Commonwealth of Pennsylvania
Environmental Resources
December 1, 1992

Subject: Stack Test Review

To: Data File
Waste Management of Pa., Inc.
Summit Township, Erie County

From: Richard St. Louis, Chief
Source Testing Section
Division of Source Testing and Monitoring
Bureau of Air Quality Control

Through: Acting Chief
Division of Source Testing and Monitoring

Waste Management of Pennsylvania, Inc., operates the Lake View Landfill (Erie County) gas extraction system and enclosed flare, consisting of gas extraction wells, gas collection header pipe, enclosed ground flare and condensate management structures. The enclosed ground flare (McGill Environment) is designed to operate at a minimum of 1500°F and to achieve a 98% (by weight) destruction efficiency for Non-Methane Volatile Organic Compounds (NMVOCs).

ET Air Quality Services simultaneously collected summa canister samples at the inlet and outlet of the flare, and analyzed the inlet samples for NMVOCs, methane (CH_4), nitrogen (N_2), carbon dioxide (CO_2), carbon monoxide (CO) and oxygen (O_2), and analyzed the outlet samples for NMVOCs, CH_4, N_2, CO_2, CO, O_2 and specific organic compounds (benzene, chloroform, 1, 2-dichloroethane, methyl chloride, methylene chloride, perchloroethylene, trichloroethylene, carbon tetrachloride, vinylidene chloride, and vinyl chloride) as part of a Method 25C test on July 29, 1992. Method 7A testing was also conducted at the outlet for NO_x emission rates. Flare inlet flow rates averaged 1,050 dry standard cubic feet per minute (DSCFM) and temperatures averaged 90°F. Flare outlet flow rates averaged 7,500 DSCFM (compared with 10,600 DSCFM determined by carbon balance) and 1,787°F. A total of three test runs were conducted for both Method 25C and Method 7A.

The test appears to be acceptable to the Department with the following comments:

1. Methylene chloride was the only NMVOC detected at the outlet for all three Method 25C runs. Trichloroethane was detected on Runs 1 and 2, but not on Run 3. All other NMVOC compounds were below the detectable limit.

2. Pressure drops measured by the pitot tube at the outlet were less than the accuracy of the manometer, resulting in unreliable volumetric flow determinations. An alternative method, based on carbon balance, was performed to obtain data in addition to the Method 2 data. Data in Tables 2, 3 and 4 use the calculated carbon balance data for emission rates.

cc: 25-322-003
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Reading File - Stack Testing

AZaCms

TABLE I

SUMMARY OF GAS CONDITIONS (July 29, 1982)

RUN NO.	SAMPLING LOCATION	GAS FLOW RATE DSCFM	TEMPERATURE °F	MOISTURE (%)	COMPOSITION (% BY VOLUME, DRY BASIS)				
					CO_2	O_2	CH_4	N_2	CO
VI-1	Inlet	1040	80	2.3	39.1	1.3	53.8	5.8	<0.3
VO-1	Outlet	7640	1755	16.8	10.4	5.8	<0.1	83.8	<0.1
		(10,800)*							
VI-2	Inlet	1050	80	2.4	40.1	0.8	54.9	4.2	<0.3
VO-2	Outlet	7420	1820	15.5	10.4	6.4	<0.1	83.2	<0.1
		(10,900)*							
VI-3	Inlet	1070	80	2.5	39.8	0.8	55.4	4.0	<0.3
VI-3	Outlet	7360	1819	12.7	10.5	6.4	<0.1	83.1	<0.1
		(10,200)*							
AVERAGE	Inlet	1050	80	2.4	39.7	1.0	54.7	4.7	<0.3
	Outlet	7500	1787	15.0	10.4	6.2	<0.1	83.4	<0.1
		(10,600)*							

* Values in parentheses calculated by carbon balance method

TABLE II

SUMMARY OF NMNMOC EMISSIONS AND REMOVAL EFFICIENCY

RUN NO.	LOCATION	TIME	CONCENTRATION (ppm)[a]	EMISSION RATE lb/h[b]	DESTRUCTION EFFICIENCY
1	Inlet Outlet	1133 - 1233	440 3.3 (0.4)	7.1 .06	96[c] 99.2%
2	Inlet Outlet	1332 - 1432	460 4.4 (1.5)	7.5 0.25	96.7%
3	Inlet Outlet	1518 - 1618	470 2.0 (0.0)	7.8 0.00	100.0%
Average	Inlet Outlet		460 4.9 (0.6)	7.5 0.10	98.6%

Note: [a]ppm = Parts per million by volume as heptane. Values in parentheses are blank-corrected.
[b]lb/h = Pounds per hour as heptane. Values are based on calculated flow rates and blank-corrected concentrations.
[c] Efficiency = Based on calculated flow rates and no blank corrections.

TABLE III

SUMMARY OF NMVOC EMISSIONS

POLLUTANT	LOCATION	RUN NO. 1 Concentration ppb	RUN NO. 1 Emission Rate lb/h	RUN NO. 2 Concentration ppb	RUN NO. 2 Emission Rate lb/h	RUN NO. 3 Concentration ppb	RUN NO. 3 Emission Rate lb/h	AVERAGE Concentration ppb	AVERAGE Emission Rate lb/h
Methylene Chloride	Outlet	210	0.101	450	0.065	330	0.045	497	0.070
1, 1, 1 Trichloroethane	Outlet	5.5	0.0012	3.0	0.0009	<5.2	0.0011	<4.6	0.0011

Note: ppb = Parts per billion
Less than sign indicates detection value limit used.

