Y&S, 2/95

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NOx & DRE
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Y & S MAINTENANCE, INC.
SCOTTDALE, PENNSYLVANIA

Report on

DETERMINATION OF ENCLOSED LANDFILL GAS FLARE PERFORMANCE

FEBRUARY 1995

Prepared By
Advanced Technology Systems, Inc.
3000 Tech Center Drive
Monroeville, Pennsylvania 15146 - 3055

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EXECUTIVE SUMMARY

On December 14, 1994, a compliance air test program was conducted for Y & S Maintenance, Inc. their landfill located in Scottdale, Pennsylvania. The objective of the test program was to conduct gas sampling at the inlet and outlet of an enclosed landfill gas flare operating at the landfill with the intent of demonstrating compliance with the following four permit conditions as listed in Pennsylvania Department of Environmental Resources (PA DER) Plan Approval No. 65-322-003 for this facility:

Flare gas temperatures greater than or equal to 1500^{O}F (Condition 6)

Destruction/removal efficiency (DRE) of nonmethane hydrocarbon compounds greater than or equal to 98 percent (Conditions 7 and 13b)

Emission rates of oxides of nitrogen (Condition 13c)

Residence time of the gas in the flare greater than or equal to 0.3 seconds (Condition 6)

The results of the testing showed an average DRE value of 99.0 percent, thus satisfying Condition Nos. 7 and 13b of the Plan Approval for this facility. Flare gas temperatures were greater than 1500^{O}F, thus satisfying Condition No. 6 of the Plan Approval for this facility. Residence times of the gas in the flare were equal to 39 seconds, thus satisfying Condition No. 6 of the Plan Approval for this facility.

1.0 INTRODUCTION

On December 14, 1994, a compliance air test program was conducted for Y & S Maintenance, Inc. their landfill located in Scottdale, Pennsylvania. The objective of the test program was to conduct gas sampling at the inlet and outlet of an enclosed landfill gas flare operating at the landfill with the intent of demonstrating compliance with the following four permit conditions as listed in Pennsylvania Department of Environmental Resources (PA DER) Plan Approval No. 65-322-003 for this facility:

Flare gas temperatures greater than or equal to 1500^{o}F (Condition 6)

Destruction/removal efficiency (DRE) of nonmethane hydrocarbon compounds greater than or equal to 98 percent (Conditions 7 and 13b)

Emission rates of oxides of nitrogen (Condition 13c)

Residence time of the gas in the flare greater than or equal to 0.3 seconds (Condition 6)

Testing was performed by Messrs. Richard Casselberry, John Shimshock, and Kelly Ajala of Advanced Technology Systems, Inc. (ATS) under the direction of Mr. Michael P. Kearns of Y & S Maintenance, Inc.

2.0 METHODOLOGIES

The compliance air test program was conducted in accordance with the document entitled "Test Protocol for Determination of Enclosed Landfill Gas Flare Performance at Y & S Maintenance, Inc.", which was submitted to PA DER in September 1994. A copy of this document and a copy of PA DER's acceptance letter can be found in Appendix A.

Testing was performed during periods of normal maximum process operation and during periods in which the following atmospheric conditions were satisfied:

No precipitation
Average surface wind speeds less 10 mph (to prevent ambient air entrainment in the flare stack)

Hourly weather updates (including surface wind data) from the National Weather Service Observation Site at Pittsburgh International Airport were recorded during the testing periods. The field test crew observed no precipitation and calm winds during the testing periods.

Specifics of the individual test methodologies used in this test program are summarized in the following sections.

2.1 Volumetric Flow Rate - Flare Inlet Gas Stream

The volumetric flow rate of the pressurized landfill gas in the 10.432 inch diameter horizontal duct which supplies gas to the flare was measured in accordance with EPA Methods 1A, 2C, 4, and TO-12 and ASTM Method 3416. Five separate gas velocity measurements were conducted during the test program through two ports separated by 90 degrees in the same vertical plane with the use of a standard type pitot tube in accordance with EPA Method 2C. Velocity measurements were conducted at twelve traverse points, six points per diameter; the traverse point locations were calculated in accordance with EPA Method 1A. Flare inlet gas temperature was measured simultaneously with the gas velocity measurements using a type K thermocouple.

Dry gas molecular weight of the inlet gas stream was calculated in accordance with EPA Method TO-12 and ASTM Method 3416 as described in Section 2.3. The moisture content of the inlet gas stream was calculated in accordance with EPA Method 4 from the knowledge of the weight gain of the four sample train impingers and dry gas volume sampled. One 30 minute EPA Method 4 run was conducted during the test program. Theoretical maximum moisture content of the inlet gas stream was also calculated based on the gas stream temperature and pressure.

2.2 Volumetric Flow Rate and Flare Gas Residence Time - Flare Outlet Gas Stream

The volumetric flow rate of the combusted gas in the flare was calculated in accordance with EPA Methods 2B, 4, and TO-12 and ASTM Method 3416 using a carbon balance technique. The volumetric flow rate of the combusted gas was calculated from the knowledge of the flare inlet volumetric flow rate (measured) and concentrations of carbon dioxide, carbon monoxide, methane, and nonmethane hydrocarbon compounds (NMHC) in the flare inlet gas and combusted gas. The concentrations of the four carbon compounds were measured as described in Section 2.3. The following equation was used to calculate the volumetric flow rate of the combusted gas in the flare:

$$\begin{array}{l} \text{Volumetric Flow Rate} \\ \text{of Outlet Flare Gas (dry cfm)} \end{array} = \begin{array}{l} \text{Volumetric Flow Rate of} \\ \text{Inlet Flare Gas (dry cfm)} \end{array} * R$$

$$R = \frac{(CO_2 + CO + CH_4 + \text{NMHC}) \text{ inlet gas concentrations (ppmv C)}}{(CO_2 + CO + CH_4 + \text{NMHC}) \text{ outlet gas concentrations (ppmv C)}}$$

Flare gas temperature was recorded with the enclosed landfill gas flare's continuous temperature recorder. The moisture content of the outlet gas stream was calculated in accordance with EPA Method 4 from the knowledge of the weight gain of the four sample train impingers and dry gas volume sampled. One 30 minute EPA Method 4 run was conducted during the test program. Residence time of the combusted gas was calculated from the knowledge of the flare outlet gas volumetric flow rate and total combustion volume in the flare.

2.3 Nonmethane Hydrocarbon Compounds and Destruction and Removal Efficiency (DRE)

Gas samples were collected simultaneously at the flare inlet and outlet sampling locations using stainless steel canisters in accordance with EPA Method TO-12. Each sampling train consisted of an evacuated canister, vacuum gauge, metering valve, and 1/4" sampling probe (teflon probe for the inlet gas, stainless steel probe for the outlet gas). Prior to sampling, the probes were flushed with source gas to remove possible contaminants. Each canister was filled with source gas until the canister vacuum was reduced to approximately 5" Hg. The sampling duration was 50 minutes per canister with the exception of the fifth set of canisters, which were filled in two minutes (insufficient daylight prevented a longer sampling duration for this set). Five sets of gas samples were collected as part of the test program (each set consisted of one flare inlet and one flare outlet gas sample).

Analyses of the collected gas samples were performed in accordance with EPA Method TO-12, which utilizes a preconcentration technique prior to quantification by a gas chromatograph with flame ionization detection (GC/FID). The collected gas samples were also analyzed for fixed gas components (methane, nitrogen, oxygen, carbon dioxide, carbon monoxide) using gas chromatography with thermal conductivity detection in accordance with ASTM Method 3416.

The destruction and removal efficiency of NMHC in the flare was calculated from the knowledge of the concentrations of NMHC in the inlet and outlet gas samples and the volumetric flow rates of the inlet and outlet flare gas streams. The following equation was used to calculate the DRE:

$$\text{DRE (\%)} = \frac{100 * (\text{Inlet NMHC Mass Flow Rate - Outlet NMHC Mass Flow Rate})}{\text{Inlet NMHC Mass Flow Rate}}$$

2.4 Oxides of Nitrogen - Flare Outlet Gas Stream

The concentrations and emission rates of oxides of nitrogen (NOx) from the stack were measured in accordance with EPA Method 7D. Three sequential tests, each of one-hour duration, were performed. Analyses of the EPA Method 7D samples were performed by ion chromatography in accordance with the test method. An EPA NOx audit sample was also analyzed with the test samples. The audit sample results were forwarded by ATS to Mr. Andrew C. Zemba, Quality Assurance Engineer, of PA DER's Central Office on January 30, 1995 via telephone conversation. Mr. Zemba indicated that the results of the analyses of the audit sample were within the acceptable range of values. The results of the audit sample have been included in this test report.

3.0 RESULTS

The nonmethane hydrocarbon compound test results have been summarized in Table 1. NMHC concentrations and mass flow rates are reported in units of parts per million by volume as carbon (ppmv C) and pounds per hour (lb/hr), respectively. The results of the testing showed an average DRE value of 99.0 percent, thus satisfying Condition Nos. 7 and 13b of the Plan Approval for this facility. The first set of samples was not analyzed since liquid water was collected in the inlet landfill gas flare canister (liquid water interferes in the analyses).

Table 1 also lists other duct and sampling parameters which include process gas flow rate in units of actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), dry standard cubic feet per minute (dscfm), and dry cubic feet per minute (dry cfm), moisture content of the gas streams (percent by volume), and process gas temperature (^{O}F). Flare gas temperatures were greater than 1500^{O}F, thus satisfying Condition No. 6 of the Plan Approval for this facility.

The nitrogen oxides test results have been summarized in Table 2. The results of the testing showed an average NO_2 concentration and emission rate of 32.0 milligrams per dry standard cubic meter (mg/dscm) and 0.202 lb/hr, respectively. Table 2 also lists the gas volume sampled for each test in units of dry standard cubic feet (dscf). Actual test sampling times have also been included in Table 2.

The exhaust stack gas residence times are listed in Table 3. Residence times were greater than 0.3 seconds, thus satisfying Condition No. 6 of the Plan Approval for this facility.

Copies of the test protocol, field data sheets, pre-test and post-test equipment calibration results, and flare gas temperature records can be found in Appendix A. The analytical results and emissions calculations for each test can be found in Appendix B.

Y & S MAINTENANCE, INC.
SCOTTDALE, PENNSYLVANIA

TABLE 1

NONMETHANE HYDROCARBON COMPOUNDS (NMHC) CONCENTRATIONS AND MASS FLOW RATES IN ENCLOSED GROUND FLARE INLET AND OUTLET GASES
DECEMBER 14, 1994

Test Number		Run 2	Run 3	Run 4	Run 5	Average
Concentrations and Mass Flow Rates						
Inlet to Flare	(ppmv C)	105	357	476	539	457
	(lb/hr)	0.25	0.86	1.27	1.71	1.28
Outlet from Flare	(ppmv C)	2.31	5.74	0.37	1.26	2.46
	(lb/hr)	0.007	0.022	0.001	0.005	0.009
Destruction and Removal Efficiency (DRE)	(%)	97.3	97.5	99.9	99.7	99.0
Duct Conditions						
Inlet Flow Rate	(acfm)	1270	1300	1450	1700	1430
Inlet Flow Rate	(scfm)	1280	1310	1450	1730	1440
Inlet Flow Rate	(dscfm)	1260	1290	1430	1700	1420
Inlet Temperature	(°F)	58	57	60	55	58
Inlet Moisture Content	(%)	1.7	1.6	1.8	1.5	1.7
Outlet Flow Rate	(dry cfm)	6400	8500	6800	8000	7400
Outlet Flow Rate	(dscfm)	1530	2030	1630	1920	1780
Outlet Temperature	(°F)	1700	1700	1700	1700	1700
Outlet Moisture Content	(%)	7.0				7.0

$$\text{NMHC (lb/hr)} = \frac{\text{NMHC (ppmv C)} * 28.32 * \text{Flow Rate (dscfm)} * 60 * 12}{0.08205 * 293 * 454 * 1\text{E}{+}06}$$

$$\text{DRE (\%)} = \frac{100 * (\text{Inlet NMHC (lb/hr)} - \text{Outlet NMHC (lb/hr)})}{\text{Inlet NMHC (lb/hr)}}$$

Run 1 not analyzed since liquid water was collected in the inlet landfill gas flare canister

