (in.) ROUND
PROJECT NO. | PROBE NO. 20" | STACK WIDTH (in.) ROUND
TEST CREW RPC, TM | B.P. (in. Hg) 29.20 | COMMENTS

TIME:

TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
VERT	0.17	1.9	82°	+2.2
	0.54	1.7		
	0.94	2.0		
	1.42	2.0		
	2.00	2.4		
	2.85	2.6		
	5.15	2.8		
	6.00	2.4		
	6.58	2.2		
	7.06	1.4		
	7.46	1.2		
	7.83	1.2		
		0.4415	82	+2.2

TIME:

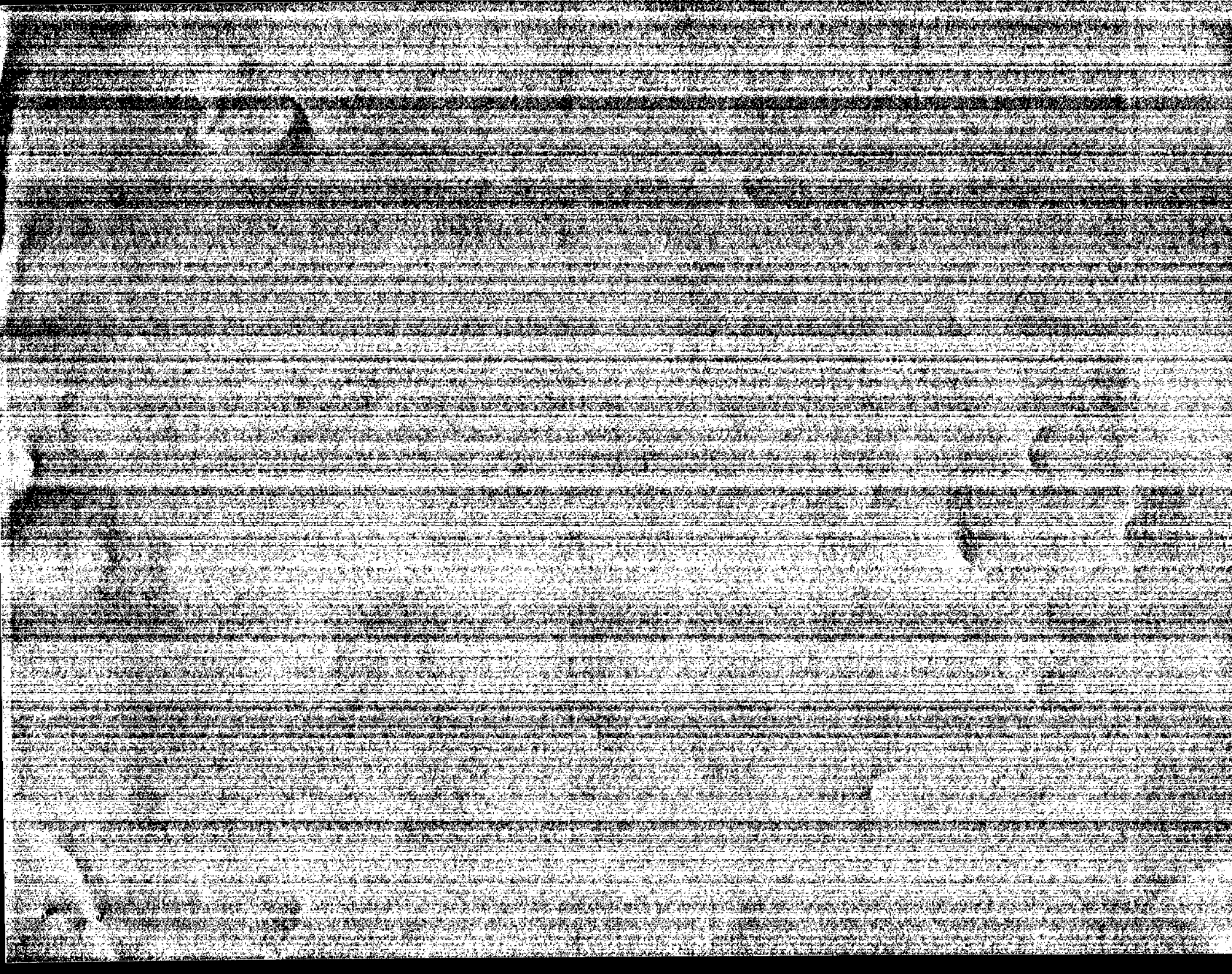
TEST PORT	TRAVERSE POINT (inches)	VELOCITY ΔP (in. H2O)	STACK TEMP. (°F)	STATIC PRESSURE (in. H2O)
HORIZ	0.17	1.9	82°	+2.2
	0.54	1.6		
	0.94	1.6		
	1.42	2.0		
	2.00	2.4		
	2.85	2.4		
	5.15	2.6		
	6.00	2.3		
	6.58	1.6		
	7.06	1.6		
	7.46	1.4		
	7.83	1.4		
		0.4334	82	+2.2

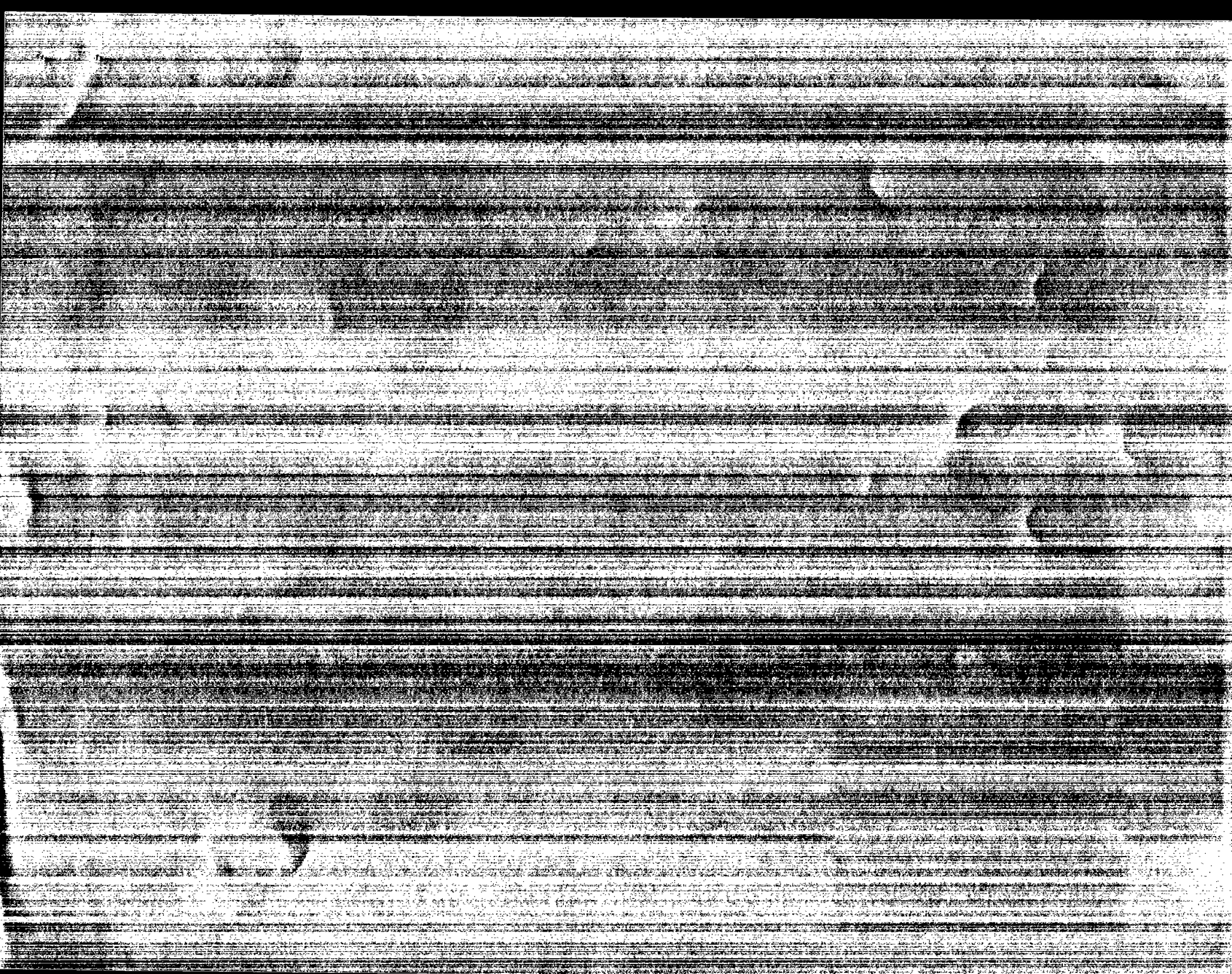
FYRITE CHECK 20:00 O_2=
O_2 = 1.5%
CO_2 = OFF SCALE

A. Barometric Pressure		in. Hg	
B. Static Pressure		in. H2O	
C. Average ΔP		in. H2O	
D. Average Stack Temperature		°F	
E. Average Stack Temperature		°R	(D+460)
F. Average Molecular Weight		lb./lb. mol	
G. Stack Pressure		in. Hg	[A+(B/13.6)]
H. Pitot Correction Factor			
I. Average Stack Velocity		fps	{85.49*H*[(C*E)/(F*G)]^0.5}
J. Stack Cross-Sectional Area:			
Round		ft²	(0.00545*DIAMETER²)
Rectangular		ft²	(LENGTH*WIDTH/144)
K. Average Flow Rate		acfm	(I*J*60)
L. Standard Flow Rate		scfm	[K*(528/E)*(G/29.92)]

AVG. RUN 4
$\sqrt{\Delta P}$ = .4469
T_s = 84
STATIC = 2.2

5/92





APPENDIX C

ANALYTICAL RESULTS

Method 25-C
Analytical Results

prepared for

CHESTER ENVIRONMENTAL

by

TRIANGLE ENVIRONMENTAL SERVICES, INC.

Larry W. Taylor
Method 25 Analyst

John Venezia
Method 25 Supervisor

Report

93102

September 17, 1993

METHOD 25 SAMPLE QA/QC DATA

DAILY CHECKS

4.3.1.1* **Condensate Recovery System Leak Check**

Evacuate system to ≤10mm Hg absolute, isolate system, and monitor for ten minutes.
Requirements: Pressure Change ≤3mm Hg

4.3.1.2* **Condensate Recovery System Background Test**

Analyze recovery system effluent for CO_2 concentrations.
Requirements: $CO_2 \leq 10$ ppm

4.3.1.3* **Condensate Oxidation Catalyst Efficiency Check**

Analyze 1% Methane standard through oxidation catalyst.
Requirements: $CO_2 = CH_4$ concentration ± 2%

5.3* **Daily Calibration**

CO_2 Response Factor Check
Requirements: DRF (CO_2) = [RF (CO_2)] ± 5%

NMO Response Factor Check
Requirements: DRF (NMO) = [RF (NMO)] ± 5%

Triplicate injections of high level CO_2 and a mixture of CO, CH_4, and C_3H_8 are made before and after of each set of samples or on a daily basis, whichever occurs first.

Initial Condensate Recovery System Tests

5.1.1* **Carrier and Auxiliary Gas Blank**

$CO + CH_4 + CO_2 + NMO =$ Requirements ≤ 5 ppm

* USEPA Method 25 Protocol Reference Number

5.1.3* **System Performance Check**

Average Percent

		Recovery	% RSD
50 uL	Hexane	101/102	.058/.101
50 uL	Decane	97/100	.120/.047
10 uL	Hexane	104/107	.118/.145
10 uL	Decane	98/ 97	.119/.232
Requirements:		100 ± 10%	≤5

Initial NMO Analyzer Performance Checks

5.2.1* **Oxidation Catalyst Efficiency Check Date: 6/5/93**

FID response with reduction catalyst in bypass mode = 0

Requirements: ≤1%

5.2.2* **Reduction Catalyst Efficiency Check Date: 6/5/93**

Response of CH_4 with Oxidation and reduction catalyst in series mode compared to response with both catalysts in bypass mode.

100.0 % Requirement 100 ± 5%

5.2.3* **Analyzer Linearity Check + NMO Calibration Date: 9/10/93**

	Requirement:
RF Value CO - ± 1.75%	± 2.5%
RF Value CH_4 - ± .65%	± 2.5%
RF Value CO_2 - ± 2.1%	± 2.5%
RF Value NMO - ± 2.1%	± 2.5%
% RSD Values - 1.08%	≤2%
RF (NMO) = .985	1.0 ± 0.1
RF (CO_2)	

5.2.4* **System Performance Check**

	Measured Value	Expected Value	Requirement
Propane in Mix	24.8	25.1	± 5%
Hexane	49.5	47.3	± 5%
Toluene	20.1	20.1	± 5%

* USEPA Method 25 Protocol Reference Number

Equipment Checks

4.1.2* **Clean Sampling Equipment Check**

Sample Unit	≤10 ppmC @ 100%
Trap	≤10 ppmC @ 100%
Tank	≤10 ppmC @ 100%

4.1.2* **Sample Tank Evacuation and Leak Check**

Evacuated to ≤10 mm Hg absolute, monitor for ≥1 hour, and pass for use if no pressure change is noted.

5.4* **Sample Tank and ICV Volumes**

Weigh empty, fill with deionized distilled water, measure temperature, and weigh to the nearest 2g and record the results. Calculate volume based on density of water at that temperature and record results in permanent file.

* USEPA Method 25 Protocol Reference Number

Wayne Stollings
QA/QC Officer

TRIANGLE ENVIRONMENTAL SERVICES, INC.
METHOD 25 PROCEDURES

Calibration:

Initial checks and calibrations of the collection and analytical systems are repeated a maximum of one year after the previous calibrations are completed.

The daily calibration gas mixture consists of 50.0 ppm carbon monoxide, 50.9 ppm methane, 25.1 ppm propane, and .989% carbon dioxide. Triplicate injections of this gas are made immediately before and after each set of samples. The response factors (average integrated area/concentration in ppmC) are calculated daily from these injections. The average response factors must agree within 5% of the CO_2 and NMO response factors from the initial performance check. The average response factors for the before and after sets must also agree within 2% of each other before the analyses are considered valid.

Collection:

The trap is maintained at -78 °C while hydrocarbon free air is flushed through to the sample tank via the CO_2 NDIR analyzer. This flushing of CO_2 is continued until no response is noted on the NDIR. The sample tank is then pressurized to about 1060 mmHg and replaced by an intermediate collection vessel (ICV). The trap is then baked at 200 °C with hydrocarbon free air passing through the oxidation catalyst and the NDIR analyzer into the ICV. When no response is noted on the NDIR, an aliquot is injected into the NMO analyzer. Collection continues until the CO_2 concentration falls below 10 ppm as determined by the NMO analyzer. The ICV is then pressurized to about 1060 mmHg and analyzed with the sample tank.

Analysis:

The propane calibration mixture, sample tank, and ICV are analyzed identically using a computer controlled GC/FID with an automated gas sampling system.

A 1 ml aliquot is injected into the GC column, which is maintained at 80 °C. This is to elute CO, CH_4, and CO_2 which pass through the oxidation and reduction catalysts to the FID. The column is then back-flushed to elute the non-methane organic (NMO) fraction, which also passes through the oxidation and reduction catalysts to the FID. Triplicate injections are made for all samples and daily calibrations.

Calculations:

Calculations are done in accord with USEPA Method 25 procedures. A sample calculation for this set is provided. A blank is subtracted from the CO calculations to correct interference caused by the coelution of O_2 with CO. This is a constant value which is solely due to the characteristics of the column set.

Equipment:

Tanks and ICV's are evacuated and filled with ambient air filtered through charcoal twice while being baked at 150 °C. They are then evacuated to below 10 mmHg and monitored for at least an hour for leak checking (no change in pressure within an hour). They are then pressurized over ambient with hydrocarbon free air, analyzed to ensure <10 ppmC, and stored for later use.

Traps are analyzed to confirm less than 10 ppmC as per the collection of a sample, in addition each is then baked at 300 °C for thirty minutes to ensure cleanliness. A random analysis of 10% of the traps is done for an added QA/QC check of handling procedures.

Sample units are reconditioned to ensure clean filters are installed and that they operate properly. A teflon jumper replaces the trap, the unit is heated and is flushed with zero air for at least thirty minutes. An aliquot of this flow is injected into the analyzer. If the concentration of NMO is below 10 ppm the unit is made ready for use and stored for shipment.

TRIANGLE ENVIRONMENTAL SERVICES, INC.
COMMENTS ON THE ANALYSES
Report #93102

Tanks Received: 9/10/93 Samples Analyzed: 9/16/93
Chain-of-custody forms: 1 page

General: The analytical system reports a background concentration of CO due to interference caused by the coelution of O_2 with CO. The reported CO concentrations reflect the deduction of a daily "blank" area count. This correction allows for more accurate reporting and comparison of the CO concentration of all analyses.

Sample #'s 1 - 8:
The analyzed concentrations of CO_2 of these samples exceeded the calibration range of the instrument. We considered these as a minimum level for each sample when the reported concentration was calculated.

Sample #'s 1 - 4:
The analyzed concentrations of CH_4 of these samples exceeded the calibration range of the instrument. We considered these as a minimum level for each sample when the reported concentration was calculated.

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C TABLE OF RESULTS

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

#	Sample Description	Concentrations (ppmC) CO	CH4	CO2	Noncondensibles	TGNMO	Mass Conc. (mgC/cu.m)
1	SL-GF-IN-#1	2	188511	199610	3183	3183	1589
2	SL-GF-IN-#2	2	207548	216094	2969	2969	1483
3	SL-GF-IN-#3	1	261272	256849	3338	3338	1667
4	SL-GF-IN-#4	0	251945	248073	3184	3184	1590
5	SL-GF-OUT-#1	62	0	78162	0	0	0
6	SL-GF-OUT-#2	17	0	79761	0	0	0
7	SL-GF-OUT-#3	16	0	79578	0	0	0
8	SL-GF-OUT-#4	11	0	80697	0	0	0

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C SAMPLE CALCULATION

Note: All pressure values have been converted when necessary to mm Hg and all temperature values to Kelvin.

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 1 SL-GF-IN-#1

D A T A

Tank N425:
Volume (cu.m) = 0.004447

	Pressure (mm Hg)	Temp.(K)
Presampling	43.2	299.8
Postsampling	678.2	299.8
Final	1271.0	297.2
Barometric	741.7	299.8
Water Vapor	26.2	299.8

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	452	484	467
CH4	14,666,060	14,704,300	14,716,340
CO2	15,713,370	15,872,140	15,926,490
Noncondensibles	233,381	239,779	247,906

C A L C U L A T I O N S

Measured Concentrations, corrected for blank:

Cm(CO) = Area(CO) - CO Blank/RF(CO)
= 452 - 297 /167.6 = 0.9
= 484 - 297 /167.6 = 1.1
= 467 - 297 /167.6 = 1.0

Cm(CH4) = Area(CH4)/RF(CH4)
= 1.466606E+07 /163.2 = 89865.6
= 1.47043E+07 /163.2 = 90099.9
= 1.471634E+07 /163.2 = 90173.6

Cm(CO2) = Area(CO2)/RF(CO2)
= 1.571337E+07 /166.1 = 94601.9
= 1.587214E+07 /166.1 = 95557.7
= 1.592649E+07 /166.1 = 95885.0

TRIANGLE ENVIRONMENTAL SERVICES, INC. METHOD 25-C SAMPLE CALCULATION

Cm(Noncondensibles) = Area(Noncondensibles)/RF(NMO)
= 233381 /158.1 = 1476.2
= 239779 /158.1 = 1516.6
= 247906 /158.1 = 1568.0

Pressure-Temperature Ratio, Q(i) = P(i)/T(i):

postsampling tank: Q(1) = 678.18 / 299.8167 = 2.261983
presampling tank: Q(2) = 43.18 / 299.8167 = .1440214
final tank: Q(3) = 1271 / 297.15 = 4.277302
Volume Sampled (dscm) = 0.3857 x Tank Volume x [Q(1)-Q(2)]
= 0.3857 x .004447 x [2.2620 - 0.1440]
= 0.003633

Averages and % Relative Standard Deviations (%RSD) of Cm's are calculated. (%RSD of C = %RSD of Cm)

Moisture Correction Factor,:

B(1) = 1 - Vapor pressure/Barometric pressure
= 1 - 26.2/ 741.7 = 0.9647

Calculated Concentrations:

C(CO) = Q(3)/[Q(1)-Q(2)] x Cm(CO)/B(1)
= 4.2773/(2.2620 - 0.1440) x 1.0/0.9647 = 2.1

C(CH4) = Q(3)/[Q(1)-Q(2)] x Cm(CH4)/B(1)
= 4.2773/(2.2620 - 0.1440) x 90046.4/0.9647 = 188511.2

C(CO2) = Q(3)/[Q(1)-Q(2)] x Cm(CO2)/B(1)
= 4.2773/(2.2620 - 0.1440) x 95348.2/0.9647 = 199610.5

C(Noncondensibles)
= Q(3)/[Q(1)-Q(2)] x Cm(Noncondensibles)/B(1)
= 4.2773/(2.2620 - 0.1440) x 1520.3/0.9647 = 3182.7

Mass Concentration
= 0.4993 x Noncondensibles
= 0.4993 x 3182.7 = 1589.1

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 1 SL-GF-IN-#1

TANK N425:

Volume (cu.m) = 0.004447

	Pressure (mm Hg)	Temp.(K)
Presampling	43.2	299.8
Postsampling	678.2	299.8
Lab receipt	702.0	297.2
Final	1271.0	297.2
Barometric	741.7	299.8
Water Vapor	26.2	299.8

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.044

Volume Sampled (dscm) = 0.003633

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	452	484	467
CH4	14,666,060	14,704,300	14,716,340
CO2	15,713,370	15,872,140	15,926,490
Noncondensibles	233,381	239,779	247,906

Concentrations (ppmC):

		%RSD
CO	2.1318	9.3811
CH4	188511.2000	0.1786
CO2	199610.5000	0.6992
Noncondensibles	3182.6790	3.0287
TGNMO	3182.6790	

(= 1589.1120 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 2 SL-GF-IN-#2

TANK N128:
Volume (cu.m) = 0.004536

	Pressure (mm Hg)	Temp.(K)
Presampling	94.0	298.2
Postsampling	678.2	297.6
Lab receipt	688.0	297.2
Final	1335.0	297.2
Barometric	741.7	297.6
Water Vapor	23.0	297.6

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.016

Volume Sampled (dscm) = 0.003435

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	407	424	421
CH4	14,312,710	14,363,810	14,360,350
CO2	15,096,580	15,241,360	15,267,250
Noncondensibles	193,522	203,250	199,701

Concentrations (ppmC):		%RSD
CO	1.6952	7.5405
CH4	207548.2000	0.1991
CO2	216094.2000	0.6050
Noncondensibles	2969.3220	2.4760
TGNMO	2969.3220	

(= 1482.5820 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 3 SL-GF-IN-#3

TANK N345:
Volume (cu.m) = 0.004521

	Pressure (mm Hg)	Temp.(K)
Presampling	81.3	297.0
Postsampling	665.5	297.0
Lab receipt	705.0	297.2
Final	1795.0	297.2
Barometric	741.7	297.0
Water Vapor	22.2	297.0

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.059

Volume Sampled (dscm) = 0.003430

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	324	322	331
CH4	13,431,600	13,477,370	13,492,400
CO2	13,377,480	13,497,550	13,548,160
Noncondensibles	165,712	166,936	167,339

Concentrations (ppmC):		%RSD
CO	0.5416	16.4854
CH4	261272.1000	0.2352
CO2	256849.1000	0.6506
Noncondensibles	3337.6740	0.5084
TGNMO	3337.6740	

(= 1666.5010 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 4 SL-GF-IN-#4

TANK N094:
Volume (cu.m) = 0.004569

	Pressure (mm Hg)	Temp.(K)
Presampling	68.6	294.3
Postsampling	665.5	293.7
Lab receipt	701.0	297.2
Final	1800.0	297.2
Barometric	741.7	293.7
Water Vapor	18.1	293.7

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.041

Volume Sampled (dscm) = 0.003582

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	336	318	297
CH4	13,431,120	13,477,510	13,474,910
CO2	13,391,840	13,503,100	13,574,470
Noncondensibles	161,190	167,857	165,390

Concentrations (ppmC):

		%RSD
CO	0.3645	97.5961
CH4	251945.2000	0.1937
CO2	248072.9000	0.6823
Noncondensibles	3184.2050	2.0453
TGNMO	3184.2050	

(= 1589.8740 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 5 SL-GF-OUT-#1

TANK N042:
Volume (cu.m) = 0.004562

	Pressure (mm Hg)	Temp.(K)
Presampling	30.5	299.8
Postsampling	678.2	299.8
Lab receipt	709.0	297.2
Final	1246.0	297.2
Barometric	741.7	299.8
Water Vapor	26.2	299.8

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.055

Volume Sampled (dscm) = 0.003801

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	5,455	5,454	5,440
CH4	0	0	0
CO2	6,385,364	6,482,302	6,489,671
Noncondensibles	0	0	0

Concentrations (ppmC):		%RSD
CO	61.8588	0.1628
CH4	0.0000	0.0000
CO2	78162.4100	0.9022
Noncondensibles	0.0000	0.0000
TGNMO	0.0000	

(= 0.0000 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 6 SL-GF-OUT-#2

TANK N043:
Volume (cu.m) = 0.004552

	Pressure (mm Hg)	Temp.(K)
Presampling	30.5	298.2
Postsampling	678.2	298.2
Lab receipt	722.0	297.2
Final	1301.0	297.2
Barometric	741.7	298.2
Water Vapor	23.8	298.2

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.068

Volume Sampled (dscm) = 0.003814

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	1,659	1,678	1,613
CH4	0	0	0
CO2	6,342,970	6,341,684	6,403,113
Noncondensibles	0	0	0

Concentrations (ppmC):

		%RSD
CO	16.8094	2.4702
CH4	0.0000	0.0000
CO2	79761.1500	0.5517
Noncondensibles	0.0000	0.0000
TGNMO	0.0000	

(= 0.0000 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL ID #93102 Date: 9/16/93

Sample # 7 SL-GF-OUT-#3

TANK N422:
Volume (cu.m) = 0.004462

	Pressure (mm Hg)	Temp.(K)
Presampling	30.5	297.0
Postsampling	678.2	297.0
Lab receipt	728.0	297.2
Final	1287.0	297.2
Barometric	741.7	297.0
Water Vapor	22.2	297.0

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.073

Volume Sampled (dscm) = 0.003753

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	1,697	1,631	1,613
CH4	0	0	0
CO2	6,477,348	6,485,720	6,403,113
Noncondensibles	0	0	0

Concentrations (ppmC):		%RSD
CO	16.4930	3.2761
CH4	0.0000	0.0000
CO2	79578.0200	0.7044
Noncondensibles	0.0000	0.0000
TGNMO	0.0000	

(= 0.0000 mgC/cu.m)

TRIANGLE ENVIRONMENTAL SERVICES, INC.

METHOD 25-C DATA REPORT

Name: CHESTER ENVIRONMENTAL

ID #93102 Date: 9/16/93

Sample # 8 SL-GF-OUT-#4

TANK N434:

Volume (cu.m) = 0.004436

	Pressure (mm Hg)	Temp.(K)
Presampling	55.9	294.3
Postsampling	678.2	294.3
Lab receipt	728.0	297.2
Final	1359.0	297.2
Barometric	741.7	294.3
Water Vapor	18.8	294.3

Field and laboratory postsampling pressure-temperature comparison

Initial laboratory ratio (P/T) / Final field ratio (P/T) 1.063

Volume Sampled (dscm) = 0.003618

Calibration Data:

	CO	CH4	CO2	NMO
Response Factor (area units/ppmC)	167.6	163.2	166.1	158.1
CO Blank (area units)	297			

Areas:

CO	1,157	1,180	1,146
CH4	0	0	0
CO2	5,989,215	6,064,521	6,068,788
Noncondensibles	0	0	0

Concentrations (ppmC):

		%RSD
CO	11.4384	2.0080
CH4	0.0000	0.0000
CO2	80696.5500	0.7410
Noncondensibles	0.0000	0.0000
TGNMO	0.0000	

(= 0.0000 mgC/cu.m)

KEYSTONE ENVIRONMENTAL RESOURCES
AIR QUALITY ENGINEERING
CHAIN OF CUSTODY RECORD

PROJECT NUMBER	398830.01
PROJECT NAME	Seneca Land Fill
ANALYTICAL LAB	Triangle Environmental Svc
DELIVER TO	Triangle Environmental Svc
COMMENTS	

ANALYSES TO BE CONDUCTED

SAMPLE IDENTIFICATION NUMBER	SAMPLE COLL. DATE	SAMPLE COLL. TIME	COMP	GRAB	NO. OF CONTAINERS	METHOD 3SC NMHC-CH4-CO-CO2								REMARKS OR OBSERVATIONS
SL-GF-IN-1	9-8-93	15:55		✓	1	✓								TANK # 425
SL-GF-IN-2		17:10		✓	1	✓								# 128
SL-GF-IN-3		18:10		✓	1	✓								# 345
SL-GF-IN-4		19:10		✓	1	✓								# ~~245~~ 94ws
SL-GF-OUT-1		15:55		✓	1	✓								# 42
SL-GF-OUT-2		17:10		✓	1	✓								# 43
SL-GF-OUT-3		18:10		✓	1	✓								# 422
SL-GF-OUT-4		19:10		✓	1	✓								# 434

Triangle Environmental Tank # Identification

(OUT: Outlet Flare Sample Site
IN: Inlet Flare Sample Site)

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
[signature]	9-7-93	10:00AM	[signature]	9/10/93	1:00

COMP = Composite Sample
GRAB = Grab Sample

AQE 9/92

Seneca Landfill Grund Flare
NO_x Calculations

Sample I.D.	NO_3^- Concentration (µg/mL)	mass of NO_2 in sample (µg)*
SL-OUT-1	0.20	742
SL-OUT-2	0.22	816
SL-OUT-3	0.16	594
SL-NOX-BLANK	<0.1	—
AUDIT SAMPLE 3Q4078	3.63	6733 +

corrected metered gas volume (dcf)	meter temp (°F)	meter pressure (in Hg)	corrected metered gas volume (dscm)**
1.076	83	29.00	0.0287
1.018	88	29.00	0.0269
1.051	91	29.00	0.0276
—	—	—	—
—	—	—	0.008

NO_2 Concentration (mg/dscm)	(ppmv)***
25.9	13.5
30.3	15.9
21.5	11.2
—	—
841.6	—

per EPA Method 7D

$$* \frac{\mu g\ NO_3^-}{mL} \times 250\,mL \times \frac{1000\,mL}{50\,mL} \times \frac{46.01\,\mu g\ NO_2}{62.01\,\mu g\ NO_3^-} + \frac{500\,mL}{50\,mL}$$

$$** \text{corrected metered gas volume (dcf)} \times \frac{29.00\ in\ Hg}{29.92\ in\ Hg} \times \frac{(68+460)^\circ R}{(\text{meter temp} + 460)^\circ R} \times \frac{0.02832\ dcm}{1\ dcf}$$

*** 1.912 mg/dscm = 1 ppmv for NO_2

STACK SAMPLING DATA SHEET

CLIENT SENECA LANDFILL | TEST DATE 06-08-93 | ORIFICE CORRECTION 0.5 LPM | HOT BOX NO. 6
TEST UNIT GROUND FLARE | TEST NO. SL-OUT-1 | METER CORRECTION 0.9889 | COLD BOX NO. 6
PROJECT NO. 398830-01 | NOZZLE (SIZE,#) — | CALIBRATION DATE 05-10-93 | PROBE NO. SS LINER
CONTROL BOX OPERATOR RIC | STATIC PRESSURE — | PITOT CORRECTION 1.0 | FILTER NO. BYPASS
BAROMETRIC PRESSURE 29.0 | PORT DIRECTION SOUTH | CONTROL BOX NO. DGM 0290322 | STACK DIA. 6

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	04/min Orifice: Req'd. (in. H2O)	04/min Orifice: Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
31"	10:34	910.410		5.26 521	498	80	80	2.0	1600		75		60 MM/PT
				529 520	500	80	80	2.0	1600		75		
				521 520	521	80	80	2.0	1660		78		
				529 500	520	82	83	2.0	1599		78		
				570 500	500	82	82	2.0	1600		75		
				490 478	479	83	83	2.5	1598		76		
				500 520	500	83	83	2.5	1600		76		
				540 542	500	84	84	2.5	1600		77		
				534 530	550	85	85	2.5	1605		79		
				551 543	550	86	86	2.5	1600		78		
				560 531	540	86	86	2.5	1600		80		
	11.34	911.498		500 501	500	87	87	2.5	1600		83		
						(Tamb) Avg = 83°F			(Tstack) Avg = 1600°F				
	Δ =												Estimates:
	60	Δ =											MW=
	min	1.028 dcf		506.2		83.2		2.5	1600.2		77.6		%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	10.0	0.1 cc/min
After	3.0	11 cc/min

<2 % of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	~~9.0~~	9.0
O2	10.5	10.5
CO		
N2		

↑ evacuated canister

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	200 mL KMnO4	554.3	552.8	1.5
2.	200 mL KMnO4	519.5	518.1	1.4
3.	200 mL KMnO4	523.3	522.5	0.8
4.	200g Silica Gel	655.6	654.3	1.3
5.				

3.7g

5.0g total

Actual Moisture = 18.9%

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

CLIENT SENECA LANDFILL | TEST DATE 06-07-93 | ORIFICE CORRECTION Ø.5LPM | HOT BOX NO. 5
TEST UNIT GROUND FLARE | TEST NO. SL-OUT-#2 | METER CORRECTION Ø.9889 | COLD BOX NO. 5
PROJECT NO. 398830-01 | NOZZLE (SIZE,#) — | CALIBRATION DATE 05-10-93 | PROBE NO. SS LINER
CONTROL BOX OPERATOR RPC | STATIC PRESSURE — | PITOT CORRECTION 1.0 | FILTER NO. BYPASS
BAROMETRIC PRESSURE 29.0 | PORT DIRECTION SOUTH | CONTROL BOX NO. 16m #1029032 | STACK DIA. 6'

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pilot ΔP (in. H2O)	Orifice ΔH Req'd. (in. H2O)	Orifice ΔH Act. (in. H2O)	Meter Temperature In (°F)	Meter Temperature Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
34"	11:56	911.546		540 540	521	82	82	2.0	1600		80		6m.2/PT
				480 470	465	86	86	2.5	1605		81		
				515 511	510	87	87	2.5	1603		79		
				510 511	500	89	89	2.5	1603		77		
				505 511	516	89	89	2.5	1601		77		
				505 511	516	89	90	2.5	1604		77		
				490 491	489	88	88	2.5	1605		80		
				500 500	500	88	88	2.5	1602		81		
				521 520	536	88	88	2.5	1600		81		
				510 500	500	89	89	2.5	1603		83		
				510 511	516	90	90	2.5	1603		84		
	12:56	912.575		490 481	491	90	90	2.5	1600		83		
						(Tmeter)Avg = 88°F			(Tstack)Avg = 1602°F				
	Δ = 60												
	min	Δ =											Estimates:
		1.029 dcf		505.9		~~87.9~~		2.5			80.2		MW=
													%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	10.0	0 cc/min
After	3.0	0 cc/min

< 2% of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	~~one Sample~~	90
O2	10.5	10.6
CO		
N2		

↑ evacuated canister

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	200mL KMnO4	517.5	515.6	0.9
2.	200mL KMnO4	523.3	521.8	1.5
3.	200mL KMnO4	517.7	517.0	0.9
4.	200g Silica Gel	651.4	650.4	1.0
5.				

3.3g

4.3g total

Actual Moisture = 17.6%

AQE 2/92

KEYSTONE ENVIRONMENTAL RESOURCES, INC.