TABLE IV

SUMMARY OF NO_x EMISSIONS DATA (July 29, 1992)

RUN NO.	TIME (24-h)	CONCENTRATION ppm	EMISSION RATE, lb/h
LVL-0-1A	1645	21	1.5
LVL-0-1B	1700	23	1.7
LVL-0-1C	1715	27	2.0
LVL-0-1D	1730	21	1.5
Average		23	1.7
LVL-0-2A	1945	29	2.2
LVL-0-2B	1800	23	1.7
LVL-0-2C	1815	20	1.8
LVL-0-2D	1830	20	1.8
Average		25	1.9
LVL-0-3A	1845	26	1.9
LVL-0-3B	1900	17	1.3
LVL-0-3C	1915	17	1.2
LVL-0-3D	1930	21	1.6
Average		20	1.5
Overall Average		23	1.7

INTERNATIONAL
TECHNOLOGY
CORPORATION

EMISSION TEST REPORT

PERFORMANCE EVALUATION
NORTH AMERICAN WASTE OF PENNSYLVANIA
ENCLOSED GAS FLARE
AT LAKE VIEW LANDFILL
ERIE, PENNSYLVANIA

July 1992

Prepared by: Brian L. Garls

JTN: 332190

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332190Emission Test Report0-02nc

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Contents

List of Tables

List of Figures

1.0 Introduction

On July 29, 1992, IT Air Quality Services (ITAQS) personnel conducted an atmospheric emission test program on the McGill enclosed flare system at Lake View Landfill in Erie, Pennsylvania. The purpose of the test program was to satisfy the requirements of the Commonwealth of Pennsylvania. Summa canister samples were collected simultaneously at the inlet and outlet of the flare. Inlet samples were analyzed for nonmethane volatile organic compounds (NMVOC), methane (CH_4), nitrogen (N_2), carbon dioxide (CO_2), carbon monoxide (CO), and oxygen (O_2). Outlet samples were analyzed for NMVOC, CH_4, N_2, CO_2, CO, O_2, and specific organic compounds (benzene, chloroform, 1,2-dichloroethane, methyl chloride, methylene chloride, perchloroethylene, trichloroethylene, carbon tetrachloride, vinylidene chloride, and vinyl chloride). Testing was also conducted to determine the presence of nitrogen oxide (NO_x) at the flare outlet.

Mr. Denny Laden of Lake View Landfill coordinated on-site activities.

2.0 Summary of Results

Table 2-1 summarizes the inlet and outlet gas conditions observed during the test program. U.S. Environmental Protection Agency (EPA) Method 2* was used to collect flow rate data at both the inlet and outlet; EPA Method 2C* (standard pitot) could not be used at the inlet because the sampling port was too long. The velocity at the outlet stack, however, was very low. The pressure drop (ΔP) measured across the S-type pitot tube was at or near the level of detection (0.005 in. H_2O) on a 0- to 0.25-in. manometer, thereby increasing potential error in the methodology. Appropriate data were obtained during the sampling program to allow the use of an alternative method for low-flow determination. Procedures similar to those described in Method 2B* were used to determine the flare stack flow rate. Method 2B uses a carbon balance method to calculate the flow rate downstream of a combustion source. Appendix A presents the calculations for this determination.

Flare inlet flow rates averaged 1050 dry standard cubic feet per minute (dscfm) [1170 actual cubic feet per minute (acfm)]. Temperatures averaged 80°F; moisture content averaged 2.4 percent; and CO_2, O_2, and CH_4 contents averaged 39.7, 1.0, and 54.7 percent, respectively.

Flare outlet flow rates measured by Method 2 averaged 7500 dscfm (37,600 acfm) compared with 10,600 dscfm determined by carbon balance. Temperatures averaged 1787°F, moisture content averaged 15.0 percent, and CO_2 and O_2 contents averaged 10.4 and 6.2 percent, respectively. The outlet stack emission rates were calculated on the basis of the carbon balance flow-rate value; these results may be biased high. For consistency, the carbon balance flow rates were calculated using the inlet and outlet canister analysis data. Some differences existed between the normalized canister data and the Orsat data from the outlet O_2 and CO_2. Use of the Orsat data would result in flow rates between the measured and calculated flow rates.

NMVOC emissions and destruction efficiencies (DE) are summarized in Table 2-2. Concentrations are presented in parts per million (ppm) by volume and milligrams per dry normal cubic meter (mg/dNm^3) as heptane, and emission rates are presented in pounds per hour (lb/h). Inlet concentrations averaged 460 ppm, which corresponds to an emission rate of 7.5 lb/h. Outlet concentrations averaged 4.9 ppm, with a corresponding average emission rate of

* 40 CFR 60, Appendix A.

Table 2-1
Summary of Gas Conditions (July 29, 1992)

Run No.	Sampling Location	Gas Flow Rate acfm[a]	Gas Flow Rate dscfm[b]	Temperature (°F)	Moisture (%)	CO_2[c]	O_2[c]	CH_4	N_2[c]	CO
						Composition (% by volume, dry basis)				
VI-1	Inlet	1,150	1,040	80	2.3	39.1	1.3	53.8	5.8	<0.3
VO-1	Outlet	38,400	7,640 (10,800)[d]	1755	16.8	10.4	5.8	<0.1	83.8	<0.1
VI-2	Inlet	1,170	1,050	80	2.4	40.1	0.8	54.9	4.2	<0.3
VO-2	Outlet	37,800	7,420 (10,900)	1620	15.5	10.4	6.4	<0.1	83.2	<0.1
VI-3	Inlet	1,180	1,070	80	2.5	39.8	0.8	55.4	4.0	<0.3
VO-3	Outlet	36,600	7,360 (10,200)	1819	12.7	10.5	6.4	<0.1	83.1	<0.1
Average	Inlet	1,170	1,050	80	2.4	39.7	1.0	54.7	4.7	<0.3
	Outlet	37,600	7,500 (10,600)	1787	15.0	10.4	6.2	<0.1	83.4	<0.1

a acfm = Actual cubic feet per minute.

b dscfm = Dry standard cubic feet per minute at 68°F and 29.92 in.Hg.

c Outlet CO_2 and O_2 measured by Orsat, N_2 determined by difference. Inlet composition determined from canister samples.

d Values in parentheses are flow rates calculated by carbon balance.

Table 2-2
Summary of NMVOC Emissions and Removal Efficiency (July 29, 1992)

Run No.	Location	Time (24-h)	Concentration ppm[a]	Concentration mg/dNm³[b]	Emission rate, lb/h[c]	Destruction efficiency, %[d]
1	Inlet	1133-1233	440	1630	7.1	
	Outlet		3.3 (0.4)	13.7	0.6 (0.05)	92.3 (99.3)
2	Inlet	1332-1432	460	1813	7.5	
	Outlet		4.4 (1.5)	18.3	0.8 (0.17)	89.0 (97.7)
3	Inlet	1518-1618	470	1855	7.8	
	Outlet		2.0 (0.0)	8.3	0.3 (0.0)	95.8 (100.0)
Average	Inlet		460	1800	7.5	
	Outlet		4.6 (0.6)	13.4	0.6 (0.07)	92.7 (99.0)

a ppm = Parts per million by volume as heptane. Values in parentheses are blank-corrected.

b mg/dNm³ = Milligrams per dry normal cubic meter as heptane.

c lb/h = Pounds per hour as heptane. Values in parentheses are based on measured and blank-corrected concentrations.

d Efficiency = $\frac{\text{lb/h in} - \text{lb/h out}}{\text{lb/h in}} \times 100$. Based on calculated flow rates and no blank corrections; values in parentheses are based upon measured flow rates and blank-corrected outlet data.