Y & S MAINTENANCE, INC.
SCOTTDALE, PENNSYLVANIA

TABLE 2

NITROGEN OXIDES CONCENTRATIONS AND EMISSION RATES IN ENCLOSED GROUND FLARE EXHAUST GAS
DECEMBER 14, 1994

		Run 1	Run 2	Run 3	Average
Test Number		Y&S-NOX-1	Y&S-NOX-2	Y&S-NOX-3	
<u>Concentrations and Emission Rates</u>					
Nitrogen Oxides	(mg/dscm)	35.5	31.5	29.1	32.0
(as NO2)	(lb/hr)	0.203	0.181	0.221	0.202
<u>Stack Conditions</u>					
Flow Rate	(dscfm)	1530	1530	2030	1700
Moisture Content	(%)	7.0			7.0
<u>Sampling Conditions</u>					
Test times	(EST)	1120 to 1220	1246 to 1346	1407 to 1507	
Sampling Time	(minutes)	60	60	60	
Sample Volume	(dsL)	25.93	26.82	29.44	

Y & S MAINTENANCE, INC.
SCOTTDALE, PENNSYLVANIA

TABLE 3

ENCLOSED GROUND FLARE EXHAUST GAS RESIDENCE TIME
DECEMBER 14, 1994

		Run 2	Run 3	Run 4	Run 5	Average
Stack Conditions						
Stack Diameter	(ft)	11	11	11	11	
Stack Height	(ft)	50	50	50	50	
Flow Rate	(dry cfm)	6400	8500	6800	8000	
Gas Residence Time	(sec)	45	34	42	36	39

$$\text{Gas Residence Time (sec)} = \frac{\pi * (\text{Stack Diameter }\hat{}\,2) * \text{Stack Height} * 60}{4 * \text{Flow Rate}}$$

DETERMINATION OF ENCLOSED LANDFILL GAS FLARE PERFORMANCE

Y & S MAINTENANCE, INC.
SCOTTDALE, PENNSYLVANIA

APPENDIX A

TEST PROTOCOL, FIELD DATA SHEETS, EQUIPMENT CALIBRATION DATA, FLARE GAS TEMPERATURE RECORDS

ATS

ADVANCED TECHNOLOGY SYSTEMS, INC.

Test Protocol For Determination of Enclosed Landfill Gas Flare Performance

at

Y & S Maintenance, Inc.
Scottdale, Pennsylvania

September 1994

Prepared By

Advanced Technology Systems, Inc.
3000 Tech Center Drive
Monroeville, Pennsylvania 15146

Project No.: IKM-0782

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1.0 INTRODUCTION

This test protocol outlines specific test procedures and guidelines to be employed by Advanced Technology Systems, Inc. (ATS) in performing emission measurements from the Y & S Maintenance, Inc. (Y & S) enclosed landfill gas flare operated in Scottdale, Pennsylvania. The test program will include gas sampling at the inlet and outlet of the landfill gas flare with the intent of demonstrating compliance with the following five permit conditions as listed in Pennsylvania Department of Environmental Resources (PA DER) Plan Approval No. 65-322-003 for this facility:

Flare gas temperatures greater than or equal to 1500°F (Condition 6)

Destruction/removal efficiency of nonmethane hydrocarbon compounds greater than or equal to 98 percent (Conditions 7 and 13b)

Emission rates of specific volatile organic compounds (Condition 13a)

Emission rates of oxides of nitrogen (Condition 13c)

Residence time of the gas in the flare greater than or equal to 0.3 seconds (Condition 6)

The testing of the flare, as required by PA DER, is tentatively scheduled for early November 1994. Y & S personnel will collect flare gas temperature and combustion chamber volume data for inclusion in ATS's final report.

Testing will only be performed during periods of normal maximum 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. In addition, testing will only be performed during periods in which the following atmospheric conditions are satisfied:

No precipitation
Average surface wind speeds less 10 mph (to prevent ambient air entrainment in the flare stack)

Hourly weather updates (including surface wind data) from the National Weather Service Observation Site at Pittsburgh International Airport are available via telephone recording (412-936-1212). Hourly weather updates from the National Weather Service Observation Site at Latrobe Area Airport (which is closer to Scottdale than Pittsburgh International Airport) may also be available during the testing periods. ATS will record this weather information during the test periods to ensure that the testing is only performed during the appropriate periods.

2.0 PROCESS DESCRIPTION

Following closure of disposal cells (final grading and capping), a network of landfill gas collection wells were installed in large diameter borings which were drilled into the landfill. Gas collected by the wells is routed via an extensive piping network to a central location which is identified as the enclosed flare station. Blowers are used to apply a vacuum to the gas collection network. A series of valves are adjusted to maintain the appropriate vacuum on each extraction well. The vacuum on any given well may also be adjusted in order to mitigate landfill gas migration. The landfill gas is combusted in an enclosed flare in order to mitigate landfill odors and to minimize emissions from the landfill.

3.0 TEST METHODOLOGIES

The execution of the test program will require the use of several EPA and ASTM promulgated procedures. Specifics of the individual test methodologies to be used in this test program are summarized in the following sections.

3.1 Volumetric Flow Rate - Flare Inlet Gas Stream

The volumetric flow rate of the pressurized landfill gas in the approximately 12 inch diameter horizontal duct which supplies gas to the flare will be determined in accordance with EPA Methods 1, 2, 4, and TO-12 and ASTM Method 3416. Four separate gas velocity measurements will be conducted during the test program through two ports separated by 90 degrees in the same vertical plane with the use of an S-type pitot tube in accordance with EPA Method 2. Velocity measurements will be conducted at twelve traverse points, six points per diameter; the traverse point locations will be calculated in accordance with EPA Method 1. Flare inlet gas temperature will be determined simultaneously with the gas velocity measurements using a type K thermocouple.

Dry gas molecular weight of the inlet gas stream will be determined in accordance with EPA Method TO-12 and ASTM Method 3416 as described in Section 3.3. The moisture content of the inlet gas stream will be determined by knowledge of the weight gain of the four sample train impingers and dry gas volume sampled in accordance with EPA Method 4. Three separate one-half hour EPA Method 4 runs will be conducted during the test program.

3.2 Volumetric Flow Rate and Flare Gas Residence Time- Flare Outlet Gas Stream

The volumetric flow rate of the combusted gas in the flare will be calculated in accordance with EPA Methods 2B, 4, and TO-12 and ASTM Method 3416 using a carbon balance technique. The volumetric flow rate of the combusted gas will be calculated from the knowledge of the flare inlet volumetric flow rate (measured) and concentrations of carbon dioxide, carbon monoxide, methane, and nonmethane hydrocarbon compounds (NMHC) in the flare inlet gas and combusted gas. The concentrations of the four carbon compounds will be determined as described in Section 3.3. The following equation will be used to calculate the volumetric flow rate of the combusted gas in the flare:

$$\begin{array}{lcll} \text{Volumetric Flow Rate} & = & \text{Volumetric Flow Rate of} & * \quad R \\ \text{of Outlet Flare Gas (dry cfm)} & & \text{Inlet Flare Gas (dry cfm)} & \end{array}$$

$$R = \frac{(CO_2 + CO + CH_4 + \text{NMHC}) \text{ inlet gas concentrations (ppmv C)}}{(CO_2 + CO + CH_4 + \text{NMHC}) \text{ outlet gas concentrations (ppmv C)}}$$

Flare gas temperature will be recorded via a type K thermocouple inserted at the sampling port and checked against the flare's continuous temperature recorder. Percent moisture content, by volume, of the exhaust gas will determined by the knowledge of the weight gain of the four sample train impingers used in the NOx sampling train (see Section 3.5) and dry gas volume sampled in accordance with EPA Method 4.

Residence time of the combusted gas will be calculated from the knowledge of the flare outlet gas volumetric flow rate and total combustion volume in the flare.

3.3 Nonmethane Hydrocarbon Compounds and Destruction and Removal Efficiency (DRE)

Gas samples will be collected simultaneously at the flare inlet and outlet sampling locations using stainless steel canisters in accordance with EPA Method TO-12. Each sampling train consists of an evacuated canister, vacuum gauge, metering valve, and 1/4" stainless steel sampling probe. Prior to sampling, the probe will be flushed with source gas to remove possible contaminants. Each canister will be filled with source gas until the canister vacuum is reduced to approximately 5" Hg (approximately one hour sampling duration). Four sets of gas samples will be collected as part of the test program (each set consists of one flare inlet and one flare outlet gas sample).

Analyses of the collected gas samples will be performed in accordance with EPA Method TO-12, which utilizes a preconcentration technique prior to quantification by a gas chromatograph with flame ionization detection (GC/FID). The preconcentration simultaneously allows for (i) separating the fixed gas components (methane, nitrogen, oxygen, carbon dioxide, carbon monoxide) from nonmethane hydrocarbon compounds and (ii) concentrating the NMHC in order to achieve analytical detection limits of 0.01 parts per million by volume (ppmv) as hexane. The use of helium or argon as the GC/FID carrier gas as required by EPA Method TO-12 eliminates the variable response of the GC/FID to various organic compounds in an oxygen atmosphere, such as in EPA Methods 25A and 25C. (EPA Method 25C does address this problem by first requiring the oxidation of all NMHC to carbon dioxide, then reduction of carbon dioxide to methane before quantification by the FID. However, since there is no preconcentration of NMHC, the EPA Method 25C analytical detection limit is ca. 5 ppmv, which is about 500 times greater than the EPA Method TO-12 analytical detection limit). As such, the detector response for EPA Method TO-12 is nearly one for all compounds.

The collected gas samples will also be analyzed for fixed gas components (methane, nitrogen, oxygen, carbon dioxide, carbon monoxide) using gas chromatography with thermal conductivity detection in accordance with ASTM Method 3416.

The destruction and removal efficiency of NMHC in the flare will be calculated from the knowledge of the concentrations of NMHC in the inlet and outlet gas samples and the volumetric flow rates of the inlet and outlet flare gas streams. The following equation will be used to calculate the DRE:

$$\text{DRE (\%)} = \frac{100 * (\text{Inlet NMHC Mass Flow Rate - Outlet NMHC Mass Flow Rate})}{\text{Inlet NMHC Mass Flow Rate}}$$

3.4 Volatile Organic Compounds - Flare Outlet Gas Stream

Three additional gas samples will be collected at the stack location only in accordance with EPA Method TO-14. Collection of gas sample will be performed by drawing source gas into a pre-evacuated 6 liter SUMMA passivated stainless steel canister. Quantification for the following volatile organic compounds will be completed using gas chromatography / mass spectroscopy procedures for each gas sample in accordance with EPA Method TO-14: benzene, chloroform, 1,2-dichloroethane, chloromethane (methyl chloride), methylene chloride, perchloroethylene (tetrachloroethene), trichloroethylene, carbon tetrachloride, vinylidene chloride (1,1-dichloroethene), and vinyl chloride.

3.5 Oxides of Nitrogen - Flare Outlet Gas Stream

The concentrations and emission rates of oxides of nitrogen (NOx) from the stack will be determined in accordance with EPA Method 7D. Three sequential tests, each of one-hour duration, will be performed. Analyses of the EPA Method 7D samples will be performed by ion chromatography in accordance with the test method. An EPA NOx audit sample will also analyzed with the test samples.

4.0 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:

4.1 Organization and Responsibilities

ATS'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.

4.2 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.

4.3 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 the following:

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.

4.3.1 Volumetric Flow Rate

All pitot tubes, thermocouples, differential pressure gauges, and balances 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.

4.3.2 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. A laboratory blank summa canister will be analyzed for total nonmethane hydrocarbon compounds and speciated volatile organic compounds and contaminate levels, and, if found in these canister samples, will be subtracted from actual test sample results for destruction efficiency and emission determinations.

4.3.3 Nitrogen Oxides

Nitrogen oxides sampling trains will be 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 will be performed. A NO_x blank and PA DER supplied audit sample will be analyzed with the test samples to verify the accuracy of the results. If analysis results indicate non-quantifiable values below the detection limit, then a zero value will be used for emission calculations. If values can be approximated below the detection limit, then these values will be used in an emission calculation.

5.0 TEST PROGRAM REPORT

A test report will be submitted at the conclusion of the sampling program. The results of the individual test parameters will be presented in a summary table with a comparison with allowable emissions to demonstrate compliance with the provisions of PA DER Plan Approval No. 65-322-003 for this facility. This report will also include an overview of the test program conducted, personnel conducting the tests, the analytical results, and any occurrence that could have an effect on the test results. The appendices to this report will contain field data sheets, pre and post-test calibration information, process description, process production information, and emission calculations.