STACK SAMPLING DATA SHEET

CLIENT Seneca Landfill	TEST DATE 06-07-93	ORIFICE CORRECTION Ø.5 LPM	HOT BOX NO. 2
TEST UNIT Ground Flare	TEST NO. SL-OUT-#3	METER CORRECTION Ø.9889	COLD BOX NO. 2
PROJECT NO. 398830-01	NOZZLE (SIZE,#) —	CALIBRATION DATE 05-10-93	PROBE NO. SS Linea
CONTROL BOX OPERATOR RPC	STATIC PRESSURE —	PITOT CORRECTION Standard	FILTER NO. B/PASS
BAROMETRIC PRESSURE 29.0	PORT DIRECTION South	CONTROL BOX NO. Dgm # 102903.2	STACK DIA. 6'

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	cc/min Orifice ~~ΔH~~ Req'd. (in. H2O)	Act. (in. H2O)	Meter Temperature In (°F)	Out (°F)	Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F)	Impinger Temp. (°C/°F)	Hot Box Temp. (°F)	Comments
	13:13	912.585		512 500	502	92	92	2.0	1600		73		60 min/pt
				515 510	506	92	92	2.0	1600		73		
				450 450	460	92	92	2.5	1600		74		
				520 502	506	92	92	2.5	1601		74		
				506 509	519	92	92	2.5	1602		75		
				509 521	520	92	92	2.5	1603		75		
				513 512	506	90	90	2.5	1600		75		
				529 511	511	89	89	2.5	1601		75		
				530 469	505	89	89	2.5	1604		75		
				506 510	486	89	89	2.5	1599		77		
				510 516	498	90	90	2.5	1599		79		
	14:13	913.648		511 516	490	90	90	2.5	1597		82		
	Δ = 60 min	Δ = 1.063 dcf				$(T_{meter})_{AVG}$ = 91°F			$(T_{stack})_{AVG}$ = 1601°F				Estimates:
													MW=
				504.1		~~90.8~~		2.5	~~1600.5~~		75.6		%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	10.0	0.0 cc/min
After	3.0	0.0 cc/min

↑ < 2% of average flow rate

PITOT LEAK CHECK

	Positive	Negative
Before		
After		

	1	2
CO2	~~OFF~~	~~SCALE~~ 9.0
O2	105	105
CO		
N2		

↑ evacuated canister

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	200mL KMnO4	502.5	500.8	1.3
2.	200mL KMnO4	519.1	518.0	1.1
3.	200mL KMnO4	509.8	508.5	1.3
4.	200g Silica Gel	643.7	642.8	0.9
5.				

3.7

4.6g total

Actual Moisture = 18.2%

KEYSTONE ENVIRONMENTAL RESOURCES, INC

AQE 2/92

DRY GAS METER CALIBRATION

THREE POINT CALIBRATION

SERIAL 1029032 BP 29.05 RATE .5 LPM
DATE 05-10-93 OPERATOR RPC

	WET TEST METER				DRY TEST METER					
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD	METER CORRECTY
START			0.000	29.05				0.00	906.652	
HALF		84.0			85.0	85.0	85.0			
STOP	58.08		1.000						907.672	
CALCULATION	58.08	544.0	1.003	29.05			545.0	29.05	1.020	0.9846
START			0.000	29.05				0.00	907.780	
HALF		86.0			86.0	86.0	86.0			
STOP	58.17		1.000						908.799	
CALCULATION	58.17	546.0	1.003	29.05			546.0	29.05	1.019	0.9838
START			0.000	29.05				0.00	908.900	
HALF		89.0			91.0	91.0	91.0			
STOP	57.97		1.000						909.908	
CALCULATION	57.97	549.0	1.003	29.05			551.0	29.05	1.008	0.9982
AVERAGE										0.9889

POST TEST

SERIAL 1029032 BP 28.95 RATE .5 LPM
DATE 06-09-93 OPERATOR RPC

	WET TEST METER				DRY TEST METER					
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD	METER CORRECTY
START			0.000	28.95				0.00	915.500	
HALF		82.0			91.0	91.0	91.0			
STOP	58.00		1.000						916.520	
CALCULATION	58.00	542.0	1.003	28.95			551.0	28.95	1.020	0.9992
START			0.000	28.95				0.00	916.550	
HALF		83.0			92.0	92.0	92.0			
STOP	57.97		1.000						917.571	
CALCULATION	57.97	543.0	1.003	28.95			552.0	28.95	1.021	0.9982
START			0.000	28.95				0.00	917.600	
HALF		83.0			92.0	92.0	92.0			
STOP	58.08		1.000						918.616	
CALCULATION	58.08	543.0	1.003	28.95			552.0	28.95	1.016	1.0031
AVERAGE										1.0001
DIFFERENCE										-1.13%

RJ LeeGroup, Inc.

350 Hochberg Road • Monroeville, PA 15146
412/325-1776 • FAX 412/733-1799

June 30, 1993

Mr. Patrick Stockton
Chester Environmental, Inc.
Air & Hazardous Waste Management
3000 Tech Center Drive
Monroeville, PA 15146

RE: RJ Lee Group Project No. INH306169
Chester Environmental Project No. 398830-01
Chester Environmental Purchase Order No. B-7185

Dear Pat:

Enclosed are the results of the nitrate analysis on the above-referenced samples.

The samples were analyzed by ion chromatography (Dionex 2120i) for nitrate.

The results are reported in the enclosed Table I as total mg nitrate according to the volumes provided by you. The detection limit for this analysis is 0.1 ppm in solution. Duplicate analysis of the same solutions indicates a precision of ± 5%.

These results are submitted pursuant to RJ Lee Group's current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions. No responsibility or liability is assumed for the manner in which the results are used or interpreted. Unless notified in writing to return the samples covered by this report, RJ Lee Group will store the samples for a period of thirty (30) days before discarding. A shipping and handling fee will be assessed for the return of any samples.

If you have any questions about this report, or if I can be of further assistance, please let me know.

Sincerely,

Kimberly S. DiNatale

Kimberly S. DiNatale
Supervisor, Inorganic Chemistry

KSD/dcd
Enclosure

KEYSTONE ENVIRONMENTAL RESOURCES, INC.
AIR QUALITY ENGINEERING

CHAIN OF CUSTODY RECORD

Page 1 of 1

PROJECT NUMBER	600708-01-SO4+CCSEM Analysis only
PROJECT NAME	CLR SL=>398830-01-NO3 Analysis.
ANALYTICAL LAB	R.J. Lee Group, Inc.
DELIVER TO	
COMMENTS	

SAMPLE IDENTIFICATION NUMBER	SAMPLE COLLECTION DATE	SAMPLE COLLECTION TIME	COMP	GRAB	NO. OF CONTAINERS	SO4 by Ion Chromatography	CCSEM Scan	NO3 by I.C.	REMARKS OR OBSERVATIONS
CLR-SIS-1	6/2/93		✓		1	✓			Impinger H2O Total Vol. 100ml
CLR-SIS-2	6/2/93		✓		1	✓			Impinger H2O Total Vol. 100ml
CLR-SIS-3	6/3/93		✓		1	✓			Impinger H2O Total Vol. 100ml ½ Filter
CLR-SIS-1	6/2/93		✓		1	✓			Filter #1026 Total Vol. 100ml
CLR-SIS-2	6/2/93		✓		1	✓			Filter #1024 Total Vol. 100ml
CLR-SIS-3	6/3/93		✓		1	✓			Filter #1030 Total Vol. 100ml
CLR-SO4-BLANK	6/16/93			✓	1	✓			Total Vol. 100ml
CLR-SIS-1	6/2/93		✓		1		✓		Front-half-H2O } Combine
CLR-SIS-1	6/2/93		✓		1		✓		Front-half-Acetone }
CLR-SIS-1	6/2/93		✓		1		✓		Filter #1026
SL-OUT-1	6/7/93		✓		1			✓	Total Vol. 250ml Original Vol. 1L
SL-OUT-2	6/7/93		✓		1			✓	Total Vol. 250ml } THEN 50ml
SL-OUT-3	6/7/93		✓		1			✓	Total Vol. 250ml } DILUTED TO
SL-NOX-BLANK	6/7/93			✓	1			✓	Total Vol. 250ml } 250ml
Audit Spl. 804078				✓	1			✓	Total Vol. 250ml → Original Vol. 50ml diluted To 250ml

Relinquished by (Signature)	Date	Time	Received by (Signature)	Date	Time
Patrick J. Hockton	6/17/93				

COMP = Composite Sample
GRAB = Grab Sample

AQE 7/92

Table I

RJ Lee Group Project No. INH306169
For: Chester Environmental, Inc.

NITRATE ANALYSIS

Chester Environmental Identification	RJ Lee Group Sample No.	ppm NO_3	Volume (ml)	Total mg SO_4	Analytical Method
SL-OUT-1	110019	0.20	250	0.050	IC
SL-OUT-2	110020	0.22	250	0.055	IC
SL-OUT-3	110021	0.16	250	0.040	IC
SL-NOX-Blank	110022	<0.1	250	<0.025	IC
AUDIT SPL. B04078	110023	3.63	250	0.908	IC

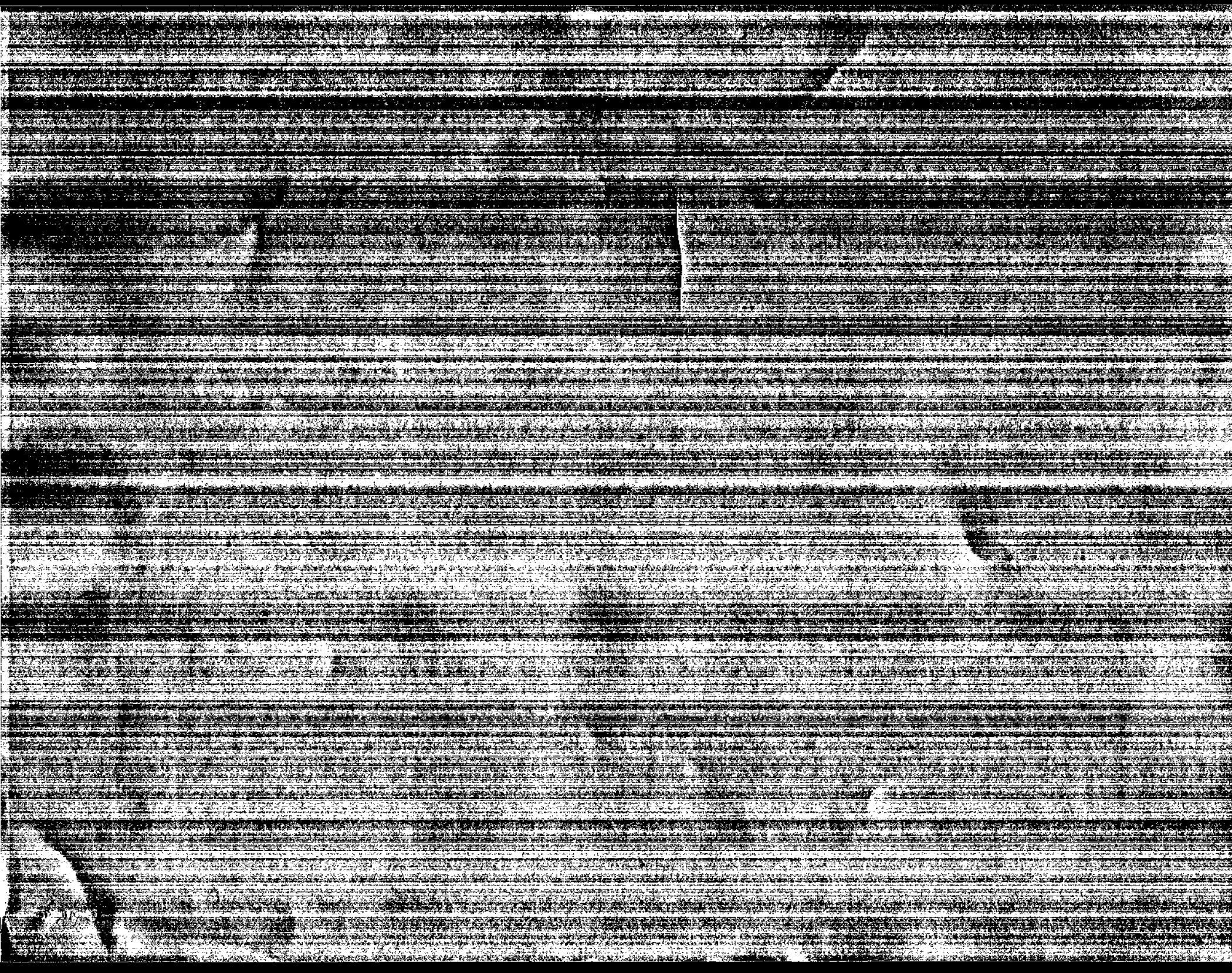
IC Ion Chromatography

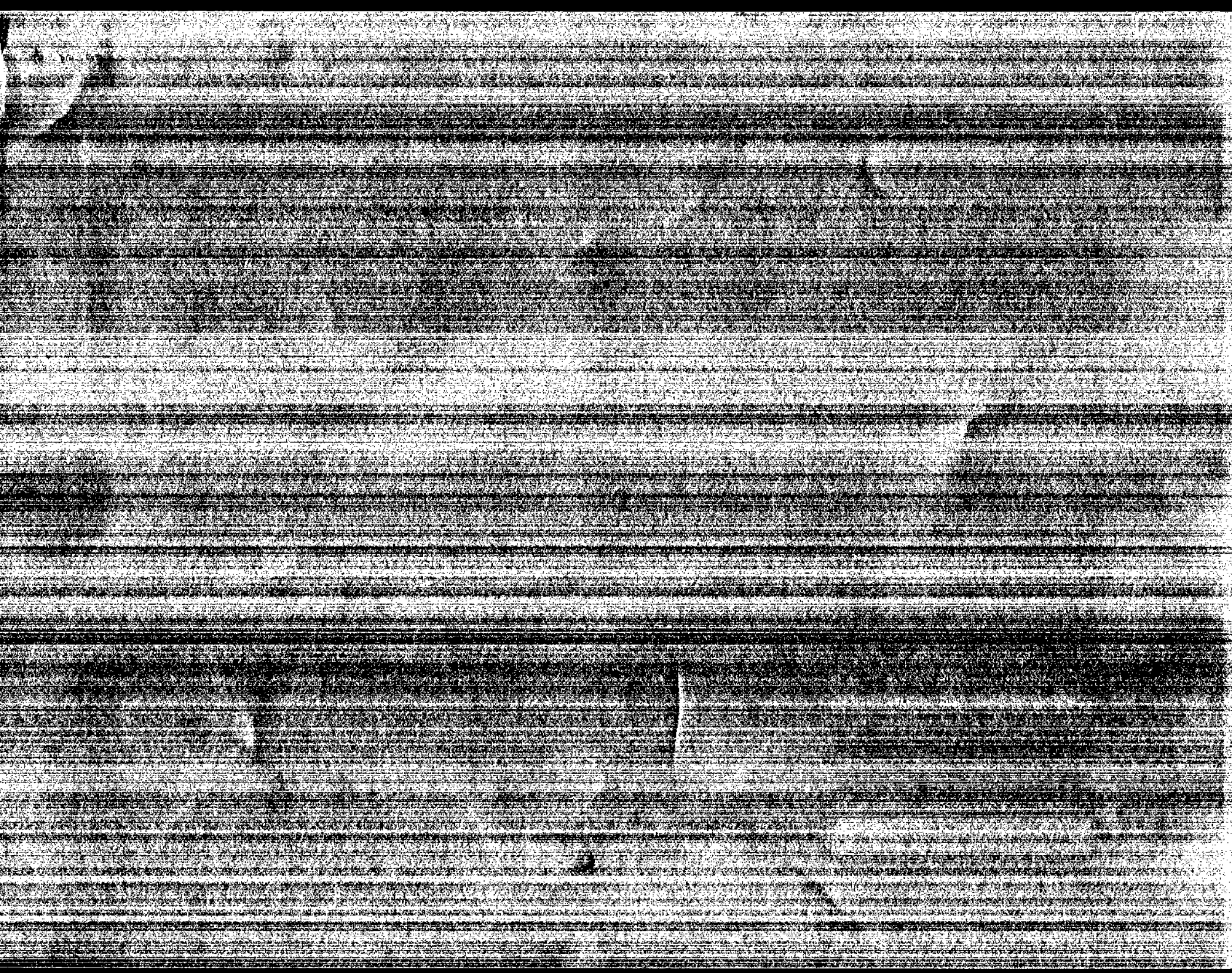
Authorized Signature Kimberly S. Watrel
Date 7/11/93

RJ Lee Group, Inc.
Headquarters

350 Hochberg Road
Monroeville, PA 15146

(412) 325-1776
FAX (412) 733-1799





APPENDIX D

FLARE OPERATING DATA

SENECA LANDFILL, INC.

P.O. Box 847
Mars, PA 16046
412/625-1511

October 11, 1993

Mr. Michael Steele
Chester Environmental
3000 Tech Center Drive
Monroeville, PA 15146

Dear Mr. Steele:

Enclosed is a copy of the recording chart from the ground flare at Seneca Landfill for the day Chester Environmental accomplished the flare test. The line on the chart represents 1600° F.

The flare stack is thirty (30) feet high and six (6) feet in diameter. The flame is positioned five (5) feet above the ground. This would leave twenty-five (25) feet for the combustion chamber. Therefore, there is approximately 706.8 cubic feet of space in the combustion chamber.

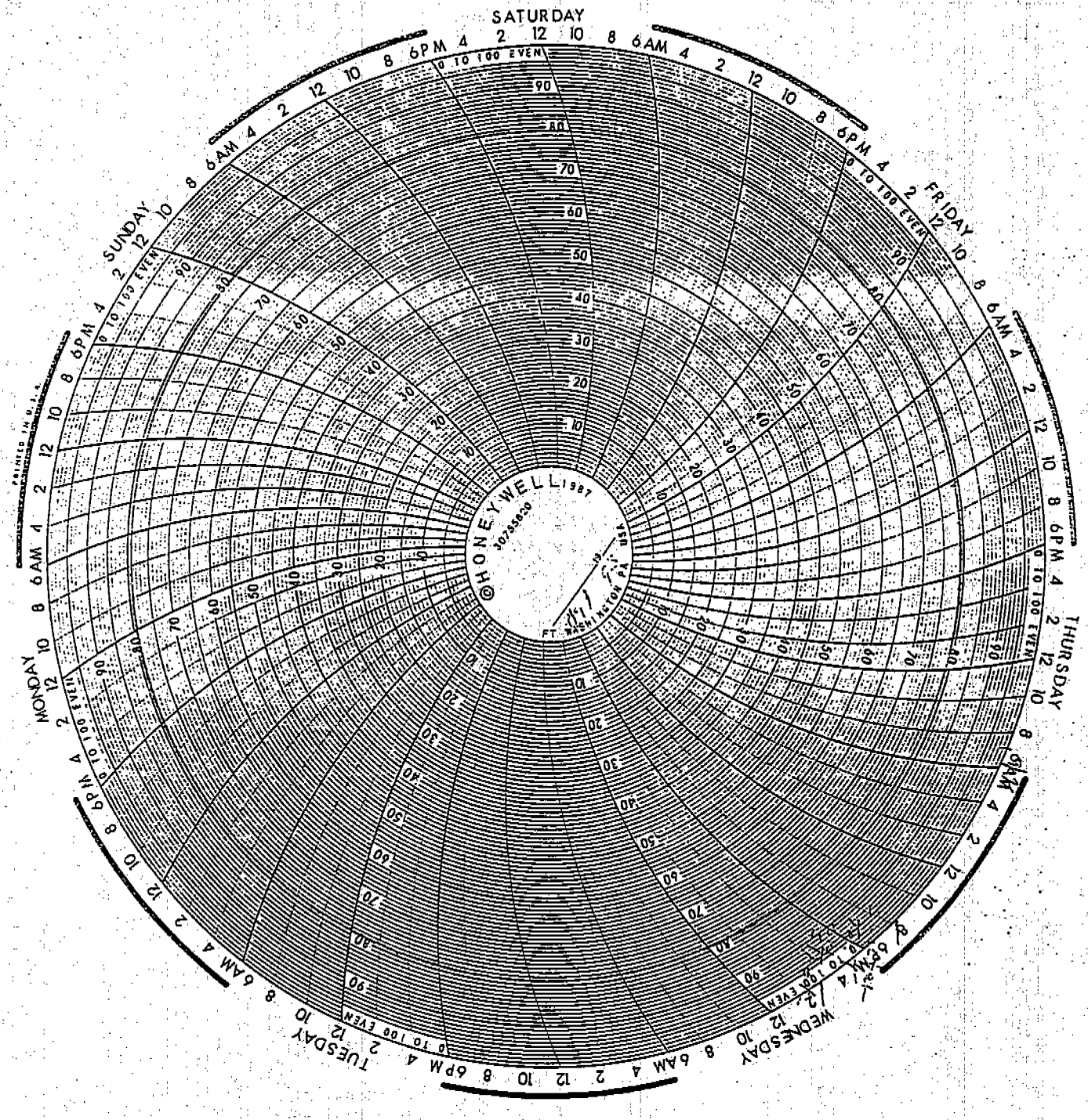
We must apply for permanent operating status by the end of October. I would appreciate having the final report in my hands next week.

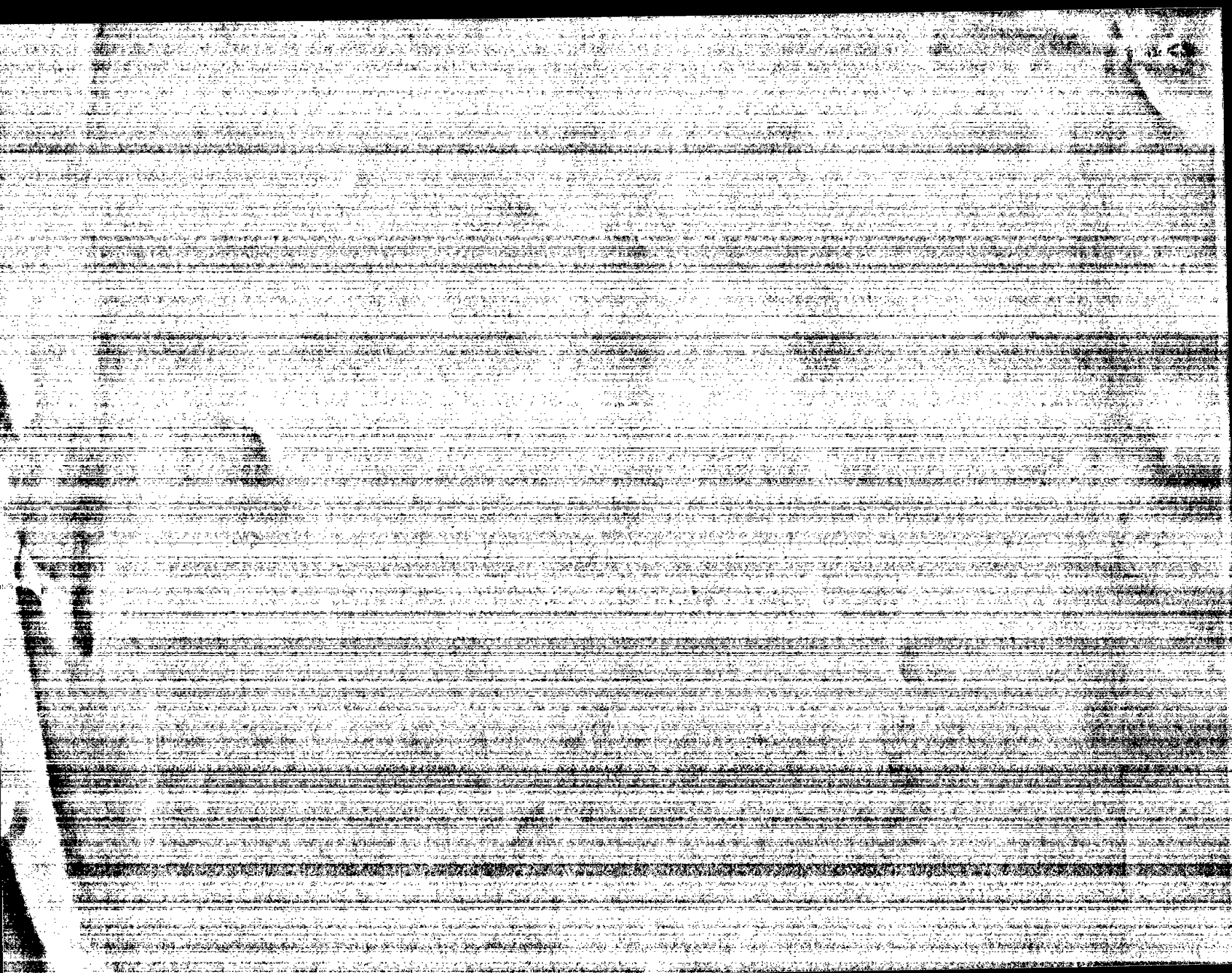
If you require further information, please contact me.

Sincerely,
SENECA LANDFILL, INC.

J. David Newcomer

J. David Newcomer, P.E., L.S.


SATURDAY
FRIDAY
THURSDAY
WEDNESDAY
TUESDAY
MONDAY
SUNDAY
0 TO 100 EVEN
HONEYWELL 1987
30755820
FT. WASHINGTON PA USA
PRINTED IN U.S.A.



APPENDIX E

EXAMPLE CALCULATIONS

EXAMPLE CALCULATIONS - Seneca Landfill Inc. - Run 1

1. Dry Standard Meter Volume, Vstd

$$Vstd = [(Vm) \times (DGMCF) \times [(Tstd) / (Tm + 460)] \times (Pbar + Delta H / 13.6) / (Pstd)] \text{ in Hg}]$$

Where:
- Vm = Volume of Gas Sampled (ft^3)
- DGMCF = Dry Gas Meter Correction Factor
- Tstd = Standard Temperature, 528 (deg R)
- Tm = Average Meter Temperature (deg R)
- Pbar = Barometric Pressure at Meter (in Hg)
- Pstd = Standard Pressure, 29.92 (in Hg)

Run 1

$$Vstd = [(33.625 \text{ ft^3}) \times (1.0151) \times [(528 \text{ deg R}) / (101.0 + 460 \text{ deg R})] \times (29.20 \text{ in Hg} + 2.0 / 13.6) / (29.92 \text{ in Hg})] \text{ in Hg}]$$

Vstd = 31.50 ft^3

2. Volume of Water Vapor, Vm

$$Vm = [(Cw) \times (0.04707)]$$

Where: Cw = Weight of Condensed Water Vapor (g)

Run 1

$$Vm = [(32.8 \text{ g}) \times (0.04707 \text{ ft^3/g})] = 1.54 \text{ ft^3}$$

3. Flue Gas Moisture, BWS

$$BWS = [[Vw) / (Vw) + (Vstd)] \times (100)]$$

Run 1

$$BWS = [[1.54 \text{ ft^3}) / (1.54 \text{ ft^3}) + (31.50 \text{ ft^3})] \times (100)] = 4.67 \%$$

4. Gas Molecular Weight (wet), Ms

$$Ms = [[(0.44) \times (\%CO2)] + [(0.32) \times (\%O2)] + [(0.16) \times (\%CH4)] + [(0.28) \times (100 - \%CO2 - \%O2 - \%CH4)]] \times (1 - BWS) + (18) \times (BWS)$$

Where:
- %CO2 = Carbon Dioxide Concentration, (%)
- %O2 = Oxygen Concentration, (%)
- %CH4 = Methane Concentration, (%)

Run 1

$$Ms = [[(0.44) \times (20.0)] + [(0.32) \times (3.3)] + [(0.16) \times (18.9)] + [(0.28) \times (100 - 20.0 - 3.3 - 18.9)]] \times (1 - 0.0467) + (18) \times (0.0467)$$

Ms = 28.55

EXAMPLE CALCULATIONS - SENECA LANDFILL INC. - RUN 1

5. Absolute Stack Pressure

Ps = [(Pbar) + (Pstat / 13.6)]

Where: Pbar = Barometric Pressure at Meter (in Hg)
Pstat = Static Pressure of Stack (in H2O)

Run 1

Ps = [(29.20 in Hg) + (2.05 in H2O / 13.6in H2O/in Hg)] = 29.35 in Hg

6. Average Gas Velocity

$$Vs = (K1) \times (Cp) \times (dP) \times \left[\left(\frac{Ts}{Ps} + 460 \right) \times \left(\frac{}{Ms} \right) \right]$$

Where: K1 = $85.49 \dfrac{\text{ft}}{\text{sec}} \left[\left(\dfrac{\text{lb/lb-mole}}{\text{deg R}} \right) \times \left(\dfrac{\text{in Hg}}{\text{in H2O}} \right) \right]^{1/2}$

Cp = Pitot Tube Correction Factor
dP = Average of Square Root Delta P Values (in H2O) ^ 1/2
Ts = Stack Temperature (deg R)
Ms = Gas Molecular Weight (wet)
Ps = Absolute Stack Pressure (in Hg)

Run 1

$$Vs = (85.49) \times (1.00) \times (0.4578 \text{ in H2O}) \times \left[\left(\frac{101.0}{29.35 \text{ in Hg}} + 460 \text{ deg R} \right) \times \left(\frac{}{28.55 \text{ lb/lb-mole}} \right) \right]^{1/2}$$

Vs = 31.62 ft/sec

7. Average Flue Gas Flow at Stack Conditions, Qa - INLET

Qa = (As) x (Vs) x (60)

Where: As = Cross-Sectional Area of Duct (ft^2) = Pi x Stack Radius Squared
Vs = Average Gas Velocity, ft/sec

Run 1

Qa = (0.349 ft^2) x (31.62 ft/sec) x (60 sec/min) ACFM

Qa = 663 ft^3/min

8. Average Flue Gas Flow at Standard Conditions, Qs - INLET

$$Qs = [(Qa) \times \left(\frac{Ps}{[(Ts + 460) \times (Tstd)]} \right) \times \left(\frac{}{Pstd} \right) \times (1 - BWS)]$$

Run 1

$$Qs = [(663 \text{ ft^3/min}) \times \left(\frac{29.35 \text{ in Hg}}{[(101.0 + 460 \text{ deg R}) \times (528 \text{ deg R})]} \right) \times \left(\frac{}{29.92 \text{ in Hg}} \right) \times (1 - 0.0467)]$$

Qs = 598 ft^3/min

EXAMPLE CALCULATIONS - SENECA LANDFILL INC. - RUN 1

9. AVERAGE FLUE GAS FLOW AT STANDARD CONDITIONS, Q_s - OUTLET (CARBON BALANCE)

$$Q_s(\text{OUTLET}) = Q_s(\text{INLET}) \times \frac{(\text{ppmv } CO_2 + \text{ppmv } CH_4 + \text{ppmv CO} + \text{ppmv NHHC})_{\text{INLET}}}{(\text{ppmv } CO_2 + \text{ppmv } CH_4 + \text{ppmv CO} + \text{ppmv NHHC})_{\text{OUTLET}}}$$

RUN 1

$$Q_s(\text{OUTLET}) = 598 \frac{ft^3}{\text{min}} \times \frac{(199610 \text{ ppmv} + 188511 \text{ ppmv} + 2 \text{ ppmv} + 3183 \text{ ppmv})_{\text{INLET}}}{(78162 \text{ ppmv} + 0 \text{ ppmv} + 62 \text{ ppmv} + 0 \text{ ppmv})_{\text{OUTLET}}}$$

ALL ppmv VALUES EXPRESSED AS °CARBON.

$$Q_s(\text{OUTLET}) = 2{,}991 \frac{ft^3}{\text{min}}$$

10. AVERAGE FLUE GAS FLOW AT STACK CONDITIONS, Q_a - OUTLET

$$Q_a(\text{OUTLET}) = Q_s(\text{OUTLET}) \times \frac{P_{STD}}{T_{STD}} \times \frac{T_s}{P_s(B_p)}$$

RUN 1

$$Q_a(\text{OUTLET}) = 2{,}991 \frac{ft^3}{\text{min}} \times \frac{29.92 \text{ IN HG}}{528 \text{ °R}} \times \frac{1600 + 460 \text{ °R}}{29.20 \text{ IN HG}}$$

$$Q_a(\text{OUTLET} = 11{,}957 \frac{ft^3}{\text{min}}$$

11. MASS EMISSION RATE

$$\text{MASS EMISSION RATE (lb/hr)} = \text{CONCENTRATION (ppmv)} \times \frac{MW}{\text{g mole}} \times \underbrace{\frac{1}{10^6} \times \frac{\text{mole}}{24.04\text{L}} \times \frac{\text{lb}}{454\text{g}} \times \frac{28.32\text{L}}{ft^3}}_{1/3.851 \times 10^8} \times Q_s\left(\frac{ft^3}{\text{min}}\right) \times \frac{60 \text{ min}}{\text{hr}}$$

RUN 1 - NHHC INLET

$$\text{MASS EMISSION RATE} = 3183 \text{ ppmv} \times \frac{12}{3.851 \times 10^8} \times 598 \frac{ft^3}{\text{min}} \times \frac{60 \text{ min}}{\text{hr}}$$

$$= 3.56 \text{ lb/hr}$$

ALL OTHER MASS EMISSION RATES ARE CALCULATED IN AN IDENTICAL MANNER USING APPROPRIATE MOLECULAR WEIGHTS.

EXAMPLE CALCULATIONS - SENECA LANDFILL, INC. - RUN 1

12. DESTRUCTION / REMOVAL EFFICIENCY, DRE

$$DRE = \frac{(\text{NMHC EMISSION RATE, INLET}) - (\text{NMHC EMISSION RATE, OUTLET})}{(\text{NMHC EMISSION RATE, INLET})} \times 100$$

RUN 1

$$DRE = \frac{(356\ \text{lb/hr}) - (<5.59 \times 10^{-4}\ \text{lb/hr})}{(356\ \text{lb/hr})} \times 100$$

$$DRE = > 99.98\ \%$$

13. RESIDENCE TIME, SEC

$$\text{RESIDENCE TIME} = \frac{\text{COMBUSTION CHAMBER VOLUME, } ft^3}{Q_A\text{(OUTLET)}, \frac{ft^3}{min} \times \frac{min}{60\ sec}}$$

RUN 1

$$\text{RESIDENCE TIME} = \frac{706.8\ ft^3}{11{,}957\ \frac{ft^3}{min} \times \frac{min}{60\ sec}} = 3.56\ \text{sec.}$$

NOTE: SOME VALUES MAY BE SLIGHTLY DIFFERENT WHEN CALCULATED BY HAND. THIS IS DUE TO ROUNDOFF DIFFERENCES FROM THE COMPUTER USED IN CALCULATIONS.

SMITH
ENVIRONMENTAL TECHNOLOGIES CORPORATION

Clinton Co., 4/96

April 25, 1996

Mr. John Twardowski
Air Pollution Control Engineer
Pennsylvania Department of Environmental Protection
Air Quality Control
208 West Third Street
Williamsport, PA 17701

Subject: Compliance Evaluation of the Enclosed Ground Flare and Leachate Process Vents
Operated by Clinton County Solid Waste Authority
Located in Wayne Township, Pennsylvania
-Final Report-
Smith Environmental Project No. 00-0798-01

Dear Mr. Twardowski:

Enclosed for your review, you will find a copy of the final report for the above-referenced compliance project. Please note that we have also provided a copy of the report to Mr. Timothy Brooks of the Pennsylvania Department of Environmental Protection in Harrisburg for his review.

If you have any questions regarding the report, please give me a call.

Very truly yours,

Philip C. Burg
Section Manager, Air Quality

Attachments
cc M. Crist, Cummings & Smith
T. Brooks, PADEP, Harrisburg
J. Woods, Smith Environmental
i:\air\client\ccswa\report.doc

One Plymouth Meeting • Plymouth Meeting, PA 19462 • (610) 825-3800 • fax (610) 834-8236

[redacted]

COMPLIANCE EMISSION INVENTORY
FOR THE
ENCLOSED LANDFILL GAS FLARE
AND
LEACHATE TREATMENT PROCESSMENTS

APRIL 1991

SMITH ENVIRONMENTAL PROJECT NO. [redacted]

SMITH

REPORT TO

CLINTON COUNTY SOLID WASTE AUTHORITY
McELHATTAN, PENNSYLVANIA

FOR
COMPLIANCE EMISSION DETERMINATION
OF THE
ENCLOSED LANDFILL GAS FLARE
AND
LEACHATE TREATMENT PROCESS VENTS

APRIL 1996

SMITH ENVIRONMENTAL PROJECT NO. 00-0798-01

PREPARED BY

PHILIP C. BURG
PROJECT MANAGER

REVIEWED BY

WILLIAM G. MURRAY, P.G.
DIRECTOR SITE INVESTIGATIONS

SMITH
ENVIRONMENTAL TECHNOLOGIES CORPORATION

Engineering • Consulting • Remediation • Construction

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EXECUTIVE SUMMARY

Clinton County Solid Waste Authority (CCSWA) operates a landfill gas flare and a leachate treatment facility at its Wayne Township facility located in McElhattan, Pennsylvania. According to Plan Approval No. 18-322-003, issued by the Pennsylvania Department of Environmental Protection (PADEP) for the processes, CCSWA was required to perform a compliance emission demonstration. The compliance demonstration was conducted by Smith Environmental Technologies Corp. (Smith Environmental), formerly BCM Engineers Inc., and included the following:

- Oxides of nitrogen (NO_X) emissions determination at the flare stack
- Destruction removal efficiency (DRE) determination of the flare for non-methane volatile organic compounds (NMVOC).
- NMVOC emissions determination at the exhaust vents of the Leachate Treatment Process Nos. 260 and 270

We used procedures outlined in U.S. Environmental Protection Agency (EPA) Reference Methods 7D and TO-12 for NO_x emissions and NMVOC testing respectively. Flare testing was performed with the landfill gas flare operating at the maximum possible rate achievable at the time, and with a minimum flare operating temperature of 1,500° F. Testing at the leachate treatment vents was conducted with the treatment facility at normal operating conditions.