0.6 lb/h based on the flow rates calculated from the carbon balance. NMVOC DE averaged 92.7 percent. The target efficiency was 98 percent.

Use of the Method 2 flow data to calculate emission rates would result in an average outlet emission rate of 0.38 lb/h, which corresponds to an average destruction efficiency of 94.9 percent. Also shown in Table 2-2 are the results after blank-correcting the outlet samples. An unused canister taken to the field and analyzed with the samples showed a concentration of 2.9 ppm, which is on the same level as the outlet samples, but insignificant with respect to the inlet samples. Using the blank-corrected outlet sample values and the measured volumetric flow rates yields an average DE of 99 percent. Calculation of the DE using the calculated flow rates and blank-corrected sample values results in an average DE of 98.6 percent.

Table 2-3 summarizes the emission data for the specific volatile organic compounds (VOC) that were detected in the samples. At the outlet, methylene chloride was the only compound detected above the detection level. Methylene chloride contamination is not unusual because it is a common laboratory solvent. Methylene chloride was detected in the blank, and it is possible that the sample values are biased high. The compounds 1,1,1-trichloroethane (in the samples), vinyl chloride, and tetrachloroethane (in the blank) were detected at or below the detection level of the method. Table 2-4 presents NO_x emission data. The average emission for NO_x was 1.7 lb/h. Emission rates for specific organics and NO_x are based on the flow rates calculated by carbon balance; results would be lower if the measured flow rates were used.

Calculations can be found in Appendix A, field data are in Appendix B, and laboratory data are in Appendix C.

Table 2-3
Summary of VOC Emissions

Pollutant	Sampling location	Run No. 1 Concentration ppb[a]	Run No. 1 Concentration µg/dNm³[b]	Run No. 1 Emission rate, lb/h[c]	Run No. 2 Concentration ppb	Run No. 2 Concentration µg/dNm³	Run No. 2 Emission rate, lb/h	Run No. 3 Concentration ppb	Run No. 3 Concentration µg/dNm³	Run No. 3 Emission rate, lb/h	Average Concentration ppb	Average Concentration µg/dNm³	Average Emission rate, lb/h
Methylene chloride	Outlet	710	2510	0.101	450	1591	0.065	330	1167	0.045	497	1756	0.070
1,1,1-Trichloroethane	Outlet	5.5	30	0.0012	3.8	21	0.0009	<5.7[d]	<29	0.0011	<4.8	<27	0.0011

[a] ppb = Parts per billion by volume.

[b] µg/dNm³ = Micrograms per dry normal cubic meter.

[c] lb/h = Pounds per hour.

[d] Compound not detected in sample. Detection limit value used.

Table 2-4
Summary of NO_x Emissions Data

(July 29, 1992)

Run No.	Time (24-h)	Concentration, ppm	Emission rate, lb/h
LVL-0-1A	1645	21	1.5
LVL-0-1B	1700	23	1.7
LVL-0-1C	1715	27	2.0
LVL-0-1D	1730	21	1.5
Average		23	1.7
LVL-0-2A	1745	29	2.2
LVL-0-2B	1800	23	1.7
LVL-0-2C	1815	24	1.8
LVL-0-2D	1830	24	1.8
Average		25	1.9
LVL-0-3A	1845	26	1.9
LVL-0-3B	1900	17	1.3
LVL-0-3C	1915	17	1.2
LVL-0-3D	1930	21	1.6
Average		20	1.5
Overall average		23	1.7

3.0 Quality Assurance

This section outlines the steps ITAQS takes to ensure that quality data are obtained from our testing procedures.

Routine standard reference method quality control (QC) procedures were followed throughout this test series. These included, but were not limited to, the following:

- Calibration of field sampling equipment. Sampling equipment was calibrated in accordance with the procedures of the "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III," EPA 600/4-72-027B, August 1977. The calibration data are summarized in Table 3-1. Calibration guidelines are described in more detail in Appendix E.

- Onsite dry gas meter and thermocouple digital indicator calibration checks (see Appendix B).

- Train configuration and calculation checks.

- Onsite quality assurance (QA) checks such as sampling train and pitot tube leak checks.

- Use of designated analytical equipment and sampling reagents.

- Laboratory analytical procedure QA checks.

Sampling equipment, reagents, and analytical procedures for this test series followed and met all necessary guidelines set forth for accurate test results. All sampling equipment was calibrated within the limits described in U.S. EPA Method 5.*

The QC procedures followed in the sample analyses in this test program included, but were not limited to, the following:

- Use of designated analytical equipment and experienced laboratory personnel.
- Internal and external audits to ensure accuracy in sampling and analysis.
- Reagent and field blanks to determine blank levels.

* 40 CFR 60, Appendix A, July 1991.

Table 3-1
Field Equipment Calibration

Equipment	ID. No.	Calibrated Against	Allowable Error	Actual Error	Comments
Meter box	FT-10	Wet test meter	Y ±0.02	0.004	Pretest (maximum deviation)
			ΔH@ ±0.15	0.12	Pretest (maximum deviation)
			(Y ±0.05 Y posttest)	0.01/	Pre- versus posttest
		Critical orifice	Y ±0.02	0.008	Checked on site prior to testing
			ΔH@ ±0.15	0.11	Checked on site prior to testing
Pitot tube	595	Geometric specifications	a	a	Visually inspected on site
	T0003		a	a	Visually inspected on site
Digital indicator	FT-10	Millivolt signals	±0.5%	0.3%	Pretest (maximum deviation)
				0.6%	Checked on site prior to testing
Stack thermocouple	101	ASTM-3F	1.5%	0.2%	Pretest (maximum deviation)
	645			0.0%	Pretest (maximum deviation)
Orsat analyzer	423	Calibration gas	±0.5%, by volume	0.0%	CO_2
				0.2%	O_2
Impinger thermocouple	I-1	ASTM-3F	±2°F	0°F	Pretest (maximum deviation)
Balance	422	Type-S weights	±0.5 g	0.0 g	Pretest (maximum deviation)
Barometer	431	NBS-traceable barometer	±0.10 in.Hg	0.01 in.Hg	Pretest
			(±0.20 in.Hg, posttest)	0.03 in.Hg	Posttest
Dry gas thermocouple	FT-10	ASTM 3F	±5°F	3°F	Inlet (pretest, maximum deviation)
				1°F	Outlet (pretest, maximum deviation)

[a] See Appendix E.