P.O. Box 8468
Harrisburg, PA 17105-8468
November 4, 1994

717-787-6547

Bureau of Air Quality Control

Mr. Michael P. Kearns
Environmental Engineer
Y&S Maintenance, Inc.
R.D. #1, Landfill Road
P.O. Box 223
Scottdale, PA 15683

Dear Mr. Kearns:

The test protocol, submitted with your letter of September 30, 1994, to Mr. William J. Charlton for nonmethane organic compounds (NMOC) and nitrogen oxides (NO_X) emissions testing for your landfill gas enclosed ground flare located in East Huntingdon Township, Westmoreland County, is acceptable to the Department with the following conditions:

1. Moisture content in the flare outlet must be determined by using EPA Method 4. Moisture determination from NO_X sample train as proposed by you is not acceptable.
2. An EPA NO_X audit sample will be mailed to you. This sample must be analyzed concurrently with the NO_X test samples and the result must be included in the final test report.

You are not required to perform tests for specific volatile organic compounds as stated in Section 3.4 of the protocol, since Condition Nos. 13a (tests for specific volatile organic compounds) and 15 (ambient impact analysis) have been eliminated from special conditions of Plan Approval No. 65-322-003 by Mr. Philip Sapala of our Southwest Regional Office.

Acceptance of the final test report will be contingent upon fulfilling all applicable requirements of Chapter 139 of the Pennsylvania Department of Environmental Resources' Rules and Regulations, the Source Testing Manual, and Plan Approval No. 65-322-003.

Sincerely,

Jaydeb Pai
Air Pollution Control Engineer
Division of Source Testing and Monitoring

STACK GAS SAMPLING
GAS VELOCITY SHEET

Lift operator = Terry McBeth

PLANT	Y+S Maintenance	DATE	12-14-94	PAGE #	1 of 3
LOCATION	Grand Flare Inlet	TEST #	Flows	STK DIA.(in.)	~~0.10"~~ 10.432"
ACTIVITY NO#	IKH-0782	PROBE #	3' std.	STK WIDTH (in.)	— JPS
TESTERS	JPS, PC	B.P.	29.30	COMMENTS	

TIME: 0955

PORT	POINT	VELOCITY ΛP in. H2O	TEMP. F	STATIC PRESSURE
Vert.	1.0	0.27	62°F	4.2
	1.5	0.30		
	3.01	0.16		
	7.03	0.13		
	8.9	0.11		
	9.04	0.09		
Horz	1.0	0.21	62°F	4.2
	1.5	0.20		
	3.01	0.21		
	7.03	0.24		
	8.9	0.25		
	9.04	0.25		

Pitot Leak check OK - 15 sec

TIME: 1245

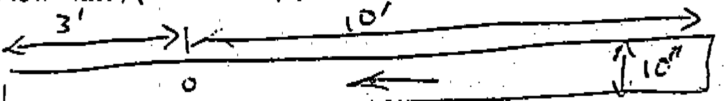
PORT	POINT	VELOCITY ΛP in. H2O	TEMP. F	STATIC PRESSURE
Vert	1.0	0.24	58°F	4.0
	1.5	0.25		
	3.01	0.29		
	7.03	0.37		
	8.9	0.35		
	9.04	0.34		
Horz	1.0	0.26	58°F	4.0
	1.5	0.26		
	3.01	0.27		
	7.03	0.29		
	8.9	0.29		
	9.04	0.26		

Pitot Leak check OK - 15 sec

A. Ave. ΛP – in/H2O	0.20	0.29
B. Average Stack Temperature – F	62	58
C. Average Stack Temperature (F + 460) – R	522	518
D. Ave. Molecular Weight – (g/mol) (see attached sheet)	—	29.04
E. Stack Pressure (in. Hg), B.P. + (static P/13.6)	29.61	29.59
F. Pitot Correction Factor	1.00	1.00
G. Velocity (ft/sec), 85.49 x F x ((A x C)/(D x E))^1/2	—	35.7
H. Stack Area – sqr. ft. Round: 3.14 x (STK DIA)^2/(4 x 144)	0.594 ~~0.951~~	~~0.5154~~ 0.594
Rectangular: (L x W)/144	—	—
I. Flow Rate, G x H x 60 – ACFM	—	1270
J. Flow Rate, (528 x E x I)/(29.92 x C) – SCFM	—	1280

1260 = dscfm

ATS



Inlet

STACK GAS SAMPLING
GAS VELOCITY SHEET

PLANT Y+S Maintenance
LOCATION Grand Flare Inlet
ACTIVITY NO# IKM-0782
TESTERS JTS, RC
DATE 12-14-94
TEST # Flows
PROBE #
B.P. 29.30
PAGE # 2 of 3
STK DIA.(in.) ~~6~~ 10.43"
STK WIDTH (in.)
COMMENTS

TIME: 1400

PORT	POINT	VELOCITY ΛP in. H2O	TEMP. F	STATIC PRESSURE
Vert	1.0	~~0.65~~ 0.20	57°F	3.7
	1.5	~~0.65~~ 0.23		
	3.~~0~~1	~~0.65~~ 0.37		
	7.~~0~~3	0.37		
	8.9	0.35		
	9.~~0~~4	0.15		
Horz.	1.0	0.38	57°F	3.7
	1.5	0.38		
	3.~~0~~1	0.37		
	7.~~0~~3	0.35		
	8.9	0.28		
	9.~~0~~4	0.25		

Pitot Leak Check OK 15 sec

TIME: 1540

PORT	POINT	VELOCITY ΛP in. H2O	TEMP. F	STATIC PRESSURE
Vert.	1.0	0.24	60°F	3.6
	1.5	0.32		
	3.~~0~~1	0.35		
	7.~~0~~3	0.32		
	8.9	0.20		
	9.~~0~~4	0.15		
Horz.	1.0	0.46	60°F	3.6
	1.5	0.46		
	3.~~0~~1	0.52		
	7.~~0~~3	0.54		
	8.9	0.54		
	9.~~0~~4	0.54		

Pitot Leak Check OK 15 sec.

A. Ave. ΛP – in/H2O	0.30	0.37
B. Average Stack Temperature – F	57	60
C. Average Stack Temperature (F + 460) – R	517	520
D. Ave. Molecular Weight – (g/mol) (see attached sheet)	28.87	28.82
E. Stack Pressure (in. Hg), B.P. + (static P/13.6)	29.57	29.56
F. Pitot Correction Factor	1.00	1.00
G. Velocity (ft/sec), 85.49 x F x ((A x C)/(D x E))^1/2	36.4	40.6
H. Stack Area – sqr. ft. Round: 3.14 x (STK DIA)^2/(4 x 144)	0.594 ~~0.5454~~	~~0.5454~~ 0.594
Rectangular: (L x W)/144	—	—
I. Flow Rate, G x H x 60 – ACFM	1300 ~~1190~~	~~1330~~ 1450
J. Flow Rate, (528 x E x I)/(29.92 x C) – SCFM	1310 ~~1200~~	~~1332~~ 1450
K. Flow Rate, SCFM x(1 – %H2O/100) – DSCFM	1290 ~~1180~~	~~1310~~ 1430

ATS

STACK GAS SAMPLING
GAS VELOCITY SHEET

PLANT Y-5 Maintenance
LOCATION Grand Flare Inlet
ACTIVITY NO# F44-Ø782
TESTERS JTB, RC
DATE 12-14-94
TEST # Flows
PROBE #
B.P. 29.30
PAGE # 3 / 3
STK DIA.(in.) ~~24~~ 10.432"
STK WIDTH (in.) —
COMMENTS

TIME: 1700

PORT	POINT	VELOCITY ΛP in. H2O	TEMP. F	STATIC PRESSURE
Vert	1.0	0.52	53°F	3.6
	1.5	0.53		
	3.0	0.53		
	7.0	0.54		
	8.5	0.35		
	9.0	0.35		
Horz.	1.0	0.51	53°F	3.6
	1.5	0.54		
	3.0	0.56		
	7.0	0.~~4~~59		
	8.5	0.60		
	9.0	0.64		

TIME:

PORT	POINT	VELOCITY ΛP in. H2O	TEMP. F	STATIC PRESSURE

Pitot Leak Check OK 15 sec

A. Ave. ΛP – in/H2O 0.52
B. Average Stack Temperature – F 55
C. Average Stack Temperature (F + 460) – R 515
D. Ave. Molecular Weight – (g/mol) (see attached sheet) 29.01
E. Stack Pressure (in. Hg), B.P. + (static P/13.6) 29.56
F. Pitot Correction Factor 1.00
G. Velocity (ft/sec), 85.49 x F x ((A x C)/(D x E))^1/2 47.8
H. Stack Area – sqr..ft. Round: 3.14 x (STK DIA)^2/(4 x 144) ~~[illegible]~~ 0.594
Rectangular: (L x W)/144 →
I. Flow Rate, G x H x 60 – ACFM ~~1560~~ 1700
J. Flow Rate, (528 x E x I)/(29.92 x C) – SCFM ~~1580~~ 1730
K. Flow Rate, SCFM * $(1 - \frac{\%H_2O}{100})$ – DSCFM ~~1560~~ 1700

ATS

STACK SAMPLING DATA SHEET

Page 1 of 1

CLIENT Y45 Maintenance
TEST UNIT Ground Flare Inlet
PROJECT NO. IKM - Ø782
TEST CREW JTS
BAROMETRIC PRESSURE 29.30

TEST DATE 12-14-94
TEST NO. Y45-H2O-IN-1
NOZZLE (SIZE,#) —
STATIC PRESSURE 3.6"
PORT DIRECTION vertical

ORIFICE CORRECTION (ΔH@) 1.837
METER CORRECTION (Y) 1.0172
CALIBRATION DATE 6-20-94
PITOT CORRECTION —
CONTROL BOX NO. 6

HOT/COLD BOX NO. 2
PROBE NO. — teflon line
FILTER NO. —
STACK DIA. 10"
PORT SIZE —

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	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
Single	1555	674.620		1.50	1.50	58	56	3.5	60		<68		30 min./point
point	1600					72	57	3.0					
	1605					79	58	3.0					
	1610					81	60	3.0					
	1615					83	61	3.0					
	1620					85	63	3.0					
	1625	694.681				86	63	3.0					
Test Totals	Δ=30 min	Δ=20.061 dcf		(ΔH)avg =	1.50	(Tmeter)avg = 69°F							

$H_2O(v) = 12.1 g * 0.04715$ scf/g $= 0.571$ scf

Dry gas volume $= 20.061$ dcf $* 1.0172 * \left\{\frac{528}{69+460}\right\} * \left\{\frac{29.30 + (1.5/13.6)}{29.92}\right\}$ dscf $= 20.021$ dscf

$T_{stack} = 60°F$ $P_{static} = 3.6"$

$\frac{6.11 * 29.92}{1013} \exp\left\{\frac{2.5\times10^6}{462}\left[\frac{1}{273} - \frac{1}{T_{stack}(K)}\right]\right\}$

$\%H_2O(V)$ saturated $= \frac{100\% * 0.525 \text{ in Hg}}{29.30 + (3.6/13.6) \text{ in Hg}} = \boxed{1.8\%}$

Estimates:
MW=
%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.005
After	4.0	0.005

PITOT LEAK CHECK

	Positive	Negative
Before	—	—
After	—	—

GAS	1	2
CO2		
O2	Canister	
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL D.I. H2O	567.0	560.7	6.3
2.	100 mL D.I. H2O	619.9	619.6	0.3
3.	Empty	449.9	449.7	0.2
4.	Silica Gel	591.9	586.6	5.3
5.				
6.			total =	12.1 g
7.				
8.				