The following table summarizes results of the testing program. Complete results are contained in Section 3.0 of this report.

TABLE 1

Test Result Summary(1)(2)(3)

Test Location	Emission Parameter	Test Result
Flare	NMVOC DRE	99.8% by weight
Flare	NO_X emissions	1.5 lb/hr
Leachate Vent No. 260	NMVOC emissions	30 ppmv
Leachate Vent No. 260	NMVOC emissions	6.7E-03 lb/hr
Leachate Vent No. 270	NMVOC emissions	22 ppmv
Leachate Vent No. 270	NMVOC emissions	7.0E-03 lb/hr

Notes: 1) Results represents averages of three test runs
2) NO_X emissions are express as NO_2
3) NMVOC emissions are expressed as methane

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According to the Plan Approval, the flare must achieve a minimum DRE for NMVOC of at least 98 percent by weight. No allowable NO_x limit for the flare or NMVOC limit for the leachate treatment vents are specified. Results of the testing program show that the flare met the required NMVOC DRE of the Plan Approval.

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1.0 SCOPE AND OBJECTIVES

The scope of the project was outlined in Smith Environmental's Protocol dated May 19, 1995 and in Cummings & Smith Inc.'s Protocol dated January 12, 1995. Appendix A of this report contains a copy of each protocol as well as copies of related correspondence. The objectives of the sampling program were to determine the following parameters:

- Gas flow - acfm and dscfm
- Gas temperature - °F
- Gas moisture content - percent by volume
- Gas molecular weight - lb/lb-mole
- NMVOC emissions - ppmv and lb/hr
- DRE of NMVOC - percent by weight (flare only)
- NO_x emissions - ppmv and lb/hr (flare outlet only)

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2.0 PROCEDURES

2.1 FIELD WORK

Field testing at the enclosed flare was conducted on April 2 and testing at the leachate treatment vents was conducted on April 3, 1996. The sampling team consisted of the following Smith Environmental personnel:

Philip C. Burg - Project Manager
John Woods - Scientist

Mr. Michael Crist of Cummings & Smith Inc. acted as liaison between CCSWA and Smith Environmental and assured operating conditions were suitable for testing. Mr. John Twardowski of the PADEP regional office located in Williamsport, Pennsylvania was present to witness a portion of the testing program.

Gas flow rate determinations and NO_x emission testing were conducted according to EPA Methods contained in 40 CFR 60, Appendix A. NMVOC testing was conducted according to U.S. Environmental Protection Agency (EPA) Method TO-12 of EPA/600/4-89/017, *Method for the Determination of Non-methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Preconcentration and Direct Flame Ionization Detection (PCFID).* Gas molecular weight was determined at the flare inlet and outlet by laboratory analyses of the TO-12 samples utilizing ASTM D1946. The following table summarizes all test methodologies.

Test Location	EPA Method	Emission Parameter
Flare inlet and leachate vents	1 and 2C	Gas flow rate and temperature
Flare outlet	1, 2 and 2B	Gas flow rate and temperature
Leachate vents	3	Gas molecular weight
Flare inlet and outlet	ASTM D1946	Gas molecular weight
All	4	Gas moisture content
Flare outlet	7D	Oxides of nitrogen (NO_x)
All	TO-12	NMVOC emissions

Description of the sampling procedures are presented in the test protocols included in Appendix A of this report. Appendix B contains a description of the sampling locations and all field data forms generated during the testing program.

2.2 ANALYTICAL METHODS

All samples generated during the NMVOC sampling were submitted to Quanterra Environmental Services located in City of Industry, California, for analysis. The EPA Method 7D NO_x samples were submitted to Quanterra Environmental Services located Knoxville, Tennessee. Analytical methodologies and laboratory data are contained in Appendix C.

2.3 CALCULATIONS

Descriptions of the calculations performed to determine test results are contained in Appendix C. Appendix C also lists equations and all reduced field data used to obtain test results.

2.4 EQUIPMENT CALIBRATION

In accordance with accepted procedures published by the EPA, calibration of all gas velocity measuring equipment, gas volume metering equipment, and temperature measuring equipment was conducted prior to the test program. Post test calibrations of the gas volume metering equipment were also conducted. Appendix D provides calibration data.

2.5 PROCESS OPERATING DATA

Enclosed flare and leachate process operating data recorded during the testing project are included in Appendix E.

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3.0 PROCESS DESCRIPTION

3.1 ENCLOSED FLARE

The enclosed landfill flare is designed to burn combustible landfill gases generated by the decomposition of organic material. A collection system in the landfill captures and routes the gases to the flare. A single 5.5-inch inside diameter (ID) duct delivers gas to the flare burners where combustion takes place. The inlet duct contains a fan, an *in situ* devise for measuring inlet gas flow rates, and a flame arrestor. The burners are completely enclosed by a circular stack, 30 feet from grade to outlet, designed to conceal the flame. Combustion air is provided to the burners by louvers located at the base of the stack. Flare temperatures are measured by a thermocouple located in the stack and are recorded on a circular strip chart.

Schematic drawings of the enclosed flare are included in the flare test protocol.

3.2 LEACHATE TREATMENT FACILITY

A description of the leachate treatment facility is included in the Cummings & Smith Protocol which is presented in Appendix A.

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4.0 TEST RESULTS

4.1 ENCLOSED FLARE GAS FLOW RATE DATA

Gas flow rate data determined at the enclosed flare inlet and outlet are presented in Table Nos. 2 and 3, respectively. Both tables contain flow rates determined by pitot traverses (EPA Method 2). In addition, Table No. 3 contains flare outlet gas flow rates determined by carbon mass balance (EPA Method 2B).

4.2 ENCLOSED FLARE NMVOC RESULTS

Results of the NMVOC testing conducted at the enclosed flare inlet and outlet are presented in Table 4. Included are the destruction removal efficiencies calculated for each test run. We utilized flare outlet gas flow rates determined by carbon mass balance (EPA 2B) to calculate pound per hour NMVOC emissions rates.

4.3 ENCLOSED FLARE OXIDES OF NITROGEN EMISSION RESULTS

Results of the NO_x emission testing conducted at the flare outlet are presented in Table 5. We calculated pound per hour emissions from outlet gas flow rates determined by carbon mass balance.

4.4 LEACHATE TREATMENT TEST RESULTS

Results of the NMVOC testing conducted at the Leachate Treatment Process Nos. 260 and 270 are presented in the respective Table Nos. 6 and 7. Also included are gas flow rate data determined during the testing.

4.5 PROCESS OPERATING DATA

During emission testing, the flare was operating at the maximum possible rate achievable at that time. The flare operating temperature during all test runs was 1,525 °F. A copy of the flare operating temperature chart, and all other operating data recorded during the testing, is contained in Appendix E.

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TABLE 2

Enclosed Flare Inlet
Gas Flow Rate Data

	Run No.			
	1	2	3	Average
Test date	4/2/96	4/2/96	4/2/96	-
Test time start	0900	1204	1434	-
Test time stop	1027	1304	1539	-
Carbon Dioxide Concentration (%)	44.0	44.0	41.0	43.0
Oxygen Concentration (%)	2.1	2.9	3.7	2.9
Carbon Monoxide Concentrartion (ppmv)	<19	<18	<19	<19
Methane Concentration (%)	41.0	40.0	36.0	39.0
Moisture Content (%)	1.1	1.7	1.3	1.4
Gas Temperature (°F)	69	79	81	76
Gas Velocity (fpm)	1,577	1,544	1,577	1,566
Stack Gas Flow Rate (acfm)	260	255	260	258
Stack Gas Flow Rate (dscfm)	253	243	248	248

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TABLE 3

Enclosed Flare Outlet
Gas Flow Rate Data

	Run No.			
	1	2	3	Average
Test date	4/2/96	4/2/96	4/2/96	-
Test time start	0900	1204	1434	-
Test time stop	1027	1304	1539	-
Carbon Dioxide Emission Concentration (%)	8.6	8.8	7.4	8.3
Oxygen Emission Concentration (%)	12.0	13.0	14.0	13.0
Carbon Monoxide Emission Concentration (ppmv)	<18	<19	<19	<19
Methane Emission Concentration (ppmv)	<4	<4	<4	<4
Moisture Content (%)	7.1	8.5	7.7	7.8
Gas Temperature (°F)	1,324	1,360	1,337	1,340
Gas Flow Rates Determined by Pitot Traverse				
Gas Velocity (fpm)	599	433	359	463
Stack Gas Flow Rate (acfm)	15,103	10,910	9,051	11,688
Stack Gas Flow Rate (dscfm)	4,091	2,859	2,424	3,125
Gas Flow Rates Determined by Carbon Mass Balance				
Stack Gas Flow Rate (acfm)	9,293	8,886	9,694	9,291
Stack Gas Flow Rate (dscfm)	2,517	2,329	2,596	2,481

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TABLE 4

Enclosed Flare NMVOC Test Results

Test Date: April 2, 1996

Run No.	Test Time	Flare Inlet Gas Flow Rate (dscfm)	Flare Inlet NMVOC Concentration (ppmv)	Flare Inlet NMVOC Loading Rate (lb/hr)	Flare Outlet Gas Flow Rate (dscfm)	Flare Outlet NMVOC Concentration (ppmv)	Flare Outlet NMVOC Emission Rate (lb/hr)	NMVOC Destruction Efficiency (% by wt.)
1	0900-1026	253	1,500	0.949	2,517	0.31	0.0019	99.8
2	1204-1304	243	1,700	1.030	2,329	0.40	0.0023	99.8
3	1434-1539	248	1,600	0.991	2,596	0.43	0.0028	99.7
Ave.	-	248	1,600	0.990	2,481	0.38	0.0024	99.8

Note: 1) No sampling during Run No.1 from 0903 to 0924
2) Test duration of Run No. 3 was 65 minutes
3) Outlet gas flow rates determined by carbon mass balance
4) All NMVOC results are expressed as methane
5) lb/hr NMVOC = (gas flow rate, dscfm) (ppmv of NMVOC) (MW) (1.557 E-7)
where: MW = molecular weight of methane, 16.04 lb/mole

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TABLE 5

Enclosed Flare
Oxides of Nitrogen Emission Results
Test Date: April 2, 1996

Run No.	Test Time	Gas Flow Rate (dscfm)	Emission Concentration (ppmv)	Emission Rate (lb/hr)
1	0900-1021	2,517	<69	<1.25
2	1204-1304	2,329	116	1.93
3	1434-1534	2,596	<70	<1.31
Ave.	-	2,481	85	1.50

Note: 1) No sampling during Run No. 1 from 0901 to 0924
2) Gas flow rates determined by carbon mass balance
3) NOx emission results expressed as NO2

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TABLE 6

Leachate Reactor No. 260
Gas Flow Rate Data and NMVOC Emission results

	Run No.			
	1	2	3	Ave.
Test date	4/3/96	4/3/96	4/3/96	-
Test time start	0850	1109	1305	-
Test time stop	0950	1214	1405	-
Carbon Dioxide Emission Concentration (%)	0.0	0.0	0.0	0.0
Oxygen Emission Concentration (%)	21.0	21.0	21.0	21.0
Moisture Content (%)	3.1	3.1	3.2	3.1
Gas Temperature (°F)	77	77	78	78
Gas Velocity (fpm)	511	598	481	530
Stack Gas Flow Rate (acfm)	92	108	87	96
Stack Gas Flow Rate (dscfm)	86	101	81	89
NMVOC Emission Concentration (ppmv)	40	26	25	30
NMVOC Emission Rate (lb/hr)	8.6E-03	6.5E-03	5.0E-03	6.7E-03

Note: 1) All NMVOC emission results are expressed as methane
2) lb/hr NMVOC = (gas flow rate, dscfm) (NMVOC emission concentration, ppmv) (MW) (1.557 E-7)
where: MW = molecular weight of methane, 16.04 lb/mole

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TABLE 7

Leachate Reactor No. 270
Gas Flow Rate Data and NMVOC Emission results

	Run No.			
	1	2	3	Ave.
Test date	4/3/96	4/3/96	4/3/96	-
Test time start	0845	1110	1305	-
Test time stop	0945	1215	1405	-
Carbon Dioxide Emission Concentration (%)	0.0	0.0	0.0	0.0
Oxygen Emission Concentration (%)	21.0	21.0	21.0	21.0
Moisture Content (%)	3.1	3.1	3.1	3.1
Gas Temperature (°F)	77	77	77	77
Gas Velocity (fpm)	767	749	757	758
Stack Gas Flow Rate (acfm)	138	135	136	137
Stack Gas Flow Rate (dscfm)	129	126	127	128
NMVOC Emission Concentration (ppmv)	15	17	34	22
NMVOC Emission Rate (lb/hr)	4.8E-03	5.4E-03	1.1E-02	7.0E-03

Note: 1) All NMVOC results are expressed as methane
2) lb/hr NMVOC = (gas flow rate, dscfm) (NMVOC emission concentration, ppmv) (MW) (1.557 E-7)
where: MW = molecular weight of metane, 16.04 lb/mole

5.0 DISCUSSION OF RESULTS

5.1 NMVOC SAMPLING

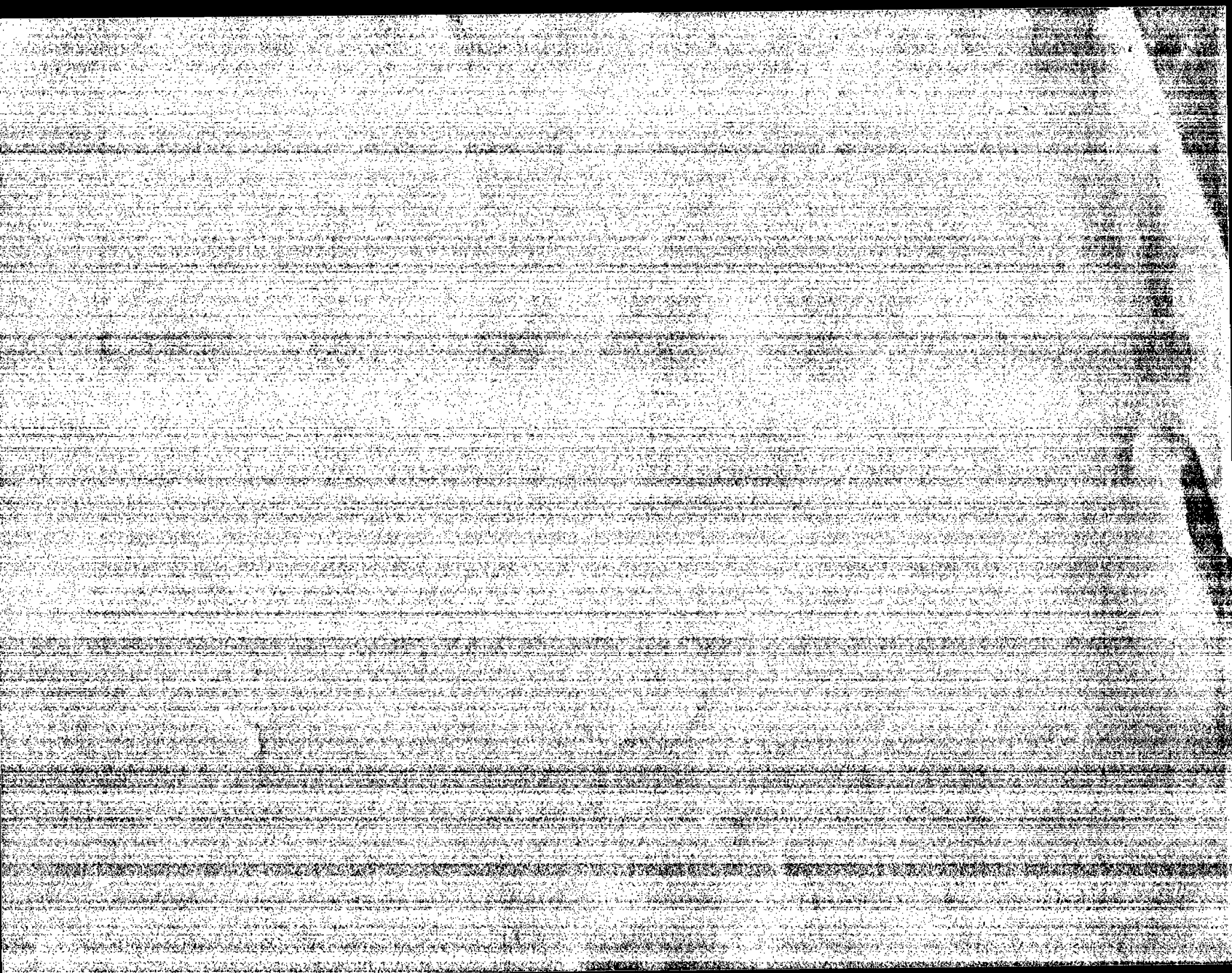
During NMVOC sampling, we extended several sample runs beyond the specified sample time of 60 minutes to 65 minutes in order to reduce the final vacuum in the sample canisters to approximately 4 inches of mercury. The lower final sample vacuum provided a lower analytical detection limit by reducing the amount of sample dilution required for sample analyses.

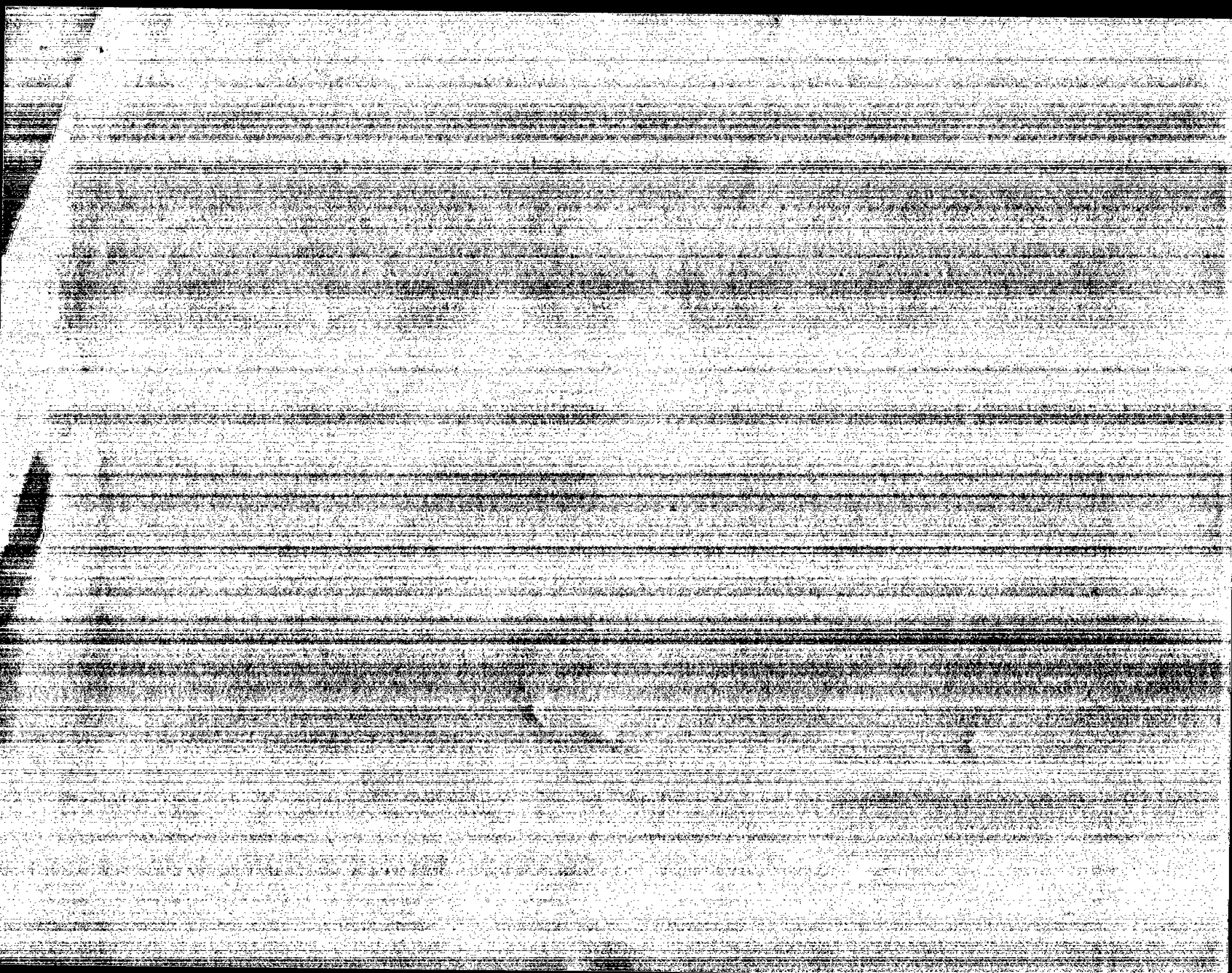
5.2 ENCLOSED FLARE GAS FLOW RATE DETERMINATIONS AND MASS EMISSION RATES

We calculated gas flow rates at the flare outlet according to EPA Method 2B by carbon mass balance to provide a check of the flare outlet gas flow rates determined by pitot traverses. Due to the inconsistent results of gas flow rates determined by pitot traverses, we feel gas flow rates determined by carbon mass balance are more accurate. We, therefore, calculated NO_X and NMVOC mass emission rates using outlet gas flow rates calculated by carbon mass balance.

5.3 ENCLOSED FLARE NMVOC DESTRUCTION EFFICIENCY COMPLIANCE

Results of the NMVOC determinations at the flare inlet and outlet showed good agreement between all three test runs conducted. The average NMVOC DRE of the flare was 99.8% by weight which exceeds the required DRE of 98 percent by weight.





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APPENDIX A

TEST PROTOCOLS AND RELATED CORRESPONDENCE

MRE

Cummings & Smith Inc.

CONSULTING ENGINEERS

January 12, 1995

Mr. Miles R. Murphy
Air Pollution Control Engineer
Pennsylvania Department of Environmental Resources
200 Pine Street
Williamsport, PA 17701-6510

Subject: Wayne Township Landfill
Plan Approval No. 18-322-003
Leachate Equalization Pond and
Leachate Treatment Facility Air Emissions Test Plan

Dear Mr. Murphy:

In response to comments from Mr. Bryon Richwine, Harrisburg Region of the Bureau of Air Quality Control, we have revised the leachate equalization pond and leachate treatment facility air emissions test plan to include volumetric flow and moisture determinations. Two copies of the revised plan are enclosed.

Please forward the revised plan to Mr. Richwine for his review and approval. Contact our Lewisburg office in the event you have any questions regarding this submittal.

Very truly yours,

Cummings & Smith, Inc.

Michael L. Crist
Engineer

Enclosure

cc: G.F. Lacy
G.L. Smith, P.E.
B. Richwine, DER-BAQ

434 MARKET STREET, SUITE 300 LEWISBURG PA 17837

(717) 524-5775 • (800) 462-6197 • FAX (717) 524-5717

... JERSEY AN... ORI...

CLINTON COUNTY SOLID WASTE AUTHORITY
WAYNE TOWNSHIP LANDFILL
McELHATTAN, PA

LEACHATE EQUALIZATION POND

AND

LEACHATE TREATMENT FACILITY

AIR EMISSIONS TEST PLAN

CUMMINGS & SMITH, INC.
Consulting Engineers
434 Market Street, Suite 300
Lewisburg, PA 17837
717-524-5775

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1.0 INTRODUCTION

The Department of Environmental Resources - Bureau of Air Quality issued Plan Approval No. 18-322-003 to the Clinton County Solid Waste Authority for the Wayne Township Landfill. The plan approval contains special conditions which must be fulfilled. The purpose of this procedure address conditions 20 and 21, i.e. quantify the volatile organic compounds (VOCs) being discharged from the leachate equalization pond vent and the leachate treatment facility, i.e. biological reactor vents.

2.0 PROCESS DESCRIPTIONS

2.1 Leachate Equalization Pond

Leachate is collected from the lined disposal area in an equalization pond equipped with a floating hypalon cover. Air diffusers below the floating cover provide forced ventilation up through the leachate. The ventilating air is collected in a perimeter header, which contains an inline duct fan, and then discharged to the atmosphere through a 12" diameter stack. The typical exhaust volume is approximately 400 CFM, which equals that of the air blower used in the ventilation process. Drawing G-502A provides details on the leachate equalization pond.

2.2 Leachate Treatment Facility

The leachate treatment facility has the capability to treat leachate with the following processes: physical/chemical treatment, biological treatment, settling, and polishing treatment along with sludge dewatering. The unit processes for the preferred treatment scheme are: caustic pH adjustment; settling; acid neutralization; biological treatment consisting of both anaerobic filtration and aerobic filtration; caustic pH adjustment; settling; acid neutralization; carbon adsorption; pressure filtration; followed by direct discharge a publicly owned treatment works or to the Landfill's treated leachate pond. The biological treatment process vents will be tested under this procedure.

The biological treatment process consists of two (2) separate Matrix Biological Film (MBF) reactors operating in parallel trains. Each MBF reactor contains five MBF biological treatment modules which are submerged biological fixed film

units. The first mode biological modules operate in an anaerobic mode with the four remaining modules operating in an aerobic mode.

As shown on Drawing 0410116648, the aerobic modules on each biological reactor receive process air from two sources: a low pressure purge blower, rated for 140 cfm @ 3.0" w.c. (ID#'s AB311 and AB321), and a solids purge air blower, rated at 150 cfm @ 5.0 psig (ID# AB301). The low pressure purge blower operates on continual basis, while the solids purge air blower operates on an intermittent basis. The process air is vented to atmosphere through a 6-inch vent located on the last aerobic module in each biological reactor, reference Drawing P-1103.

3.0 PREREQUISITES

3.1 Obtain test plan approval from DER - Bureau of Air Quality.

3.2 Notify DER - Bureau of Air Quality of test date and time at least 10 day prior to its performance.

4.0 LEACHATE EQUALIZATION POND VENT

4.1 Install test ports in accordance with EPA Method 1.

4.2 Confirm that the pond aeration system is on.

4.3 Perform volumetric flow and moisture determinations in accordance with EPA Test Methods 1-4.

4.4 Perform one-hour compliance test for total non-methane hydrocarbons using EPA Method 18.

5.0 BIOLOGICAL TREATMENT PROCESS VENTS

5.1 Install test ports in accordance with EPA Method 1A.

5.2 Confirm that the low pressure purge blower is operating and determine cycle of the solids purge air blower.

5.3 Perform volumetric flow and moisture determinations in accordance with EPA Test Methods 1-4.

5.4 Perform one-hour compliance test for total non-methane hydrocarbons using EPA Method 18.

5.5 Repeat steps 5.1 - 5.4 for the other biological reactor vent.

6.0 SAMPLE ANALYSIS

6.1 EPA Method 18, Measurement of Gaseous Organic Compound Emissions by Gas Chromatography, will be used to analyze all air samples.

7.0 DOCUMENTATION

7.1 Prepare test report for submission to the DER - Bureau of Air Quality. The report shall include the following:

1. results of testing,
2. quantification of VOCs discharged from each source in lbs/hour or tons/year,
3. description of testing and analytical procedures actually used in the performance of the testing,
4. all process equipment and operating data collected during the testing,
5. a copy of all raw test data, and
6. a copy of all calculations generated during the data analysis.

7.2 Submit 2 copies of the final test report to the Department within sixty days of the test completion.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
P.O. Box 8468
Harrisburg, PA 17105-8468
January 26, 1995

Bureau of Air Quality Control

Mike Crist
Cummings & Smith, Inc.
434 Market Street, Suite 300
Lewisburg, PA 17837

Dear Mr. Crist:

On January 18, 1995 I received your revised sampling procedures for the test program to be conducted on Clinton County Solid Waste Authority's Wayne Township Landfill Leachate Equalization Pond and Leachate Treatment Facility exhaust stacks. It is our understanding you will be testing for Volatile Organic Compounds(EPA Method 18), and using EPA methods 1-4 to determine moisture and volumetric flow rates. The revised protocol, as outlined, is acceptable to the Department with the following comments:

1. Sampling must be conducted while the source is operating at its maximum normal operating condition.

2. A compliance test consists of three one hour test runs and not one test run as was proposed.

Final acceptance of the test report is contingent upon meeting the requirements of Chapter 139 of the Pennsylvania Department of Environmental Resources' Rules and Regulations, the Source Testing Manual, and any stipulations specified in Plan Approval No. 18-322-003.

Please feel free to contact me at 717-787-9483 if you have any questions or require additional information.

Sincerely,

Bryon M. Richwine
Air Pollution Control Engineer
Source Testing Section
Division of Source Testing and Monitoring

An Equal Opportunity/Affirmative Action Employer

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SMITH
ENVIRONMENTAL TECHNOLOGIES CORPORATION

May 19, 1995

BCM Engineers

Mr. Richard St. Louis
Pennsylvania Department of Environmental Resources
Division of Source Testing and Monitoring
Post Office Box 8468
Harrisburg, PA 17105-8468

Subject: Compliance Evaluation of the Enclosed Ground Flare and Leachate Process Vents
Operated by Clinton County Solid Waste Authority
Located in Wayne Township, Pennsylvania
Flare Intent-to-Test Protocol and
Leachate Process Vents Protocol Revision
Smith Environmental Project No. 00-0798-01

Dear Mr. St. Louis:

Enclosed for your review, you will find a copy of the intent-to-test protocol for the above referenced flare stack compliance project. In addition to the flare stack compliance testing, Smith Environmental will be performing the emissions compliance testing at the leachate treatment process vents. We understand Mr. Bryon M. Richwine of PADER has responded by letter, dated January 26, 1995, to a protocol submitted to PADER by Cummings & Smith describing how emissions will be determined from the vents. We also understand that final acceptance of the test report is contingent upon satisfaction of comments stated in the letter. The following is a response addressing those comments:

1) Sampling will be performed while the sources are operating at their maximum normal operating condition.

2) Three 1-hour test runs will be performed for total non-methane hydrocarbon compounds (TNMHC) at each vent.

Furthermore, we request approval for TNMHC testing to be performed by Method TO-12. Smith Environmental recommends the use of EPA Method TO-12 in place of the previously prescribed EPA Method 18. This change is recommended for the following reasons:

1) Tedlar bag samples collected for Method 18 have a short holding time.

2) Method TO-12 is designed specifically for TNMHC analyses and will provide more reliable results with a lower detection limit.

At the present time, leachate vent emission testing is planned to be conducted at the two Biological Treatment Process vents. Clinton County Solid Waste Authority has issued a request to the PADER regional office in Williamsport, Pennsylvania to defer testing requirements at the Leachate Equalization Pond vent.

Please address any comments concerning flare stack testing protocol or the leachate vent protocol revision to me or Philip Burg.

Very truly yours,

John D. Woods
Air Quality Specialist

Attachments
cc: P. Burg, Smith
M. Crist, Cummings & Smith
M. Murphy, PADER Williamsport

i:\jdw\clinton.doc

INTENT-TO-TEST PROTOCOL

FOR

COMPLIANCE EVALUATION

OF THE

ENCLOSED GROUND FLARE

FOR

CLINTON COUNTY SOLID WASTE AUTHORITY
WAYNE TOWNSHIP LANDFILL

SMITH ENVIRONMENTAL PROJECT NO. 00-0798-01

PREPARED BY

JOHN D. WOODS
AIR QUALITY SPECIALIST

AND

PHIL BURG
AIR QUALITY SECTION MANAGER

SMITH
ENVIRONMENTAL TECHNOLOGIES CORPORATION

Engineering - Consulting - Remediation - Construction

SMITH

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- 2.5 NMVOC Destruction Efficiency Determinations 3
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FIGURES

Figure 1 Flare Outlet Stack
Figure 2 Flare Inlet Duct

SMITH

1.0 INTRODUCTION

The Clinton County Solid Waste Authority (CCSWA) will be operating a landfill gas flare at its Wayne Township Landfill located in McElhattan, Pennsylvania. Start-up of the flare is planned for mid June, 1995. According to Plan Approval No. 18-322-003, issued by the Pennsylvania Department of Environmental Resources (PADER) for the gas flare, CCSWA must determine emissions of oxides of nitrogen (NO_x) and the destruction removal efficiency (DRE) for non-methane volatile organic compounds (NMVOC). The plan approval specifies that the flare must be able to achieve a minimum DRE of 98 percent by weight for NMVOC.

U.S. Environmental Protection Agency (EPA) Reference method 7D will be used for NO_x and TO12 for NMVOC DRE determinations. All testing will be performed with the landfill gas flare operating at the maximum possible rate achievable at that time, and with a minimum flare operating temperature of 1,500° F.

SMITH

2.0 FIELD TESTING PROGRAM

2.1 SAMPLING LOCATIONS

The sampling locations described below will be used for gas flow rate determinations and for emission sampling.

The flare outlet stack has an inside diameter of 5 feet 10 inches. Two test ports are located 27 feet from ground level, 90 degrees apart. The nearest downstream flow disturbance will be located 3 feet above the test ports (0.5 duct diameters). The nearest upstream flow disturbance is located 10 feet below the test ports (1.7 duct diameters). Figure 1 illustrates the outlet sampling location. Twenty four traverse points, twelve per test port, will be used to determine gas flow rates at the flare outlet.

The flare stack inlet duct has an inside diameter of 6 inches. Two test ports will be located 90 degrees apart, 6 feet from the nearest upstream flow disturbance (12 duct diameters). The nearest downstream disturbance will be located 1.5 feet downstream of the test ports (3 duct diameters). A total of 8 traverse points (4 per port) will be used to determine gas flow rates at the flare stack inlet. Figure 2 illustrates the location of the sampling ports for inlet sampling.

2.2 GAS FLOWRATE DETERMINATIONS

Gas flow and temperature determinations will be performed at the flare stack inlet and outlet in accordance with EPA Reference Method 1, *Sample and Velocity Traverses for Stationary Sources*, and EPA Reference Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate*. The gas flow rate and temperature profiles will be measured at the inlet with a standard pitot tube and at the outlet with a Type S pitot tube connected to an inclined manometer. A Chromel-Alumel thermocouple connected to a potentiometer will be used to determine the gas temperature. One set of gas flow and temperature determinations will be performed simultaneously with each of the three NO_x and NMVOC test runs.

Carbon mass balance flow determinations will be performed at the flare stack outlet in order to support the gas flow rate determinations conducted by EPA Method 2. Equations 2B-1 and 2B-2 of EPA Method 2B will be used to calculate outlet gas flow rates. The total organic carbon concentrations at the inlet and outlet will be determined by ASTM D1946 analysis, which use gas chromatography with flame ionization detection (FID) and thermoconductivity detection (TCD).

Volume percent methane (CH_4), carbon dioxide (CO_2), and carbon monoxide (CO) will be measured in order to determine total organic carbon concentrations. The minimum detection limit for each parameter will be 0.01 percent. ASTM D1946 analyses will be performed on the inlet and outlet NMVOC samples and will also include percent oxygen.

2.3 MOISTURE DETERMINATIONS

Moisture determinations will be performed at the flare stack outlet in accordance with EPA Reference Method 4, *Determination of Moisture Content in Stack Gases*. The parameters evaluated to determine the gas stream's moisture content will be: sample gas volume, sample gas temperature, sample gas pressure, impinger moisture gain, and silica gel moisture gain. The wet bulb/dry bulb technique will be used to determine gas moisture content at the flare stack inlet. One set of moisture determinations will be conducted simultaneously with each of the NO_x, and NMVOC test runs.

2.4 MOLECULAR WEIGHT DETERMINATIONS

Molecular weight of the flare stack inlet and outlet gases will be calculated from results of the ASTM D1946 analyses to be conducted for the carbon mass balance flow determinations outlined in Section 2.2. Volume percent CH_4, CO_2, O_2, and Nitrogen (N_2) will be used to calculate molecular weight. Nitrogen will be determined by difference. One set of molecular weight determinations will be conducted simultaneously with each of the three NO_x and NMVOC test runs.

2.5 NMVOC DESTRUCTION EFFICIENCY DETERMINATIONS

Destruction efficiency determinations will be performed using sampling and analytical procedures outlined in EPA Reference Method TO12, to measure the emission concentration of NMVOC. Three (3) 1-hour integrated samples will be collected in stainless steel evacuated cylinders simultaneously at the flare inlet and outlet. The evacuated cylinders will be analyzed by cryogenic pre-concentration and mass spectroscopy for NMVOC within 48 hours of collection. NMVOC will be quantified as propane, using calibration curves prepared from standard injections.

2.6 OXIDES OF NITROGEN EMISSION DETERMINATIONS

Oxides of nitrogen emission determinations will be performed in accordance with EPA Reference Method 7D, Determination of Nitrogen Oxide Emissions from Stationary Sources, Alkaline Permanganate /ion Chromatographic Method. Three (3) 1-hour test runs will be performed at the flare stack outlet to determine NO_x emissions expressed as nitrogen dioxide (NO_2). Sampling will be performed by extracting exhaust gas from the mid-point of the stack with a stainless steel sampling probe at a rate of 400 to 500 cc/min and passing it through a chilled condenser containing 600 ml of alkaline permanganate solution. Glass wool will be used to filter particulate matter.