3.1 Nonmethane Organics

NMVOCs were not detected in the laboratory blank (<0.01 ppm), but were detected in the field blank at 2.9 ppm as heptane. This is significant when compared with the outlet samples; therefore, results were calculated using both measured and blank-corrected concentrations.

3.2 Specific VOCs

The field blank for TO-14 showed concentrations of vinyl chloride, methylene chloride, and tetrachloroethene at or below the detection limit.

3.3 Permanent Gases

Neither CH_4, CO_2, CO, N_2, nor O_2 were detected in the field or laboratory blanks.

3.4 Nitrogen Oxides

NO_x was not detected in the reagent blank.

4.0 Process Description

Lake View Landfill operates an enclosed ground flare to control emissions of CH_4 and NMVOC contained in the landfill gas collected at their disposal site in Erie, Pennsylvania. Landfill gas is combusted through a burner system equipped with a flame arrestor to prevent flashback in the event the gas flow is lost. Combustion air is controlled by two sets of automatic dampers located near the bottom of the flare assembly.

5.0 Sampling Locations and Test Methods

5.1 Sampling Locations

Sampling was conducted at the flare inlet and outlet as shown in Figures 5-1 and 5-2, respectively. At the inlet, two sampling ports were located approximately 9.2 duct diameters downstream and 4.4 duct diameters upstream from the nearest flow disturbances in the 11.5-in. inside-diameter (i.d.) duct. Eight points were used to traverse the duct for velocity measurements. At the outlet, two sampling ports were located approximately 3.1 stack diameters downstream and 0.5 stack diameter upstream from the nearest flow disturbances in the 9-ft 8-in.-i.d. stack. Sixteen points were used to traverse the duct for velocity measurements.

5.2 Test Methods

5.2.1 Canister Samples

Canister samples were collected simultaneously at the inlet and outlet of the flare. Each sample was collected in a passivated canister in accordance with procedures described in Draft U.S. EPA Method 25C.* The canister samples were than analyzed using Method 25C procedures, but the detection limit was not low enough to allow calculation of the destruction efficiency. The samples were subsequently analyzed using U.S. EPA Method TO-12,** which did achieve an acceptable detection limit. During TO-12 analysis, the sample is drawn through a cryogenic trap, capturing the NMVOC. The NMVOC sample is heated, driving off the captured compounds, which are then measured by the GC/FID. Both sets of samples were also analyzed for CH_4, N_2, O_2, CO_2, and CO by a gas chromatograph with a thermal conductivity detector (GC/TCD). It should be noted that the method of detection used in TO-12 is different from the method stated in 25C. In 25C, the NMVOC compounds are oxidized to CO_2, reduced to methane, and measured by an FID. No oxidation/reduction process takes place in TO-12.

The outlet samples were also analyzed for specific organic compounds*** by procedures described in U.S. EPA Method TO-14.**

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* 56 FT 24468, May 30, 1991.

** Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA-600/4-84-041.

*** Benzene, chloroform, 1,2-dichloroethane, methyl chloride, methylene chloride, perchloroethylene, trichloroethylene, carbon tetrachloride, vinylidene chloride, vinyl chloride.