$\% H_2O(v) = \frac{0.571 \text{ scf}}{0.571 \text{ scf} + 20.021 \text{ dscf}} * 100\% = 2.8\%$

Page 1 of 1

STACK SAMPLING DATA SHEET

LIENT Y+S Maintenance
EST UNIT Grand Flare Exhaust Stack
ROJECT NO. IKM - Ø782
EST CREW KPC, JPS, KA
AROMETRIC PRESSURE 29.30

TEST DATE 12-14-94
TEST NO. Y+S- H20-OUT-1
NOZZLE (SIZE,#) —
STATIC PRESSURE —
PORT DIRECTION

ORIFICE CORRECTION (ΔH@) 1.627
METER CORRECTION (Y) 1.0042
CALIBRATION DATE 6-16-94
PITOT CORRECTION —
CONTROL BOX NO. 3

HOT/COLD BOX NO. 8
PROBE NO. — Steel probe
FILTER NO. —
STACK DIA. 11"
PORT SIZE 3"

Traverse Point (inches)	Time	Dry Gas Meter Reading (dcf)	Pitot ΔP (in. H2O)	Orifice ΔH Required (in. H2O)	Orifice ΔH Actual (in. H2O)	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
													30 min./point
[illegible]	15:54	418,065		1.50	1.50	60	60	20	~~20~~	1347	<68		
				1.50	1.50	64	61	2.0	1357				
				1.50	1.50	66	63	2.0	1444				
				1.50	1.5	69	63	2.0	1351				
				1.50	1.50	70	62	2.0	1395				
				1.50	1.50	75	63	2.0	1390	←	downdraft	?	
	16:24	439.620											
				$(\Delta H)_{AVG}$ = 1.50		$(T_{meter})_{AVG}$ = 65°F			$(T_{stack})_{AVG}$ = 1380°F				
Test Totals	Δ=30 min	Δ=21.535 dcf											

$H_2O(v) = 34.4 g * 0.04715 scf/g = 1.622 scf$

$Dry\ Gas\ Volume = 21.535\ dcf * 1.0042 * \left\{\frac{528}{(65+460)}\right\} * \left\{\frac{29.30 + (1.5/13.6)}{29.92}\right\} = 21.398\ dscf$

Estimates:
MW=
%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	DGM Rate (cfm)
Before	5.0	0.010
After	0.0	<0.01cfm

PITOT LEAK CHECK

	Positive	Negative
Before	—	—
After	—	—

GAS	1	2
CO2		
O2	canister	
CO		
N2		

Impinger No.	Impinger Contents	Final	Initial	Difference
1.	100 mL D.I. H_2O	607.4	593.1	14.3
2.	100 mL D.I. H_2O	513.8	501.6	12.2
3.	Empty	443.2	440.8	2.4
4.	Silica Gel	659.7	654.2	5.5
5.				
6.			total =	34.4g
7.				
8.				

ATS

$\%H_2O(v) = \frac{1.622\ scf}{1.622\ scf + 21.398\ dscf} * 100\% = 7.0\%$

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AIR QUALITY ENGINEERING

EPA METHOD $\overset{7D}{26}$ SOURCE SAMPLING DATA SHEET

CLIENT Y+S Maintenance
TEST UNIT Grand Flare Exhaust Stack
PROJECT NO. IKM- 0782
SYSTEM OPERATOR JB
BAROMETRIC PRESSURE 29.30

TEST DATE 12-14-94
TEST NO. Y+S- NOX- 1
SITE NO.
STACK DIAMETER 11'
PORT DIRECTION

DRY GAS METER NO. 500304
METER CORRECTION (Y) ~~0.9854~~ 0.9876
CALIBRATION DATE 8-18-94

Required Flow Rate: 400-500 cc/min

Traverse Point (inches)	Clock Time EST	Dry Gas Meter Reading dry (~~ft³~~) L	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (Hotport) (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
Single point	1120	8078.57		0.25	61	3.5	997		<68		10AM EST
	1125				62	3.5	1026				WS=6mph NE
	1130				61	3.5	1240	downdraft?			
	1135				62	3.5	1075				Pittsburgh
	1140				62	3.5	993				International
	1145				60	3.0	1252				Airport
	1150				60	3.0	1173				
	1155				60	3.0	1249				
	1200				59	3.0	1366				
	1205				59	3.0	1092				
	1210				59	3.0	1338				
	1215				59	3.0	1143				Estimates:
Test	1220	8104.98			57	3.0	1146				MW=
Totals	Δ= 60min	Δ=26.41	dry L	AVG =	60°F		1161°F	= AVG			%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	10.0	5
After	10.0	5

← required ≤ 8-10 cc/min (< 2% of average flow rate)

Impinger No.	Impinger Contents	Final	Initial	Difference
200 1. ml	~~150~~ mL KMnO4/NaOH	504.4	510.1	-5.7
200 2. ml	~~150~~ mL KMnO4/NaOH	522.3	514.7	7.6
200 3. ml	~~150~~ mL KMnO4/NaOH	512.9	512.0	0.9
4.	Silica Gel	644.1	643.8	0.3
5.				

total = 3.1g

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2	canister	
CO		
N2		

$$\frac{26.41 \text{ dry L} \times 0.98\cancel{54}^{76}}{60 \text{ min}} = 0.435 \text{ L/min}$$

AQE 7/92

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AIR QUALITY ENGINEERING

EPA METHOD 26 SOURCE SAMPLING DATA SHEET

CLIENT YHS Maintenance
TEST UNIT Grand Flare Exhaust Stack
PROJECT NO. IKM-0782
SYSTEM OPERATOR JCS
BAROMETRIC PRESSURE 29.70

TEST DATE TD 12-14-94
TEST NO. YHS-NOx-2
SITE NO.
STACK DIAMETER 11'
PORT DIRECTION

DRY GAS METER NO. 500304
METER CORRECTION (Y) ~~0.9859~~ 0.9876
CALIBRATION DATE 8-19-94
Required Flow Rate : 400-500 cc/min

Traverse Point (inches)	Clock Time EST	Dry Gas Meter Reading dry L	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. Hot part (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
single	1246	8106.36		0.25	61	3.0	1205	~~[illegible]~~	<68		
point	1251				56	3.0	1177	~~[illegible]~~			
	1256				59	3.0	1086	← downdraft ?			
	1301				57	3.0	1073				1pm EST
	1306				59	3.0	1243				WS = 7mph NE
	1311				57	3.0	1368				
	1316				59	3.0	1367				Pittsburgh
	1321				59	3.0	1191				International
	1326				59	3.0	1223				Airport
	1331				60	3.0	1258				
	1336				60	3.0	1248				Estimates:
	1341				60	3.0	1280				MW=
Test	1346	8133.67			60	3.0	1240				%H2O=
				AVG =	59°F		1228°F = AVG				
Totals	Δ=60min	Δ=27.31 dry L									

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	10.0	5
After	10.0	7

← required <8-10 cc/min

(<2% of average flow rate)

Impinger No.	Impinger Contents	Final	Initial	Difference
200 1. ml	~~150 ml~~ KMnO4/NaOH	543.6	542.5	1.1
200 2. ml	~~150 ml~~ KMnO4/NaOH	518.1	517.1	1.0
200 3. ml	~~150 ml~~ KMnO4/NaOH	491.4	491.0	0.4
4.	Silica Gel	579.3	579.0	0.3
5.				

total ≈ 2.8 g

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2	Constant	
CO		
N2		

$$\frac{27.31 \text{ dry L} * 0.98\cancel{59}^{76}}{60 \text{ min}} = \cancel{0.449}\ 0.450 \text{ L/min}$$

AQE 7/92

8130 → 8136

Page 1 of 1

AIR QUALITY ENGINEERING

EPA METHOD ~~26~~ 7D SOURCE SAMPLING DATA SHEET

CLIENT Y+S Maintenance
TEST UNIT Grand Flare Exhaust Stack
PROJECT NO. IKM - 0782
SYSTEM OPERATOR JPJ
BAROMETRIC PRESSURE 29.30

TEST DATE 12-14-94
TEST NO. Y+S - NOx - 3
SITE NO.
STACK DIAMETER 11'
PORT DIRECTION

DRY GAS METER NO. 500304
METER CORRECTION (Y) ~~0.9859~~ 0.9876
CALIBRATION DATE 8-18-94
Required Flow Rate: 400-500 cc/min

Traverse Point (inches)	Clock Time EST	Dry Gas Meter Reading dry ([illegible]) L	Buck Reading (cc/min)	Rotameter Reading	Meter Exit Temp. (°F)	Vacuum (in. Hg)	Stack Temp. (test port) (°F)	Hot Box Temp. (°F)	Impinger Temp. (°F)	Probe Temp. (°F)	Comments
single	1407	8134.90		0.40	60	3.0	1070				2 PM EST
point	1412				60	3.0	1232	← downdraft?			WS = 6 mph NE
	1417				60	3.0	1177				
	1422				59	3.0	1038				
	1427				60	3.0	1263				Pittsburgh
	1432				59	3.0	1108				International
	1437				61	3.0	1248				Airport
	1442				55	3.0	948				
	1447				56	3.0	852				
	1452				57	3.0	859				
	1457				59	3.0	815				
	1502				60	3.0	1170				Estimates:
Test	1507	8164.88		↓	58	3.0	1096				MW=
Totals	Δ=60 min	Δ = 29.98 dry L		AVG =	59°F		1067	= AVG			%H2O=

SYSTEM LEAK CHECK

	Vacuum (in. Hg)	Rate (cc/min)
Before	10.0	5
After	10.0	5

← required <8-16 cc/min

(<2% of average flow rate)

Impinger No.	Impinger Contents	Final	Initial	Difference
200 1. ml	~~150 ml~~ KMnO4/NaOH	524.7	523.5	1.2
200 2. ml	~~150 ml~~ KMnO4/NaOH	524.9	524.2	0.7
200 3. ml	~~150 ml~~ KMnO4/NaOH	502.0	501.7	0.3
4.	Silica Gel	663.9	663.7	0.2
5.				

total = 2.4 g

FYRITE MEASUREMENTS

GAS	Run 1	Run 2
CO2		
O2	canister	
CO		
N2		

$$\frac{29.98 \text{ dry L} \times 0.98\overset{76}{\cancel{59}}}{60 \text{ min}} = 0.493 \text{ L/min}$$

AQE 7/92

R158 → R11-1

DRY GAS METER CALIBRATION

THREE POINT CALIBRATION

SERIAL 500304
DATE 08-18-94

BP 28.95
OPERATOR RPC

RATE 1.0 LPM

	WET TEST METER				DRY TEST METER					METER
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD	CORRECT Y
START			0.000	28.95				0.00	7719.000	
HALF		70.0			80.0	76.0	78.0		7747.940	
STOP	28.17		1.000							
CALCULATION	28.17	530.0	1.003	28.95			538.0	29.15	1.022	0.9890
START			0.000	28.95				0.00	7750.000	
HALF		70.0			81.0	77.0	79.0		7779.090	
STOP	28.22		1.000							
CALCULATION	28.22	530.0	1.003	28.95			539.0	29.15	1.027	0.9857
START			0.000	28.95				0.00	7781.000	
HALF		70.0			81.0	77.0	79.0		7810.020	
STOP	28.23		1.000							
CALCULATION	28.23	530.0	1.003	28.95			539.0	29.15	1.025	0.9881
AVERAGE										0.9876

POST TEST

SERIAL 500304
DATE 01-04-95
BP 29.15
OPERATOR RPC
RATE 1.0 LPM

	WET TEST METER				DRY TEST METER					METER CORRECT Y
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD	
START			0.000	29.15				0.00	2300.000	
HALF		70.0			81.0	76.0	78.5			
STOP	28.18		1.000						2328.960	
CALCULATION	28.18	530.0	1.003	29.15			538.5	29.15	1.023	0.9961
START			0.000	29.15				0.00	2330.000	
HALF		70.0			82.0	77.0	79.5			
STOP	28.25		1.000						2359.010	
CALCULATION	28.25	530.0	1.003	29.15			539.5	29.15	1.024	0.9962
START			0.000	29.15				0.00	2360.000	
HALF		70.0			82.0	77.0	79.5			
STOP	28.30		1.000						2389.090	
CALCULATION	28.30	530.0	1.003	29.15			539.5	29.15	1.027	0.9935
AVERAGE										0.9952
DIFFERENCE										-0.77%

CONTROL BOX CALIBRATION

THREE POINT CALIBRATION

BOX # 3 BP 29 In. Hg

DATE 06-16-94 OPERATOR RPC

	WET TEST METER				DRY TEST METER					METER COEFFICIENT Y	ORIFICE COEFFICIENT ΔH@
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD		
START			0.000	29.00				0.50	799.000		
HALF		87.0			97.0	90.0	93.5		804.050		
STOP	11.53		5.000								
CALCULATION	11.53	547.0	5.013	29.00			553.5	29.04	5.050	1.0031	1.563
START			0.000	29.00				1.00	804.600		
HALF		88.0			105.0	93.0	99.0		809.686		
STOP	8.42		5.000								
CALCULATION	8.42	548.0	5.013	29.00			559.0	29.07	5.086	1.0028	1.657
START			0.000	29.00				2.00	810.300		
HALF		88.0			107.0	98.0	102.5		815.385		
STOP	5.98		5.000								
CALCULATION	5.98	548.0	5.013	29.00			562.5	29.15	5.085	1.0067	1.661
AVERAGE										1.0042	1.627