SMITH

2.7 PROCESS OPERATING DATA

Process operating data will be recorded during the testing program and will include inlet gas flow rate, landfill gas inlet temperature, and flare gas outlet temperature.

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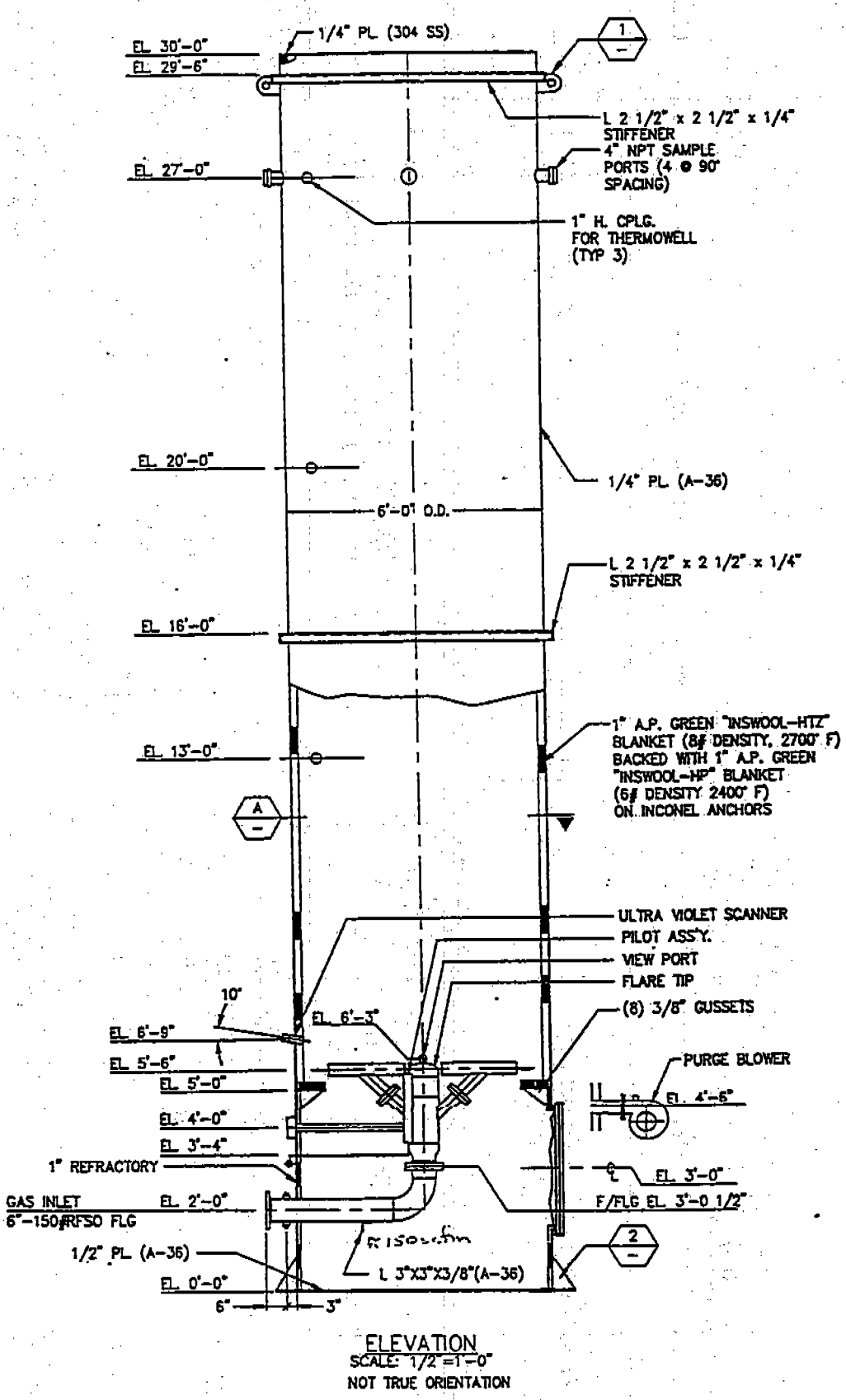
3.0 REPORT PREPARATION

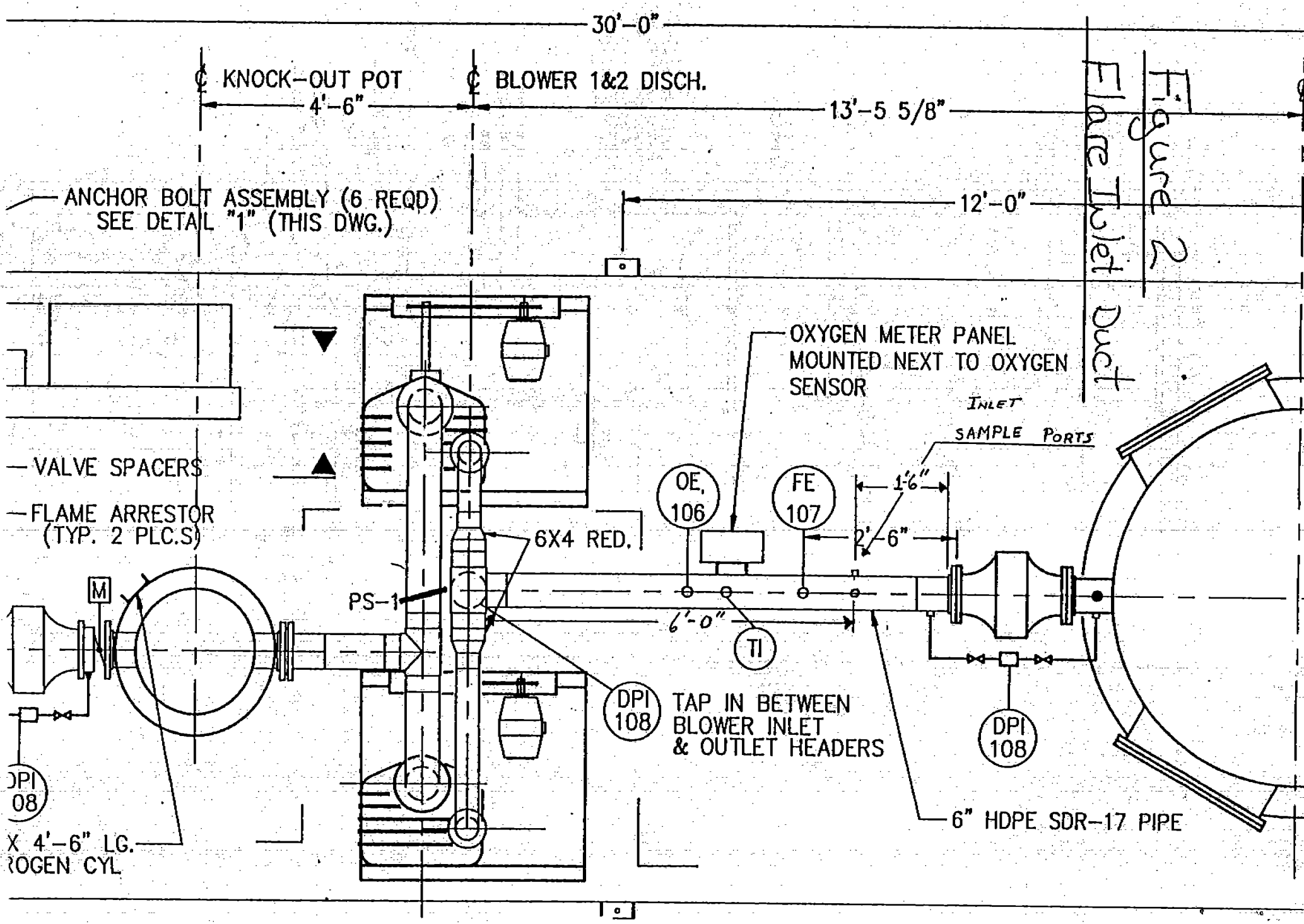
Smith Environmental will review the testing data and any pertinent operating data and incorporate them into a final report. The report will include, but will not be limited to the following:

1. Brief description of work undertaken
2. Outline of sampling techniques employed
3. Tabulation of emissions determined for each test period as compared to the allowable emission standards
4. Equations utilized in calculated test results
5. Any pertinent operating data



ELEVATION
SCALE: 1/2"=1'-0"
NOT TRUE ORIENTATION

Figure 1 -
Flare Stack


30'-0"
℄ KNOCK-OUT POT
4'-6"
℄ BLOWER 1&2 DISCH.
13'-5 5/8"
12'-0"
ANCHOR BOLT ASSEMBLY (6 REQD)
SEE DETAIL "1" (THIS DWG.)
OXYGEN METER PANEL
MOUNTED NEXT TO OXYGEN
SENSOR
INLET
SAMPLE PORTS
VALVE SPACERS
FLAME ARRESTOR
(TYP. 2 PLC.S)
OE
106
FE
107
1'-6"
2'-6"
6X4 RED.
M
PS-1
6'-0"
TI
DPI
108
TAP IN BETWEEN
BLOWER INLET
& OUTLET HEADERS
DPI
108
DPI
08
X 4'-6" LG.
ROGEN CYL
6" HDPE SDR-17 PIPE
Figure 2
Flare Inlet Duct

JUN 14 1995

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

P.O. Box 8468
Harrisburg, PA 17105-8468
June 8, 1995

Bureau of Air Quality Control

CC: P. Burg
M. Gist

John D. Woods
Smith Environmental Technologies Corporation
One Plymouth Meeting
Plymouth Meeting, PA 19462

Dear Mr. Woods:

On May 24, 1995 I received your sampling procedures for the test program to be conducted on Clinton County Solid Waste Authority's Wayne Township Landfill Enclosed Ground Flare exhaust stack. It is our understanding you will be testing for destruction removal efficiency of NMVOC(EPA Method TO-12), and NO_x(EPA Method 7D), and using EPA methods 1-4 to determine moisture and volumetric flow rates. The protocol, as outlined, is acceptable to the Department:

Also, the change from using the previously approved EPA method 18 to EPA method TO-12 for TNMVOC testing on the above mentioned facilities Leachate Equalization Pond and Leachate Treatment Facility exhaust stack is acceptable to the Department.

Final acceptance of the test report is contingent upon meeting the requirements of Chapter 139 of the Pennsylvania Department of Environmental Resources' Rules and Regulations, the Source Testing Manual, and any stipulations specified in Plan Approval No. 18-322-003.

Please feel free to contact me at 717-787-9483 if you have any questions or require additional information.

Sincerely,

Bryon M Richwine

Bryon M. Richwine
Air Pollution Control Engineer
Source Testing Section
Division of Source Testing and Monitoring

An Equal Opportunity/Affirmative Action Employer

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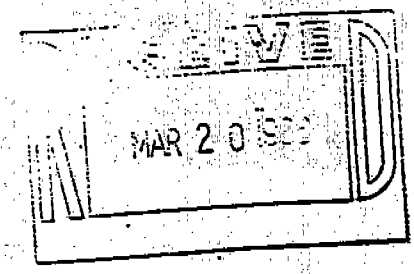
Clinton County Solid Waste Authority
P.O. Box 209
McElhattan, PA 17748
717-769-6977



March 14, 1996

Mr. Miles R. Murphy
Air Pollution Control Engineer
Department of Environmental Protection
208 West Third Street, Suite 101
Williamsport, PA 17701-6448

Subject: Wayne Township Landfill
Plan Approval No. 18-322-003
Stack Compliance Testing

Dear Mr. Murphy:

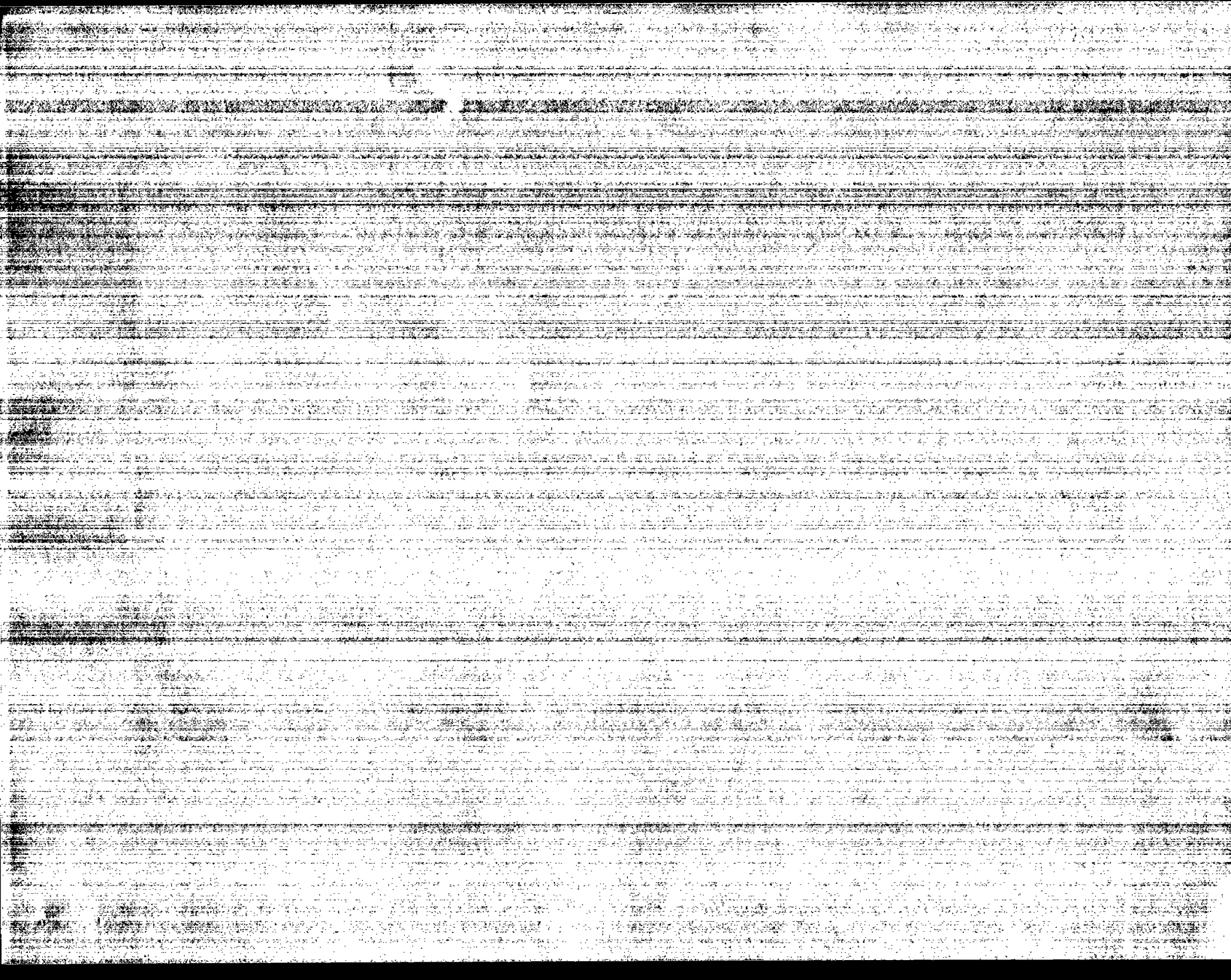
In accordance with Plan Approval Condition No. 22, the Authority would like to advise the Department of the testing schedule for the enclosed ground flare and the leachate process vents at the Wayne Township Landfill. The testing will be performed during the week of April 1, 1996. The flare will be tested on April 2 and the leachate process vents will be tested on either April 3 or April 4.

Please contact myself or the Lewisburg office of Cummings & Smith, Inc. at 800-462-6197 if you have any questions regarding this information.

Very truly yours,

Gerald F. Lacy
Executive Director

cc: Timothy Brooks, DEP - Division of Source Testing & Monitoring
Philip Burg, Smith Environmental Technologies Corp.
G.L. Smith, P.E.
Cummings & Smith, Inc.



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APPENDIX B

FIELD SAMPLING PROGRAM AND FIELD DATA FORMS

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APPENDIX B

FIELD SAMPLING PROGRAM AND FIELD DATA FORMS

1.0 SAMPLING PROCEDURES

1.1 SAMPLING LOCATION DESCRIPTIONS AND TRAVERSE POINTS

A description of the flare inlet and outlet sampling locations are included with the Smith Environmental Protocol included in Appendix A. Several corrections to the sampling location descriptions in the protocol must be noted, however, and include the following: The inside diameter of the flare inlet duct is 5.5 inches instead of 6 inches provided in the protocol. The inside diameter of the flare outlet stack is 5 feet 10 inches as outlined in the protocol. The stack, however, has an inside lining of insulation approximately 1 inch thick. We used an inside diameter of 5 feet 8 inches, therefore, to calculate flare stack outlet gas flow rates.

The leachate treatment facility process vents are both identical and are described as follows: The Leachate Treatment Process vents are round with an inside diameter of 5.75 inches. Two test ports are located in the same cross sectional plane 90 degrees apart. The nearest upstream and downstream flow disturbances are 83 inches (14 duct diameters) and 56 inches (9.7 duct diameters) respectively from the test ports. Twelve traverse points (6 per port) were utilized for flow rate determinations at the Leachate Treatment Process vents.

1.2 SAMPLING PROCEDURES

Descriptions of the sampling procedures utilized at the flare are outlined in the Smith Environmental Protocol in Appendix A. Gas flow rate, moisture, and NMVOC procedures outlined in the protocol were also used at the leachate vents.

Molecular weight determinations were conducted at the Leachate Treatment Process vents in accordance with EPA Reference Method 3, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight." A grab sample was collected during emission sampling and analyzed by a Fyrite gas analyzer to determine the gas molecular weight. The following parameters were measured in order to determine gas molecular weight: volume percent carbon dioxide (CO_2), volume percent oxygen (O_2) and volume percent nitrogen (N_2) determined by difference. Results of all gas analyses showed the leachate exhaust gases contained 21.0 percent O_2 and 0.0 percent CO_2.

SMITH

2.0 Field Data Sheets

All field data sheets generated during the field testing program are contained at the end of this appendix.

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TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT CCSWA
DATE 4/1/96
SAMPLING LOCATION Flare Inlet
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE (DISTANCE A) 6 3/4
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE (DISTANCE B) 3/4"
STACK I.D., (DISTANCE A - DISTANCE B) ~~6.0~~ 5.5
NEAREST UPSTREAM DISTURBANCE 6 FT
NEAREST DOWNSTREAM DISTURBANCE 1.5 FT
CALCULATOR JDW John Woods

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	3.2	6"	.192 inch	0.75 inch	0.942
2	10.5	"6"	0.630	0.75	1.38
3	19.4	6"	1.164	0.75	1.914
4	32.3	6"	1.938	0.75	2.688
5	67.7	6"	4.062	0.75	4.812
6	80.6	6"	4.836	0.75	5.586
7	89.5	6"	5.370	0.75	6.120
8	96.8	6"	5.808	0.75	6.558
1	3.2	5.5"	0.5	.75	1.3
2	10.5		0.58		1.3
3	19.4		1.1		1.8
4	32.3		1.8		2.5
5	67.7		3.7		4.5
6	80.6		4.4		52
7	89.5		4.9		5.7
8	96.8	↓	5.5	↓	5.8

SMITH

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

PLANT CCSWA
DATE 4-1-96
SAMPLING LOCATION FLARE OUTLET
INSIDE OF FAR WALL TO OUTSIDE OF NIPPLE (DISTANCE A) -NA-
INSIDE OF NEAR WALL TO OUTSIDE OF NIPPLE (DISTANCE B) -NA-
STACK I.D. (DISTANCE A - DISTANCE B) 70 inches
NEAREST UPSTREAM DISTURBANCE 10 FT
NEAREST DOWNSTREAM DISTURBANCE 3 FT
CALCULATOR John Woods

SEE Protocol

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	2.1	70"	1.47	-NA-	1.47
2	6.7	70"	4.69	-NA-	4.69
3	11.8	70	8.26	-NA-	8.26
4	17.7	70	12.39	-NA-	12.39
5	25	70	17.5	-NA-	17.5
6	35.6	70	24.92	-NA-	24.92
7	64.4	70	45.08	-NA-	45.08
8	75.0	70	52.50	-NA-	52.50
9	82.3	70	57.61	-NA-	57.61
10	88.2	70	61.74	-NA-	61.74
11	93.3	70	65.31	-NA-	65.31
12	97.9	70	68.53	-NA-	68.53

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VELOCITY DETERMINATIONS

Client: CCSWA

Location: Inlet

Date: 4-2-96

Stack Pressure: +.5, +.5, +.56

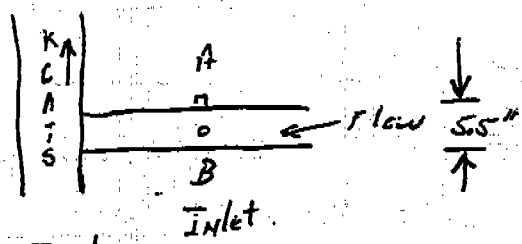
Barometric Pressure: 29.50

Pitot Factor: .99

Engineer: JDW/PCB

Sample Port Location:

Wet Bulb = 57° F



Inside Diameter = 5.5 inches

Pre Test 3

Pitot/Temperature Readings

← Pre Test #1 → | Pre Test #2 →

Point No.	Distance (Inches)	Port A ΔP	Port A T	Port B ΔP	Port B T	Port A ΔP	Port A T	Port B ΔP	Port B T	Port A ΔP	Port A T	Port B ΔP	Port B T
1		.150	69	.170	69	.155	79	~~.160~~ .155	78	~~.145~~ .165	81	.165	81
2		.155	69	.175	69	.165	79	~~.170~~ .165	78	.160	81	.165	
3		.165	69	.165	69	.170	79	.135	78	.165	81	.170	
4		.165	69	.175	69	.180	79	.180	78	.175	81	.170	
5		.170	69	.175	69	.140	79	.180	78	.175	81	.185	
6		~~.120~~ .170	69	.170	69	.115	79	.170	78	.155	81	.170	81
7		.125	69	.150	69	.115	78	.165	78	.150	81	.135	81
8		.155	69	.160	69	.110	78	.155	78	.140	81	.125	81
			Dry Bulb 69°				Dry Bulb	78.4					
			Wet Bulb 57°				Dry Bulb WET	65.9					
TOTAL													
AVG.													

Dry 81.4
Wet 62.7

SMITH

VELOCITY DETERMINATIONS

Client: CCSWA

Sample Port Location:

Location: Flare Inlet

Date: 4-2-96

Stack Pressure: + .76

Barometric Pressure: 29.57

Pitot Factor: .99

Engineer: JW/PB

Pitot/Temperature Readings

Point No.	Distance (Inches)	Pots Test 3 Port A		Port B		Port __		Port __		Port __	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.15	81	.15	81						
2		.185	81	.16	81						
3		.180	81	.17	81						
4		.180	81	.175	81						
5		.185	81	.175	81						
6		.180	81	.165	81						
7		.185	81	.165	81						
8		.180	81	.160	81						
TOTAL											
AVG.											

81.2 c
62.7 uncf

SMITH

VELOCITY DETERMINATIONS

Client: Clinton County S.W.A.

Location: Flare Stack Outlet

Date: 4-2-96

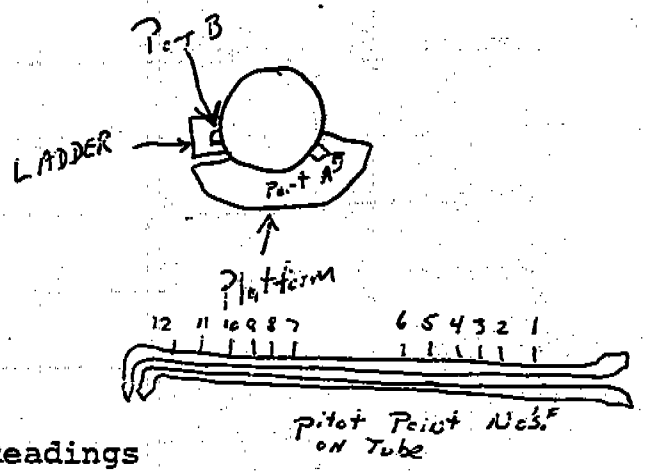
Stack Pressure: +.015, .0125, +.020

Barometric Pressure: 29.50

Pitot Factor: .84

Engineer: JW

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port A		Port B		Port A		Port B		Port A		Port B	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.01	1330	.005	1300	0.001	1330	.002	1320	0.000	1280	0.000	130
2		.01	1335	.005	1335	0.001	1343	.002	1352	0001	1300	0.002	132
3		.01	1348	.008	1340	.005	1347	.004	1369	0.001	1350	0.002	136
4		.01	1350	.01	1346	.005	1350	.005	1370	0.005	1322	0.003	135
5		.01	1347	.01	1344	.005	1358	.005	1373	0.005	1337	0.003	135
6		.015	1330	.011	1344	.005	1363	.006	1325	0005	1340	0.004	13
7		.015	1330	.011	1340	.007	1350	.007	1377	0.008	1345	0.005	13
8		.01	1240	.013	1335	.006	1348	.007	1378	0.007	1336	0.005	13
9		.01	1305	.013	1335	.005	1348	.008	1380	0005	1338	0.005	135
10		.008	1295	.010	1330	.006	~~1348~~ 1351	.006	1380	0.004	1336	0.005	130
11		.005	1282	.009	1310	.006	1352	.005	~~1420~~ 1385	0.005	1336	0.004	13
12		.005	1282	.005	1297	.005	1352	.005	~~1420~~ 1385	0.005	1330	0.002	133
TOTAL													
AVG.													

SMITH

VELOCITY DETERMINATIONS

Client: CCSWA

Location: Flare Outlet

Date: 4-2-96

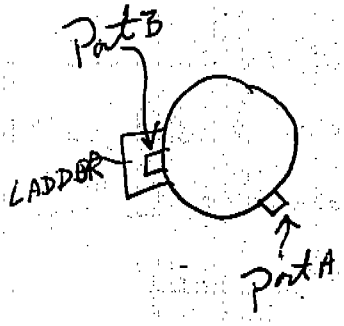
Stack Pressure: +.02

Barometric Pressure: 29.57

Pitot Factor: .84

Engineer: JW/PB

Sample Port Location:



Pitot/Temperature Readings

Port Run 3 →

Point No.	Distance (Inches)	Port B		Port A		Port__		Port__		Port__	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.005	1320	.01	1320						
2		.005	1320	.01	1320						
3		.005	1348	.008	1329						
4		.005	1351	.007	1332						
5		.006	1347	.008	1328						
6		.006	1340	.008	1327						
7		.006	1335	.01	1327						
8		.006	1339	.01	1323						
9		.004	1336	.01	1330						
10		.005	1335	.01	1312						
11		.005	1338	.01	1312						
12		.005	1334	.01	1312						
TOTAL											
AVG.											

SMITH

PLANT Clinton County Solid Waste Authority
DATE 4-2-96
SAMPLING LOCATION Flare Stack

METER BOX NUMBER 1.25 ΔH@ 1.84
SAMPLE BOX NUMBER(S) NA
PROBE NUMBER 610 TYPE S
METER CORRECTION: .984

BWS Run 1

METHOD 4 FIELD DATA SHEET

initial leak ch. 0.00 @ 10" VAC

9:03 STOP
9:25 Restart
Final leak check = 0.003 @ 10" VAC

Traverse Point Number	Sampling Time (min)	Clock Time (24-hr Clock)	Gas Meter Reading (V_m), ft_3	Stack Temperature (T_s), °F	Inlet ($T_{m\,in}$), °F	Oulet ($T_{m\,out}$), °F	Pump Vacuum, in. Hg	Impinger Temperature °F
	0	0900	776.081		40	40		
	5	0927	781.0		45	43	3	35
	10	0932	784.1		49	45	3	36
	15	0937	787.4		52	44	3	38
	20	0942	791.5		56	47	3	38
	25	0947	796.7		60	49	3	40
	30	0952	799.7		61	52	3	40
	35	0957	803.7		63	52	3	43
	40 END	10:02	807.719		64			

Given Moisture
#1 = 30
#2 = 12
#3 =
#4 = 8
51.09m

CO_2 _____
O_2 _____
CO _____
P_b _____

CO_2 _____
O_2 _____
CO _____
P_b _____

CO_2 _____
O_2 _____
CO _____
P_b _____

PLANT CCSWA

DATE 4-2-96 OPERATOR

SAMPLING LOCATION Flare Outlet

SMITH

METER BOX NUMBER 125 $\Delta H_@$ 1.84

SAMPLE BOX NUMBER(S) NA

PROBE NUMBER 610 TYPE S

METHOD 4 FIELD DATA SHEET

BWS Run 2

initial Leak check = 000 @ 12 in Hg

Final Leak check = 000 @ 12 in Hg

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m, ft³)	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F
					INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F		
	0	12:04	807.853		49	47	4	50
	5	12:09	811.9		52	48	4	50
	10	12:14	815.7		58	48	4	50
	15	12:19	819.5		62	50	4	50
	20	12:24	823.4		64	51	4	50
	25	12:29	827.1		66	53	4	50
	30	12:34	831.2		68	55	4	52
	35	12:39	836.2		70	56		52
End	36	12:40	836.395		72	58		

CO_2 _____ %

O_2 _____ %

CO _____ %

P_b _____ in Hg

Moisture gain

#1 = -60 ml

#2 = -18 ml

#3 = 126 ml

#4 = 7 ml

55 ml

BWS Run 3

Final Leak check = 0.00 @ 12 in Hg.

Final leak check = _____

Start	0	14134	836.594		58	56	8	58
	5	14139	840.5		68	55	8	58
	10	1444	844.8		68	55	8	58
	15	1449	850.0		72	58	8	40
	20	1454	852.6		74	60	8	41
	25	1459	862.3		77	62	8	41
End	30	1504	860.809		76	64	5	41
	35	1509						

CO_2 _____ %

O_2 _____ %

CO _____ %

P_b _____ in Hg

Moisture gain

#1 +39

#2 +8

#3 +1

#4 +5.9

+53.9

CO_2 _____ %

O_2 _____ %

CO _____ %

P_b _____ in Hg

PLANT CCSWA

DATE 4/2/96 OPERATOR P Bung

SAMPLING LOCATION Flare Outlet

SMITH

METER BOX NUMBER VOST $\Delta H_@$

SAMPLE BOX NUMBER(S)

PROBE NUMBER TYPE

70

NOx Run 1

METHOD 6 FIELD DATA SHEET

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F	Meter Pressure
					INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
mid	00	0900	271.89	1401	12	12	10		.08 CO_2
	01	0904	272.14	1400	12	12	15		.08 O_2
			Stop test						CO
	01	0924	275.70	1396	13	13	3	38	.08 P_b 29.50
	07	0930	278.7	1398	14	14	3	38	.07
	10	0933	279.9	1384	15	15	3	38	.07
	15	0938	282.2	1408	16	16	3	38	.07
	20	0943	284.4	1402	16	16	3	38	.07
	25	0948	286.5	1391	17	17	3	40	.08
	30	0953	288.8	1409	19	19	3	42	.07
	35	0958	291.0	1394	19	19	3	44	.07 CO_2
	40	1003	293.2	1400	20	20	3	42	.07 O_2
	45	1008	295.4	1387	20	21	3	42	.07 CO
	50	1013	297.5	1376	21	22	3	42	.08 P_b 29.57
	55	1018	299.7	1400	22	22	3	44	.08
	60	1021	301.96	1401	23	22	3	44	.08
			leak check @ 7 "Hg =		0.00	lpm			

CO_2

O_2

CO

P_b

PLANT CCSWA

DATE 4/2/96 OPERATOR PBurg

SAMPLING LOCATION Flare Outlet

SMITH

7D

METER BOX NUMBER VOST $\Delta H_@$

SAMPLE BOX NUMBER(S)

PROBE NUMBER TYPE

METHOD 8 FIELD DATA SHEET

NOx Run 2

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F	Meter Pressure (in H_2O)
					INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
Mid	00	1204	322.16	1395	19	19	3.6	54	.07
	05	1209	324.2	1385	20	20	3.5	54	.07
	10	1214	326.4	1390	20	21	3.5	54	.07
	15	1219	328.6	1388	21	21	3.5	54	.07
	20	1224	330.7	1369	21	21	3.5	54	.07
	25	1229	332.8	1394	22	22	3.5	54	.08
	30	1234	335.0	1384	23	23	3.5	54	.07
	35	1239	337.2	1395	23	23	3.5	52	.07
	40	1244	339.3	1375	23	23	3.5	52	.07
	45	1249	341.5	1393	23	23	3.5	52	.08
	50	1254	343.6	1394	23	23	3.5	50	.07
	55	1259	345.8	1389	23	23	3.5	50	.06
	60	1304	348.12	1390	23	23	3.5	50	.06
			leak check@	7"Hg =	0.00	lpm			

CO_2 _____ O_2 _____ CO _____ P_b 29.57 Beginning Run 2

P_b 29.57 End Run 2

NOx Run 3

Mid	00	1434	364.37	1387	16	16	3.5	52	.08
	05	1439	366.4	1375	16	17	3.5	54	.08
	10	1444	368.6	1381	17	17	3.5	56	.07
	15	1449	371.8	1389	17	17	3.5	58	.07
	20	1464	373.0	1390	17	18	3.5	56	.07
	25	1459	3752	1390	18	18	3.5	56	.07
	30	1504	377.4	1370	18	18	3.5	56	.07
	35	1509	379.6	1340	18	18	3.5	56	.08
	40	1514	382.0	1386	18	18	3.5	56	.07
	45	1519	384.2	1335	19	19	3.5	54	.08
	60	1524	386.3	1329	19	19	3.5	54	.07
	55	1529	388.5	1330	19	19	3.5	54	.07
	60	1534	390.78	1330	19	19	3.5	54	.07

leak check@10"Hg = 0.00 lpm

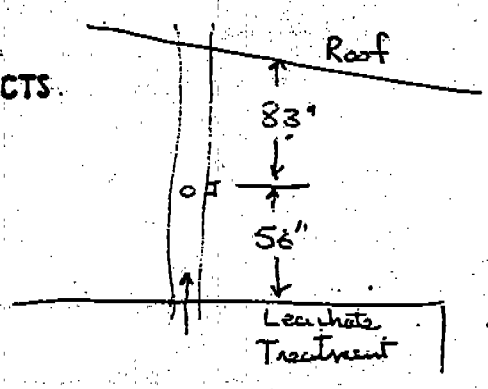
CO_2 _____ O_2 _____ CO _____ P_b 29.57 Beginning Run 3

29.47 End

P. 3

SMITH

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS



PLANT CCSWA
DATE
SAMPLING LOCATION Leachate treatment stacks
INSIDE OF FAR WALL TO
OUTSIDE OF NIPPLE (DISTANCE A)
INSIDE OF NEAR WALL TO
OUTSIDE OF NIPPLE (DISTANCE B)
STACK I.D. (DISTANCE A - DISTANCE B) 5.75"
NEAREST UPSTREAM DISTURBANCE
NEAREST DOWNSTREAM DISTURBANCE
CALCULATOR

SCHEMATIC OF SAMPLING LOCATION

TRAVERSE POINT NUMBER	FRACTION OF STACK I.D.	STACK I.D.	PRODUCT OF COLUMNS 2 AND 3 (TO NEAREST 1/8 INCH)	DISTANCE B	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	4.4	5.75	0.5		
2	14.6	↓	0.8		
3	29.6		1.7		
4	70.4		4.0		
5	85.4		4.9		
6	95.6		5.3		

SMITH

VELOCITY DETERMINATIONS

Client: CCSWA

Location: Reactor 260 Vent

Date: 4-3-96

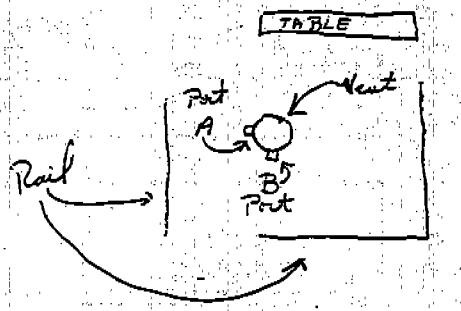
Stack Pressure: Run 1 -.002 / Run 2 +.010

Barometric Pressure: Run 1 29.38 / Run 2 29.35

Pitot Factor: .99

Engineer: JA/PCP

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port B		Port A		Port B		Port A		Port A		
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP T
1		~~.015~~ ~~.025~~	78	.012	77	.010	78	~~.020~~	77	.012	77	~~.032~~ 77
2		~~.016~~ ~~.026~~	78	.017	78	.013	78	~~.025~~	77	.013	77	~~.030~~ 77
3		~~.018~~ ~~.028~~	78	.018	78	.015	78	~~.030~~	77	.015	77	~~.030~~ 77
4		~~.018~~ ~~.028~~	78	.017	77	.015	78	~~.025~~	77	.015	77	.030 78
5		~~.016~~ ~~.026~~	77	.015	77	.016	78	~~.040~~ ~~.025~~	77	.015	77	.030 78
6		~~.015~~ ~~.025~~	77	.013	77	.015	78	~~.040~~ ~~.025~~	77	.015	77	.030 78
		Run No. 1A				Run 2A				Run 2B		
		Static = -.002				+.010				+.005		
1												
2												
3												
4												
5												
6												
TOTAL												
AVG.												