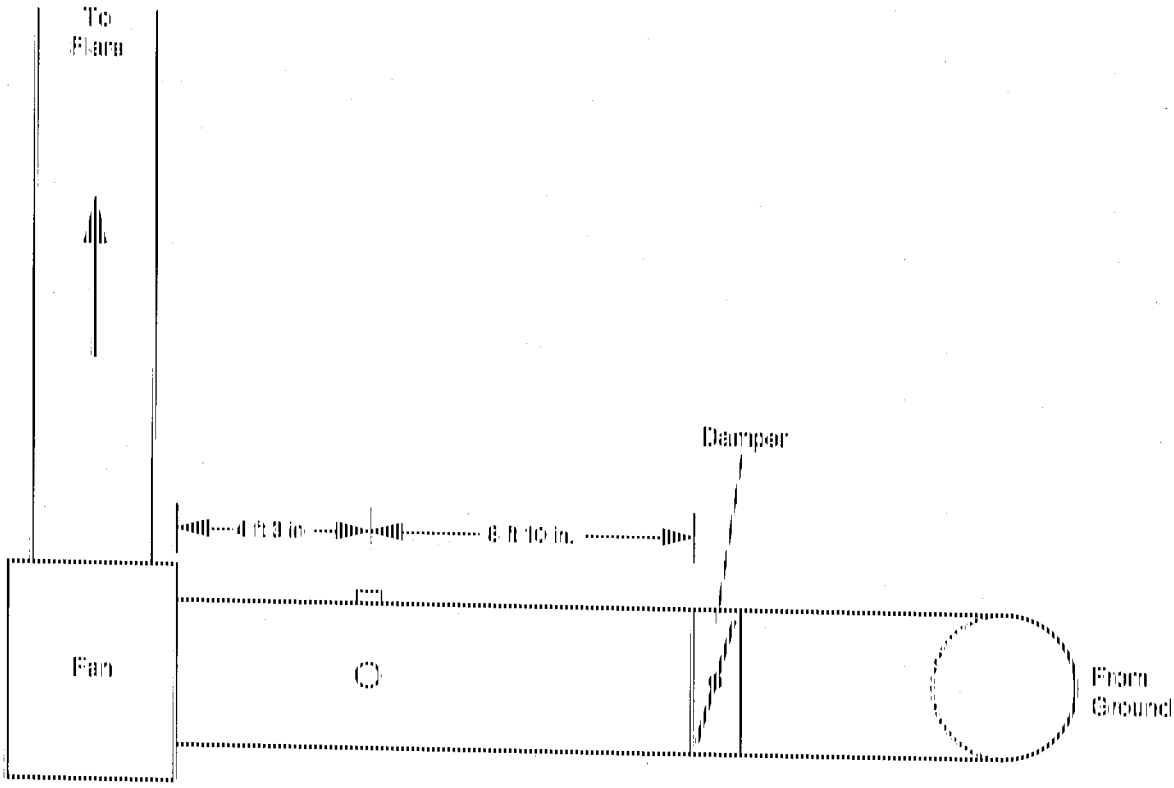

Figure 5-1.
Flare Inlet Sampling Location — Top View

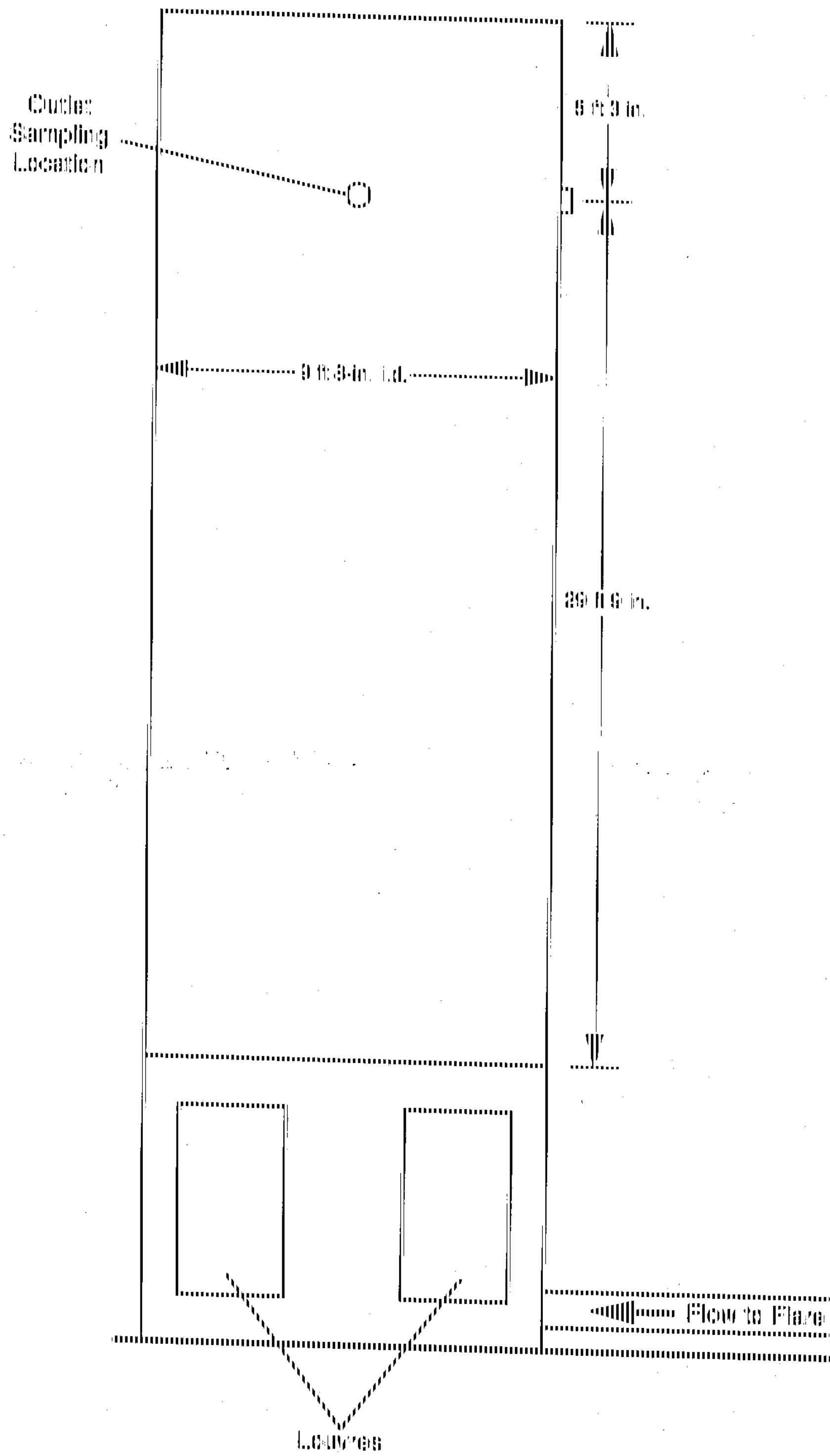

Figure 5-2.
Flare Outlet Sampling Location.

Inlet and outlet samples were also analyzed for CH_4, N_2, O_2, CO_2, and CO by GC/TCD.

5.2.2 *Nitrogen Oxides*

The NO_x sampling was conducted at the outlet in accordance with U.S. EPA Method 7A.* Three tests were conducted, each consisting of four grab samples. The samples were collected in evacuated flasks containing a dilute sulfuric acid/hydrogen peroxide absorbing solution. The NO_x was measured by ion chromatography.

5.2.3 *Velocity, Gas Temperature, Molecular Weight, and Moisture*

At the inlet, flow rate and temperature measurements were obtained in accordance with U.S. EPA Method 2C* by use of a Type-S standard pitot tube, an inclined manometer, and a thermocouple and digital readout. Gas composition and molecular weight were determined by ASTM Method D1945.** The canister sample analyses described earlier (CH_4, N_2, O_2, CO_2, and CO by GC/TCD) were used to calculate molecular weight. Moisture determinations were made by use of a wet bulb/dry bulb thermometer and psychrometric chart.

At the outlet, velocity and temperature measurements were obtained in accordance with U.S. EPA Method 2 by use of a Type-S pitot tube, an inclined manometer, and a thermocouple and digital readout. During the sampling program, pressure drops across the pitot tube were extremely low (<0.01 in.H_2O). Such low pressure drops greatly decreased the accuracy of the method. Therefore, an alternative method was used to represent the flow data in addition to the data collected by Method 2 procedures. The outlet flow rate was determined by carbon balance in accordance with U.S. EPA Method 2B.

Levels of CO_2 and O_2 were measured in accordance with U.S. EPA Method 3,*** and stack gas moisture was measured in accordance with U.S. EPA Method 4.***

Appendix D contains more detailed descriptions of the sampling and analytical procedures used during stack gas testing.

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* 40 CFR 60, Appendix A.

** Annual Book of ASTM Standards, Section 5, Volume 05.05.

*** 40 CFR 60, Appendix A.

APPENDIX A

CALCULATIONS

Nomenclature and Dimensions

An = Cross-sectional area of stack, sq. ft.