CONTROL BOX CALIBRATION

THREE POINT CALIBRATION

BOX # 6
DATE 06-20-94
BP 28.95 In. Hg
OPERATOR RPC

	WET TEST METER				DRY TEST METER					METER COEFFICIENT Y	ORIFICE COEFFICIENT ∆ H@
	TIME (min)	TEMP TW	VOLUME VM	PRESSURE PW	TEMP IN TI	TEMP OUT TO	TEMP AVG TA	ORIFICE PD	VOLUME VD		
START			0.000	28.95				0.50	350.100		
HALF		81.0			98.0	89.0	93.5				
STOP	12.75		5.000						355.151		
CALCULATION	12.75	541.0	5.013	28.95			553.5	28.99	5.051	1.0140	1.873
START			0.000	28.95				1.00	355.600		
HALF		81.0			105.0	90.0	97.5				
STOP	8.95		5.000						360.700		
CALCULATION	8.95	541.0	5.013	28.95			557.5	29.02	5.100	1.0103	1.833
START			0.000	28.95				2.00	361.200		
HALF		81.0			110.0	92.0	101.0				
STOP	6.30		5.000						366.234		
CALCULATION	6.30	541.0	5.013	28.95			561.0	29.10	5.034	1.0273	1.805
AVERAGE										1.0172	1.837

PRE-TEST MAGNEHELIC CALIBRATION

BOX# 6
DATE 06-09-94
OPERATOR RPC

0 to 3.0" H2O RANGE

MAGNEHELIC

Δ P	MANOMETER
0.50	0.50
1.00	1.00
2.00	2.00
3.00	3.00

0 to 0.50" H2O RANGE
SLANT TUBE
PRIMARY STANDARD

0 to 5" H2O RANGE

MAGNEHELIC

Δ H	MANOMETER
4.00	4.00
3.00	3.00
2.00	2.00
1.00	1.00
0.50	0.50

PRE-TEST LEAK CHECK

DATE 06-20-94
OPERATOR RPC

	START CF	STOP CF	VOLUME CF	TIME (min)	LEAK RATE
DRY	394.400	394.619	0.219	10.000	0.000
WET	0.000	0.222	0.222		

PYROMETER CALIBRATION

DATE 04-28-88
OPERATOR AGL

VOLTAGE INPUT (mV)	ARGE TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	400.0
10.57	500	500.0

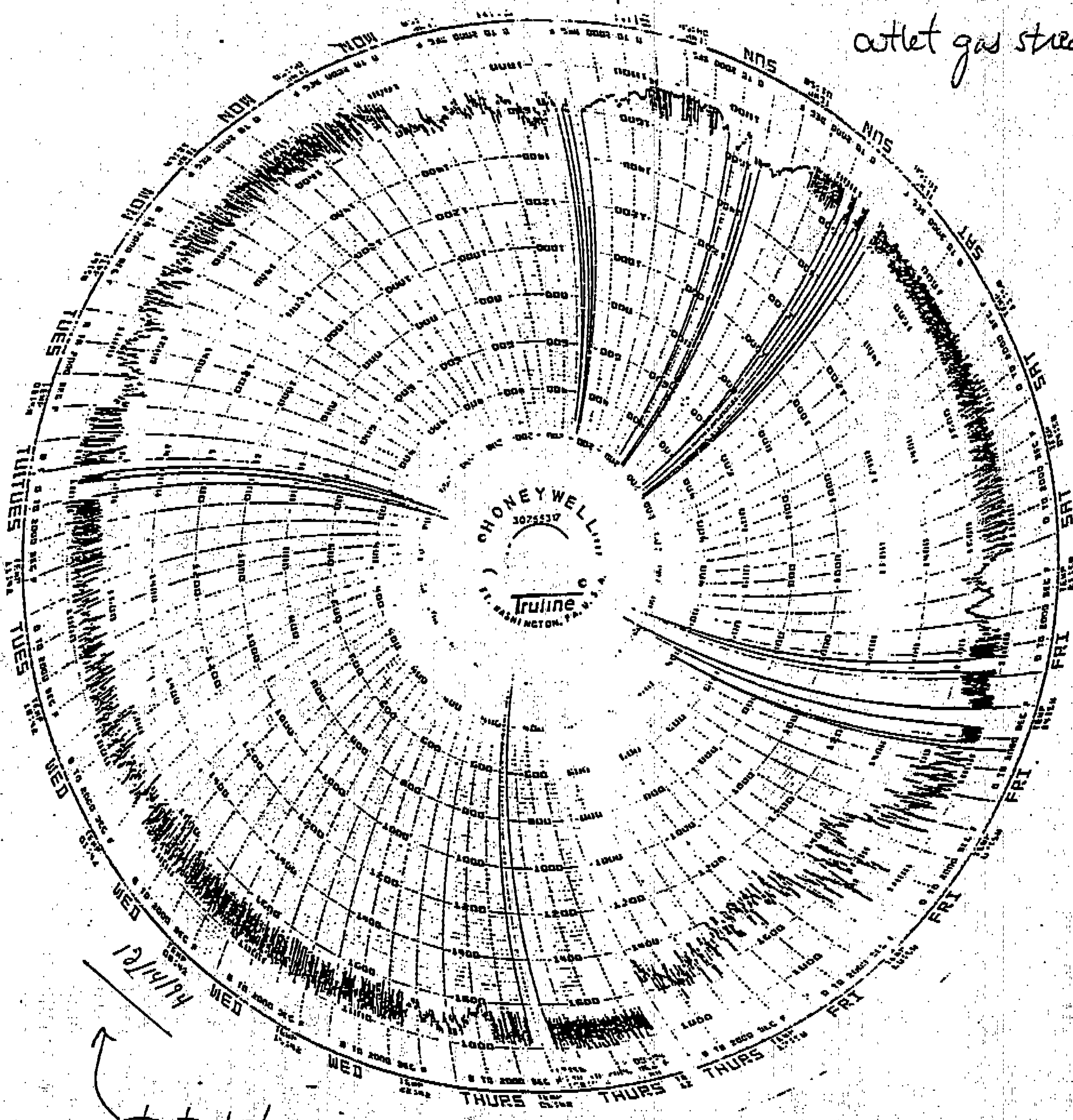
PRE-TEST PYROMETER CHECK

DATE 06-09-94
OPERATOR RPC

VOLTAGE INPUT (mV)	TARGET TEMP (°F)	TEMP READING (°F)
0.18	40	40.0
0.40	50	50.0
0.84	70	70.0
1.29	90	90.0
1.74	110	110.0
2.66	150	150.0
3.82	200	200.0
6.09	300	301.0
8.31	400	402.0
10.57	500	502.0

Y & S Maintenance, Inc.
Scottdale, Pennsylvania

Enclosed Landfill Gas
Ground Flare Temperature Chart –



outlet gas stream

12/14/94

test date

DETERMINATION OF ENCLOSED LANDFILL GAS FLARE PERFORMANCE

Y & S MAINTENANCE, INC.
SCOTTDALE, PENNSYLVANIA

APPENDIX B

ANALYTICAL RESULTS, EMISSIONS CALCULATIONS

ATS
ADVANCED TECHNOLOGY SYSTEMS, INC.

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9412210B

Work Order Summary

CLIENT:
Mr. Patrick Stockton
Advanced Technology Systems, Inc.
3000 Tech Center Drive
Monroeville, PA 15146-3055

BILL TO:
Accounts Payable
Advanced Tech. Sys., Inc.
339 Haymaker Rd., Suite 201
Monroeville, PA 15146

PHONE: 412-829-2208
FAX: 412-829-2415
DATE RECEIVED: 12/16/94
DATE COMPLETED: 12/30/94

INVOICE # 5665
P.O. # 1003
PROJECT # IKM 0782 Y & S
AMOUNT$: $800.00

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	Y & S-NMHC-IN-1*	TO-12	NA	NC
02A	Y & S-NMHC-IN-2	TO-12	1.5 "Hg	$100.00
03A	Y & S-NMHC-IN-3	TO-12	3.0 "Hg	$100.00
03B	Y & S-NMHC-IN-3 Duplicate	TO-12	3.0 "Hg	NC
04A	Y & S-NMHC-IN-4	TO-12	2.5 "Hg	$100.00
05A	Y & S-NMHC-IN-5	TO-12	6.0 "Hg	$100.00
06A	Y & S-NMHC-OUT-1*	TO-12	3.5 "Hg	NC
07A	Y & S-NMHC-OUT-2	TO-12	3.5 "Hg	$100.00
08A	Y & S-NMHC-OUT-3	TO-12	3.0 "Hg	$100.00
09A	Y & S-NMHC-OUT-4	TO-12	0 "Hg	$100.00
10A	Y & S-NMHC-OUT-5	TO-12	2.0 "Hg	$100.00
11A	Method Spike	TO-12	NA	NC
12A	Lab Blank	TO-12	NA	NC

LAB NARRATIVE:
*Sample on hold per client's request.

CERTIFIED BY: Linda L. Freeman
Laboratory Director

DATE: 12/30/94

1 ppmv heptane = .

7 ppmv carbon

AIR TOXICS LTD.

Total Non-Methane Hydrocarbons by EPA Method TO-12
GC/FID

Field Sample I.D.	Lab Sample I.D.	File Name	Sample Date	Analyzed For	Dilution Factor	Det. Limit (ppmv)	Amount (ppmv)
Y & S-NMHC-IN-1*	9412210B-01A	NA	12/14/94	TNMHC**	1.0	0.010	Not Analyzed
Y & S-NMHC-IN-2	9412210B-02A	6122106	12/14/94	TNMHC**	2.1	0.021	15
Y & S-NMHC-IN-3	9412210B-03A	6122115	12/14/94	TNMHC**	19	0.19	51
Y & S-NMHC-IN-3 Duplicate	9412210B-03B	6122116	12/14/94	TNMHC**	19	0.19	58
Y & S-NMHC-IN-4	9412210B-04A	6122109	12/14/94	TNMHC**	11	0.11	68
Y & S-NMHC-IN-5	9412210B-05A	6122110	12/14/94	TNMHC**	13	0.13	77
Y & S-NMHC-OUT-1*	9412210B-06A	NA	12/14/94	TNMHC**	1.0	0.010	Not Analyzed
Y & S-NMHC-OUT-2	9412210B-07A	6122113	12/14/94	TNMHC**	2.3	0.023	0.33
Y & S-NMHC-OUT-3	9412210B-08A	6122111	12/14/94	TNMHC**	2.2	0.022	0.82
Y & S-NMHC-OUT-4	9412210B-09A	6122112	12/14/94	TNMHC**	2.0	0.020	0.053
Y & S-NMHC-OUT-5	9412210B-10A	6122114	12/14/94	TNMHC**	2.2	0.022	0.18
Lab Blank	9412210B-12A	6122105	NA	TNMHC**	1.0	0.010	Not Detected
Spiked Sample							**% Recovery**
Method Spike	9412210B-11A	6122102	NA	TNMHC**	1.0	0.010	80

Analysis Date: 12/21/94
Container Type: 1 Liter SUMMA Canister

COMMENTS: NA = Not Applicable
*Sample on hold per client's request.
**Total Non-Methane Hydrocarbons referenced to Heptane (MW=100).

AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

№ 002677

CHAIN-OF-CUSTODY RECORD

Page 2 of 2

Contact Person John Shimshock
Company ADVANCED Technology Systems
Address 3000 TechCenter Drive City Monroeville State PA Zip 15146
Phone 412-824-2208 FAX 412-829-2415

Project Info:
P.O. # 1003
Project # IKM0782
Project Name Y+S

Turn Around Time:
☒ Normal
☐ Rush ____ Specify

Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum Initial	Final	Receipt
01A	Y+S-NMHC-IN-1	12/14/94 1125-1215	VOID - H2O IN CANISTER	28.5	3.5	
02A	Y+S-NMHC-IN-2	12/14/94 1252-1342	NONMETHANE Hydrocarbon VIA	28.5	2.5	1.5" Hg
03A	Y+S-NMHC-IN-3	12/14/94 1412-1502	EPA Method TO-12 plus CO,	29.0	4.0	3" Hg
04A	Y+S-NMHC-IN-4	12/14/94 1550-1640	CO2, CH4, O2 + N2 VIA ASTM	28.0	3.0	2.5" Hg
05A	Y+S-NMHC-IN-5	12/14/94 1653-1655	3416 ON All samples except the	28.0	7.0	6" Hg
06A	Y+S-NMHC-OUT-1	12/14/94 1125-1215	DO NOT ANALYZE - Hold as to spl.	29.0	5.0	3.5" Hg
07A	Y+S-NMHC-OUT-2	12/14/94 1252-1342	ONES NOTED.	29.5	5.0	3.5" Hg
08A	Y+S-NMHC-OUT-3	12/14/94 1412-1502	↓	29.5	5.0	3" Hg
09A	Y+S-NMHC-OUT-4	12/14/94 1550-1640	↓	30.0	1.5	0" Hg
10A	Y+S-NMHC-OUT-5	12/14/94 1653-1655	↓	28.0	3.5	2" Hg

KJ

Collected By: Print Rich Casselberry + John Shimshock Signature

Relinquished By: (Signature) Patrick J. Stockton Date/Time 12/15/94 1630 Received By: (Signature) Date/Time

Relinquished By: (Signature) Date/Time Received By: (Signature) Date/Time

Relinquished By: (Signature) Date/Time Received By: (Signature) ATL Date/Time 12/16/94 10:00

Notes:

Lab Use Only	Shipper Name	Air Bill #	Opened By:	Date/Time	Temp. (°C)	Condition	Custody Seals Intact?	Work Order #
	Fed-X	3159170663		12/16/94 1000	Ambient	Good	Yes No [✓ None]	9412210B

Form 1293 rev. 05

@ AIR TOXICS LTD.

AN ENVIRONMENTAL ANALYTICAL LABORATORY

WORK ORDER #: 9412210A

Work Order Summary

CLIENT:
Mr. Patrick Stockton
Advanced Technology Systems, Inc.
3000 Tech Center Drive
Monroeville, PA 15146-3055

BILL TO: Accounts Payable
Advanced Tech. Sys., Inc.
339 Haymaker Rd., Suite 201
Monroeville, PA 15146

PHONE: 412-829-2208
FAX: 412-829-2415
DATE RECEIVED: 12/16/94
DATE COMPLETED: 12/30/94

INVOICE # 5665
P.O. # 1003
PROJECT # IKM 0782 Y & S
AMOUNT$: $1,235.40

FRACTION #	NAME	TEST	RECEIPT VAC./PRES.	PRICE
01A	Y & S-NMHC-IN-1*	ASTM D-3416	NA	NC
02A	Y & S-NMHC-IN-2	ASTM D-3416	1.5 "Hg	$120.00
03A	Y & S-NMHC-IN-3	ASTM D-3416	3.0 "Hg	$120.00
04A	Y & S-NMHC-IN-4	ASTM D-3416	2.5 "Hg	$120.00
05A	Y & S-NMHC-IN-5	ASTM D-3416	6.0 "Hg	$120.00
06A	Y & S-NMHC-OUT-1*	ASTM D-3416	3.5 "Hg	NC
07A	Y & S-NMHC-OUT-2	ASTM D-3416	3.5 "Hg	$120.00
08A	Y & S-NMHC-OUT-3	ASTM D-3416	3.0 "Hg	$120.00
09A	Y & S-NMHC-OUT-4	ASTM D-3416	0 "Hg	$120.00
10A	Y & S-NMHC-OUT-5	ASTM D-3416	2.0 "Hg	$120.00
11A	Lab Blank	ASTM D-3416	NA	NC

Misc. Charges	1 Liter SUMMA Canister Preparation (10) @ $10.00 each.	$100.00
	Shipping (11/29/94)	$175.40

LAB NARRATIVE:
*Sample on hold per client's request.

CERTIFIED BY:
Laboratory Director

DATE: 12/30/94

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-IN-2
ID#: 9412210A-02A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**3122709**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**2.1**	**Date of Analysis:**	**12/27/94**

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.002	5.7
Nitrogen	0.002	58
Carbon Monoxide	0.002	Not Detected
Methane	0.002	17
Carbon Dioxide	0.002	19

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-IN-3
ID#: 9412210A-03A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name: 3122710
Dil. Factor: 2.2
Date of Collection: 12/14/94
Date of Analysis: 12/27/94

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.002	8.1
Nitrogen	0.002	55
Carbon Monoxide	0.002	Not Detected
Methane	0.002	18
Carbon Dioxide	0.002	18

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-IN-4
ID#: 9412210A-04A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**3122711**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**2.2**	**Date of Analysis:**	**12/27/94**

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.002	8.5
Nitrogen	0.002	57
Carbon Monoxide	0.002	Not Detected
Methane	0.002	17
Carbon Dioxide	0.002	17

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-IN-5
ID#: 9412210A-05A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name: 3122712
Dil. Factor: 2.5
Date of Collection: 12/14/94
Date of Analysis: 12/27/94

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.003	8.4
Nitrogen	0.003	56
Carbon Monoxide	0.003	Not Detected
Methane	0.003	17
Carbon Dioxide	0.003	18

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-OUT-1*
ID#: 9412210A-06A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**NA**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**1.0**	**Date of Analysis:**	**NA**

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.001	Not Analyzed
Nitrogen	0.001	Not Analyzed
Carbon Monoxide	0.001	Not Analyzed
Methane	0.001	Not Analyzed
Carbon Dioxide	0.001	Not Analyzed

***Sample on hold per client's request.**

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-OUT-2
ID#: 9412210A-07A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**3122713**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**2.3**	**Date of Analysis:**	**12/27/94**

Compound	**Det. Limit (%)**	**Amount (%)**
Oxygen	0.002	14
Nitrogen	0.002	79
Carbon Monoxide	0.002	Not Detected
Methane	0.002	0.010
Carbon Dioxide	0.002	7.0

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-OUT-3
ID#: 9412210A-08A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**3122714**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**2.2**	**Date of Analysis:**	**12/27/94**

Compound	**Det. Limit (%)**	**Amount (%)**
Oxygen	0.002	17
Nitrogen	0.002	78
Carbon Monoxide	0.002	0.002
Methane	0.002	0.020
Carbon Dioxide	0.002	5.4

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-OUT-4
ID#: 9412210A-09A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**3122715**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**2.0**	**Date of Analysis:**	**12/27/94**

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.002	14
Nitrogen	0.002	79
Carbon Monoxide	0.002	Not Detected
Methane	0.002	0.004
Carbon Dioxide	0.002	7.1

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Y & S-NMHC-OUT-5
ID#: 9412210A-10A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name:	**3122716**	**Date of Collection:**	**12/14/94**
Dil. Factor:	**2.2**	**Date of Analysis:**	**12/27/94**

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.002	15
Nitrogen	0.002	78
Carbon Monoxide	0.002	Not Detected
Methane	0.002	Not Detected
Carbon Dioxide	0.002	7.3

Container Type: 1 Liter SUMMA Canister

AIR TOXICS LTD.

SAMPLE NAME: Lab Blank
ID#: 9412210A-11A

Atmospheric Gases by Modified ASTM D-3416
GC/TCD/FID

File Name: 3122706
Dil. Factor: 1.0
Date of Collection: NA
Date of Analysis: 12/27/94

Compound	Det. Limit (%)	Amount (%)
Oxygen	0.001	Not Detected
Nitrogen	0.001	100
Carbon Monoxide	0.001	Not Detected
Methane	0.001	Not Detected
Carbon Dioxide	0.001	Not Detected

Container Type: NA

AIR TOXICS LTD.
AN ENVIRONMENTAL ANALYTICAL LABORATORY

180 BLUE RAVINE ROAD, SUITE B
FOLSOM, CA 95630-4719
(916) 985-1000 FAX: (916) 985-1020

CHAIN-OF-CUSTODY RECORD

№ 002677

Page 2 of 2

Contact Person John Slimshock
Company Advanced Technology Systems
Address 3000 Tech Center Drive City Monroeville State PA Zip 15146
Phone 412-829-2208 FAX 412-829-2415

Project info:
P.O. # 1003
Project # IKM 0782
Project Name Y+S

Turn Around Time:
☒ Normal
☐ Rush ______ Specify

KB

Lab I.D.	Field Sample I.D.	Date & Time	Analyses Requested	Canister Pressure / Vacuum Initial	Final	Receipt
01A	Y+S-NMHC-IN-1	12/14/94 1125-1215	VOID - H2O IN CANISTER	28.5	3.5	
02A	Y+S-NMHC-IN-2	12/14/94 1252-1342	Nonmethane Hydrocarbon via	28.5	2.5	1.5"Hg
03A	Y+S-NMHC-IN-3	12/14/94 1412-1502	EPA Method TO-12 plus CO,	29.0	4.0	3"Hg
04A	Y+S-NMHC-IN-4	12/14/94 1550-1640	CO_2, CH_4, O_2 + N_2 via ASTM	28.0	3.0	2.5"Hg
05A	Y+S-NMHC-IN-5	12/14/94 1653-1655	3416 on all samples except the	28.0	7.0	6"Hg
06A	Y+S-NMHC-OUT-1	12/14/94 1125-1215	Do not analyze -- Hold [illegible]	29.0	5.0	3.5"Hg
07A	Y+S-NMHC-OUT-2	12/14/94 1252-1342	ones noted.	29.5	5.0	3.5"Hg
08A	Y+S-NMHC-OUT-3	12/14/94 1412-1502	↓	29.5	5.0	3"Hg
09A	Y+S-NMHC-OUT-4	12/14/94 1550-1640	↓	30.0	1.5	0"Hg
10A	Y+S-NMHC-OUT-5	12/14/94 1653-1655	↓	28.0	3.5	2"Hg

Collected By: Print Rich Casselberry + John Slimshock Signature

Relinquished By: (Signature) Date/Time 1630 12/15/94 Received By: (Signature) Date/Time

Relinquished By: (Signature) Date/Time Received By: (Signature) Date/Time

Relinquished By: (Signature) Date/Time Received By: (Signature) Date/Time ATL 12/16/94 10:00

Notes:

Lab Use Only

Shipper Name	Air Bill #	Opened By:	Date/Time	Temp. (°C)	Condition	Custody Seals Intact?	Work Order #
Fed-X	715917066031		12/16/94 1000	Ambient	Good	Yes No [✓ None]	9412210A

Form 1293 rev. 05

4000 Tech Center Drive
Monroeville, PA 15146
412 825 2400
Fax: 412 825 2407

IH & Environmental Health Laboratory

UEC
USX Engineers & Consultants, Inc.

FEB 6 1995

February 2, 1995

Advanced Technology Systems, Inc.
ATTN: Mr. Patrick Stockton
3000 Tech Center Drive
Monroeville, PA 15146

Gentlemen:

Attached are the analytical result(s) of the analysis on sample(s) submitted to the UEC Laboratories on January 10, 1995. Should you have any questions regarding this report, please contact us. An invoice will be issued shortly.

These results are submitted persuant to USX Engineers & Consultants, Inc.'s current terms and conditions of sale, including the company's standard warranty and limitation of liability provisions, and no responsibility or liability is assumed for the manner in which the results are used or interpreted.

The results were derived with the following methods and limits of detection.

ANALYTE	METHOD	LOD
NITRIC OXIDE/NITROGEN DIOXIDE	EPA METHOD 7D-I	

We appreciate the opportunity to be of service and look forward to our continued assistance to you.

NOTE: Samples will be stored for only one month following the report date.