SMITH

VELOCITY DETERMINATIONS

Client: CCSWA

Location: Leachate Treatment # 260

Date: 4/3/96

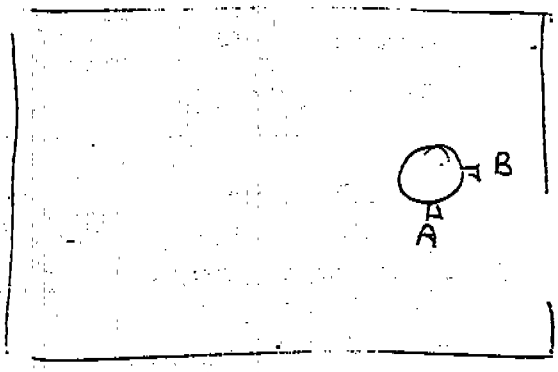
Stack Pressure: _____

Barometric Pressure: _____

Pitot Factor: .99

Engineer: RCB/JW

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port B		Port A		Port B		Port A		Port	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.038	78	.032	77						
2		.030	78	.035	77						
3		.034	78	.038	77						
4		.035	77	.040	77						
5		.036	77	.040	77						
6		.035	77	.040	77						
		Run 1B		-.002							
				29.38		Port A		Port B			
1		.015	78	.012	78	.010	78	.015	78		
2		.015	78	.014	77	.012	78	.015	78		
3		.015	78	.015	77	.010	78	.015	78		
4		.015	78	.015	77	.012	78	.015	78		
5		.015	78	.015	77	.015	78	.013	78		
6		.015	78	.015	77	.014	78	.013	78		
TOTAL		Run 3A				Run 3B					
AVG.			29.30				29.25				
			+.015	+.002			+.010				

SMITH

VELOCITY DETERMINATIONS

Client: CCSWA

Location: Leachate Treatment #270

Date: 4/3/96

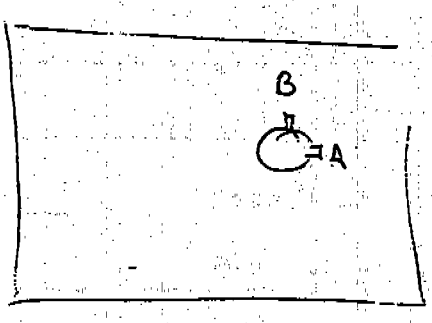
Stack Pressure: Run 1 +.018 / Run 2 +.020

Barometric Pressure: Run 1 29.38 / Run 2 29.35 / Run 3 29.30

Pitot Factor: .99

Engineer: PCB/JW

Sample Port Location:



Pitot/Temperature Readings

Point No.	Distance (Inches)	Port A		Port B		Port B		Port B		Port A	
		ΔP	T	ΔP	T	ΔP	T	ΔP	T	ΔP	T
1		.033	77	.040	77	.060	77	.030	77	.030	77
2		.035	76	.040	77	.060	77	.035	77	.032	77
3		.036	76	.038	77	.060	77	.035	77	.035	77
4		.037	77	.035	77	.060	77	.035	77	.035	77
5		.035	76	.034	77	.060	77	.035	77	.035	77
6		.035	76	.030	77	.065	77	.035	77	.035	77
		Run 1		29.38				Run 2		29.30	
						Port A		Port B		Port A	
1		.030	77	.030	77	.065	77	.025	78	.030	77
2		.035	77	.033	78	.075	77	.032	78	.032	77
3		.037	77	.035	78	.075	77	.035	77	.035	77
4		.038	77	.036	78	.080	77	.035	77	.035	77
5		.038	77	.035	77	.082	77	.035	77	.035	77
6		.038	77	.030	77	.082	77	.035	77	.035	77
TOTAL		Run 3A				Run BB					
AVG.			29.30				29.25				

+.015 +.010

PLANT CCSWA

DATE 4-3-96 OPERATOR JDW

SAMPLING LOCATION Reactor 2600

SMITH

METER BOX NUMBER 125 · $\Delta H_@$ 1.84

SAMPLE BOX NUMBER(S) NA

PROBE NUMBER ____ TYPE ____

METHOD 4 FIELD DATA SHEET

Run 1 260 BWs

SET #2 imps

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft³	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F
					INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F		
Mid	0825	0	890.925	78	83	80	2	60
	0830	5	894.9	78	88	80	2	60
	0835	10		78	88	81		
	0840	15	902.4	78	88	82	3	60
	0845	20	906.7	78	93	83	3	60
	0850	25	909.3	78	92	84	3	60
END	0855	30	913.183	78				

leak check = 0.005 at 10" Hg
final leak check = 0.005 at 11" Hg

			H_2O IMPS START	End
CO_2	0.0	#1	100 m/s	109
O_2	21.0	#2	100 m/s	102
CO	0.0	#3	0	2
P_b	29.38	#4	239.31	243.42
				+17.1 Total

Run 2

	11:30	0	937.566	78	89	85	3	60
	1135	5		78	92	85		
	1140	10	945.1	78	95	85	2	55
	1145	15	950.1	78	96	86	2	55
	1150	20	954	78	97	87	2	55
	1155	25	958.6	78	97	89	2	55
END	12:00	30	964.565	78				

initial leak check = 0.05 at 12 in Hg
Final leak check = 0.05 at 12 in Hg

CO_2	0.0	#1	109	120
O_2	21.0	#2	102	104
CO	0.0	#3	0	3
P_b	29.35	#4	202.69	208.01
				+21.3 total

Run 3

	13:39	0	985.761	78	88	85	2	60
	13:44	5	991	78	94	85	2	60
	1349	10	995	78	96	86	2	55
	1354	15	998	78	98	87	2	50
	1359	20	1002.1	78	98	88	2	50
	14:04	25	1006.2	78	99	89	2	50
	14 09	30	1009.368	78	99	89	2	50

initial leak check = 0.05 @ 12" Hg

CO_2		#1	120	128
O_2		#2	104	105
CO		#3	0	3
P_b	29.30	#4	214.95	219.82

PLANT CCSWA

DATE 4-3-96 OPERATOR

SAMPLING LOCATION Reactor 270

SMITH

METER BOX NUMBER 625 $\Delta H_@$ 1.84

SAMPLE BOX NUMBER(S) N/A

PROBE NUMBER TYPE

Run 1 270 BWs

METHOD 4 FIELD DATA SHEET

Set #1 imps

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24 hr CLOCK)	GAS METER READING (V_m), ft^3	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	IMPINGER TEMPERATURE, °F
					INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F		
Mid	00	0845	868.060	77	71	71	4	56
	5	0850	869.5	78	73	71	4	54
	10	0855	875.2	77	80	72	4	54
	15	0900	878.5	77	83	73	4	54
	20	0905	882.5	76	87	75	4	54
	25	0910	886.6	76	90	77	4	54
	30	0915	890.800	77	91	79	4	54
	35							

Run 2

	00	0953	913.386	77	77	77	3	66
	5	0958		77	80	78	3	59
	10	10:03		77	85	79	3	58
	15	10 08	925.6	77	90	80	3	58
	20	1013	929.80	78	93	81	3	55
	25	1018	934.2	79	94	83	3	55
End.	50	1023	937.410					
	35	10:28						

Run 3

	00	12:45	961.633	77	78	79	4	60
12:47 STOP	5	1304	965.8	77	84	79	4	55
	10	1306	970.5	77	87	79	4	54
	15	1311	973.9	78	90	80	4	45
	20	1316	979	78	93	82	4	45
	25	1321	982.3	78	94	83	4	45
	30	1326	985.610					

initial leak check = .005 @ 6" Hg
final leak check = 0.005 @ 10" Hg

		H_2O		Start	End	Tot
CO_2	0.0		#1	169	1860	19
O_2	21.0		#2	110	121	11
CO	0.0		#3	0 mls	1 mls	1
P_b	29.38		#4	226.39	233.52	7.1
						25.7

initial leak check = 0.00 at 11 in Hg
final = 0.05 @ 12 in Hg

CO_2	0.0	#1	186.0	206	20
O_2	21.0	#2	121	122	1
CO	0.0	#3	0	2	2
P_b	29.35	#4	198.20	205.51	7.3
					30.31

initial leak check = 0.00 at 12 in Hg
Final leak check = 0.00 at 12 in Hg

CO_2	#1	206	220	14
O_2	#2	122	122	0
CO	#3	0	1	1
P_b	#4	240.00	246	5.6
				20.6

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4-2-96

Source: Flare Stack Site: Inlet Run: 1

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: A-172 $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.50 mm H_g	$P_{b(f\ test)}$ 29.57 mm H_g
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ 29.5 mm H_g	$P_{tk(f\ test)}$ 6 mm H_g
Guage vacuum _____ in. H_g	Guage vacuum _____ in. H_g
Leak check _____	Leak check _____

OPERATOR: JW OPERATOR: ~~PCB~~ JDW

TESTING DATA			
TIME	ELAPSED TIME	GUAGE VACUUM	T_s COMMENTS
Top 0903 Restart 0900	0	29.5	68
0905	3	25	69
0907	5	25	69
0932	10	25	69.7
0937	15	25	69
0942	20	25	69
0947	25	24.5	71
0952	30	23.5	71
0957	35	20.5	71
10:02	40	17.5	72
10:07	45	15.5	73
10:12	50	14.5	73
10:17	55	12.0	74
10:22	60	9	75
END 10:27	65	6	

OPERATOR: JW

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4-2-96

Source: Flare Inlet Site: _____ Run: 2

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 9138B $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.57 mm H_g	$P_{b(f\ test)}$ _____ mm H_g
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ 29.5 mm H_g	$P_{tk(f\ test)}$ 2.5 mm H_g
Guage vacuum _____ in. H_g	Guage vacuum _____ in. H_g
Leak check _____	Leak check _____
OPERATOR: JW	OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	T_s COMMENTS	flow met
12:04	0	29.5 in Hg	79.8	80
12:09	5	25	79.9	80
12:14	10	24.9	79.8	80
12:19	15	23.5	79.8	80
12:24	20	20.5	79.9	80
12:29	25	17.5	80	80
12:34	30	15.0	79.7	70
12:39	35	12	79.9	70
12:44	40	9	79.9	70
12:49	45	7	80	60
12:54	50	5	80.1	50
12:59	55	3.5	80.2	30
13:04	60	2.5		

OPERATOR: JW

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4-2-96

Source: Flare Inlet Site: _____ Run: Three

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 9154B $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.57 mm Hg	$P_{b(f\ test)}$ _____ mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ 295 mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum _____ in. Hg	Guage vacuum _____ in. Hg
Leak check _____	Leak check _____

OPERATOR: JW OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	T_s	COMMENTS Rotameter
1434	0	30.0	81	70
1439	5	27.5	82	70
1444	10	25.5	82	70
1449	15	24.9	82	70
1454	20	23	81.5	80
1459	25	20	81	60
1504	30	18	81	60
1509	35	16.5	81	60
1514	40	13.5	81	60
1519	45	12.5	81	60
1524	50	11.5	81	80
1529	55	8	81	60
1534	60	5.5	81.6	60
1539	65	4.0		

OPERATOR: _____

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4/2/98

Source: Flare Outlet Site: _____ Run: One

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: ~~A122~~ 136 $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	**POST-TEST DATA**
$P_{b(i\ test)}$ 29.50 mm Hg	$P_{b(f\ test)}$ 29.57 mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum 29.5 in. Hg	Guage vacuum 3.5 in. Hg
Leak check _____	Leak check _____
OPERATOR: P Burg	OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	Flow (cc/m)	COMMENTS
0900	0	29.5	60	
0903	3	28.0	60	Stop test, NOx train problem
0924	3	28.0	62	Start test
0931	10	24.5	62	
0936	15	22.0	62	
0941	20	19.5	62	
0946	25	17.5	60	
0951	30	15.5	60	
0956	35	14.0	58	
1001	40	12.0	58	
1006	45	10.0	~~60~~	
1011	50	8.0	55	
1016	55	6.5	55	
1021	60	5.0	60	
1026	65	3.5	62	

OPERATOR: P Burg

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4/2/96

Source: Flare Site: Flare Outlet Run: Two

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 12652 $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.57 mm Hg	$P_{b(f\ test)}$ 29.57 mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum _____ in. Hg	Guage vacuum _____ in. Hg
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	Flow (cc/m)	COMMENTS
1204	00	29.5	60	
1209	05	27.0	60	
1214	10	25.0	60	
1219	15	23.5	60	
1224	20	20.5	60	
1229	25	19.0	60	
1234	30	16.5	60	
1239	35	13.5	60	
1244	40	10.5	60	
1249	45	9.0	60	
1254	50	7.5	60	
1259	55	6.0	60	
1304	60	4.0	60	

OPERATOR: P Burg

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4/2/96

Source: Flare Outlet Site: _____ Run: Three

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 809 $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.57 mm H_g	$P_{b(f\ test)}$ _____ mm H_g
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm H_g	$P_{tk(f\ test)}$ _____ mm H_g
Guage vacuum 29.5 in. H_g	Guage vacuum 5.0 in. H_g
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA			
TIME	ELAPSED TIME	GUAGE VACUUM	COMMENTS
1434	0	29.5	
1439	5	28.0	
1444	10	26.0	
1449	15	24.5	
1454	20	22.5	
1459	25	21.0	
1504	30	19.0	
1509	35	17.0	
1514	40	16.5	
1519	45	14.0	
1524	50	12.0	
1529	50	10.0	
1534	60	7.0	
1539	65	5.0	

OPERATOR: P. Bunge

METHOD 25 FIELD DATA

Client: CCSWA Leachate treatment PN: _____ Date: 4/3/96

Source: # 260 Site: _____ Run: one

PCS Sample Number: _____

Regulator: _____ Trap: C Tank: 02706 $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.38 mm Hg	$P_{b(f\ test)}$ 29.38 mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum 30.0 in. Hg	Guage vacuum 4.5 in. Hg
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	T_s	COMMENTS
0850	0	30.0	80	78
0855	5	28.5	80	78
0900	10	27.0	80	78
0905	15	25.5	80	78
0910	20	24.0		78
0915	25	22.0		77
0920	30	20.5 19.5		78
0925	35	16.5		78
0930	40	15.0		78
0935	45	13.0		77
0940	50	10.5		77
0945	55	7.0		79
0950	60	4.5		78

PCS

OPERATOR: P Burg

METHOD 25 FIELD DATA

Client: CCSWA Leachate PN: _____ Date: 4/3/96

Source: Treatment #260 Site: _____ Run: Two

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 9235B $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	**POST-TEST DATA**
$P_{b(i\ test)}$ _____ mm H_g	$P_{b(f\ test)}$ _____ mm H_g
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm H_g	$P_{tk(f\ test)}$ _____ mm H_g
Guage vacuum 30.0 in. H_g	Guage vacuum _____ in. H_g
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	T_s	COMMENTS
1109	00	30.0	78	
1114	05	29.0	78	
1119	10	27.5	78	
1124	15	26.0	77	
1129	20	25.0	77	
1134	25	23.5	77	
1139	30	21.0	77	
1144	35	18.5	78	
1149	40	15.5	78	
1154	45	13.5	78	
1159	50	12.0	78	
1204	55	9.0	78	
1209	60	7.0	78	
1214	65	4.0	78	

OPERATOR: P Burg

METHOD 25 FIELD DATA

Client: CCSWA #260 PN: _____ Date: 4/3/96

Source: Leachate Treatment #260 Site: _____ Run: Three

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 9309B $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ ~~30~~ 29.25 mm H_g	$P_{b(f\ test)}$ ~~30~~ 29.20 mm H_g
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm H_g	$P_{tk(f\ test)}$ _____ mm H_g
Guage vacuum 30.0 in. H_g	Guage vacuum ~~30~~ 3.5 in. H_g
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA			
TIME	ELAPSED TIME	GUAGE VACUUM	COMMENTS (Ts)
1305	0.0	30.0	77
1310	05	28.0	78
1315	10	26.0	78
1320	15	24.5	77
1325	20	22.5	77
1330	25	19.5	78
1335	30	18.0	77
1340	35	15.0	77
1345	40	13.0	78
1350	45	10.5	78
1355	50	8.5	77
1400	55	6.5	77
1405	60	3.5	77

OPERATOR: _____

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4-3-96

Source: Reactor 270 Site: _____ Run: ONE

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: A-295 $V_{tk(cal)}$: _____ L

Reactor 270

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.38 mm Hg	$P_{b(f\ test)}$ 29.38 mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum 28.5 in. Hg	Guage vacuum 6.0 in. Hg
Leak check _____	Leak check _____

OPERATOR: JW OPERATOR: _____

TESTING DATA			
TIME	ELAPSED TIME	GUAGE VACUUM	COMMENTS T_S
0845	0	29.5	77
0850	5	25.5	78
0855	10	24.0	77
0900	15	21.0	77
0905	20	19.0	76
0910	25	17.0	76
0915	30	15.0	76
0920	35	13.5	76
0925	40	12.0	77
0930	45	10.5	77
0935	50	9.5	77
0940	55	8.0	77
0945	60	6.0	77

OPERATOR: _____

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4/3/96

Source: Leachate Treatment #270 Site: _____ Run: Two

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 9413BB $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA	
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.35 mm Hg	$P_{b(f\ test)}$ 29.30 mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum 30.00 in. Hg	Guage vacuum 3.0 in. Hg
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA				
TIME	ELAPSED TIME	GUAGE VACUUM	T_s	COMMENTS
1110	00	29.5	77	
1105	05	26.0	77	
1120	10	24.0	77	
1125	15	22.0	77	
1130	20	20.5	77	
1135	25	17.0	77	
1140	30	15.0	77	
1145	35	12.5	77	
1150	40	11.0	77	
1155	45	9.5	78	
1200	50	8.0	77	
1205	55	6.0	77	
1210	60	4.5	77	
1215	65	3.0	77	

OPERATOR: CBurg

METHOD 25 FIELD DATA

Client: CCSWA PN: _____ Date: 4/3/96

Source: Leachate Treatment #270 Site: _____ Run: Three

PCS Sample Number: _____

Regulator: _____ Trap: _____ Tank: 9101B $V_{tk(cal)}$: _____ L

SAMPLE VOLUME DATA

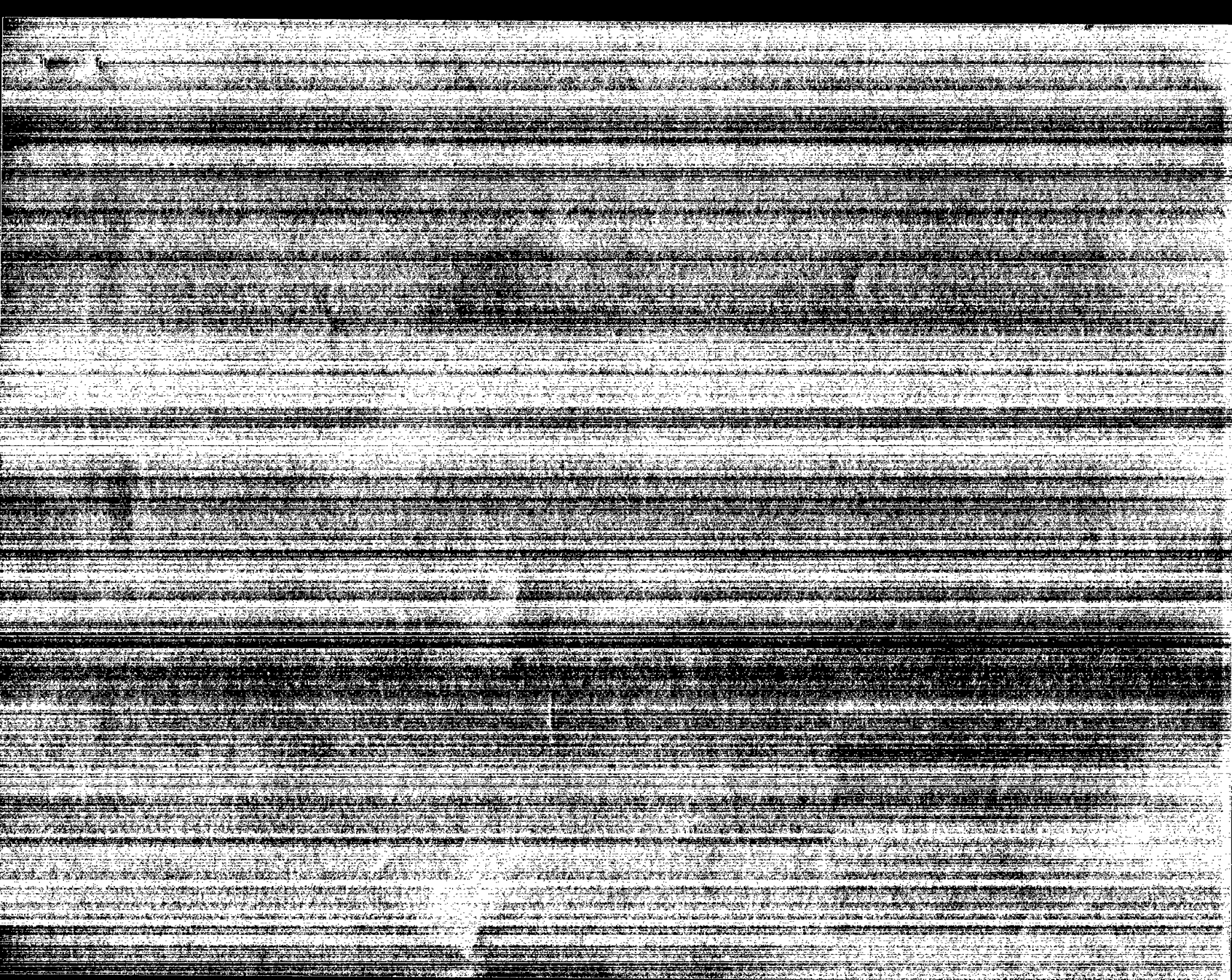
PRE-TEST DATA	POST-TEST DATA
$P_{b(i\ test)}$ 29.25 mm Hg	$P_{b(f\ test)}$ 29.23 mm Hg
$T_{(i\ test)}$ _____ degrees C	$T_{(f\ test)}$ _____ degrees C
$P_{tk(i\ test)}$ _____ mm Hg	$P_{tk(f\ test)}$ _____ mm Hg
Guage vacuum 30.0 in. Hg	Guage vacuum 25 in. Hg
Leak check _____	Leak check _____

OPERATOR: _____ OPERATOR: _____

TESTING DATA

TIME	ELAPSED TIME	GUAGE VACUUM	✓ IS	COMMENTS
1306	0.0	29.5	76	
1311	05	28.0	78	
1316	10	25.0	78	
1321	15	22.5	78	
1326	20	20.5	77	
1331	25	19.0	77	
1336	30	X6.17.5	77	
1341	35	15.0	78	
1346	40	13.5	78	
1351	45	11.8	78	
1356	50	9.0	77	
1401	55	6.5	77	
1406	60	2.5		

OPERATOR: CBurg



SMITH

APPENDIX C

LABORATORY ANALYSES AND CALCULATIONS

SMITH

APPENDIX C

LABORATORY ANALYSES AND CALCULATIONS

1.0 LABORATORY ANALYSES

1.1 NMVOC ANALYSIS

All NMVOC samples generated during the testing program were submitted for analysis to Quanterra Environmental Services in City of Industry, California. The following describes the analytical methods employed.

The final SUMMA canister vacuum is measured and compared with the final vacuum measured in the field. Any significant difference in the final vacuums indicates that a leak occurred during shipment and may void sample results. Helium is used to relieve the canister vacuum and also to provide a slight positive pressure to the samples.

A fixed-volume portion of the sample gas is drawn through a glass bead-filled trap that is cooled to approximately -186°C with liquid argon. The cryogenic trap simultaneously collects and concentrates the nonmethane volatile organic compounds (NMVOC), while allowing the methane, nitrogen, oxygen, etc., to pass through the trap. A helium carrier gas flow is then diverted to pass through the trap, in the opposite direction to the sample flow, and into a flame ionization detector (FID). When the residual air and methane have been flushed from the trap and the FID baseline restabilizes, the cryogen is removed and the temperature of the trap is raised to approximately 90° C. The organic compounds previously collected in the trap revolatilize and are carried into the FID, resulting in a response peak or peaks. The area of the peak or peaks is integrated, and the integrated value is translated into concentration units by way of a previously obtained calibration curve relating integrated peak area with known concentrations of methane. The concentrations of NMVOC, therefore, are expressed as units of parts per million as methane.

1.2 OXIDES OF NITROGEN ANALYSIS

All NO_x samples generated during the test program were submitted for analysis to Quanterra Environmental Services located in Knoxville, Tennessee. The following paragraphs describe the EPA Method 7D analytical methodology.

The samples are allowed to equilibrate a minimum of 36 hours to ensure all nitrogen dioxide (NO_2) contained in the samples is converted to nitrogen trioxide (NO_3).

A 50-ml aliquot of each sample is taken and 5 percent hydrogen peroxide (H_2O_2) is added in 5-ml increments. The precipitate formed is allowed to settle, and the color of the supernatant liquid is observed. Additions of H_2O_2 are continued until the supernatant liquid is clear. The samples are then filtered.

The concentration of NO_3 in each sample is determined by ion chromatography. A calibration curve is generated for the chromatograph by injection of at least 4 standards, which cover the range of the samples.

1.3 LABORATORY REPORTS

A copy of the Quanterra Environmental Services NMVOC and NO_X analytical reports are included at the end of this appendix.

2.0 CALCULATIONS

Results of the testing program were calculated by personal computer (PC). Equations presented in EPA Methods 2, 2B, 3, 4, and 7D were programmed into the PC along with the reduced field data and laboratory results. A list of equations is presented at the end of this appendix following the laboratory reports. Following the equations are copies of the computer printouts containing a summary of input data as well as test results.

Quanterra Incorporated
18501 East Gale Avenue #130
City of Industry, California 91748

818 965-1006 Telephone
818 965-1003 Fax

April 22, 1996

SMITH ENVIRONMENTAL
One Plymouth Meeting Mall
Plymouth Meeting, PA 19462
ATTN: Mr. Philip Burg

ANALYSIS NO.: 117997-0001/0012-SA
ANALYSIS: EPA TO12 - Total Non-methane Hydrocarbons, ASTM-D1946 (Fixed Gases)
DATES SAMPLED: 04/02/96, 04/03/96
DATE SAMPLES REC'D: 04/08/96

PROJECT: CCSWA/0798-01

Enclosed with this letter is the report on the chemical and physical analyses for the samples from ANALYSIS NO.: 117997-0001/0012-SA as shown above.

The samples were received by Quanterra Environmental Services, City of Industry, intact and with the chain-of-custody record attached.

Please note that ND means not detected at the reporting limits expressed.

Thomas Bries for
Val Mallari
Laboratory Manager

4/22/96
Date
Approved

Quanterra
Environmental Services

SAMPLE DESCRIPTION INFORMATION
for
Smith Environmental

Lab ID	Client ID	Matrix	Sampled Date	Sampled Time	Received Date
117997-0001-SA	FLARE INLET RUN 1	AIR	02 APR 96		08 APR 96
117997-0002-SA	FLARE INLET RUN 2	AIR	02 APR 96		08 APR 96
117997-0003-SA	FLARE INLET RUN 3	AIR	02 APR 96		08 APR 96
117997-0004-SA	FLARE OUTLET RUN 1	AIR	02 APR 96		08 APR 96
117997-0005-SA	FLARE OUTLET RUN 2	AIR	02 APR 96		08 APR 96
117997-0006-SA	FLARE OUTLET RUN 3	AIR	02 APR 96		08 APR 96
117997-0007-SA	LEACHATE REACTOR 260 RUN 1	AIR	03 APR 96		08 APR 96
117997-0008-SA	LEACHATE REACTOR 260 RUN 2	AIR	03 APR 96		08 APR 96
117997-0009-SA	LEACHATE REACTOR 260 RUN 3	AIR	03 APR 96		08 APR 96
117997-0010-SA	LEACHATE REACTOR 270 RUN 1	AIR	03 APR 96		08 APR 96
117997-0011-SA	LEACHATE REACTOR 270 RUN 2	AIR	03 APR 96		08 APR 96
117997-0012-SA	LEACHATE REACTOR 270 RUN 3	AIR	03 APR 96		08 APR 96

Quanterra Environmental Services

Fixed Gases
ASTM-D1946

Client Name: Smith Environmental
Client ID: FLARE INLET RUN 1
LAB ID: 117997-0001-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-1

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.9

Received: 08 APR 96
Analyzed: 08 APR 96

Parameter	Result	Qualifier	RL	Units
Carbon dioxide	44		0.19	% (v/v)
Oxygen	2.1		0.19	% (v/v)
Methane	41		0.19	% (v/v)
Carbon monoxide	ND		0.0019	% (v/v)

ND = Not Detected

Quanterra
Environmental Services

Fixed Gases
ASTM-D1946

Client Name: Smith Environmental
Client ID: FLARE INLET RUN 2
LAB ID: 117997-0002-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-1

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.8

Received: 08 APR 96
Analyzed: 08 APR 96

Parameter	Result	Qualifier	RL	Units
Carbon dioxide	44		0.18	% (v/v)
Oxygen	2.9		0.18	% (v/v)
Methane	40		0.18	% (v/v)
Carbon monoxide	ND		0.0018	% (v/v)

ND = Not Detected

Quanterra Environmental Services

Fixed Gases
ASTM-D1946

Client Name: Smith Environmental
Client ID: FLARE INLET RUN 3
LAB ID: 117997-0003-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-1

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.9

Received: 08 APR 96
Analyzed: 08 APR 96

Parameter	Result	Qualifier	RL	Units
Carbon dioxide	41		0.19	% (v/v)
Oxygen	3.7		0.19	% (v/v)
Methane	36		0.19	% (v/v)
Carbon monoxide	ND		0.0019	% (v/v)

ND = Not Detected

Quanterra
Environmental Services

Fixed Gases
ASTM-D1946

Client Name: Smith Environmental
Client ID: FLARE OUTLET RUN 1
LAB ID: 117997-0004-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-1

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.8

Received: 08 APR 96
Analyzed: 12 APR 96

Parameter	Result	Qualifier	RL	Units
Carbon dioxide	8.6		0.18	% (v/v)
Oxygen	12		0.18	% (v/v)
Methane	ND		0.00037	% (v/v)
Carbon monoxide	0.0068		0.0018	% (v/v)

ND = Not Detected

Quanterra Environmental Services

Fixed Gases
ASTM-D1946

Client Name: Smith Environmental
Client ID: FLARE OUTLET RUN 2
LAB ID: 117997-0005-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-1

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.9

Received: 08 APR 96
Analyzed: 08 APR 96

Parameter	Result	Qualifier	RL	Units
Carbon dioxide	8.8		0.19	% (v/v)
Oxygen	13		0.19	% (v/v)
Methane	ND		0.00037	% (v/v)
Carbon monoxide	ND		0.0019	% (v/v)

ND = Not Detected

Quanterra
Environmental Services

Fixed Gases
ASTM-D1946

Client Name: Smith Environmental
Client ID: FLARE OUTLET RUN 3
LAB ID: 117997-0006-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-1

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.9

Received: 08 APR 96
Analyzed: 08 APR 96

Parameter	Result	Qualifier	RL	Units
Carbon dioxide	7.4		0.19	% (v/v)
Oxygen	14		0.19	% (v/v)
Methane	ND		0.00039	% (v/v)
Carbon monoxide	ND		0.0019	% (v/v)

ND = Not Detected

Quanterra Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: FLARE INLET RUN 1
LAB ID: 117997-0001-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 02 APR 96
Prepared: N/A
Dilution: 190

Received: 08 APR 96
Analyzed: 12 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	1500		9.4	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: FLARE INLET RUN 2
LAB ID: 117997-0002-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 02 APR 96
Prepared: N/A
Dilution: 180

Received: 08 APR 96
Analyzed: 16 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	1700		9.0	ppm-c

Quanterra Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: FLARE INLET RUN 3
LAB ID: 117997-0003-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 02 APR 96
Prepared: N/A
Dilution: 190

Received: 08 APR 96
Analyzed: 16 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	1600		9.4	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: FLARE OUTLET RUN 1
LAB ID: 117997-0004-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.8

Received: 08 APR 96
Analyzed: 12 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	0.31		0.092	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: FLARE OUTLET RUN 2
LAB ID: 117997-0005-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.9

Received: 08 APR 96
Analyzed: 12 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	0.40		0.094	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: FLARE OUTLET RUN 3
LAB ID: 117997-0006-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 02 APR 96
Prepared: N/A
Dilution: 1.9

Received: 08 APR 96
Analyzed: 12 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	0.43		0.097	ppm-c

Quanterra Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name:	Smith Environmental		
Client ID:	LEACHATE REACTOR 260 RUN 1		
LAB ID:	117997-0007-SA		
Matrix:	AIR	Sampled: 03 APR 96	Received: 08 APR 96
Authorized:	08 APR 96	Prepared: N/A	Analyzed: 16 APR 96
Instrument:	GC-2	Dilution: 4.9	

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	40		0.24	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: LEACHATE REACTOR 260 RUN 2
LAB ID: 117997-0008-SA
Matrix: AIR
Authorized: 08 APR 96
Instrument: GC-2

Sampled: 03 APR 96
Prepared: N/A
Dilution: 4.8

Received: 08 APR 96
Analyzed: 16 APR 96

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	26		0.24	ppm-c

Quanterra Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name:	Smith Environmental		
Client ID:	LEACHATE REACTOR 270 RUN 1		
LAB ID:	117997-0010-SA		
Matrix:	AIR	Sampled: 03 APR 96	Received: 08 APR 96
Authorized:	08 APR 96	Prepared: N/A	Analyzed: 15 APR 96
Instrument:	GC-2	Dilution: 2.1	

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	15		0.10	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: LEACHATE REACTOR 260 RUN 3
LAB ID: 117997-0009-SA
Matrix: AIR
Sampled: 03 APR 96
Received: 08 APR 96
Authorized: 08 APR 96
Prepared: N/A
Analyzed: 16 APR 96
Instrument: GC-2
Dilution: 4.7

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	25		0.23	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name:	Smith Environmental		
Client ID:	LEACHATE REACTOR 270 RUN 2		
LAB ID:	117997-0011-SA		
Matrix:	AIR	Sampled: 03 APR 96	Received: 08 APR 96
Authorized:	08 APR 96	Prepared: N/A	Analyzed: 15 APR 96
Instrument:	GC-2	Dilution: 1.9	

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	17		0.096	ppm-c

Quanterra
Environmental Services

Non-Methane Organic Compounds
Method EPA TO-12

Client Name: Smith Environmental
Client ID: LEACHATE REACTOR 270 RUN 3
LAB ID: 117997-0012-SA
Matrix: AIR Sampled: 03 APR 96 Received: 08 APR 96
Authorized: 08 APR 96 Prepared: N/A Analyzed: 16 APR 96
Instrument: GC-2 Dilution: 4.5

Parameter	Result	Qualifier	RL	Units
Non-Methane Organic Compounds	34		0.23	ppm-c

Quanterra
Environmental Services

QC LOT ASSIGNMENT REPORT - MS QC
Air Toxics

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK/LCS)	MS QC Run Number (SA,MS,SD,DU)
117997-0001-SA	AIR	TO-12-G		12 APR 96-A2	
117997-0001-SA	AIR	ASTM-D1946	08 APR 96-A1	08 APR 96-A1	
117997-0002-SA	AIR	TO-12-G		16 APR 96-A2	
117997-0002-SA	AIR	ASTM-D1946	08 APR 96-A1	08 APR 96-A1	
117997-0003-SA	AIR	TO-12-G		16 APR 96-A2	
117997-0003-SA	AIR	ASTM-D1946	08 APR 96-A1	08 APR 96-A1	
117997-0004-SA	AIR	TO-12-G		12 APR 96-A2	
117997-0004-SA	AIR	ASTM-D1946	12 APR 96-A1	12 APR 96-A1	
117997-0005-SA	AIR	TO-12-G		12 APR 96-A2	
117997-0005-SA	AIR	ASTM-D1946	08 APR 96-A1	08 APR 96-A1	
117997-0006-SA	AIR	TO-12-G		12 APR 96-A2	
117997-0006-SA	AIR	ASTM-D1946	08 APR 96-A1	08 APR 96-A1	
117997-0007-SA	AIR	TO-12-G		16 APR 96-A2	
117997-0008-SA	AIR	TO-12-G		16 APR 96-A2	
117997-0009-SA	AIR	TO-12-G		16 APR 96-A2	
117997-0010-SA	AIR	TO-12-G		15 APR 96-A2	
117997-0011-SA	AIR	TO-12-G		15 APR 96-A2	
117997-0012-SA	AIR	TO-12-G		16 APR 96-A2	

Quanterra
Environmental Services

DUPLICATE CONTROL SAMPLE REPORT
Air Toxics
Project: 117997

Category: ASTM-D1946 Fixed Gases (ASTM-D1946)
Matrix: AIR
QC Lot: 08 APR 96-A1 Date Analyzed: 08 APR 96
Concentration Units: % (v/v)

Analyte	Concentration Spiked	Measured DCS1	Qual	DCS2	Qual	AVG	Accuracy Average (%) DCS	Limits	Precision (RPD) DCS	Limit
Methane	0.0100	0.0105		0.0102		0.0104	104	80-120	3.1	20
Carbon dioxide	10.0	9.70		9.96		9.83	98	80-120	2.6	20

Category: ASTM-D1946 Fixed Gases (ASTM-D1946)
Matrix: AIR
QC Lot: 12 APR 96-A1 Date Analyzed: 12 APR 96
Concentration Units: % (v/v)

Analyte	Concentration Spiked	Measured DCS1	Qual	DCS2	Qual	AVG	Accuracy Average (%) DCS	Limits	Precision (RPD) DCS	Limit
Methane	0.0100	0.00995		0.0101		0.0100	100	80-120	1.1	20
Carbon dioxide	10.0	10.0		9.99		10.0	100	80-120	0.10	20

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quanterra
Environmental Services

METHOD BLANK REPORT
Air Toxics
Project: 117997

Test: TO-12-G Method EPA TO-12 - Non-Methane Organic Compounds
Matrix: AIR
QC Run: 12 APR 96-A2 Date Analyzed: 12 APR 96

Analyte	Result	Units	Reporting Limit
Non-Methane Organic Compounds	ND	ppm-c	0.050

QC Run: 16 APR 96-A2 Date Analyzed: 16 APR 96

Analyte	Result	Units	Reporting Limit
Non-Methane Organic Compounds	ND	ppm-c	0.050

QC Run: 15 APR 96-A2 Date Analyzed: 15 APR 96

Analyte	Result	Units	Reporting Limit
Non-Methane Organic Compounds	ND	ppm-c	0.050

Test: ASTM-D1946 Method ASTM-D1946 - Fixed Gases
Matrix: AIR
QC Run: 08 APR 96-A1 Date Analyzed: 08 APR 96

Analyte	Result	Units	Reporting Limit
Carbon dioxide	ND	% (v/v)	0.010
Oxygen	ND	% (v/v)	0.10
Methane	ND	% (v/v)	0.00020
Carbon monoxide	ND	% (v/v)	0.0010

QC Run: 12 APR 96-A1 Date Analyzed: 12 APR 96

Analyte	Result	Units	Reporting Limit
Carbon dioxide	ND	% (v/v)	0.010
Oxygen	ND	% (v/v)	0.10
Methane	ND	% (v/v)	0.00020
Carbon monoxide	ND	% (v/v)	0.0010

ND = Not Detected

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: A-172

DATE CLEANED: 3/25A

~~VFR ID:~~

~~Duration of comp.: hrs./min.~~

~~Flow setting: ml/min~~

~~Initials:~~

READING	VAC. (inches Hg) or PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/2/96	PCB
FINAL FIELD READING	~~3.5~~ 6.0 (PCB)	4/2/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/2/96	PCB

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N2

COMMENTS Inlet

Flare ~~Outlet~~ Run 1

Time (Hours)	Acceptable Range(-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 9138B

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ number

Initials: _____

READING	VAC. (inches Hg = PRESS. (psia	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/2/96	PCB
FINAL FIELD READING	2.5	4/2/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/2/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	2"HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N2

COMMENTS Flow inlet Run 2

Time (Hours)	Acceptable Range(+-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 9154B

DATE CLEANED: 3/22A

VFR ID: _____

Duration of comb.: _____ hrs./min.