Bwsm = Proportion by volume of water vapor in the gas stream, dimensionless

Cnox = NOx concentration, ppm

Cp = Pitot tube coefficient, dimensionless

%CO = Percent of carbon monoxide by volume, dry basis

%CO2 = Percent of carbon dioxide by volume, dry basis

ΔH = Average pressure drop across the sampling meter flow orifice, inches of water (in. H2O)

La = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.020 cubic foot per minute or 4% of the average sampling rate, whichever is less

Md = Dry molecular weight, lb/lb-mole

Ms = Molecular weight of stack gas (wet basis), lb/lb-mole

%N2 = Percent of nitrogen by volume, dry basis

%O2 = Percent of oxygen by volume, dry basis

ΔP = Velocity head of stack gas, inches of water (in. H2O)

P = Flask pressure, in. Hg

Pbar = Barometric pressure, inches of mercury (in. Hg)

Pmcx = Micrograms NOx, µg

Ps = Absolute stack gas pressure, inches of mercury (in. Hg)

Pstd = Gas pressure at standard conditions, inches of mercury (29.92 in. Hg)

Qa = Volumetric flow rate - wet basis at stack conditions, actual cubic feet per minute (acfm)

Qstd = Volumetric flow rate - dry basis at standard conditions, dry standard cubic feet per minute (dscfm)

Nomenclature and Dimensions (continued)

(continued)

T = Flask temperature, °F

Tm = Average temperature of dry gas meter, °R

Ts = Average temperature of stack gas, °R

$Tstd$ = Temperature at standard conditions, (528°R)

Vf = Flask volume, ml

Vlc = Total volume of liquid collected in impingers and silica gel, ml

Vm = Volume of dry gas sampled at meter conditions, cu. ft.

$Vmstd$ = Volume of dry gas sampled at standard conditions, cu. ft.

V_{NOx} = NOx sample volume, ml

Vs = Average stack gas velocity at stack conditions, ft/s

$Vwstd$ = Volume of water vapor at standard conditions, scf

Y = Dry gas meter calibration factor, dimensionless

θ = Total sampling time, minutes

NOTES: Standard condition = 68°F and 29.92 in.Hg

Example Calculations For Pollutant Emissions

1. Volume of dry gas sampled corrected to standard conditions, ft^3. Note: Vm must be corrected for leakage if any leakage rates exceed La.

$$Vmstd = 17.647 \times Vm \times Y\left[\frac{Pbar + \frac{\Delta H}{13.6}}{Tm}\right]$$

2. Volume of water vapor at standard conditions, ft^3.

$$Vwstd = 0.04707 \times Vlc$$

3. Moisture content in stack gas, dimensionless.

$$Bws = \frac{Vwstd}{Vwstd + Vmstd}$$

4. Dry molecular weight of stack gas, lb/lb-mole.

$$Md = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2 + \%CO)$$

5. Molecular weight of stack gas, lb/lb-mole.

$$Ms = Md(1 - Bws) + 18Bws$$

6. Stack velocity at stack conditions, Fps.

$$Vs = (85.49)(Cp)(avg\sqrt{\Delta P})\sqrt{\frac{Ts}{(Ps)(Ms)}}$$

7. Stack gas volumetric flow rate at stack conditions, acfm.

$$Qs = 60 \times Vs \times As$$

8. Dry stack gas volumetric flow rate at standard conditions, dscfm.

$$Qsstd = (17.647)(Qs)\left(\frac{Ps}{Ts}\right)(1 - Bws)$$

UNITS FOR CORRECTION FACTORS

$$17.647 = \left(\frac{\text{Tstd}}{\text{Pstd}}\right)$$

$$0.04707 = \left(\frac{\text{ft}^3}{\text{mL}}\right)$$

0.44 = molecular weight of CO_2/100

0.32 = molecular weight of O_2/100

0.28 = molecular weight of N_2/100

18 = molecular weight of water (H_2O), lb/lb-mole

$$85.49 = \left[\frac{(\text{lb/lb-mole})(\text{in. Hg})}{(^\circ\text{R})(\text{in. } H_2O)}\right]^{\frac{1}{2}} \times D_n$$

NO_x CALCULATIONS

$$\text{Equation 1:}\quad V_s = 17.647 \times (V_f - 25) \times \left| \left(\frac{P_b - P}{T + 460} \right)_f - \left(\frac{P_b - P}{T + 460} \right)_i \right|$$

Where:

V_s = Sample volume, ml

V_f = Flask volume, ml

P_b = Barometric pressure, in.Hg

P = Flask pressure, in.Hg

T = Flask temperature, °F

Note: Subscripts f and i indicate final and initial, respectively.

$$\text{Equation 2:}\quad C_{NO_x} = \frac{522.6 \times P_{NO_x}}{V_s}$$

Where:

C_{NO_x} = NO_x concentration, ppm

P_{NO_x} = micrograms NO_x, µg

INTERNATIONAL TECHNOLOGY CORPORATION

By B. Cagle Date 9/2/92 Subject Moisture Determination for Lake View Landfill Sheet No. 1 of 1
Chkd. By [illegible] Date [illegible] Proj. No. 232192

0.5cm. X 0.5cm.

Moisture determined for flare inlet using vapor pressure table and psychrometric chart. To determine moisture:

1) Determine % saturation at stack temp using vapor pressure table.

2) Determine % Relative Humidity (RH) from psychrometric chart using wetbulb/drybulb measurements.

3) Multiply % saturation by % Relative Humidity ÷ 100 equals stack moisture.

Run LVL-II-1

WB/DB = 70/78 P_{bar} = 29.96
P_{static} = -21.6
RH = 68% P_s = 28.37

Vapor Pressure = 0.9666

% $Moisture_{sat}$ = 3.41

% $Moisture_{stack}$ = 3.41 × 68 ÷ 100 = 2.32

Run LVL-II-2

WB/DB = 69/77 P_{bar} = 29.90 P_{static} = -21.0
RH = 68% P_s = 28.36

Vapor Pressure = 0.9352 % $Moist_{sat}$ = 3.30

% $Moist_{stack}$ = 3.30 × 68 ÷ 100 = 2.24

Run LVL-II-3

WB/DB = 73/80 P_{bar} = 29.94 P_{static} = -21.4
RH = 72% P_s = 28.35 Vapor Pressure = 1.032