Sincerely,

Mark R Banister

Mark R. Banister, CIH, Quality Assurance Officer

Enclosures

USX Engineers & Consultants Inc.
IH & Environmental Laboratories
4000 Tech Center Drive
Monroeville, PA 15146
PHONE: (412)825-2400 FAX: (412)825-2407
AIHA Accreditation #322

REPORT OF TEST RESULTS

DATE - 01/31/95
PAGE - 1

Customer: CD-002D

Advanced Technology Systems, Inc.
3000 Tech Center Drive

Monroeville, PA 15146

ATTENTION: Mr. Patrick Stockton

Work Requested by : Advanced Technology Systems, Inc.
Phone No : 412-825-9760 C.O.C. #:
Unit # : IKM 0782
CUSTOMER W.O. # : 1019
SITE LOCATION : Y & S

TRACKING NUMBER: 50075

UEC ID	CLIENT ID	ANALYTE	PPM	LOD/PPM	METHOD	DATE SAMPLED	DATE RECEIVED	DATE ANALYZED
00754	Y & S - NOX-1	NITRIC OXIDE/NITROGEN DIOXIDE	0.248	0.001	EPA METHOD 7D-IC	12/14/94	01/10/95	01/13/95
00755	Y & S - NOX-2	NITRIC OXIDE/NITROGEN DIOXIDE	0.233	0.001	EPA METHOD 7D-IC	12/14/94	01/10/95	01/13/95
00756	Y & S - NOX-3	NITRIC OXIDE/NITROGEN DIOXIDE	0.231	0.001	EPA METHOD 7D-IC	12/14/94	01/10/95	01/13/95
00757	Y & S - NOX-BLANK	NITRIC OXIDE/NITROGEN DIOXIDE	<0.001	0.001	EPA METHOD 7D-IC	12/14/94	01/10/95	01/13/95
00758	AUDIT SPL #D7748	NITRIC OXIDE/NITROGEN DIOXIDE	0.555	0.001	EPA METHOD 7D-IC	01/09/95	01/10/95	01/13/95

OTES: METHOD CALIBRATION EITHER PERFORMED OR VERIFIED WITHIN 24 HOURS OF ANALYSIS, UNLESS OTHERWISE SPECIFIED.
* = Information not supplied by client. < = less than.
\# = Information not requested by client. N/A = Not Applicable.
COMMENTS: Please note PPM results are a direct reading off the IC.

NALYST : Date: 2-1-95
PPROVED: Mark R. Banister Date: 2/2/95
Mark R. Banister, CIH, Quality Assurance Officer

CHAIN OF CUSTODY RECORD

PLANT CODE KM0782

PROJECT NAME Y+S

SAMPLERS (Signature)

STA. NO.	DATE	TIME	COMP	GRAB	WELL	STATION LOCATION	NUMBER OF CONTAINERS	NO3 by Ion Chromatograph							CONDUCTIVITY	pH	REMARKS OR OBSERVATIONS
	12/14/94		✓			Y+S-Nox-1	1	✓									Total Vol. 250 ml
			✓			Y+S-Nox-2	1	✓									Total Vol. 250 ml
			✓			Y+S-Nox-3	1	✓									Total Vol. 250 ml
				✓		Y+S-NOX-Blank	1	✓									Total Vol. 250 ml
	1/9/95		✓			Audit Spl.#D7748	1	✓									Total Vol. 250 ml

Original volume 1000 ml / 250 ml

Aliquot taken + diluted To Final volume of 250 ml

Original volume 500 ml (I.E. 20 ml of Audit Spl. ~~[illegible]~~ diluted to 500 ml)

50 ml Aliquot taken from original 500 ml Spl. + diluted to 250 ml.

Final volume of

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
[illegible] J. Stockton	1/10/95	1000					
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Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Ice Chest Temp °C	Ice Chest #	Chain of Custody Tag #

DISTRIBUTION: Original accompanies shipment; Copy to Coordinator Field Files.

PAGE 1 OF 1

Y & S MAINTENANCE, INC.
SCOTDALE, PENNSYLVANIA

INLET GAS MOLECULAR WEIGHT CALCULATIONS

TEST #	CO2 Conc. (%)	O2 Conc. (%)	CH4 Conc. (%)	N2 Conc. (%)	Gas Temp. (°F)	Barometric Pressure (in. Hg)	Static Pressure (in. H2O)	Saturated Moisture Content (%)	Molecular Weight (g/mol)
1	NA	NA	NA	NA	62	29.30	4.2	1.9	NA
2	19	5.7	17	58.3	58	29.30	4.0	1.7	29.04
3	18	8.1	18	55.9	57	29.30	3.7	1.6	28.87
4	17	8.5	17	57.5	60	29.30	3.6	1.8	28.82
5	18	8.4	17	56.6	55	29.30	3.6	1.5	29.01

Saturated Moisture Content (%) =

100 * (6.11*29.92/1013) * {1 / [Barometric Pressure + (Static Pressure/13.6)] } *
Exp { (2.5E+6/462) * [(1/273) – (1/Gas Temp. (K))] }

Molecular Weight (g/mol) =

{ (1–(Moisture Content/100)) * 0.01 * [(CO2 Conc. * 44) + (O2 Conc. * 32) +
(CH4 Conc. * 16) + (N2 Conc. * 28)] } + (0.01 * Moisture Content * 18)

Y & S MAINTENANCE, INC.
SCOTDALE, PENNSYLVANIA

EXHAUST STACK VOLUMETRIC FLOW RATE CALCULATIONS

Test #	Inlet Volumetric Flow Rate (acfm)	Inlet Moisture Content (%)	Inlet CO2 Conc. (ppmv)	Inlet CO Conc. (ppmv)	Inlet CH4 Conc. (ppmv)	Inlet NMHC Conc. (ppmv C)	Outlet CO2 Conc. (ppmv)	Outlet CO Conc. (ppmv)	Outlet CH4 Conc. (ppmv)	Outlet NMHC Conc. (ppmv C)
1	NA	1.9	NA	NA	NA	NA	NA	NA	NA	NA
2	1270	1.7	190000	< 20	170000	105	70000	< 20	100	2.31
3	1300	1.6	180000	< 20	180000	357	54000	20	200	5.74
4	1450	1.8	170000	< 20	170000	476	71000	< 20	40	0.37
5	1700	1.5	180000	< 30	170000	539	73000	< 20	< 20	1.26

Test #	Outlet Volumetric Flow Rate (dry cfm)	Outlet Stack Pressure (in. Hg)	Outlet Stack Temp. (F)	Outlet Volumetric Flow Rate (dscfm)
1	NA	29.30	1700	NA
2	6400	29.30	1700	1530
3	8500	29.30	1700	2030
4	6800	29.30	1700	1630
5	8000	29.30	1700	1920

$$\text{dscfm} = \frac{\text{dry cfm} * \text{stack pressure} * 528}{29.92 + (\text{Stack Temp.} + 460)}$$

Outlet Volumetric Flow Rate (dry cfm) =

Inlet Volumetric Flow Rate (acfm) * (1-(% Inlet Moisture Content/100)) * R

$$R = \frac{(CO_2 + CO + CH_4 + NMHC)\ \text{inlet concentrations (ppmv C)}}{(CO_2 + CO + CH_4 + NMHC)\ \text{outlet concentrations (ppmv C)}}$$

In calculating R, concentrations less than analytical detection limits
are assumed to be equal to zero.

Dept of Environmental Resources
Bureau of Air Quality Control
12th Floor MSSOB
P. O. Box 8468
Harrisburg, PA 17105-8468
November 3, 1994

Mr. Michael P. Kearns
Environmental Engineer
Y and S Maintenance, Inc.
P. O. Box 223
R. D. #1, Landfill Road
Scottdale, PA 15683

Dear Mr. Kearns:

Enclosed is an NOX audit sample for the testing to be conducted at the Y and S Sanitary Landfill. I have enclosed instructions for analyzing the audit in accordance with Department procedures. Please ensure the audit sample is analyzed concurrently with the compliance samples.

The results of the audit sample analyses are to be reported to me by telephone at (717) 783-9269 as soon as they are available and should also be included in the final report submitted to the Department.

If you have any questions concerning this matter, please do not hesitate to contact me.

Sincerely,

Andrew C. Zemba
Quality Assurance Engineer
Division of Source Testing and Monitoring

Instructions for Use of EPA Stationary Source NO_x QA Samples for EPA Method 7D

1. Prepare the reagents needed for the analysis.

2. Prepare each reference sample for analysis as follows: Wrap a paper towel around the ampoule and with the ampoule in an upright position, break off the top at the prescored mark by exerting pressure sideways. From the ampoule, pipette exactly 20.0 ml of the sample and place it into a 500 ml volumetric flask containing 300 ml of 4% $KMNO_4$/2.0% NaOH solution.

3. Dilute to volume (500 ml) with distilled deionized water and mix thoroughly.

4. Take a 50 ml aliquot of the solution from step 3 and place it in a 250 ml Erlenmeyer flask. Add a magnetic stirring bar and analyze the sample as described in paragraph 2 of Section 4.3 of Method 7D (40 CFR 60, Appendix A).

5. If you have followed the procedure in Method 7D, you can calculate the total ug of NO_2 (m) in the 20 ml aliquot of the QA sample as follows:

$$m = (S-B) \times \frac{500}{50} \times 250 \times \frac{46.01}{62.01}$$

where: S = Analysis of sample, ug NO_3^-/mL
B = Analysis of blank, ug NO_3^-/mL
500 = Total volume of $KMNO_4$/NaOH solution after diluting the 20 ml sample to 500 ml
250 = Volume of prepared sample, mL
50 = Aliquot of $KMNO_4$/NaOH solution taken for analysis, mL
46.01 = Molecular weight of NO_2^-
62.01 = Molecular weight of NO_3^-

6. Calculate the equivalent NO_2 concentration (C) in mg/dscm as follows:

$$C = K_2 \frac{m}{V_m}$$

where: $K_2 = 10^{-3}$ mg/ug
$V_m = 0.008\ m^3$

7. If you have questions, please call Ms. Ellen Streib, EPA, RTP, NC at 919/541-7834 (COML) or 629-7834 (FTS).

Y & S MAINTENANCE, INC.
SCOTDALE, PENNSYLVANIA

NOx EXHAUST STACK CALCULATIONS

SAMPLE #	TEST #	NITRATE CONC. (ug/mL)	SAMPLE VOLUME (mL)	DILUTION FACTOR	MASS OF NO2 (ug)	EQUIVALENT NO2 CONC. (mg/dscm)
Y&S-NOX-1	1	0.248	250	20	920	
Y&S-NOX-2	2	0.228	250	20	846	
Y&S-NOX-3	3	0.231	250	20	857	
Y&S-NOX-BLANK	Blank	< 0.001	250	20		
D7748	Audit	0.556	250	10	1031	128.9

MASS OF NO2 (ug) =

(SAMPLE CONC. - BLANK CONC.) x SAMPLE VOLUME x DILUTION FACTOR x (46.01/62.01)

EQUIVALENT NO2 CONC. (mg/dscm) = MASS OF NO2 (ug) x 0.001 / 0.008 cu. m

STACK SAMPLING CALCULATIONS

CLIENT: Y & S MAINTENANCE, INC.
TEST SITE: ENCLOSED GROUND FLARE EXHAUST STACK

TEST DATE: 12-14-94
TEST NUMBER: Y&S-NOX-1

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.30
B.	Stack Static Pressure (in. H2O)	
C.	Pitot Tube Coefficient	
D.	Dry Gas Meter Calibration Factor	0.9876
»»»	Is the Stack Round (Y/N)?	Y
E.	Stack Diameter (in.) - for round stack	132
F.	Stack Width (in.) - for rectangular stack	0
G.	Stack Depth (in.) - for rectangular stack	0
H.	Nozzle Diameter (in.) - (enter 0 if none used)	0.000
I.	Average ∆ P (in. H2O) = [(∆ P^0.5)avg]^2	
J.	Average ∆ H (in. H2O) - (enter 0 for low flow sampling)	0.00
K.	Average Stack Temperature (°F)	1161
L.	Average Meter Temperature (°F)	60
M.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	7.0
	Oxygen (%)	14.0
	Nitrogen (%)	79.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
N.	Sample Time (min)	60
O.	Total H2O Mass Collected in Impingers (g)	3.1
»»»	Is Isokinetic or Method 4 Sampling Required (Y/N)?	N
P.	Metered Gas Volume (dcf) - for iso. or M4 sampling	0.000
Q.	Metered Gas Volume (dry L) - for low flow sampling	26.41

Calculated Parameters (excluding analytical data)