Flow setting: _____ nitrogen

Inmet: _____

READING	VAC. (inches Hg) or PRES. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	30.0	4/2/96	PCB
FINAL FIELD READING	4.0	4/2/96	PCB
GAUGE READING UPON RECEIPT	30	4/2/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3"HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N_2

COMMENTS Flare Inlet Run 3

Time (Hours)	Acceptable Range (-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 136

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min

Initials: _____

READING	VAC. (inches Hg) or PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5		
FINAL FIELD READING	~~6.0~~ 3.5 (PCB)		
GAUGE READING UPON RECEIPT	29.5		

LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	2.5" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N2

COMMENTS Flare Outlet Run 1

Time (Hours)	Acceptable Range(-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 12652

DATE CLEANED: 3/25A

VER ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min.

Initials: _____

READING	VAC. (inches Hg) or PRES. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/2/96	PCB
FINAL FIELD READING	4.0	4/2/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/2/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N2

COMMENTS

Flare Outlet Run 2

Time (Hours)	Acceptable Range (-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: Southern ENV-

CANISTER SERIAL #: 809

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min.

Initials: _____

READING	VAC. (inches Hg) or PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/2/96	PCB
FINAL FIELD READING	5.0	4/2/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/2/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	4" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/9/96	QT

Pressurization gas: N2

COMMENTS Flare Outlet Run 3

Time (Hours)	Acceptable Range (-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV.

CANISTER SERIAL #: 02706

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min.

Initials: _____

READING	VAC. (inches Hg) or PRES. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	30	4/3/96	PCB
FINAL FIELD READING	4.5	4/3/96	PCB
GAUGE READING UPON RECEIPT	30	4/3/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	4" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N_2

COMMENTS Leachate Reactor #260
Run 1

Time (Hours)	Acceptable Range(+-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 9235B

DATE CLEANED: 3/25A

VER ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min.

Initials: _____

READING	VAC. (inches Hg) = PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	30.0	4/3/96	PCB
FINAL FIELD READING	4.0	4/3/96	PCB
GAUGE READING UPON RECEIPT	30.0	4/3/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3.5" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N2

COMMENTS Leachate Reactor #260
Run 2

Time (Hours)	Acceptable Range(-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 9309B

DATE CLEANED: 3/22A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min

Initials: _____

READING	VAC. (inches Hg) or PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	30.0	4/3/96	PCB
FINAL FIELD READING	3.5	4/3/96	PCB
GAUGE READING UPON RECEIPT	30.0	4/3/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N_2

COMMENTS Leachate Reacta #260
Run 3

Time (Hours)	Acceptable Range(+5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 9413 BB

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ minutes

Flow setting: _____ number

Initials: _____

READING	VAC. (inches Hg) = PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/3/96	PCB
FINAL FIELD READING	3.0	4/3/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/3/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3.5" Hg	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N_2

COMMENTS Leachate Reactor #270
Run 2

Time (Hours)	Acceptable Range (-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 9413 BB

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ minutes

Flow setting: _____ number

Initials: _____

READING	VAC. (inches Hg) = PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/3/96	PCB
FINAL FIELD READING	3.0	4/3/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/3/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	3.5 "HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N_2

COMMENTS Leachate Reactor #270
Run 2

Time (Hours)	Acceptable Ranges (-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 910 B

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min

Initials: _____

READING	VAC. (inches Hg) = PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM	29.5	4/3/96	PCB
FINAL FIELD READING	2.5	4/3/96	PCB
GAUGE READING UPON RECEIPT	29.5	4/3/96	PCB
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)	2" HG	4/8/96	QT
FINAL PRESSURE (PSIA)	24.6	4/8/96	QT

Pressurization gas: N_2

COMMENTS Leachate Reactor #270 Run 3

Time (Hours)	Acceptable Range(-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

DNA

CANISTER FIELD DATA RECORD

CLIENT: SAIC ENV-

CANISTER SERIAL #: 92844

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ ml/min.

Initials: _____

READING	VAC. (inches Hg) = PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM			
FINAL FIELD READING			
GAUGE READING UPON RECEIPT			
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)			
FINAL PRESSURE (PSIA)			

Pressurization gas: ____

COMMENTS

Time (Hours)	Acceptable Range (-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

DNA

CANISTER FIELD DATA RECORD

CLIENT: SMITH ENV-

CANISTER SERIAL #: 12608

DATE CLEANED: 3/25A

VFR ID: _____

Duration of comp.: _____ hrs./min.

Flow setting: _____ number

Initials: _____

READING	VAC. (inches Hg) or PRESS. (psia)	DATE	INITIALS
INITIAL VACUUM CHECK	30	3/27/96	QT
INITIAL FIELD VACUUM			
FINAL FIELD READING			
GAUGE READING UPON RECEIPT			
LABORATORY CANISTER PRESSURIZATION			
INITIAL VACUUM (inches Hg and PSIA)			
FINAL PRESSURE (PSIA)			

Pressurization gas: _____

COMMENTS

Time (Hours)	Acceptable Range(-5%) (ml/min)
0.5	167 - 158
1	83.3 - 79.2
2	41.7 - 39.6
4	20.8 - 19.8
6	13.9 - 13.2
8	10.4 - 9.9
10	8.3 - 7.9
12	6.9 - 6.6
24	3.5 - 3.3

Chain of Custody Record

Quanterra Environmental Services

QUA-4124-1

Client: Smith Environmental	Project Manager: Philip Bury	Date: 4/3/96	Chain Of Custody Number: 46099
Address: One Plymouth Meeting Mall	Telephone Number (Area Code)/Fax Number: (610) 825-3800 Fax (610) 825-9208	Lab Number: 117997	Page 1 of 1
City: Plymouth Meeting; State: PA; Zip Code: 19462	Site Contact:	Lab Contact:	
Project Name: CCSWA 0798-01	Carrier/Waybill Number: FedEx 305120 8381		
Contract/Purchase Order/Quote No.: 0798-01 31398			

Analysis (Attach list if more space is needed)

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Sumpa	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	TO-12 (TNMHC)	CH4	CO2	CO	O2	ASTM D1946
Flare inlet Run 1	4/2/96					X							X	X	X	X	X	
Flare inlet Run 2						X							X	X	X	X	X	
Flare inlet Run 3						X							X	X	X	X	X	
Flare outlet Run 1						X							X	X	X	X	X	
Flare outlet Run 2						X							X	X	X	X	X	
Flare outlet Run 3						X							X	X	X	X	X	
leachate Reactor 260 Run 1	4/3/96					X							Y					
" " 260 Run 2						X							X					
" " 260 Run 3						X							X					
" " 270 Run 1						X							X					
" " 270 Run 2						X							X					
" " 270 Run 3						X							X					

Special Instructions/ Conditions of Receipt

Attached table Nos. 1, 2, & 3 provide approximate TNMHC, CH_4, CO_2, O_2, and CO concentrations to expect for Flare inlet & outlet samples

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):

1. Relinquished By: Philip C. Bury	Date: 4/4/96	Time: 10:00	1. Received By:	Date: 4/8/96	Time: 1030
2. Relinquished By:	Date:	Time:	2. Received By:	Date:	Time:
3. Relinquished By:	Date:	Time:	3. Received By:	Date:	Time:

Comments: Fedex # CANS 12844 AND 12608 DO NOT ANALYZE 4/8 DL

DISTRIBUTION: WHITE Stays with Sample CANARY Returned to Client with Report PINK - Field Copy

Quanterra Environmental Services

Quanterra Incorporated
5815 Middlebrook Pike
Knoxville, Tennessee 37921

423 588-6401 Telephone
423 584-4315 Fax

April 18, 1996

Philip Burg
Smith Environmental
One Plymouth Meeting Mall
Plymouth Meeting, PA 19462

RE: Air Report
Client Project No: CCSWA 0798-01
Work Order No: 5233

Dear Mr Burg:

Enclosed please find one copy of our final Air report and the original invoice for four air samples received April 4, 1996.

Quanterra Environmental Services appreciates your business and looks forward to working with you in the future. Please call if you have any questions about our report or services.

Sincerely,

Patricia M. Parsly

Patricia M. Parsly
Project Manager

Quanterra Incorporated
5815 Middlebrook Pike
Knoxville, Tennessee 37921

423 588-6401 Telephone
423 584-4315 Fax

Quanterra
Environmental Services

Smith Environmental
One Plymouth Meeting Mall
Plymouth Meeting, PA 19462
Attn: Philip Burg

April 18, 19

Job Number: 5233

This is the Certificate of Analysis for the following samples:

Client Project ID:	CCSWA 0798-01
Date Received by Lab:	April 5, 1996
Number of Samples:	Four (4)
Sample Type:	Air

I. Introduction

On April 5, 1996, four (4) air samples arrived at Quanterra Environmental Services, Knoxville, Tennessee from Smith Environmental, Plymouth Meeting, Pennslyvania. The list of analytical tests performed, as well a date of receipt and analysis, can be found in the attached report.

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. Each set of data will include sample identification information and the analytical results. The temperature of the sample cooler upon receipt was 8°C. The samples were processed as per Philip Burgs request on April 5, 1996.

The samples were analyzed for nitrogen oxides by EPA method 7D.

Reviewed and Approved:

Patricia M. Parlsy
Project Manager

III. Quality Control

Routine laboratory level I QC was followed.

Smith Environmental
April 18, 1996

Quanterra Environmental Services

Client Project ID: CCSWA 0798-01

Job Number: 5233

NITROGEN OXIDE ANALYSIS

Results in µg/ml

Sample Matrix: Air

Client Sample ID	Lab Sample ID	Result	Qualifier
Method Blank	AH5007	1.0	U
Flare Run 1	AH4995	3.75	U
Flare Run 2	AH4996	6.06	+
Flare Run 3	AH4997	3.75	U
KMN04 Blank	AH4998	3.90	U

LABORATORY CONTROL SAMPLE PERCENT RECOVERY

Lab Sample ID	Blank Result	LCS True Value	LCS Result	% Recovery
AH5008	1.0 U	4.0	4.1	102

DUPLICATE ANALYSIS

Client Sample ID	Lab Sample ID	Original Result	Duplicate Result	Relative % Difference
Flare Run 1	AH4995	3.75 U	3.75 U	0

Analysis Date: 04/08/96

\+ - Positive result.
U - Compound was analyzed for but not detected. The number is the reporting limit for the sample.

LEGEND

A_s	=	Area of stack, $in.^2$
B_{wo}	=	Moisture content of gas stream, dimensionless
C_p	=	Pitot correction factor, dimensionless
M_d	=	Dry molecular weight of stack gas, lb/lb-mole
M_s	=	Molecular weight of stack gas, lb/lb-mole
P_{bar}	=	Barometric pressure, in. Hg
P_s	=	Stack pressure (absolute), in. Hg
$\sqrt{\Delta P}$	=	Average of square roots of pitot pressure differential, in. H_2O
Q_s	=	Stack gas flow, acfm
$Q_s(std)$	=	Stack gas flow, scfm
T_m	=	Average dry gas meter temperature, °F
T_s	=	Average stack temperature, °F
V_m	=	Dry sample volume (meter conditions), ft^3
$V_m(std)$	=	Dry sample volume (standard conditions), ft^3
V_s	=	Stack velocity, ft/min
V_{wc}	=	Volume of liquid collected in impingers and silica gel, ml
$V_w(std)$	=	Volume of liquid collected, ft^3
γ	=	Meter box calibration factor, dimensionless

TABLE 31—CONTINUED

PERCENTAGE RELATIVE HUMIDITY OF AIR AS FUNCTION OF WET- AND DRY-BULB TEMPERATURE DIFFERENCE

TEMPERATURE RANGE, −50 TO +108°F.; PRESSURE, 29.921" Hg

Dry-bulb temp., °F.	Difference between dry- and wet-bulb thermometer readings, °F.																																								Dry-bulb temp., °F.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5																															50
51	94	87	81	75	68	62	56	50	45	39	34	28	23	17	12	7	2																												51
52	94	87	81	75	69	63	57	51	46	40	35	29	24	19	14	9	4																												52
53	94	87	81	75	69	63	58	52	47	41	36	31	26	20	16	10	6	1																											53
54	94	88	82	76	70	64	59	53	48	42	37	32	27	22	17	12	8	3																											54
55	94	88	82	76	70	65	59	54	49	43	38	33	28	23	19	14	9	5																											55
56	94	88	82	76	71	65	60	55	50	44	39	34	30	25	20	16	11	7	2																										56
57	94	88	82	77	71	66	61	55	50	45	40	35	31	26	22	17	13	8	4																										57
58	94	88	83	77	72	66	61	56	51	46	41	37	32	27	23	18	14	10	6	1																									58
59	94	89	83	78	72	67	62	57	52	47	42	38	33	29	24	20	16	11	7	3																									59
60	94	89	83	78	73	68	63	58	53	48	43	39	34	30	26	21	17	13	9	5	1																								60
61	94	89	84	78	73	68	63	58	54	49	44	40	35	31	27	22	18	14	10	7	3																								61
62	94	89	84	79	74	69	64	59	54	50	45	41	36	32	28	24	20	16	12	8	4	1																							62
63	95	89	84	79	74	69	64	60	55	50	46	42	37	33	29	25	21	17	13	10	6	2																							63
64	95	90	84	79	74	70	65	60	56	51	47	43	38	34	30	26	22	18	15	11	7	4																							64
65	95	90	85	80	75	70	66	61	56	52	48	44	39	35	31	27	24	20	16	12	9	5	2																						65
66	95	90	85	80	75	71	66	61	57	53	48	44	40	36	32	30	25	21	17	14	10	7	3																						66
67	95	90	85	80	75	71	66	62	58	53	49	45	41	37	33	30	26	22	19	15	12	8	5	2																					67
68	95	90	85	80	76	71	67	62	58	54	50	46	42	38	34	31	27	23	20	16	13	10	6	3																					68
69	95	90	85	81	76	72	67	63	59	55	51	47	43	39	35	32	28	24	21	18	14	11	8	5	1																				69
70	95	90	86	81	77	72	68	64	60	55	51	48	44	40	36	33	29	26	22	19	15	12	9	6	3																				70
71	95	90	86	81	77	72	68	64	60	56	52	48	45	41	37	33	30	27	23	20	17	13	10	7	4	1																			71
72	96	91	86	82	77	73	69	65	61	57	53	49	46	42	38	34	31	28	24	21	18	15	12	9	6	3																			72
73	95	91	86	82	78	73	69	65	61	57	53	50	46	42	39	35	32	29	25	22	19	16	13	10	7	4	1																		73
74	95	91	86	82	78	74	69	65	61	58	54	50	47	43	39	36	33	29	26	23	20	17	14	11	8	5	3																		74
75	96	91	86	82	78	74	70	66	62	58	54	51	47	44	40	37	34	30	27	24	21	18	15	12	9	7	4	1																	75
76	96	91	87	82	78	74	70	66	62	59	55	51	48	44	41	38	34	31	28	25	22	19	16	13	11	8	5	3																	76
77	96	91	87	83	79	74	71	67	63	59	56	52	48	45	42	39	35	32	29	26	23	20	17	14	12	9	6	4	1																77
78	96	91	87	83	79	75	71	67	63	60	56	53	49	46	43	39	36	33	30	27	24	21	18	16	13	10	8	5	3																78
79	96	91	87	83	79	75	71	68	64	60	57	53	50	46	43	40	37	34	31	28	25	22	19	17	14	11	9	6	4	1															79
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15	12	10	7	5	3															80
82	96	92	88	84	80	76	72	69	65	61	58	55	51	48	45	42	39	36	33	30	28	25	22	20	17	14	12	10	7	5	2														82
84	96	92	88	84	80	76	73	69	66	62	59	56	52	49	46	43	40	37	35	32	29	26	24	21	19	16	14	12	9	7	5	3													84
86	96	92	88	84	81	77	73	70	66	63	60	57	53	50	47	44	42	39	36	33	31	28	26	23	21	18	16	14	12	10	8	6	3												86
88	96	92	88	85	81	77	74	70	67	64	61	57	54	51	48	46	43	40	37	35	32	30	27	25	22	20	18	16	13	11	9	7	5	3	1										88
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24	22	19	17	15	13	11	9	7	5	3	1									90
92	96	92	89	85	82	78	75	72	68	65	62	59	56	53	50	48	45	42	40	37	35	32	30	28	25	23	21	19	17	15	13	10	9	7	5	3	1								92
94	96	93	89	85	82	79	75	72	69	66	63	60	57	54	51	49	46	43	41	38	36	33	31	29	27	24	22	20	18	16	14	12	10	9	7	5	3	1							94
96	96	93	89	86	82	79	76	73	69	66	63	61	58	55	52	50	47	44	42	39	37	35	32	30	28	26	24	22	20	18	16	14	12	10	8	7	5	3	2						96
98	96	93	89	86	82	79	76	73	70	67	64	61	58	55	53	50	48	45	43	40	38	36	34	32	29	27	25	23	21	19	17	15	14	12	10	8	7	5	3	2					98
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30	28	26	24	22	21	19	16	15	13	12	10	8	7	5	4	2	1			100
102	96	93	90	86	83	80	77	74	71	68	65	63	60	57	55	52	49	47	45	42	40	38	36	34	32	30	28	26	24	22	20	18	16	15	13	11	10	8	7	5	4	2	1		102
104	97	93	90	87	83	80	77	74	71	69	66	63	60	58	55	53	50	48	46	43	41	39	37	35	33	31	29	27	25	23	21	19	18	16	14	13	12	10	8	7	5	4	2	1	104
106	97	93	90	87	84	81	78	75	72	69	66	64	61	58	56	53	51	49	46	44	42	40	38	36	34	32	30	28	26	24	23	20	19	17	16	14	13	11	10	8	7	5	4	2	106
108	97	93	90	87	84	81	78	75	72	70	67	64	62	59	57	54	52	49	47	45	43	41	39	37	35	33	31	29	27	25	24	21	20	19	17	16	14	13	12	11	10	8	7	5	108

Chain of Custody Record

COC NO. "0005906"

WO# 5233
RI# 5070

Quanterra Environmental Services

OUA-4124-1

Client	Project Manager	Date	Chain Of Custody Number
Smith Environmental	Philip Bung	4/3/96	46098
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page**
One Plymouth Meeting Mall	(610) 825-3800 Fax (610) 825-9204		Page 1 of 1
City / State / Zip Code	**Site Contact**	**Lab Contact**	
Plymouth Meeting / PA / 19462			
Project Name	**Carrier/Waybill Number**		
C.C.S.W.A., 0798-01	FedEx 3051208370		
Contract/Purchase Order/Quote No.			
~~0798-01~~ 31398			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): EPA 7D	Special Instructions/ Conditions of Receipt
Flare Run 1	4/2/96		X									X	Rec'd @ 8°C
Flare Run 2	4/2/96		X									X	No Custody Seals BPB 4/5/96
Flare Run 3	4/2/96		X									X	
KMNO4 Blank	4/2/96		X									X	

Final volume of all samples is 1,000 ml

EPA Method 7D is ion chromatographic analysis for ~~nitrate~~ NO_2

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: Philip C. Bung	4/4/96	10:00AM	1. Received By: Ryan Blomquist QESKN	4/05/96	08:50
2. Relinquished By:			2. Received By:		
3. Relinquished By:			3. Received By:		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

EQUATIONS FOR MOISTURE CONTENT AND FLOW RATE CALCULATIONS
(Based on Standard Conditions of 68°F and 29.92 in .Hg)

1. $V_w(std) = 0.0471\ V_{wc}$

2. $V_m(std) = 17.64\ V_m \dfrac{P_{bar}}{T_m + 460}\ \gamma$

3. $B_{wo} = \dfrac{V_w(std)}{V_m(std) + V_w(std)}$

4. $M_d = 0.44(\%CO_2) + 0.28(\%CO) + 0.32(\%O_2) + 0.28(\%N_2)$

5. $M_s = M_d\ (1 - B_{wo}) + 18\ B_{wo}$

6. $V_s = (85.49)(60)(C_p)\sqrt{\Delta P}\sqrt{\dfrac{T_s + 460}{(P_s)(M_s)}}$

7. $Q_s = \dfrac{(V_s)(A_s)}{144}$

8. $Q_s(std) = Q_s(1 - B_{wo})\ 17.64 \dfrac{P_s}{T_s + 460}$

9. $P_s = \dfrac{\text{Static pressure, in. water}}{13.6 \text{ in. water/in. Hg}}$

T_s °F	% H_2O	Φ_m	T_s °F	% H_2O	Φ_m	T_s °F	% H_2O	Φ_m	T_s °F	% H_2O	Φ_m	T_s °F	% H_2O	Φ_m
32	.60	.00853	72	2.64	.00786	112	9.19	.00722	152	26.58	.00651	192	66.32	.0055
33	.63	.00851	73	2.73	.00784	113	9.46	.00720	153	27.24	.00650	193	67.75	.0055
34	.65	.00850	74	2.83	.00783	114	9.73	.00719	154	27.92	.00648	194	69.19	.0055
35	.68	.00848	75	2.92	.00781	115	10.01	.00717	155	28.60	.00646	195	70.67	.0055
36	.71	.00846	76	3.02	.00780	116	10.30	.00715	156	29.31	.00644	196	72.16	.0054
37	.74	.00844	77	3.12	.00778	117	10.59	.00714	157	30.02	.00642	197	73.69	.0054
38	.77	.00843	78	3.23	.00776	118	10.89	.00712	158	30.75	.00640	198	75.24	.0054
39	.80	.00841	79	3.34	.00775	119	11.20	.00710	159	31.50	.00637	199	76.82	.0053
40	.83	.00839	80	3.45	.00773	120	11.52	.00709	160	32.26	.00635	200	78.43	.0053
41	.86	.00838	81	3.56	.00772	121	11.84	.00707	161	33.04	.00633	201	80.06	.0053
42	.89	.00836	82	3.68	.00770	122	12.17	.00705	162	33.83	.00631	202	81.73	.0052
43	.93	.00834	83	3.80	.00768	123	12.51	.00704	163	34.64	.00629	203	83.42	.0052
44	.97	.00832	84	3.93	.00767	124	12.86	.00702	164	35.47	.00627	204	85.14	.0052
45	1.00	.00831	85	4.05	.00765	125	13.22	.00700	165	36.31	.00625	205	86.89	.0051
46	1.04	.00829	86	4.19	.00764	126	13.58	.00699	166	37.17	.00623	206	88.67	.0051
47	1.08	.00827	87	4.32	.00762	127	13.95	.00697	167	38.05	.00620	207	[redacted]	[redacted]
48	1.12	.00826	88	4.46	.00760	128	14.34	.00695	168	38.94	.00618	208	92.32	.0050
49	1.17	.00824	89	4.60	.00759	129	14.73	.00693	169	39.85	.00616	209	94.20	.0050
50	1.21	.00822	90	4.75	.00757	130	15.13	.00692	170	40.78	.00614	210	96.10	.0050
51	1.26	.00820	91	4.90	.00756	131	15.53	.00690	171	41.72	.00612	211	98.03	.0049
52	1.30	.00819	92	5.06	.00754	132	15.95	.00688	172	42.69	.00609	212	100.00	.0049
53	1.35	.00817	93	5.22	.00752	133	16.38	.00687	173	43.67	.00607			
54	1.40	.00815	94	5.38	.00751	134	16.82	.00685	174	44.68	.00605			
55	1.46	.00814	95	5.55	.00749	135	17.27	.00683	175	45.70	.00602			
56	1.51	.00812	96	5.73	.00748	136	17.72	.00681	176	46.74	.00600			
57	1.57	.00810	97	5.90	.00746	137	18.19	.00679	177	47.80	.00598			
58	1.62	.00809	98	6.08	.00745	138	18.67	.00678	178	48.88	.00595			
59	1.68	.00807	99	6.27	.00743	139	19.16	.00676	179	49.99	.00593			
60	1.74	.00806	100	6.46	.00741	140	19.66	.00674	180	51.11	.00590			
61	1.81	.00804	101	6.66	.00740	141	20.17	.00672	181	52.25	.00588			
62	1.87	.00802	102	6.86	.00738	142	20.69	.00670	182	53.42	.00585			
63	1.94	.00801	103	7.07	.00736	143	21.23	.00669	183	54.61	.00583			
64	2.01	.00799	104	7.28	.00735	144	21.77	.00667	184	55.82	.00580			
65	2.08	.00797	105	7.50	.00733	145	22.33	.00665	185	57.05	.00578			
66	2.15	.00796	106	7.72	.00732	146	22.90	.00663	186	58.30	.00575			
67	2.23	.00794	107	7.95	.00730	147	23.48	.00661	187	59.58	.00572			
68	2.31	.00792	108	8.19	.00728	148	24.08	.00659	188	60.88	.00570			
69	2.39	.00791	109	8.43	.00727	149	24.68	.00657	189	62.20	.00567			
70	2.47	.00789	110	8.68	.00725	150	25.30	.00655	190	63.55	.00564			
71	2.56	.00788	111	8.93	.00724	151	25.93	.00653	191	64.92	.00561			

Gas Moisture, Molecular Weight, and Flow Rate Calculations

Plant: Clinton County SWA BCM Project No: 00-0798-01
Test Location: Enclosed Landfill Gas Flare Inlet Operator: PCB/JW

	Run No. 1	Run No. 2	Run No. 3
Test date	4/2/96	4/2/96	4/2/96
Test time start	0900	1204	1434
Test time stop	1027	1304	1539
Elapsed sampling time, min	60	60	65
Wet bulb temperature, °F	57	66	63
Dry bulb temperature, °F	69	78	81
Relative humidity of gas stream, %	47.0	53.0	36.0
Moisture content at saturation, %	2.4	3.2	3.6
Bwo - Moisture content of gas stream, %	1.1	1.7	1.3
CO2 concentration, %	44.0	44.0	41.0
O2 concentration, %	2.1	2.9	3.7
CO concentration, ppmv	<19	<18	<19
CH4 concentration, %	41.0	40.0	36.0
N2 concentration, %	12.9	13.1	19.3
Md - Dry molecular weight of stack gas, lb/lb-mole	30.20	30.36	30.39
Ms - Molecular weight of stack gas, lb/lb-mole	30.07	30.15	30.23
Duct diameter, inches	5.50	5.50	5.50
Duct width, inches			
Duct length, inches			
As - Duct area, sq. ft	0.16	0.16	0.16
Ps - Stack static pressure, in. H2O	0.5	0.5	0.6
Pbar - Barometric pressure, in. Hg	29.50	29.55	29.57
Ps - Stack absolute pressure, in. Hg	29.54	29.59	29.61
Ts - Average stack gas temperature, °F	69	79	81
$\sqrt{\Delta P}$ - Average square root of pitot pressure differencial, in. H2O	0.402	0.391	0.400
Cp - Pitot correction factor, dimensionless	0.99	0.99	0.99
Vs - Stack gas velocity, ft/min	1,577	1,544	1,577
Qs - Stack gas flow, acfm	260	255	260
Qs(std) - Stack gas flow, dscfm	253	243	248

Gas Moisture, Molecular Weight, and Flow Rate Calculations

Plant: Clinton County SWA BCM Project No: 00-0798-01
Test Location: Enclosed Landfill Gas Flare Outlet Operator: PCB/JW

	Run No. 1	Run No. 2	Run No. 3
Test date	4/2/96	4/2/96	4/2/96
Test time start	0900	1204	1434
Test time stop	1027	1304	1539
Elapsed sampling time, min	60	60	65
Vwc - Volume of liquid collected, ml	51.1	55.0	53.9
Vw (std) - Volume of liquid collected @ std. cond., ml	2.407	2.591	2.539
Vm - Dry sample volume- meter conditions, dacf	31.638	28.542	31.215
Pbar - Barometric pressure, in. Hg	29.50	29.55	29.57
Δ H - Orifice pressure drop, in. H2O	2.00	2.00	2.00
γ - Dry gas meter coefficent	0.97	0.97	0.97
Tm - Average dry gas meter temperature, °F	51	57	64
Vm (std) - Dry sample volume, dscf	31.422	28.050	30.282
Bwo - Moisture content of gas stream. %	7.1	8.5	7.7
CO2 emission concentration, %	8.6	8.8	7.4
O2 emission concentration, %	12.0	13.0	14.0
CO emission concentration, %	0.0	0.0	0.0
N2 emission concentration, %	79.4	78.2	78.6
Md - Dry molecular weight of stack gas, lb/lb-mole	29.86	29.93	29.74
Ms - Molecular weight of stack gas, lb/lb-mole	29.01	28.92	28.84
Duct diameter, inches	68.00	68.00	68.00
Duct width, inches			
Duct length, inches			
As - Duct area, sq. ft	25.22	25.22	25.22
Ps - Stack static pressure, in. H2O	-0.105	-0.120	-0.105
Ps - Stack absolute pressure, in. Hg	29.49	29.54	29.56
Ts - Average stack gas temperature, °F	1,324	1,360	1,337
$\sqrt{\Delta P}$ - Average square root of pitot pressure differencial, in. H2O	0.096	0.069	0.057
Cp - Pitot correction factor, dimensionless	0.84	0.84	0.84
Vs - Stack gas velocity, ft/min	599	433	359
Qs - Stack gas flow rate (from pitot traverse), acfm	15,103	10,910	9,051
Qs(std) - Stack gas flow rate (from pitot traverse), dscfm	4,091	2,859	2,424

Cont.