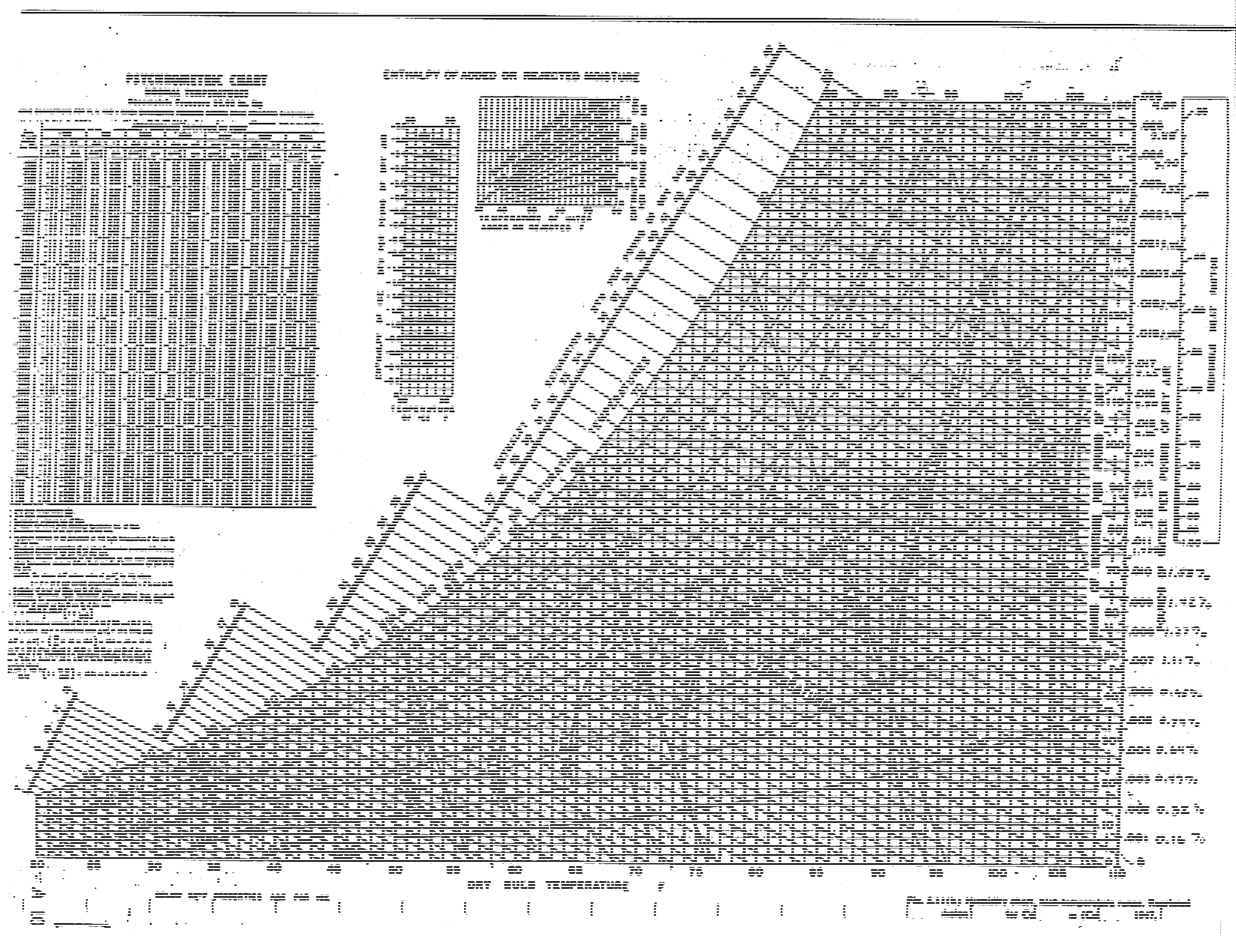
% $Moist_{sat}$ = 3.64 % $Moist_{stack}$ = 3.64 × 72 ÷ 100 = 2.62

Run LVL-II-4

WB/DB = 70/77 P_{bar} = 29.93 P_{static} = -21.4
RH = 71% P_s = 28.32 Vapor Pressure = 0.9352

% $Moist_{sat}$ = 3.30 % $Moist_{stack}$ = 3.30 × 71 ÷ 100 = 2.34

Avg = 2.38



Equation 3: $$C'_{NO_x} = \frac{6.243 \times 10^{-5} \times P_{NO_x}}{V_q}$$

Where:

C'_{NO_x} = NO_x concentration, lb/dscf

Equation 4: $$E_{NO_x} = C'_{NO_x} \times Q_{std} \times 60$$

Where:

E_{NO_x} = NO_x emission rate, lb/h

$Q_{s\ std}$ = Volumetric flow rate, dscfm

INTERNATIONAL TECHNOLOGY CORPORATION

By [illegible] Date [illegible] Subject Molecular weight of Inlet Sheet No. 1 of 1
Chkd. By [illegible] Date [illegible] Vent Proj. No. 33210
0.5cm. X 0.5cm.

Molecular Weight = $.32 \times \%O_2 + .28 \times \%N_2 + .16 \times \%CH_4 + .44 \times \%CO_2$

LVL-I-1 = 27.85

LVL-I-2 = 27.86

LVL-I-3 = 27.75

Avg = 27.82

Inlet canister Lab results used.

VAPOR PRESSURES OF WATER AT SATURATION*

(Inches of Mercury)