R.	Absolute Stack Pressure (in. Hg)	29.30	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.30	[A+(J/13.6)]
T.	Stack Area (ft.)	9.50E+01	[π*E^2/(4*144) or F*G/144]
U.	Nozzle Area (ft.) - (for isokinetic sampling only)	NA	[π*H^2/(4*144)]
V.	Average Absolute Stack Temperature (R)	1621	[K+460]
W.	Average Absolute Meter Temperature (R)	520	[L+460]
X.	Dry Gas Volume Sampled (dscf) - (for iso./M4 sampling)	NA	[P*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf) - (for iso./M4 sampling)	NA	[O*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	NA	[100*Y/(X+Y)]
AA.	Dry Gas Volume Sampled (dsL) - (for low flow sampling)	25.93	[Q*D*(528/W)*(S/29.92)]
BB.	H2O Vapor Condensed (std. L) - (for low flow sampling)	4.14	[O*1.335]
CC.	Calculated Percent H2O in Gas Stream (%)	13.8	[100*BB/(AA+BB)]
DD.	Theoretical Maximum Percent H2O in Gas Stream (%) where t = 273 + [(5/9)*(K-32)]	NA	[(100*6.11*29.92)/(1013*R)* exp{(2500000/462)*[(1/273)-(1/t)]}]
EE.	Actual Percent H2O in Gas Stream (%)	13.8	[Calculated %H2O ≤ Theoretical Max. %H2O]
FF.	Stack Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	Wt./Mol
H2O	0.138		18	2.477
CO2	0.070	0.862	44	2.656
O2	0.140	0.862	32	3.863
N2	0.790	0.862	28	19.076
CO	0.000	0.862	28	0.000
H2	0.000	0.862	2	0.000
CH4	0.000	0.862	16	0.000
C2H6	0.000	0.862	30	0.000
Ar	0.000	0.862	40	0.000

Stack Gas Molecular Weight (lb/lb-mol) 28.07

STACK SAMPLING CALCULATIONS

CLIENT: Y & S MAINTENANCE, INC.
TEST SITE: ENCLOSED GROUND FLARE EXHAUST STACK

TEST DATE: 12-14-94
TEST NUMBER: Y&S-NOX-1

GG.	Average Stack Gas Velocity (ft/sec)	0.00E+00	[85.49*C*[(I*V)/(R*FF)]^0.5]
HH.	Stack Gas Flow Rate (acfm)	0.00E+00	[GG*T*60]
II.	Stack Gas Flow Rate (scfm)	0.00E+00	[HH*(528/V)*(R/29.92)]
JJ.	Stack Gas Flow Rate (dscfm) - From carbon balance	1.53E+03	[II*(1-(EE/100))
KK.	Isokinetics (%) - (for isokinetic sampling only)	NA	[100*V*{(0.002669*O)+(P*D*S/W)}] / [60*N*R*U*GG]

NOx (as NO2) analytical results (corrected for blank)

LL.	Total Catch (mg)	0.920	
MM.	Concentration (mg/dscm)	3.55E+01	[1000*LL/AA]
NN.	Mass Flow Rate (lb/hr)	2.03E-01	[MM*JJ*0.02832*60/454000]

STACK SAMPLING CALCULATIONS

CLIENT: Y & S MAINTENANCE, INC.
TEST SITE: ENCLOSED GROUND FLARE EXHAUST STACK
TEST DATE: 12-14-94
TEST NUMBER: Y&S-NOX-2

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.30
B.	Stack Static Pressure (in. H2O)	
C.	Pitot Tube Coefficient	
D.	Dry Gas Meter Calibration Factor	0.9876
»»	Is the Stack Round (Y/N)?	Y
E.	Stack Diameter (in.) - for round stack	132
F.	Stack Width (in.) - for rectangular stack	0
G.	Stack Depth (in.) - for rectangular stack	0
H.	Nozzle Diameter (in.) - (enter 0 if none used)	0.000
I.	Average ΔP (in. H2O) = [(ΔP^0.5)avg]^2	
J.	Average ΔH (in. H2O) - (enter 0 for low flow sampling)	0.00
K.	Average Stack Temperature (°F)	1228
L.	Average Meter Temperature (°F)	60
M.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	7.0
	Oxygen (%)	14.0
	Nitrogen (%)	79.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
N.	Sample Time (min)	60
O.	Total H2O Mass Collected in Impingers (g)	2.8
»»	Is Isokinetic or Method 4 Sampling Required (Y/N)?	N
P.	Metered Gas Volume (dcf) - for iso. or M4 sampling	0.000
Q.	Metered Gas Volume (dry L) - for low flow sampling	27.31

Calculated Parameters (excluding analytical data)

R.	Absolute Stack Pressure (in. Hg)	29.30	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.30	[A+(J/13.6)]
T.	Stack Area (ft.)	9.50E+01	[π*E²/(4*144) or F*G/144]
U.	Nozzle Area (ft.) - (for isokinetic sampling only)	NA	[π*H²/(4*144)]
V.	Average Absolute Stack Temperature (R)	1688	[K+460]
W.	Average Absolute Meter Temperature (R)	520	[L+460]
X.	Dry Gas Volume Sampled (dscf) - (for iso./M4 sampling)	NA	[P*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf) - (for iso./M4 sampling)	NA	[O*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	NA	[100*Y/(X+Y)]
AA.	Dry Gas Volume Sampled (dsL) - (for low flow sampling)	26.82	[Q*D*(528/W)*(S/29.92)]
BB.	H2O Vapor Condensed (std. L) - (for low flow sampling)	3.74	[O*1.335]
CC.	Calculated Percent H2O in Gas Stream (%)	12.2	[100*BB/(AA+BB)]
DD.	Theoretical Maximum Percent H2O in Gas Stream (%) where t = 273 + [(5/9)*(K-32)]	NA	[(100*6.11*29.92)/(1013*R)* exp{(2500000/462)*[(1/273)-(1/t)]}]
EE.	Actual Percent H2O in Gas Stream (%)	12.2	[Calculated %H2O ≤ Theoretical Max. %H2O]
FF.	Stack Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	Wt./Mol
H2O	0.122		18	2.202
CO2	0.070	0.878	44	2.703
O2	0.140	0.878	32	3.932
N2	0.790	0.878	28	19.414
CO	0.000	0.878	28	0.000
H2	0.000	0.878	2	0.000
CH4	0.000	0.878	16	0.000
C2H6	0.000	0.878	30	0.000
Ar	0.000	0.878	40	0.000

Stack Gas Molecular Weight (lb/lb-mol) 28.25

STACK SAMPLING CALCULATIONS

CLIENT: Y & S MAINTENANCE, INC.
TEST SITE: ENCLOSED GROUND FLARE EXHAUST STACK

TEST DATE: 12-14-94
TEST NUMBER: Y&S-NOX-2

GG.	Average Stack Gas Velocity (ft/sec)	0.00E+00	[85.49*C*[(I*V)/(R*FF)]^0.5]
HH.	Stack Gas Flow Rate (acfm)	0.00E+00	[GG*T*60]
II.	Stack Gas Flow Rate (scfm)	0.00E+00	[HH*(528/V)*(R/29.92)]
JJ.	Stack Gas Flow Rate (dscfm) - From carbon balance	1.53E+03	[II*(1-(EE/100))
KK.	Isokinetics (%) - (for isokinetic sampling only)	NA	[100*V*{(0.002669*O)+(P*D*S/W)}] / [60*N*R*U*GG]

NOx (as NO2) analytical results (corrected for blank)

LL.	Total Catch (mg)	0.846	
MM.	Concentration (mg/dscm)	3.15E+01	[1000*LL/AA]
NN.	Mass Flow Rate (lb/hr)	1.81E-01	[MM*JJ*0.02832*60/454000]

STACK SAMPLING CALCULATIONS

CLIENT:	Y & S MAINTENANCE, INC.	TEST DATE:	12-14-94
TEST SITE:	ENCLOSED GROUND FLARE EXHAUST STACK	TEST NUMBER:	Y&S-NOX-3

Input Parameters (excluding analytical data)

A.	Barometric Pressure (in. Hg)	29.30
B.	Stack Static Pressure (in. H2O)	
C.	Pitot Tube Coefficient	
D.	Dry Gas Meter Calibration Factor	0.9876
»»	Is the Stack Round (Y/N)?	Y
E.	Stack Diameter (in.) - for round stack	132
F.	Stack Width (in.) - for rectangular stack	0
G.	Stack Depth (in.) - for rectangular stack	0
H.	Nozzle Diameter (in.) - (enter 0 if none used)	0.000
I.	Average ∆ P (in. H2O) = [(∆ P^0.5)avg]^2	
J.	Average ∆ H (in. H2O) - (enter 0 for low flow sampling)	0.00
K.	Average Stack Temperature (°F)	1067
L.	Average Meter Temperature (°F)	60
M.	Dry Gas Composition (should total to 100%)	
	Carbon Dioxide (%)	5.0
	Oxygen (%)	17.0
	Nitrogen (%)	78.0
	Carbon Monoxide (%)	0.0
	Hydrogen (%)	0.0
	Methane (%)	0.0
	Ethane (%)	0.0
	Argon (%)	0.0
N.	Sample Time (min)	60
O.	Total H2O Mass Collected in Impingers (g)	2.4
»»	Is Isokinetic or Method 4 Sampling Required (Y/N)?	N
P.	Metered Gas Volume (dcf) - for iso. or M4 sampling	0.000
Q.	Metered Gas Volume (dry L) - for low flow sampling	29.98

Calculated Parameters (excluding analytical data)

R.	Absolute Stack Pressure (in. Hg)	29.30	[A+(B/13.6)]
S.	Absolute Meter Pressure (in. Hg)	29.30	[A+(J/13.6)]
T.	Stack Area (ft.)	9.50E+01	[π*E^2/(4*144) or F*G/144]
U.	Nozzle Area (ft.) - (for isokinetic sampling only)	NA	[π*H^2/(4*144)]
V.	Average Absolute Stack Temperature (R)	1527	[K+460]
W.	Average Absolute Meter Temperature (R)	520	[L+460]
X.	Dry Gas Volume Sampled (dscf) - (for iso./M4 sampling)	NA	[P*D*(528/W)*(S/29.92)]
Y.	H2O Vapor Condensed (scf) - (for iso./M4 sampling)	NA	[O*0.04715]
Z.	Calculated Percent H2O in Gas Stream (%)	NA	[100*Y/(X+Y)]
AA.	Dry Gas Volume Sampled (dsL) - (for low flow sampling)	29.44	[Q*D*(528/W)*(S/29.92)]
BB.	H2O Vapor Condensed (std. L) - (for low flow sampling)	3.20	[O*1.335]
CC.	Calculated Percent H2O in Gas Stream (%)	9.8	[100*BB/(AA+BB)]
DD.	Theoretical Maximum Percent H2O in Gas Stream (%) where t = 273 + [(5/9)*(K-32)]	NA	[(100*6.11*29.92)/(1013*R)* exp{(2500000/462)*[(1/273)-(1/t)]}]
EE.	Actual Percent H2O in Gas Stream (%)	9.8	[Calculated %H2O ≤ Theoretical Max. %H2O]
FF.	Stack Gas Molecular Weight:		

Gas	% Volume / 100	* (1 - %H2O/100)	* Mol. Weight	Wt./Mol
H2O	0.098		18	1.767
CO2	0.050	0.902	44	1.984
O2	0.170	0.902	32	4.906
N2	0.780	0.902	28	19.696
CO	0.000	0.902	28	0.000
H2	0.000	0.902	2	0.000
CH4	0.000	0.902	16	0.000
C2H6	0.000	0.902	30	0.000
Ar	0.000	0.902	40	0.000

Stack Gas Molecular Weight (lb/lb-mol) 28.35

STACK SAMPLING CALCULATIONS

CLIENT: Y & S MAINTENANCE, INC.
TEST SITE: ENCLOSED GROUND FLARE EXHAUST STACK
TEST DATE: 12-14-94
TEST NUMBER: Y&S-NOX-3

GG.	Average Stack Gas Velocity (ft/sec)	0.00E+00	[85.49*C*[(I*V)/(R*FF)]^0.5]
HH.	Stack Gas Flow Rate (acfm)	0.00E+00	[GG*T*60]
II.	Stack Gas Flow Rate (scfm)	0.00E+00	[HH*(528/V)*(R/29.92)]
JJ.	Stack Gas Flow Rate (dscfm) - From carbon balance	2.03E+03	[II*(1-(EE/100))
KK.	Isokinetics (%) - (for isokinetic sampling only)	NA	[100*V*{(0.002669*O)+(P*D*S/W)}] / [60*N*R*U*GG]

NOx (as NO2) analytical results (corrected for blank)

LL.	Total Catch (mg)	0.857	
MM.	Concentration (mg/dscm)	2.91E+01	[1000*LL/AA]
NN.	Mass Flow Rate (lb/hr)	2.21E-01	[MM*JJ*0.02832*60/454000]