Gas Moisture, Molecular Weight, and Flow Rate Calculations

Plant: Clinton County SWA BCM Project No: 00-0798-01
Test Location: Enclosed Landfill Gas Flare Outlet Operator: PCB/SR/JW

	Run No. 1	Run No. 2	Run No. 3
Outlet Gas Flow Rate Calculation by Carbon Mass Balance			
Inlet NMVOC concentration as methane, ppmv	1,500	1,700	1,600
Inlet CH4 concentration, ppmv	410,000	400,000	360,000
Inlet CO concentration, ppmv	<19	<18	<19
Inlet CO2 concentration, ppmv	440,000	440,000	410,000
Total inlet carbon concentration, ppmv	851,519	841,718	771,619
Outlet NMVOC concentration as methane, ppmv	0.31	0.40	0.43
Outlet CH4 concentration, ppmv	<4	<4	<4
Outlet CO concentration, ppmv	<18	<19	<19
Outlet CO2 concentration, ppmv	86,000	88,000	74,000
Ambient air CO2 concentration, ppmv	300	300	300
Total outlet carbon concentration (less ambient CO2), ppmv	85,722	87,723	73,723
Inlet gas flow rate, dscfm	253	243	248
Outlet gas flow rate determined by carbon mass balance, dscfm	2,517	2,329	2,596
Outlet gas flow rate determined by carbon mass balance, acfm	9,293	8,886	9,694

Outlet flow rate, dscfm = (inlet flow rate, dscfm) (total carbon inlet, ppmv / total carbon outlet, ppmv)

EPA Method 7D
NOx Emission Determinations

Plant: Clinton County SWA
Test Location: Enclosed Landfill Gas Flare Outlet

BCM Project No: 00-0798-01
Operator: PCB

	Run No. 1	Run No. 2	Run No. 3
Test Date	4/2/96	4/2/96	4/2/96
Test time start	0900	1204	1434
Test time stop	1021	1304	1534
Elapsed sampling time, min	60	60	60
Pbar (Barametric Pressure, in. Hg)	29.50	29.55	29.57
Pm (Dry Gas Meter Pressure, in. water)	0.07	0.07	0.07
Tm (Dry Gas Meter Temperature, deg C)	17	22	18
Tm (Dry Gas Meter Temperature, deg F)	63	71	64
Gamma (Dry Gas Meter Calibration Factor)	0.98	0.98	0.98
Vm (Sample Volume, dry actual liters)	26.51	25.96	26.41
CO2 emission concentration (%)	8.6	8.8	7.4
Vm std (Sample Volume corrected for CO2, dry standard liters)	28.280	27.369	27.821
Vm std (Sample Volume corrected for CO2, dry standard m3)	0.0283	0.0274	0.0278
Qs std (Stack Gas Flow Rate Determined by Carbon Mass Balance, dscfm)	2,517	2,329	2,596
Wt (Amount NOx Collected, mg)	<3.75	6.06	<3.75
C's (Emission Concentration of NOx expressed as NO2, ppmv)	<69	116	<70
E (Emission Rate of NOx expressed as NO2, lb/hr)	<1.25	1.93	<1.31

Note: 1) Vm std = (Vm) (17.64) ((Pbar + (0.07355 x Pm) / (Tm + 460)) (1/(100-CO2%/100)) (Gamma)

2) C's = (Wt / Vm std) (24.04 / Molecular Weight)
Where : 24.04 = molar volume (liter / mole) @ 68 deg F
Molecular weight of NO2 = 46.01g / mole

3) E= (C's) (Qs std) (Molecular weight) (1.557E-7)
Where : Molecular weight of NO2 = 46.01 (g / mole)

Gas Flow Rate and NMVOC Emission Calculations

Plant: Clinton County SWA
Test Location: Leachate Reactor No. 260

BCM Project No: 00-0798-01
Operator: PCB/JW

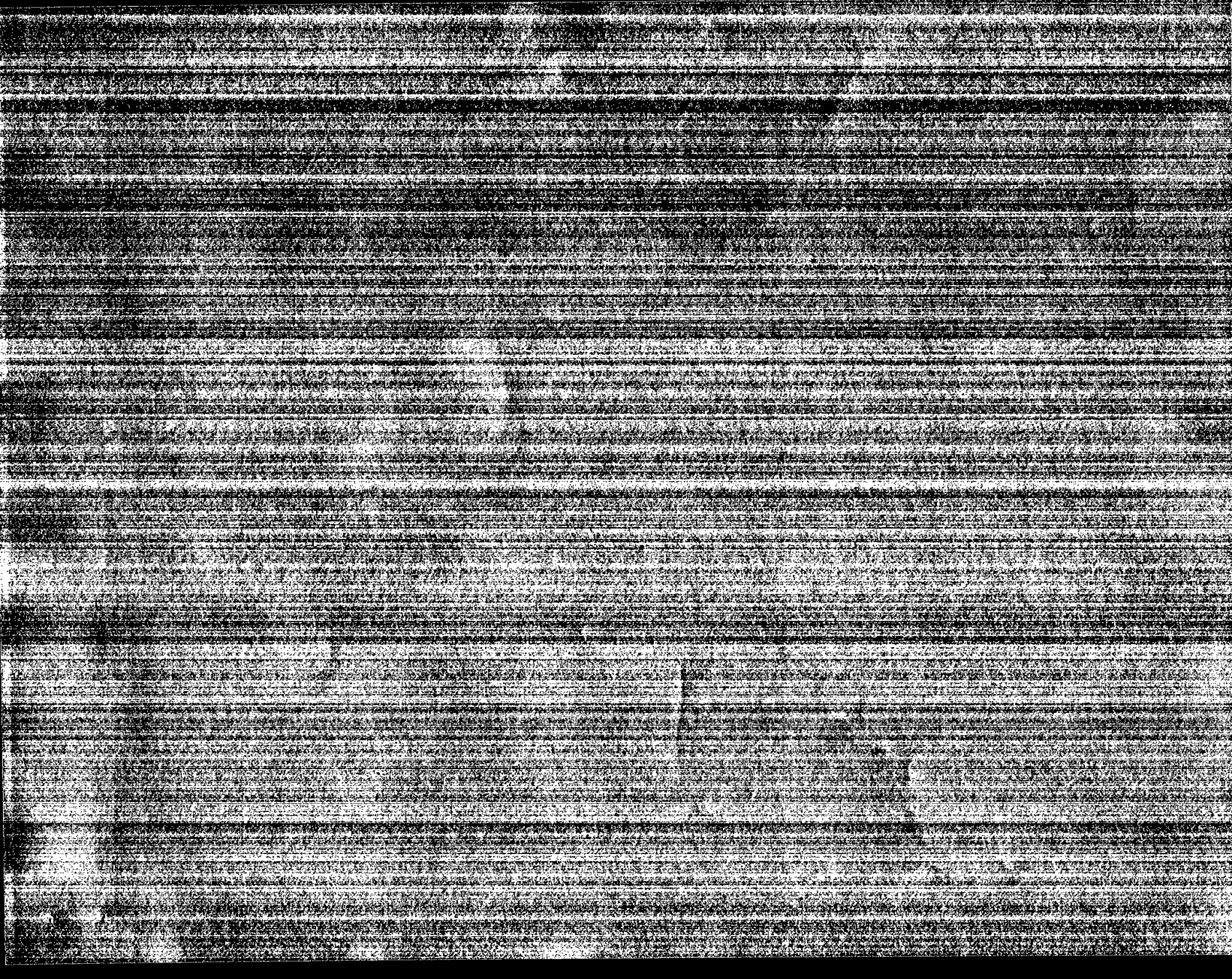
	Run No. 1	Run No. 2	Run No. 3
Test date	4/3/96	4/3/96	4/3/96
Test time start	0850	1109	1305
Test time stop	0950	1214	1405
Elapsed sampling time, min	60	65	60
Vwc - Volume of liquid collected, ml	17.1	21.3	16.8
Vw (std) - Volume of liquid collected @ std. cond., ml	0.805	1.004	0.791
Vm - Dry sample volume- meter conditions, dacf	22.258	23.999	23.607
Pbar - Barometric pressure, in. Hg	29.38	29.35	29.30
Δ H - Orifice pressure drop, in. H2O	2.00	2.00	2.00
γ - Dry gas meter coefficent	0.97	0.97	0.97
Tm - Average dry gas meter temperature, °F	85	90	92
Vm (std) - Dry sample volume, dscf	20.628	22.013	21.568
Bwo - Moisture content of gas stream, calculated, %	3.8	4.4	3.5
Bwo - Moisture content of gas stream at saturation, %	3.1	3.1	3.2
CO2 emission concentration, %	0.0	0.0	0.0
O2 emission concentration, %	21.0	21.0	21.0
CO emission concentration, %	0.0	0.0	0.0
N2 emission concentration, %	79.0	79.0	79.0
Md - Dry molecular weight of stack gas, lb/lb-mole	28.84	28.84	28.84
Ms - Molecular weight of stack gas, lb/lb-mole	28.50	28.50	28.49
Duct diameter, inches	5.75	5.75	5.75
Duct width, inches			
Duct length, inches			
As - Duct area, sq. ft	0.18	0.18	0.18
Ps - Stack static pressure, in. H2O	-0.002	0.008	0.006
Ps - Stack absolute pressure, in. Hg	29.38	29.35	29.30
Ts - Average stack gas temperature, °F	77	77	78
$\sqrt{\Delta P}$ - Average square root of pitot pressure differencial, in. H2O	0.126	0.147	0.118
Cp - Pitot correction factor, dimensionless	0.99	0.99	0.99
Vs - Stack gas velocity, ft/min	511	598	481
Qs - Stack gas flow rate, acfm	92	108	87
Qs(std) - Stack gas flow rate, dscfm	86	101	81
NMVOC emission concentration (expressed as methane), ppmv	40	26	25
NMVOC emission rate (expressed as methane), lb/hr	8.60E-03	6.54E-03	5.03E-03

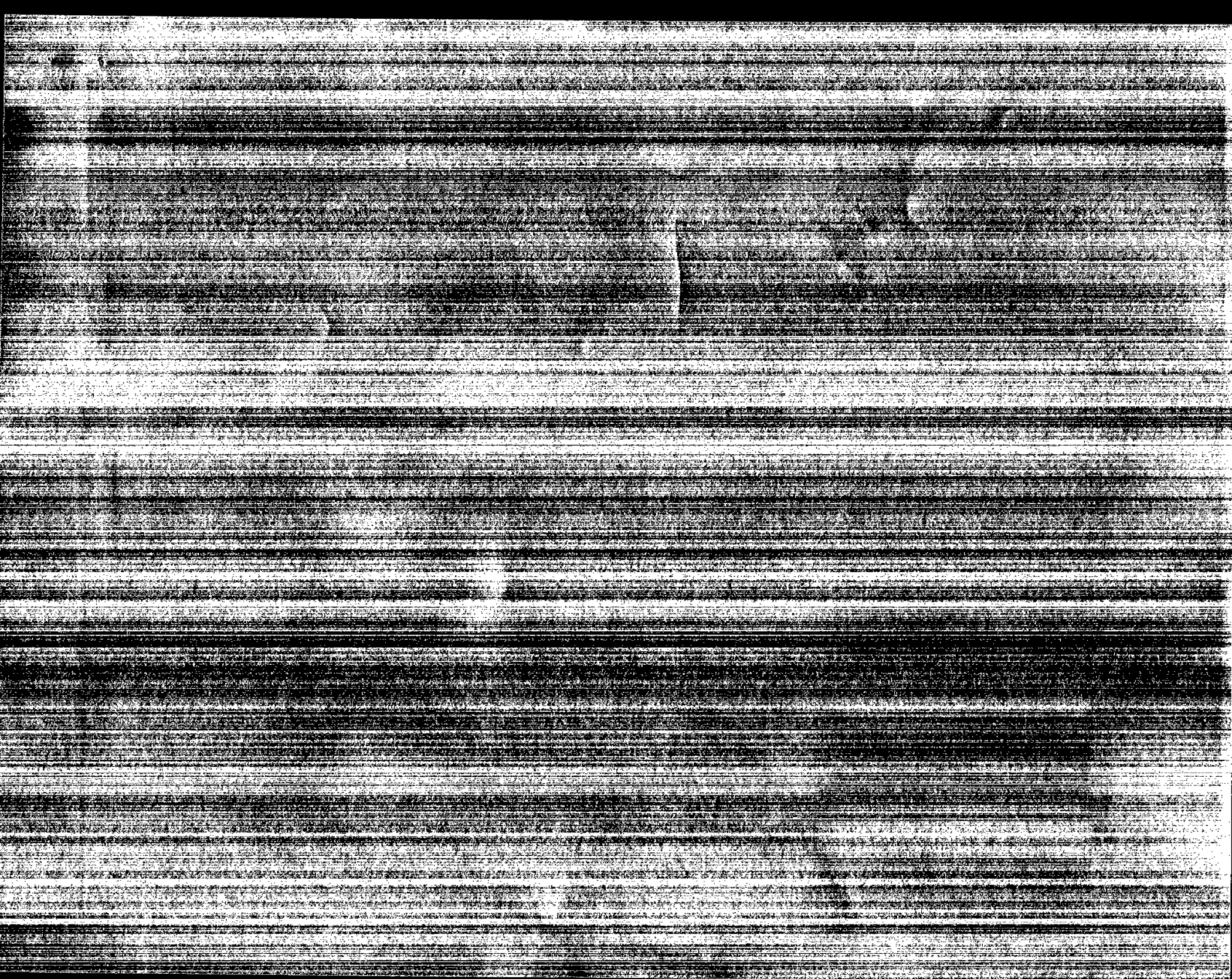
Gas Flow Rate and NMVOC Emission Calculations

Plant: Clinton County SWA
Test Location: Leachate Reactor No. 270

BCM Project No: 00-0798-01
Operator: PCB/JW

	Run No. 1	Run No. 2	Run No. 3
Test date	4/3/96	4/3/96	4/3/96
Test time start	0845	1110	1305
Test time stop	0945	1215	1405
Elapsed sampling time, min	60	65	60
Vwc - Volume of liquid collected, ml	25.7	30.3	20.6
Vw (std) - Volume of liquid collected @ std. cond., ml	1.210	1.427	0.970
Vm - Dry sample volume- meter conditions, dacf	22.740	24.024	23.977
Pbar - Barometric pressure, in. Hg	29.38	29.35	29.30
Δ H - Orifice pressure drop, in. H2O	2.00	2.00	2.00
γ - Dry gas meter coefficent	0.97	0.97	0.97
Tm - Average dry gas meter temperature, °F	78	83	84
Vm (std) - Dry sample volume, dscf	21.352	22.327	22.208
Bwo - Moisture content of gas stream, calculated, %	5.4	6.0	4.2
Bwo - Moisture content of gas stream at saturation, %	3.1	3.1	3.1
CO2 emission concentration, %	0.0	0.0	0.0
O2 emission concentration, %	21.0	21.0	21.0
CO emission concentration, %	0.0	0.0	0.0
N2 emission concentration, %	79.0	79.0	79.0
Md - Dry molecular weight of stack gas, lb/lb-mole	28.84	28.84	28.84
Ms - Molecular weight of stack gas, lb/lb-mole	28.50	28.50	28.50
Duct diameter, inches	5.75	5.75	5.75
Duct width, inches			
Duct length, inches			
As - Duct area, sq. ft	0.18	0.18	0.18
Ps - Stack static pressure, in. H2O	0.018	0.020	0.015
Ps - Stack absolute pressure, in. Hg	29.38	29.35	29.30
Ts - Average stack gas temperature, °F	77	77	77
$\sqrt{\Delta P}$ - Average square root of pitot pressure differencial, in. H2O	0.189	0.184	0.186
Cp - Pitot correction factor, dimensionless	0.99	0.99	0.99
Vs - Stack gas velocity, ft/min	767	749	757
Qs - Stack gas flow rate (from pitot traverse), acfm	138	135	136
Qs(std) - Stack gas flow rate (from pitot traverse), dscfm	129	126	127
NMVOC emission concentration (expressed as methane), ppmv	15	17	34
NMVOC emission rate (expressed as methane), lb/hr	4.85E-03	5.36E-03	1.08E-02





SMITH

APPENDIX D

EQUIPMENT CALIBRATION

BCM

METER BOX CALIBRATION SHEET

Date 4-9-96 Box No. 125 Inspector Steven Regner

Pump ✓ Oil ✓ Wick ✓ Pump Serial No. _____

Manometers * Knobs * Oil ✓ Tubing ✓

Quick Connects ✓ Vacuum Gage ✓ Valves ✓

Dry Gas Meter ✓ Volume 016.250 ft^3 Serial No. _____

Thermometers ✓ In 66 °F Out 66 °F Ambient 66 °F

Amphenol ✓ Lights ✓ Switches ✓ Variac _____

Leak Check - Max. Vacuum 27 in. Hg Leak Rate Ø CFH

Remarks Changed Knob on right side of manometer.
Pb = 29.50

Man. Orifice	CF_W	CF_d	T_W	IT_d	OT_d	T_d	Time θ
.5	5	5.171	64	80	75	78	12.17
1.0	5.0	5.152	64°F	76	68	72	8.75
2.0	10.0	10.456	64°F	82.5	72	77	13.08

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$

$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_W+460)(\theta)}{(CF_W)}\right]^2 \qquad \gamma = \frac{(CF_W)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_W+460)}$$

$\Delta H_@$ =	γ =
$\frac{(0.0317)(0.5)}{(29.5)(75+460)}\left[\frac{(64+460)(12.17)}{(5)}\right]^2$ (524, 525)	$\frac{(5)(29.5)(78+460)}{(5.171)(29.5+.0367)(64+460)}$ (538, 524)
1.67	.991
$\frac{(0.0317)(1.0)}{(29.5)(68+460)}\left[\frac{(64+460)(8.75)}{(5)}\right]^2$ (524, 528)	$\frac{(5)(29.5)(72+460)}{(5.152)(29.5+.0735)(64+460)}$ (532, 524)
1.71	.983
$\frac{(0.0317)(2.0)}{(29.5)(72+460)}\left[\frac{(64+460)(13.08)}{(10)}\right]^2$ (524, 532)	$\frac{(10)(29.5)(77+460)}{(10.456)(29.5+.147)(64+460)}$ (537, 529)
1.89	.975

AVE 1.76

AVE .983

BCM

METER BOX CALIBRATION SHEET

Date 1-2-94 Box No. 125 Inspector Steven Ragner

Pump ✓ Oil ✓ Wick ✓ Pump Serial No. _____

Manometers ✓ Knobs ✓ Oil ✓ Tubing ✓

Quick Connects ✓ Vacuum Gage ✓ Valves ✓

Dry Gas Meter 9549 ✓ Volume 9549 ft³ Serial No. _____

Thermometers ✓ In 61 °F Out 61 °F Ambient 61 °F

Amphenol ✓ Lights ✓ Switches ✓ Variac _____

Leak Check - Max. Vacuum _____ in. Hg Leak Rate _____ CFM

Remarks Pb = 29.37" Hg

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
0.5	5.000	5.350	64	87	88	88	11 25 12.42
1.0	5.000	5.291	64	79	81	80	8:55 8.92
2.0	10.000	10.675	64	87	84	86	13.00 13.00

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$

$\Delta H_@ =$	$\frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2$	$\gamma =$	$\frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$
1.67	$\frac{(0.0317)(0.5)}{(29.37)(88+460)}\left[\frac{(64+460)(12.42)}{(5)}\right]^2$ (524; 548)	.974	$\frac{(5.000)(29.37)(88+460)}{(5.350)(29.37+0.0368)(64+460)}$ (548; 29.4068; 524)
1.74	$\frac{(0.0317)(1.0)}{(29.37)(81+460)}\left[\frac{(64+460)(8.92)}{(5)}\right]^2$ (524; 541)	.971	$\frac{(5)(29.37)(80+460)}{(5.291)(29.37+0.0737)(64+460)}$ (540; 29.4431; 524)
1.84	$\frac{(0.0317)(2.0)}{(29.37)(84+460)}\left[\frac{(64+460)(\quad)}{(10)}\right]^2$ (529; 544)	.971	$\frac{(10)(29.37)(86+460)}{(10.675)(29.37+0.147)(64+460)}$ (546; 29.517; 524)

BCM

METER BOX CALIBRATION SHEET

Date 1-13-95 Box No. VOST Inspector S. Reigner

Pump ✓ Oil ____ Wick ____ Pump Serial No. ____

Manometers ____ Knobs ✓ Oil ____ Tubing ✓

Quick Connects ✓ Vacuum Gage ✓ Valves ✓

Dry Gas Meter ✓ Volume ____ ft^3 Serial No. ____

Thermometers ✓ In 70 °F Out 70 °F Ambient 70 °F

Amphenol ____ Lights ____ Switches ✓ Variac ____

Leak Check - Max. Vacuum 26 in. Hg Leak Rate Ø CFM

Remarks Pb 29.79

	Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
1 LPM	0.5	~~8~~.178	.176	70	70	70	70	4.9
1.5 LPM	1.0	~~8~~.179	.177	70	75	75	75	7.6
2. LPM	2.0	~~10~~.353	.352	70	79	79	79	10.1

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$

$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2 \qquad \gamma = \frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$$

$\frac{(0.0317)(0.5)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.008	$\frac{(.178)(29.79)(70+460)}{(.176)(29.79+0.0368)(70+460)}$ (530)	1.2/13.6
$\frac{(0.0317)(1.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.016	$\frac{(.179)(29.79)(75+460)}{(.177)(29.79+0.0737)(70+460)}$ (535) (29.92, .132) (530)	1.8/13.6
$\frac{(0.0317)(2.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.014	$\frac{(.353)(29.79)(79+460)}{(.352)(29.79+0.147)(70+460)}$ (539) (29.96, .1764) (530)	2.7/13.6

BCM

METER BOX CALIBRATION SHEET

Date 4-9-96 Box No. VOST Inspector Steven Reigner

Pump ✓ Oil ___ Wick — Pump Serial No. —

Manometers — Knobs ✓ Oil — Tubing —

Quick Connects ✓ Vacuum Gage — Valves ✓

Dry Gas Meter ✓ Volume ___ ft³ Serial No. ___

Thermometers ✓ In 68 °F Out 68 °F Ambient 20°C 68 °F

Amphenol ✓ Lights ✓ Switches ✓ Variac —

Leak Check - Max. Vacuum ___ in. Hg Leak Rate Ø CFM

Remarks Pb = 29.50

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
.5 LPM	.169	.175	64	68	68	68	
1.0 LPM	.167	.175	64	68	68	68	
2.0 LPM	.356	.356	70	79	79	79	

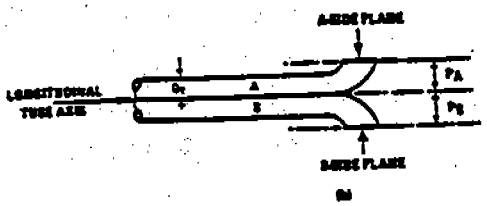
Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$

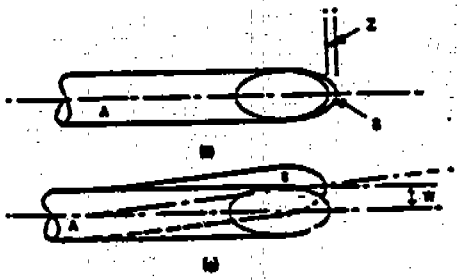
$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2 \qquad \gamma = \frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$$

	$\frac{(0.0317)(0.5)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$	.971 Lot	$\frac{(.169)(29.5)(68\ {}^{528}+460)}{(.175)(29.5+.0588)(64+460\ {}_{524})}$ ΔH .8
	$\frac{(0.0317)(1.0)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$	.959	$\frac{(.167)(29.5)(68\ {}^{528}+460)}{(.175)(29.5+.0882)(64+460\ {}_{524})}$ ΔH 1.2
	$\frac{(0.0317)(2.0)}{(\quad)(\quad+460)}\left[\frac{(\quad+460)(\quad)}{(\quad)}\right]^2$	1.011	$\frac{(.356)(29.50)(79\ {}^{529}+460)}{(.356)(29.50+.162)(70+460\ {}_{530})}$ ΔH 2.5

Ave = .980

PITOT CONSTRUCTION CALIBRATIONS





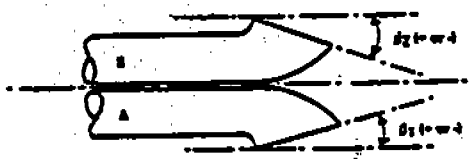
Dt = .431 inch

PA = .500 inch

PB = ~~.499~~ .500 inch

Z = 0.000 inch

W = 0.000



B1 = 0°

B2 = 0°

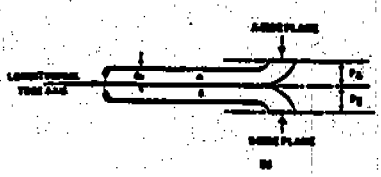
a1 = 0°

a2 = 0°

Performed by John Wood

BCM Engineers ENGINEERS, PLANNERS, SCIENTISTS and LABORATORY SERVICES 1650 Grovers Road • Newtown, PA 19401	TYPE S PITOT CALIBRATION STANDARDS
DATE: 4-4-96	PITOT I.D.: 6-10
REF. NO.: 6-10	PAGE NO.: 2 of 4

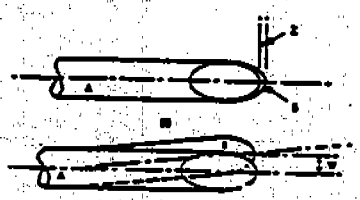
PITOT CONSTRUCTION CALIBRATIONS



Dt = 0.431

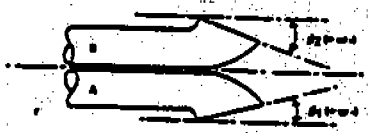
P_A = 0.500

P_B = 0.500



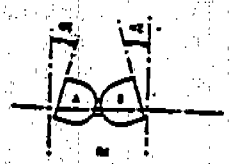
Z = 0.000

W = 0.000



B1 = 0°

B2 = 0°



a1 = 0°

a2 = 0°

Performed by _____

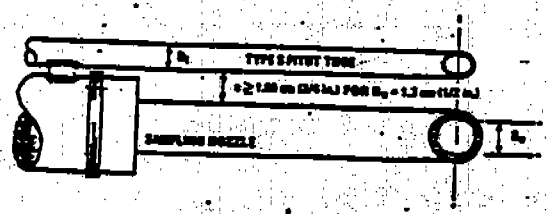
CONSTRUCTION STANDARDS:

1. Dt = between .187" - .375" (3/16 - 3/8)
2. $P_A = P_B$; $1.05 \cdot Dt \leq P \leq 1.50 \cdot Dt$
3. a1 . a2 < 10°
4. B1 . B2 < 5°
5. Z ≤ 0.125" (1/8)
6. W ≤ 0.031" (1/32)

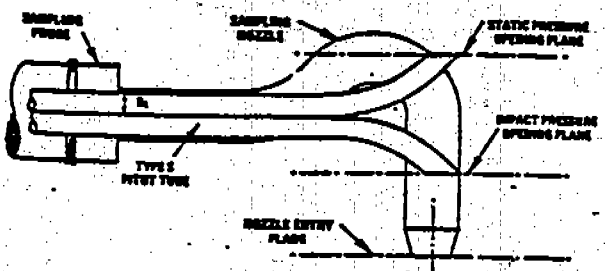
PITOT ALIGNMENT STANDARDS:

1. x ≥ 0.75" (3/4)
2. Ip must be higher than Np
3. W ≥ 3.0"
4. Z ≥ 0.75" (3/4)
5. Z_1 ≥ 2.0"
6. Y ≥ 3.0"

PITOT ALIGNMENT/NOZZLE CALIBRATIONS

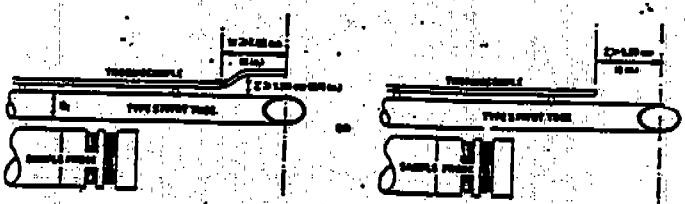


X = N/A



Is IP higher than NP? N/A

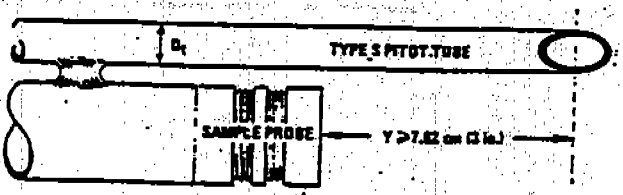
PITOT ALIGNMENT/THERMOCOUPLE CALIBRATION



W = N/A

Z_1 = N/A

Z = N/A



Y = N/A

Determined Coefficient 0.

Thermocouple Calibration Data Sheet

Thermocouple No : 5 wet
Date: 3-22-96
mbient Temperature (°F) 71
Barometric Pressure (in hg): 29.75
Calibrator: S. Reigner
Mercury-in-glass: ✓
Other:

Reference Point No.	Source (specify)	Reference Thermometer Temperature (°F)	Thermocouple Potentiometer Temperature (°F)	Difference (%)
1	BOILING H_2O	211	210	.476
1	ICE BATH	33	33	Ø
1	AMBIANT	71	70	1.4
			Average % Difference	0.625

THERMOCOUPLE CALIBRATION DATA SHEET

Thermocouple No. : 9-1 Date: 3-22-96

Ambient Temperature: 71° °F Barometric Pressure: 29.75 Hg

Calibrator: S. Reigner Reference: Mercury-in-glass: ✓

Other: _____

Reference Point No.	Source (Specify)	Reference Thermometer Temperature °F	Thermocouple Potentiometer Temperature °F	Difference %
1	BOILING H_2O	212	211	.471
1	ICE BATH	33	33	Ø
1	AMBIANT	71	70	1.4
			Average % Difference	0.625

EPA Method 7D
NOx Emission Determinations

Plant: Clinton County SWA
Test Location: Enclosed Landfill Gas Flare Outlet

BCM Project No: 00-0798-01
Operator: PCB

	Run No. 1	Run No. 2	Run No. 3
Test Date	4/2/96	4/2/96	4/2/96
Test time start	0900	1204	1434
Test time stop	1021	1304	1534
Elapsed sampling time, min	60	60	60
Pbar (Barametric Pressure, in. Hg)	29.50	29.55	29.57
Pm (Dry Gas Meter Pressure, in. water)	0.07	0.07	0.07
Tm (Dry Gas Meter Temperature, deg C)	17	22	18
Tm (Dry Gas Meter Temperature, deg F)	63	71	64
Gamma (Dry Gas Meter Calibration Factor)	0.98	0.98	0.98
Vm (Sample Volume, dry actual liters)	26.51	25.96	26.41
CO2 emission concentration (%)	8.6	8.8	7.4
Vm std (Sample Volume corrected for CO2, dry standard liters)	28.280	27.369	27.821
Vm std (Sample Volume corrected for CO2, dry standard m3)	0.0283	0.0274	0.0278
Qs std (Stack Gas Flow Rate Determined by Carbon Mass Balance, dscfm)	2,517	2,329	2,596
Wt (Amount NOx Collected, mg)	<3.75	6.06	<3.75
C's (Emission Concentration of NOx expressed as NO2, ppmv)	<69	116	<70
E (Emission Rate of NOx expressed as NO2, lb/hr)	<1.25	1.93	<1.31

Note: 1) Vm std = (Vm) (17.64) ((Pbar + (0.07355 x Pm) / (Tm + 460)) (1/(100-CO2%/100)) (Gamma)

2) C's = (Wt / Vm std) (24.04 / Molecular Weight)
Where : 24.04 = molar volume (liter / mole) @ 68 deg F
Molecular weight of NO2 = 46.01g / mole

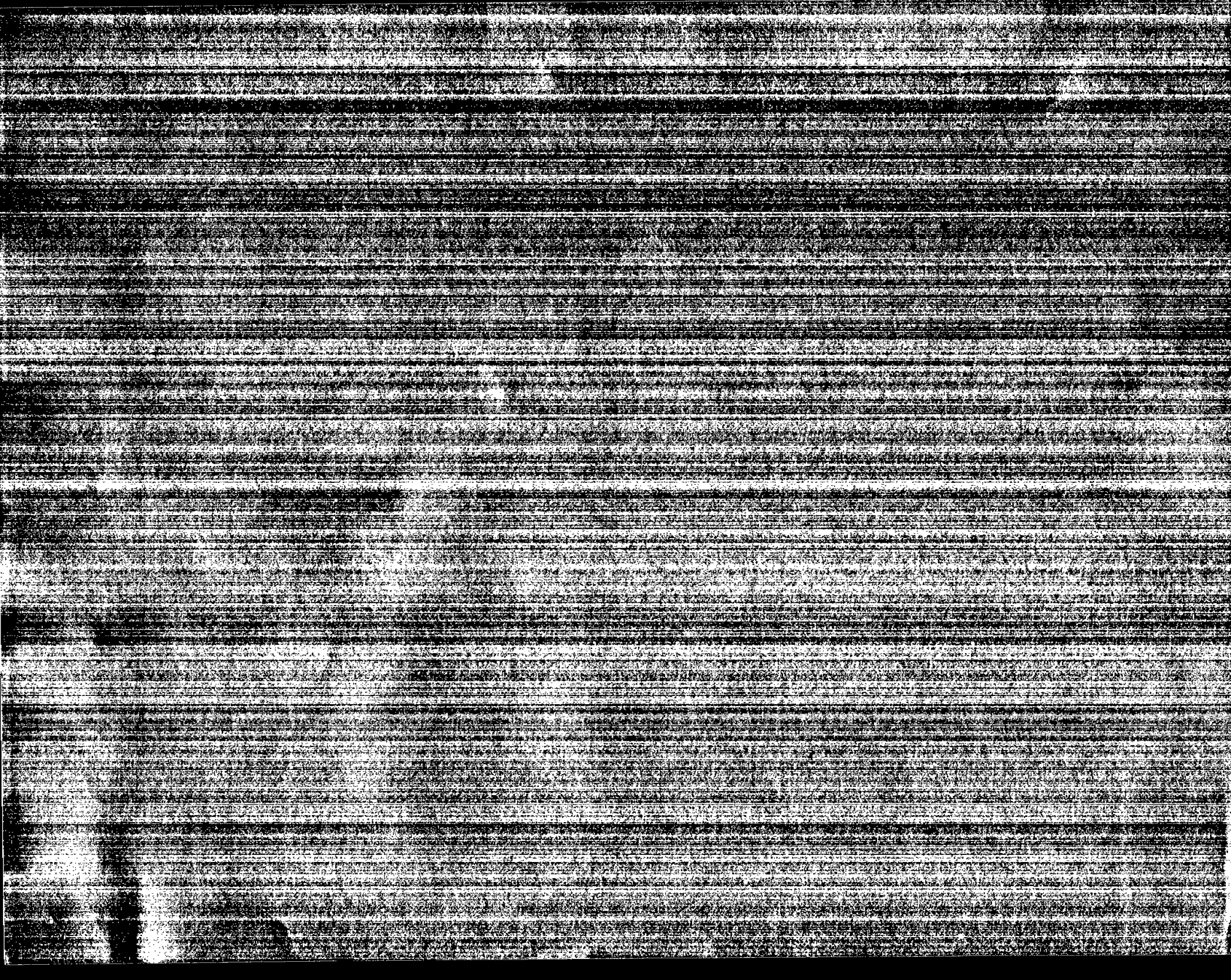
3) E= (C's) (Qs std) (Molecular weight) (1.557E-7)
Where : Molecular weight of NO2 = 46.01 (g / mole)

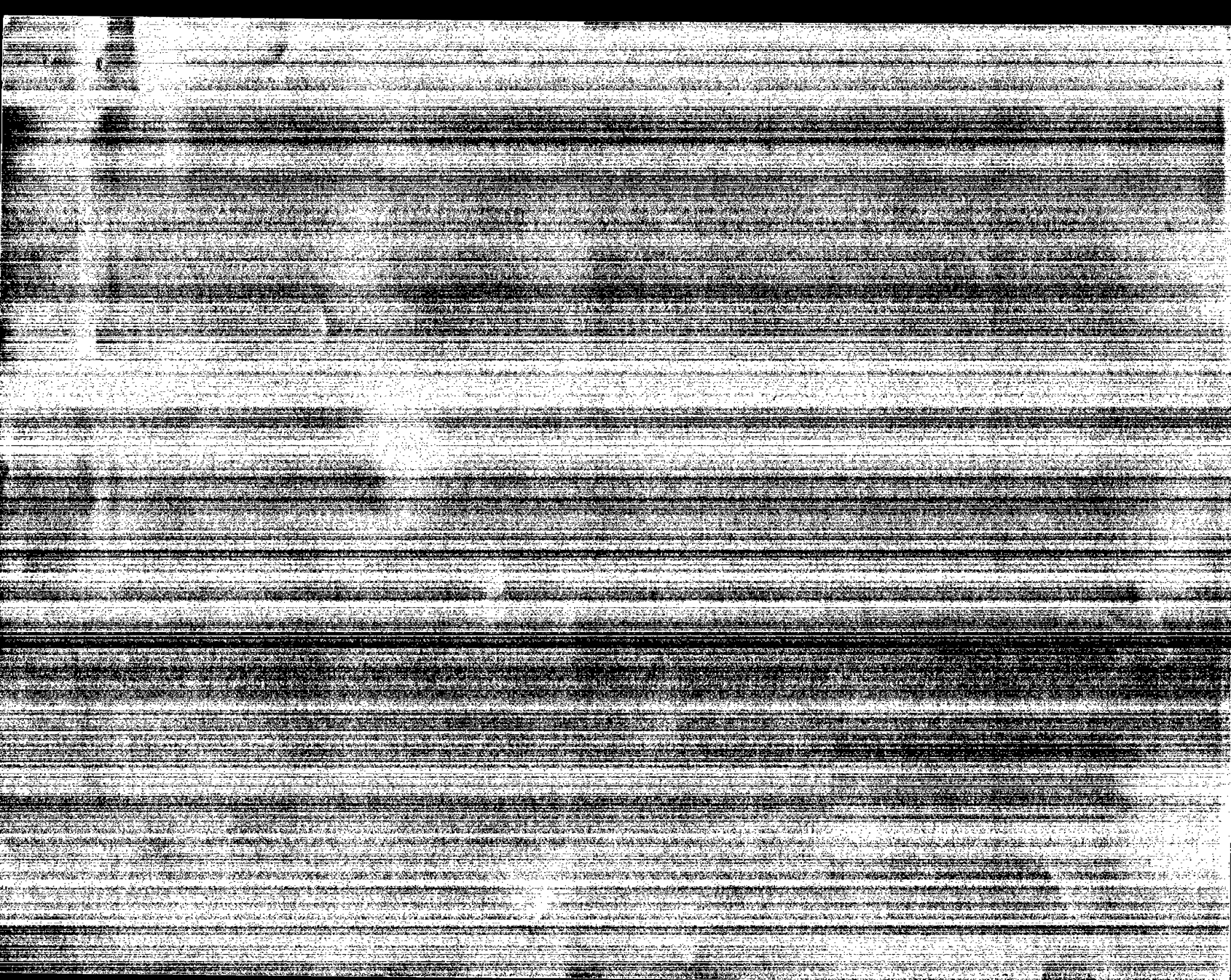
Gas Flow Rate and NMVOC Emission Calculations

Plant: Clinton County SWA
Test Location: Leachate Reactor No. 270

BCM Project No: 00-0798-01
Operator: PCB/JW

	Run No. 1	Run No. 2	Run No. 3
Test date	4/3/96	4/3/96	4/3/96
Test time start	0845	1110	1305
Test time stop	0945	1215	1405
Elapsed sampling time, min	60	65	60
Vwc - Volume of liquid collected, ml	25.7	30.3	20.6
Vw (std) - Volume of liquid collected @ std. cond., ml	1.210	1.427	0.970
Vm - Dry sample volume- meter conditions, dacf	22.740	24.024	23.977
Pbar - Barometric pressure, in. Hg	29.38	29.35	29.30
Δ H - Orifice pressure drop, in. H2O	2.00	2.00	2.00
γ - Dry gas meter coefficent	0.97	0.97	0.97
Tm - Average dry gas meter temperature, °F	78	83	84
Vm (std) - Dry sample volume, dscf	21.352	22.327	22.208
Bwo - Moisture content of gas stream, calculated, %	5.4	6.0	4.2
Bwo - Moisture content of gas stream at saturation, %	3.1	3.1	3.1
CO2 emission concentration, %	0.0	0.0	0.0
O2 emission concentration, %	21.0	21.0	21.0
CO emission concentration, %	0.0	0.0	0.0
N2 emission concentration, %	79.0	79.0	79.0
Md - Dry molecular weight of stack gas, lb/lb-mole	28.84	28.84	28.84
Ms - Molecular weight of stack gas, lb/lb-mole	28.50	28.50	28.50
Duct diameter, inches	5.75	5.75	5.75
Duct width, inches			
Duct length, inches			
As - Duct area, sq. ft	0.18	0.18	0.18
Ps - Stack static pressure, in. H2O	0.018	0.020	0.015
Ps - Stack absolute pressure, in. Hg	29.38	29.35	29.30
Ts - Average stack gas temperature, °F	77	77	77
$\sqrt{\Delta P}$ - Average square root of pitot pressure differencial, in. H2O	0.189	0.184	0.186
Cp - Pitot correction factor, dimensionless	0.99	0.99	0.99
Vs - Stack gas velocity, ft/min	767	749	757
Qs - Stack gas flow rate (from pitot traverse), acfm	138	135	136
Qs(std) - Stack gas flow rate (from pitot traverse), dscfm	129	126	127
NMVOC emission concentration (expressed as methane), ppmv	15	17	34
NMVOC emission rate (expressed as methane), lb/hr	4.85E-03	5.36E-03	1.08E-02





SMITH

APPENDIX D

EQUIPMENT CALIBRATION

BCM

METER BOX CALIBRATION SHEET

Date 4-9-96 Box No. 125 Inspector Steven Regner

Pump ✓ Oil ✓ Wick ✓ Pump Serial No. _____

Manometers ✓ Knobs ✓ Oil ✓ Tubing ✓

Quick Connects ✓ Vacuum Gage ✓ Valves ✓

Dry Gas Meter ✓ Volume 016.250 ft^3 Serial No. _____

Thermometers ✓ In 66 °F Out 66 °F Ambient 66 °F

Amphenol ✓ Lights ✓ Switches ✓ Variac _____

Leak Check - Max. Vacuum 27 in. Hg Leak Rate 0 CFM

Remarks Changed Knob on right side of manometer.
Pb = 29.50

Man. Orifice	CF_w	CF_d	T_w	IT_d	OT_d	T_d	Time θ
.5	5	5.171	64	80	75	78	12.17
1.0	5.0	5.152	64°F	76	68	72	8.75
2.0	10.0	10.456	64°F	825	72	77	13.08

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$

$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_w+460)(\theta)}{(CF_w)}\right]^2 \qquad \gamma = \frac{(CF_w)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_w+460)}$$

$\Delta H_@$	γ
1.67 $= \frac{(0.0317)(0.5)}{(29.5)(75+460)}\left[\frac{(64+460)(12.17)}{(5)}\right]^2$ (524, 525)	.991 $= \frac{(5)(29.5)(78+460)}{(5.171)(29.5+.0367)(64+460)}$ (538, 524)
1.71 $= \frac{(0.0317)(1.0)}{(29.5)(68+460)}\left[\frac{(64+460)(8.75)}{(5)}\right]^2$ (524, 528)	.983 $= \frac{(5)(29.5)(72+460)}{(5.152)(29.5+.0735)(64+460)}$ (532, 29.5735, 524)
1.89 $= \frac{(0.0317)(2.0)}{(29.5)(72+460)}\left[\frac{(64+460)(13.08)}{(10)}\right]^2$ (524, 532)	.975 $= \frac{(10)(29.5)(77+460)}{(10.456)(29.5+.147)(64+460)}$ (537, 29.647, 529)

∠ AVE 1.70

AVE. .983

BCM

METER BOX CALIBRATION SHEET

Date 1-13-95 Box No. VOST Inspector S. Reigner

Pump ✓ Oil ____ Wick ____ Pump Serial No. ____

Manometers ____ Knobs ✓ Oil ____ Tubing ✓

Quick Connects ✓ Vacuum Gage ✓ Valves ✓

Dry Gas Meter ✓ Volume ____ ft^3 Serial No. ____

Thermometers ✓ In 70 °F Out 70 °F Ambient 70 °F

Amphenol ____ Lights ____ Switches ✓ Variac ____

Leak Check - Max. Vacuum 26 in. Hg Leak Rate Ø CFM

Remarks Pb 29.79

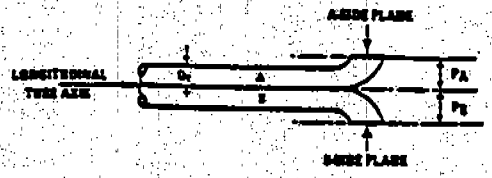
	Man. Orifice	CF_W	CF_d	T_W	IT_d	OT_d	T_d	Time θ
1 LPM	~~0.5~~	~~.178~~	.176	70	70	70	70	4.9
1.5 LPM	~~1.0~~	~~.179~~	.177	70	75	75	75	7.6
2. LPM	~~2.0~~	~~.353~~	.352	70	79	79	79	10.1

Tolerances: $1.6 \leq \Delta H_@ \leq 2.1$

$$\Delta H_@ = \frac{(0.0317)(\Delta H)}{(P_b)(OT_d+460)}\left[\frac{(T_W+460)(\theta)}{(CF_W)}\right]^2 \qquad \gamma = \frac{(CF_W)(P_b)(T_d+460)}{(CF_d)(P_b+\Delta H/13.6)(T_W+460)}$$

	$\frac{(0.0317)(0.5)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.008	$\frac{(.178)(29.79)(70+460)}{(.176)(29.79+0.0368)(70+460)}$; $\frac{1.2}{13.6}$
	$\frac{(0.0317)(1.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.016	$\frac{(.179)(29.79)(75+460)}{(.177)(29.79+0.0737)(70+460)}$; $\frac{1.8}{13.6}$
	$\frac{(0.0317)(2.0)}{(\_\_\_\_)(\_\_\_+460)}\left[\frac{(\_\_\_+460)(\_\_\_\_)}{(\_\_\_\_)}\right]^2$	1.014	$\frac{(.353)(29.79)(79+460)}{(.352)(29.79+0.147)(70+460)}$; $\frac{2.7}{13.6}$

PITOT CONSTRUCTION CALIBRATIONS

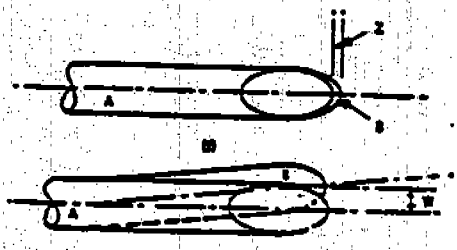


(a)

Dt = .431 inch

PA = .500 inch

PB = ~~.499~~ .500 inch



(b)

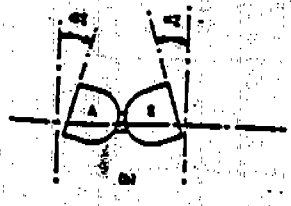
Z = 0.000 inch

W = 0.000

(c)

B1 = 0°

B2 = 0°



(d)

a1 = 0°

a2 = 0°

Performed by John Woods

BCM Engineers	TYPE S PITOT CALIBRATION STANDARDS
ENGINEERS, PLANNERS, SCIENTISTS AND LABORATORY SERVICES	DATE: 4-4-96 PITOT I.D.: 6-10
1850 Grovers Road - Norristown, PA 19401	REF. NO.: 6-10 PAGE NO.: 2 of 4

Thermocouple Calibration Data Sheet

Thermocouple No : 5 wet
Ambient Temperature (°F) 71
Calibrator: S. Reigner

Date: 3-22-96
Barometric Pressure (in hg): 29.75
Mercury-in-glass: ✓
Other:

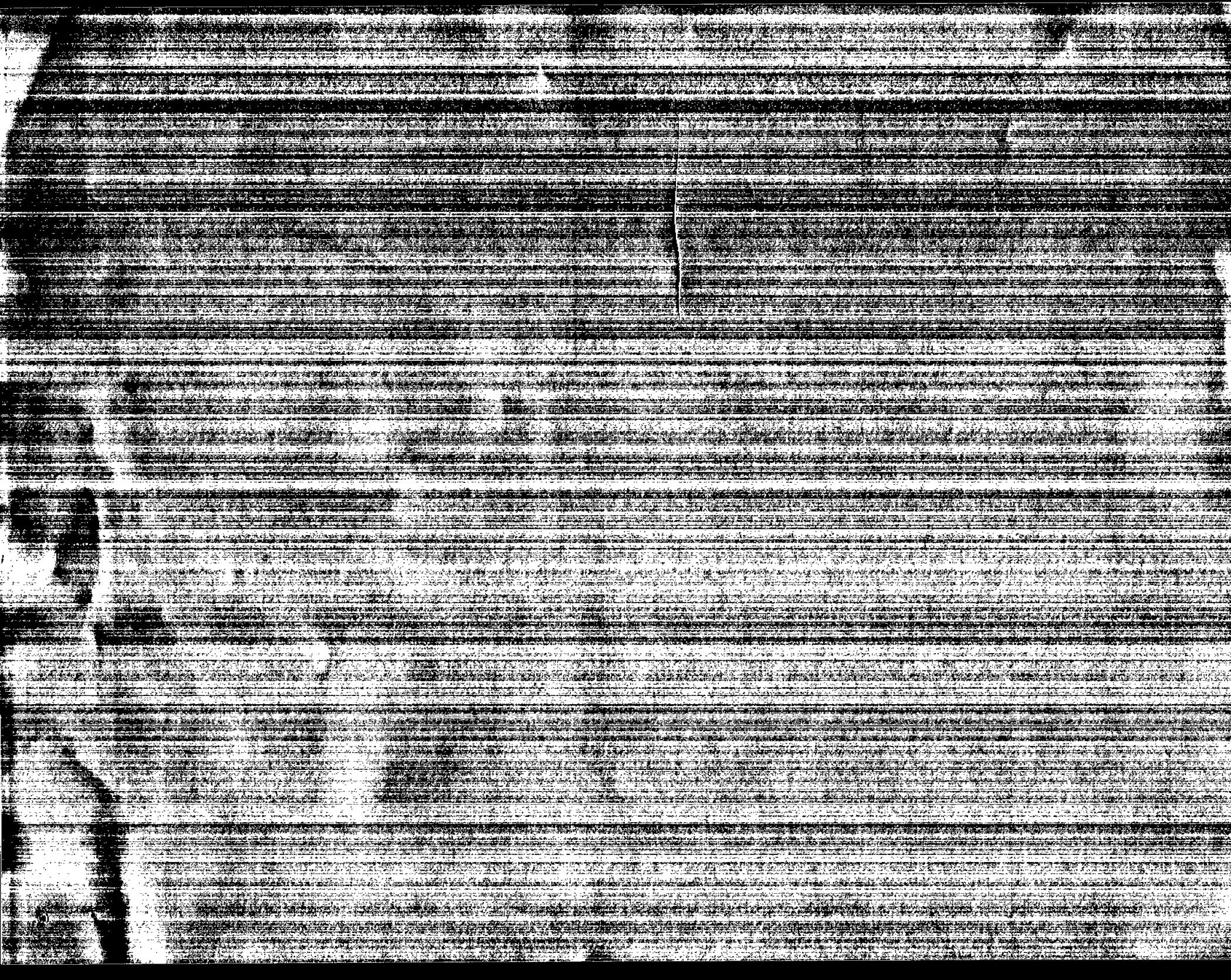
Reference Point No.	Source (specify)	Reference Thermometer Temperature (°F)	Thermocouple Potentiometer Temperature (°F)	Difference (%)
1	BOILING H_2O	211	210	.476
1	ICE BATH	33	33	0
1	AMBIANT	71	70	1.4
			Average % Difference	0.625

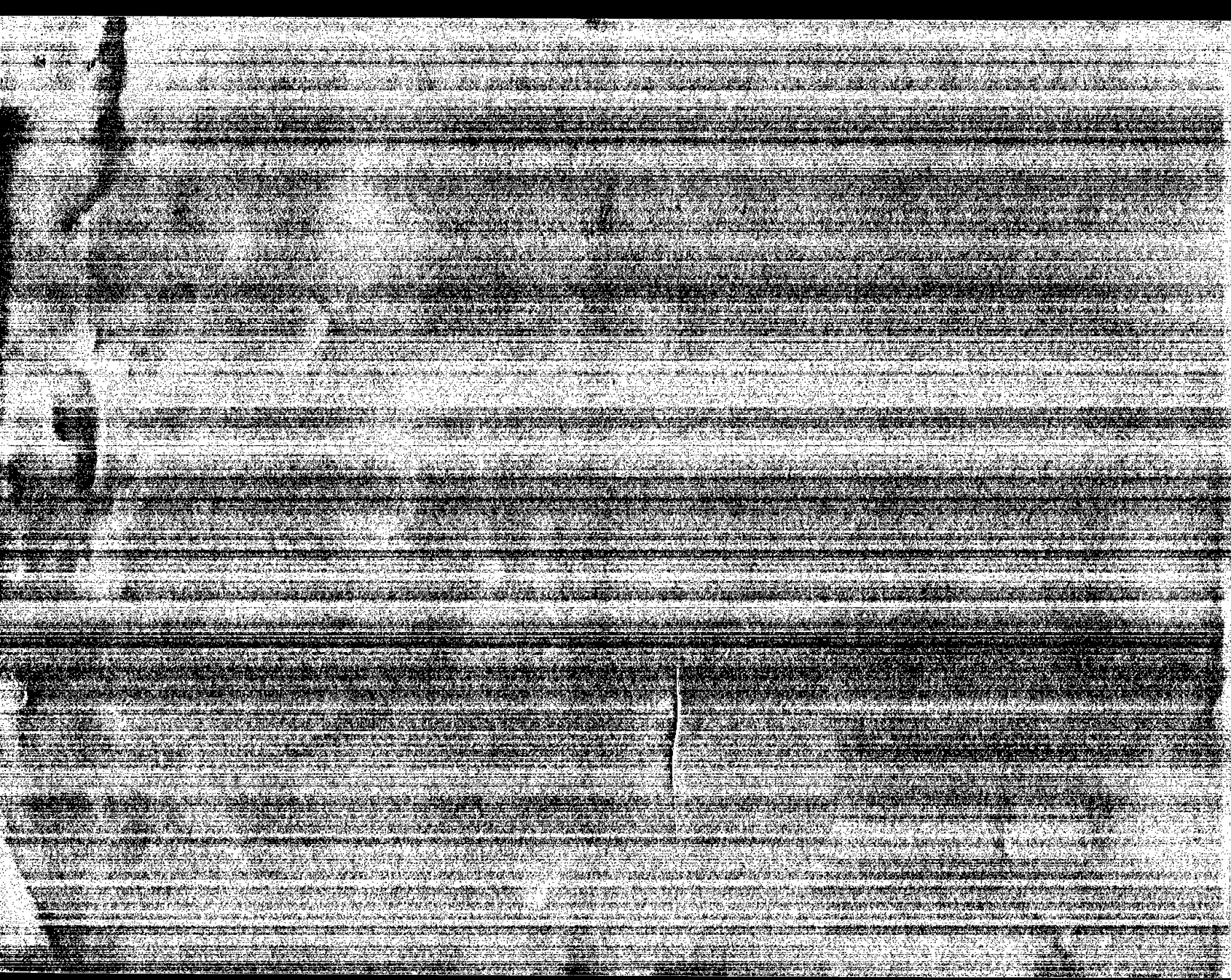
Thermocouple Calibration Data Sheet

Thermocouple No : 5 dry
mbient Temperature (°F) 71°
Calibrator: S. Regner

Date: 3-22-96
Barometric Pressure (in hg): 29.75
Mercury-in-glass: ✓
Other:

Reference Point No.	Source (specify)	Reference Thermometer Temperature (°F)	Thermocouple Potentiometer Temperature (°F)	Difference (%)
1	BOILING H_2O	210	210	Ø
1	ICE BATH	33	32	3.03
1	AMBIANT	71	71	Ø
			Average % Difference	1.01





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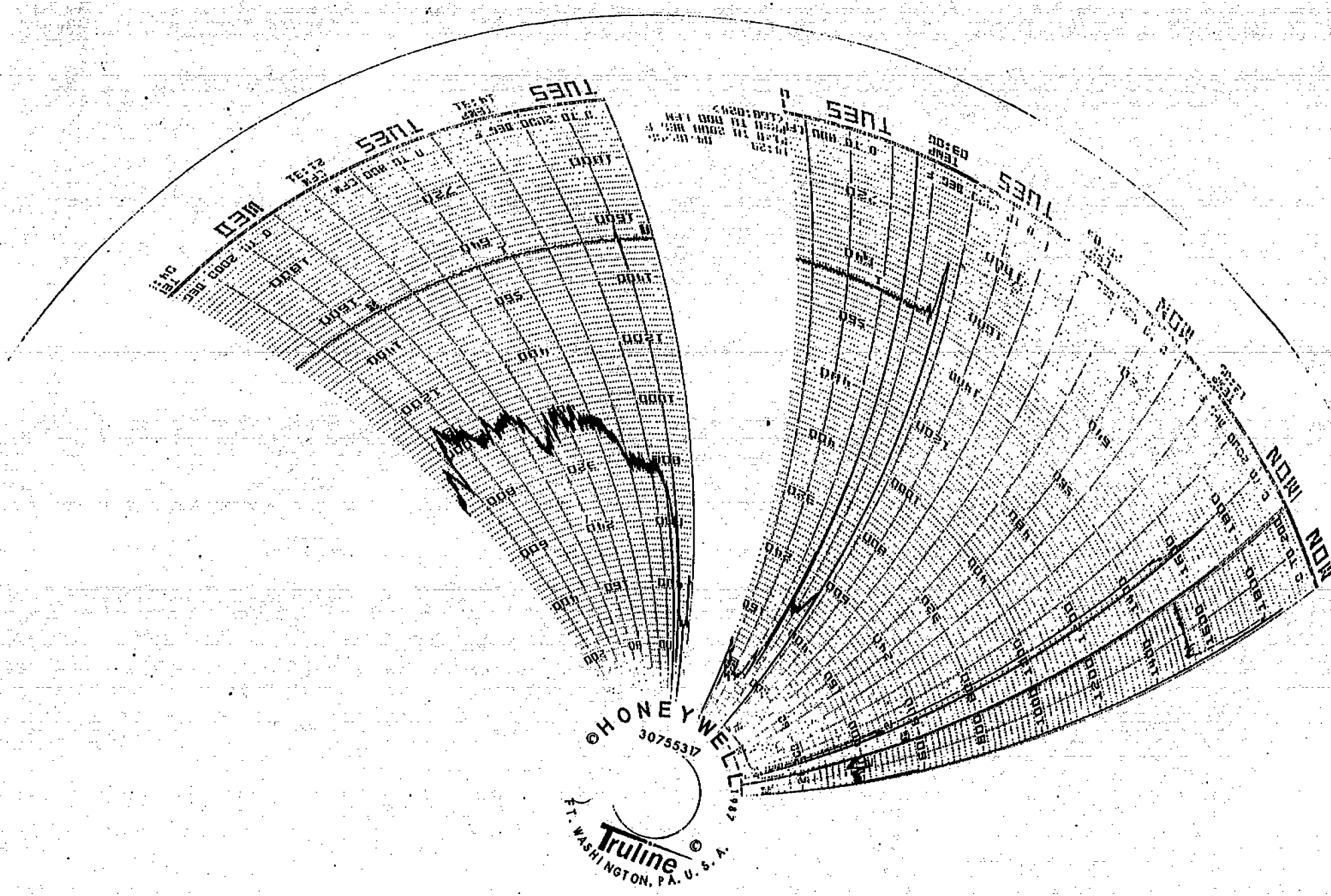
APPENDIX E

PROCESS OPERATING DATA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Consulting Engineers
434 Market Street Suite 300
LEWISBURG, PA 17837
(717) 524-5775 • 800-462-6197
FAX (717) 524-5717

JOB WAYNE TOWNSHIP LANDFILL - FLARE EMISSIONS TES
SHEET NO. 1 OF 1
CALCULATED BY MLC DATE 4-2-96
CHECKED BY _____ DATE _____
SCALE _____

TEST #	TIME	GAS TEMP (°F)	STACK TEMP (°F)	VACUUM (W.C.)	CH_4 (%)	CO_2 (%)	O_2 (%)
#1	0925	70	1525	-6"	41.9	37.5	1.3
	0940	70	1527	-6"	42.0	37.7	1.2
	0955	71	1525	-6"	42.0	37.7	1.3
	1010	73	1522	-6"	41.7	38.0	1.5
	1025	75	1525	-6"	40.9	38.5	1.7
#2	1204	80	1526	-5.5"	38.7	37.0	1.8
	1219	80	1526	-5.5"	38.5	37.8	2.1
	1234	80	1525	-5.5"	38.0	37.9	2.2
	1249	80	1527	-5.5"	36.9	37.8	2.3
	1304	80	1526	-5.5"	36.5	38.1	2.3
#3	1434	82	1524	-5.5"	34.4	38.6	2.9
	1449	82	1526	-5.5"	34.4	38.3	3.1
	1504	82	1531	-5.5"	33.1	36.6	3.4
	1519	82	1523	-5.5"	33.6	36.3	3.4
	1534	82	1525	-5.5"	33.3	36.0	3.5

GAS FLOW MEASUREMENTS FROM FIELD*

SOURCE	Flow @ 1045	Flow @ 1546
LTV-1	60 scfm	57 scfm
LTV-2	59 scfm	59 scfm
LTV-3	76 scfm	71 scfm
LTV-4	21 scfm	20 scfm
LTV-5	29 scfm	33 scfm
TOTAL	245 scfm	240 scfm

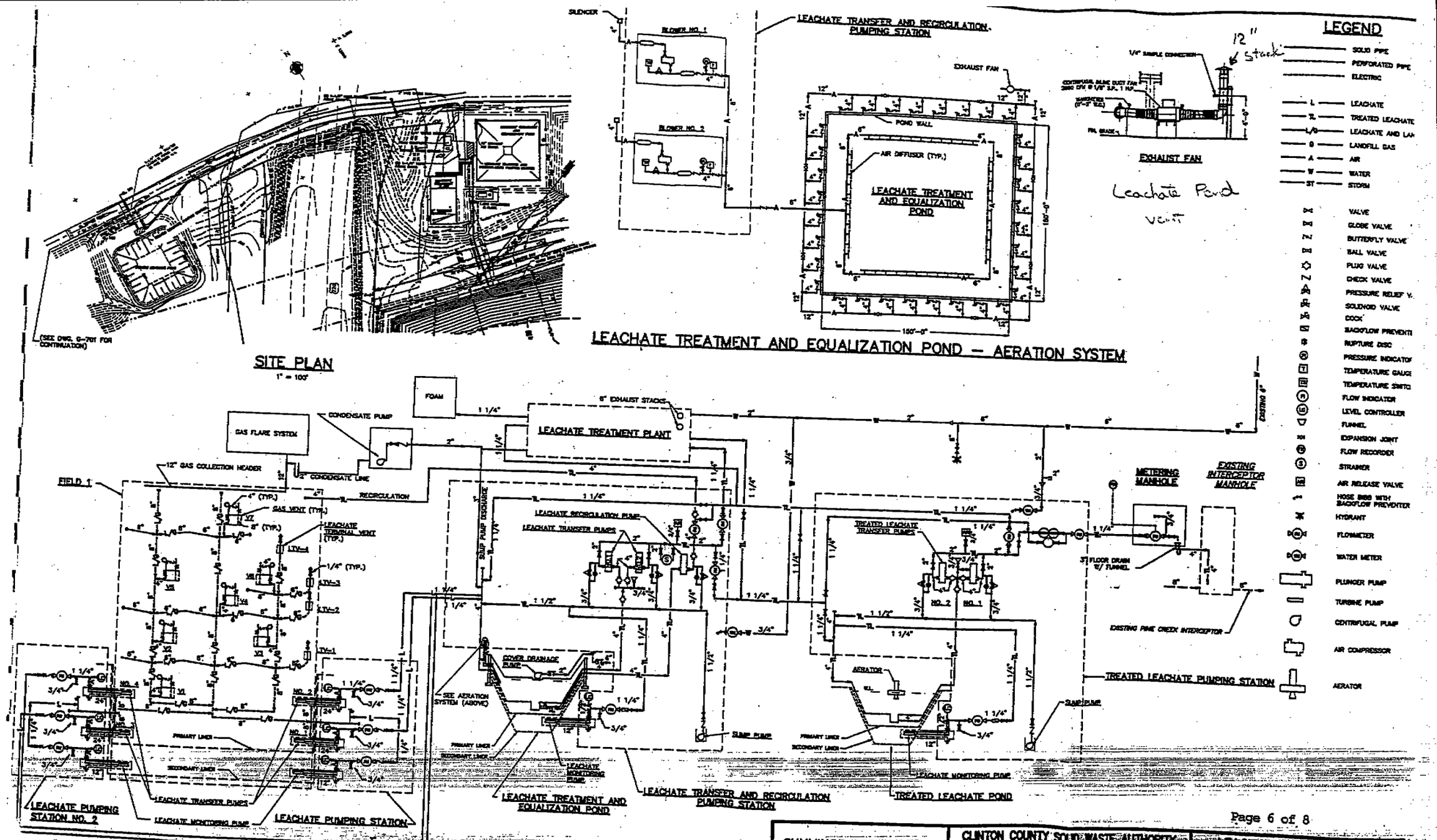
* MEASUREMENTS USED TO CONFIRM FLOW DATA AT FLARE

CUMMINGS & SMITH, INC.
Consulting Engineers
Hershey, PA - Lewisburg, PA
Upper Montclair, NJ

JOB LEACHATE ACCESS VENTS - STACK TEST
SHEET NO. 1 OF 1
CALCULATED BY MLC DATE 4/3/96
CHECKED BY _____ DATE _____
SCALE _____

TEST #	START TIME	FINISH TIME	TOTAL FLOW RATE	Rx 260 AIC261 pH	Rx 260 AIC262 ORP	Rx 260 AIC311 pH	Rx 260 AIC322 pH	Rx 270 AIC271 pH	Rx 270 AIC272 ORP	Rx 270 AIC321 pH	Rx 270 AIC323 pH	LEACHATE TEMP
1	0845		8 gpm	7.96	-693	7.61	8.34	7.83	-602	7.56	7.47	68.1°
	0915		8 gpm	7.94	-693	7.61	8.32	7.86	-602	7.57	7.51	68°
		0945	8 gpm	7.90	-693	7.61	8.38	7.87	-602	7.44	7.54	67.9°
2	1110		8 gpm	7.91	-693	7.61	8.35	7.97	-602	7.44	7.42	67.5°
	1140		8 gpm	8.00	-693	7.60	8.33	7.95	-602	7.41	7.42	69.5°
		1215	8 gpm	7.98	-692	7.62	8.35	7.94	-602	7.49	7.49	68.5°
3	1305		7.9 gpm	7.86	-692	7.61	8.33	7.79	-602	7.56	7.52	68.2°
	1335		7.9 gpm	7.94	-692	7.60	8.34	7.82	-602	7.59	7.53	67.9°
		1405	7.9 gpm	7.87	-692	7.60	8.34	7.87	-602	7.44	7.53	68.3

PRODUCT 204-1 (Green Sheets) 205-1 (Padded) MEAD Inc., Groton, Mass. 01471. To Order PHONE TOLL FREE 1-800-225-6380



Page 6 of 8

NO.	DATE	DESCRIPTION	MADE	CHKD.	APPVD.
A	3-14-94	RECORD PLAN	CJS		

REVISIONS

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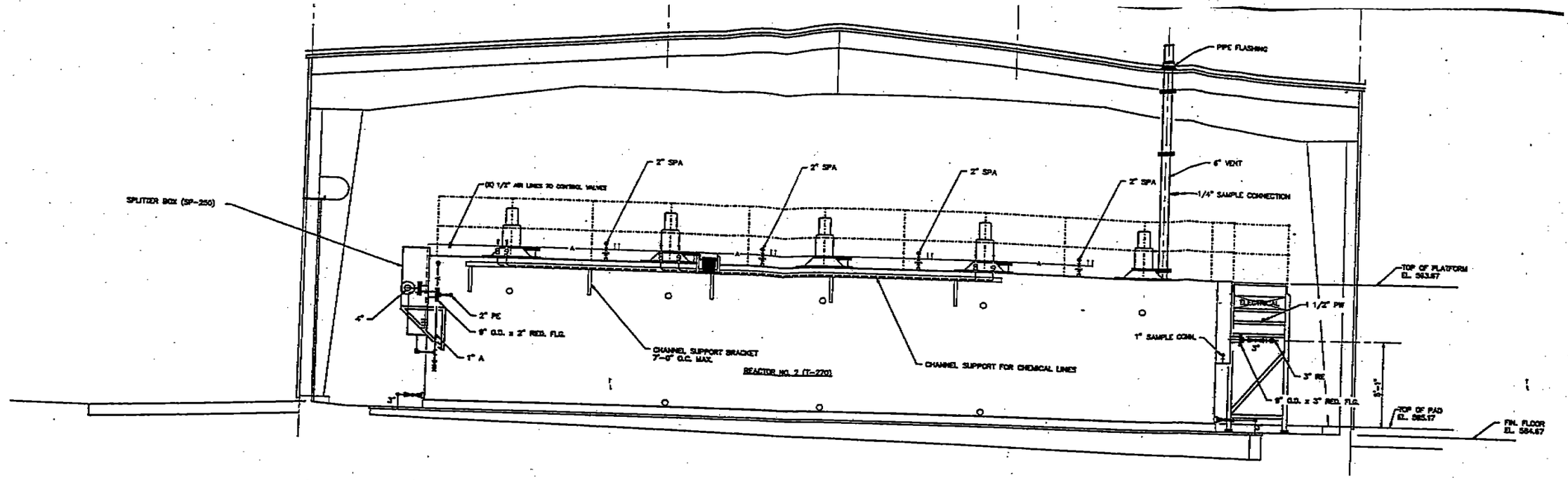
UPPER MONTCLAIR, NJ

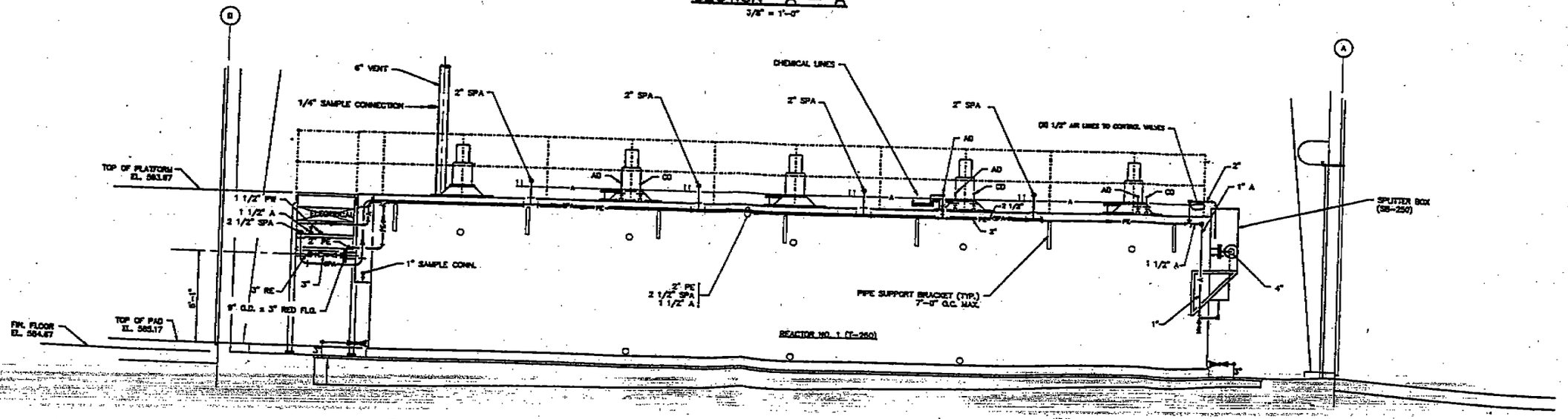
CLINTON COUNTY SOLID WASTE AUTHORITY
Mc ELHATTAN, PENNSYLVANIA
WAYNE TOWNSHIP LANDFILL
APPLICATION FOR AIR QUALITY PERMIT

LEACHATE SYSTEM SCHEMATIC FLOW DIAGRAM

D- 9109.13-G-502A A 2



SECTION A – A
3/8" = 1'-0"



SECTION R – R
3/8" = 1'-0"

3/8" = 1'-0"

A	3-11-94	RECORD PLAN	
REVISIONS			

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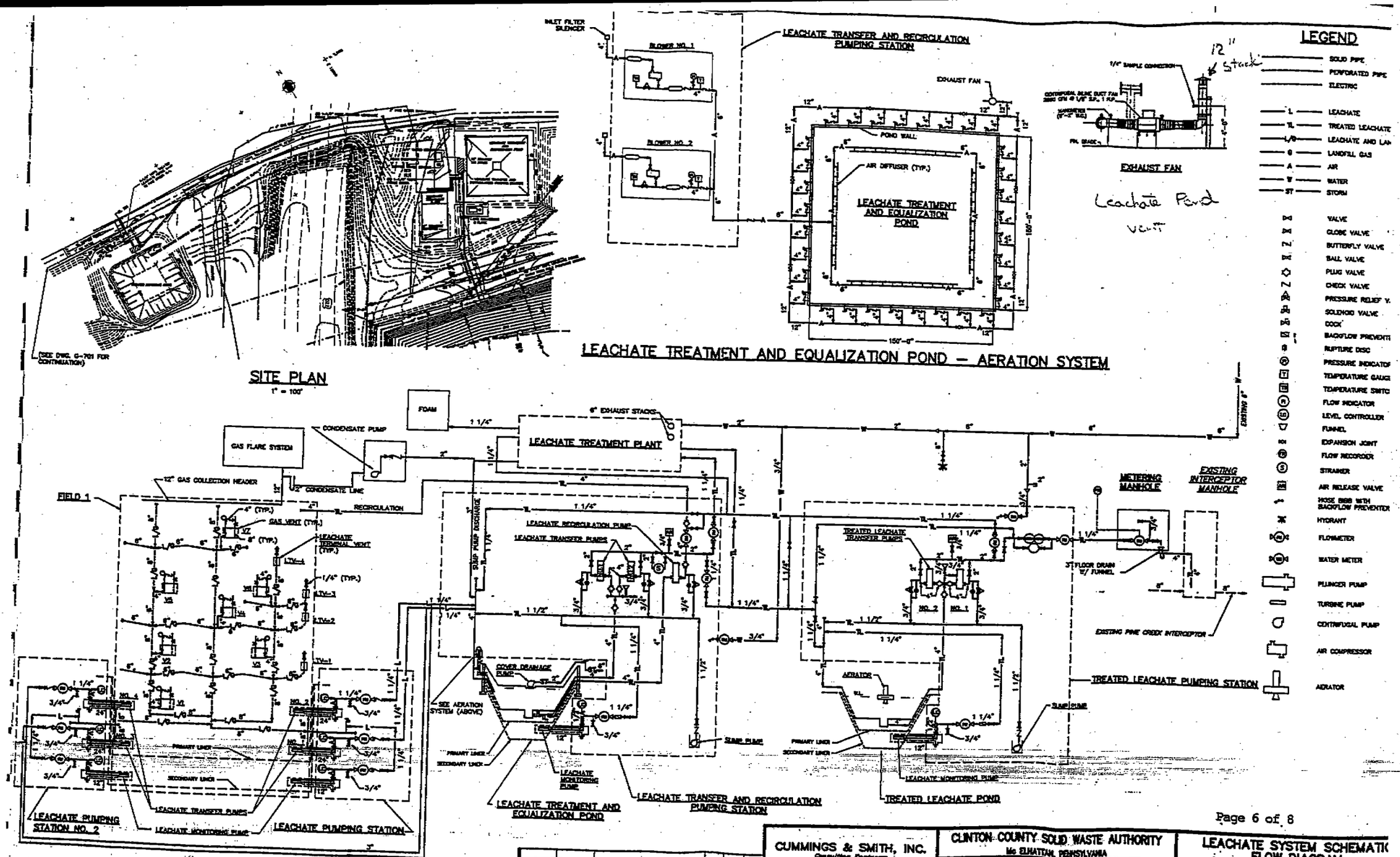
CLINTON COUNTY SOLID WASTE AUTHORITY
Mc ELHATTAN, PENNSYLVANIA
WAYNE TOWNSHIP LANDFILL
LEACHATE TREATMENT PLANT
CONTRACT NO. 011

PROCESS
BIOLOGICAL TREATMENT AREA
SECTIONS AND DETAILS I

D– 9109.08–P–1103 | A | 6



Page 6 of 8

NO.	DATE	DESCRIPTION	DRN	CHKD	APPVD
A	3-14-94	RECORD PLAN	CJS		

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UPPER MONTCLAIR, NJ

CLINTON COUNTY SOLID WASTE AUTHORITY
Mc ELHATTAN, PENNSYLVANIA
WAYNE TOWNSHIP LANDFILL
APPLICATION FOR AIR QUALITY PERMIT

LEACHATE SYSTEM SCHEMATIC FLOW DIAGRAM

CJS 10-1

D- 9109.13-G-502A A 2