Temp. Deg. F.	0	1	2	3	4	5	6	7	8	9
-20	.0126	.0119	.0112	.0106	.0100	.0095	.0089	.0084	.0080	.0075
-10	.0221	.0209	.0199	.0187	.0176	.0164	[illegible]	.0150	.0142	.0134
-0	[illegible]	.0354	.0339	.0324	.0306	.0289	.0275	.0259	.0244	.0233
0	.0376	.0398	.0417	.0463	.0441	.0466	.0517	.0546	.0571	.0600
10	.0631	.0660	.0696	.0730	.0768	.0810	.0846	.0883	.0922	.0962
20	.1025	.1080	.1127	.1186	.1248	.1302	.1356	.1429	.1503	.1567
30	.1662	.1716	.1803	.1879	.1955	.2035	.2118	.2203	.2293	.2385
40	.2410	.2576	.2677	.2903	.3004	.3004	.3120	.3240	.3364	.3493
50	.3626	.3764	.3906	.4052	.4203	.4359	.4520	.4686	.4858	.5035
60	.5218	.5409	.5601	.5802	.6009	.6222	.6442	.6669	.6903	.7144
70	.7392	.7648	.7912	.8183	.8462	.8750	.9046	.9352	.9666	.9989
80	1.032	1.066	1.102	1.138	1.175	1.213	1.253	1.293	1.335	1.378
90	1.422	1.467	1.513	1.561	1.610	1.660	1.712	1.765	1.819	1.875
100	1.933	1.992	2.052	2.114	2.178	2.243	2.310	2.379	2.449	2.521
110	2.596	2.672	2.749	2.829	2.911	2.995	3.081	3.169	3.259	3.351
120	3.446	3.543	3.642	3.744	3.848	3.954	4.063	4.174	4.289	4.406
130	4.525	4.647	4.772	4.900	5.031	5.165	5.302	5.442	5.585	5.732
140	5.881	6.034	6.190	6.350	6.513	6.680	6.850	7.024	7.202	7.384
150	7.569	7.759	7.952	8.150	8.351	8.557	8.767	8.981	9.200	9.424
160	9.652	9.885	10.12	10.36	10.61	10.86	11.12	11.38	11.65	11.92
170	12.20	12.48	12.77	13.06	13.36	13.67	13.98	14.30	14.62	14.96
180	15.29	15.63	15.98	16.34	16.70	17.07	17.44	17.82	18.21	18.61
190	19.01	19.42	19.84	20.27	20.70	21.14	21.59	22.05	22.52	22.99
200	23.47	23.96	24.46	24.97	25.48	26.00	26.53	27.07	27.62	28.18
210	28.75	29.33	29.93	30.53	31.13	31.75	32.38	33.02	33.67	34.33
220	35.00	35.68	36.37	37.07	37.78	38.50	39.24	39.99	40.75	41.52
230	42.31	43.11	43.92	44.74	45.57	46.41	47.27	48.13	49.01	49.90
240	50.84	51.76	52.70	53.65	54.62	55.60	56.60	57.61	58.63	59.66
250	60.72	61.80	62.88	63.98	65.09	66.22	67.36	68.51	69.68	70.87
260	72.13	73.36	74.60	75.86	77.13	78.42	79.73	81.05	82.39	83.75
270	85.13	86.52	87.93	89.36	90.81	92.28	93.76	95.27	96.79	98.34
280	100.1	101.4	103.1	104.6	106.3	108.0	109.6	111.3	113.0	114.7
290	116.4	118.1	119.9	121.7	123.5	125.3	127.1	129.0	130.9	132.8
300	134.7	136.6	138.6	140.6	142.6	144.6	146.7	148.8	150.9	153.0
310	155.2	157.3	159.5	161.8	164.0	166.3	168.6	170.9	173.3	175.6
320	178.0	180.5	182.9	185.4	187.9	190.5	193.0	195.6	198.3	200.9
330	203.6	206.3	209.1	211.8	214.6	217.5	220.3	223.2	226.2	229.1
340	232.1	235.1	238.2	241.3	244.4	247.6	250.8	254.0	257.2	260.5
350	263.9	267.2	270.6	274.0	277.5	281.0	284.5	288.1	291.7	295.4
360	299.0	302.8	306.5	310.3	314.2	318.0	322.0	325.9	329.9	334.0
370	338.0	342.2	346.3	350.5	354.8	359.1	363.4	367.8	372.2	376.7
380	381.2	385.8	390.4	395.0	399.7	404.4	409.2	414.0	418.9	423.8
390	428.8	433.8	438.8	444.0	449.1	454.3	459.6	464.9	470.2	475.6
400	481.1	486.6	492.2	497.8	503.4	509.1	514.9	520.7	526.6	532.5

*Methods for Determination of Velocity, Volume, Dust, and Mist Content of Gases, Bulletin WP-50, Western Precipitation Corp., Los Angeles, Calif.

% Moisture (decimal) = partial pressure @ stack temp / stack pressure

A-3

4.65

4.58

FT AIR QUALITY SERVICES
VELOCITY DETERMINATIONS

PLANT :	Lake View Landfill
SAMPLE LOCATION :	Flare Inlet
RUN NUMBER :	LVL-I-V1

DATE :	7/29/92	BAROMETRIC PRESS., in. Hg :	29.96
TIME(24-HR) :	1300	STATIC PRESS., in. H2O :	-21.6
OPERATOR(S) :	D.C/D.C		
PREDICTED VELOCITY :	2.3	PITOT TUBE, Cp :	0.84
STACK AREA, sq. ft. :	109.87	PERCENT CO2 :	37.0
NO. OF TRAVERSE PTS. :	9	PERCENT O2 :	1.2

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.18	78
2	0.19	79
3	0.22	80
4	0.21	79
5	0.17	78
6	0.19	78
7	0.19	78
9	0.18	78
	0.18	78

TT AIR QUALITY SERVICES
VELOCITY DETERMINATION

PLANT :	Lake View Landfill
SAMPLE LOCATION :	Flare Inlet
RUN NUMBER :	LVL-1-V2

DATE :	7/29/92	BAROMETRIC PRESS., in. Hg :	29.9
TIME(24-HR) :	1244	STATIC PRESS., in. H2O :	-21
OPERATOR(S) :	DC/DC		
PREDICTED MOISTURE :	3.2	PITOT TUBE, Cp :	0.84
STACK AREA, sq. ft. :	109.37	PREDICT CO2 :	37.4
NO. OF TRAVERSE PTS. :	8	PREDICT O2 :	1.0

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.17	80
2	0.19	80
3	0.24	80
4	0.23	80
5	0.21	70
6	0.21	70
7	0.21	70
8	0.18	60
	0.21	80

PT AIR QUALITY SERVICES
VELOCITY DETERMINATION

PLANT :	Lake View Landfill
SAMPLE LOCATION :	Flare Inlet
RUN NUMBER :	LVL-1-V3

DATE :	7/29/92	BAROMETRIC PRESS., in. Hg :	29.94
TIME(24-HR) :	1456	STATIC PRESS., in. H2O :	-21.0
OPERATOR(S) :	DC/DC		
PREDICTED MOISTURE :	2.6	PITOT TUBE, Cp :	0.84
STACK AREA, sq. ft. :	109.87	PERCENT CO2 :	38.0
NO. OF TRAVERSE PTS. :	8	PERCENT O2 :	0.8

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.15	82
2	0.18	80
3	0.34	78
4	0.32	78
5	0.19	79
6	0.22	79
7	0.21	79
8	0.20	79
	AVE.	80

IT AIR QUALITY SERVICES
VELOCITY DETERMINATION

PLANT : Lake View Landfill
SAMPLE LOCATION : Flare Inlet
RUN NUMBER : LVL-1-V4

DATE :	7/28/92	BAROMETRIC PRESS., in. Hg :	29.93
TIME(24-HR) :	1624	STATIC PRESS., in. H2O :	-21.9
OPERATOR(S) :	DC/DC		
PERCENT MOISTURE :	2.9	PITOT TUBE, Cp :	0.84
STACK AREA, SQ. IN. :	103.87	PERCENT CO2 :	38.3
NO. OF TRAVERSE PTS. :	8	PERCENT O2 :	0.6

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.17	80
2	0.21	80
3	0.24	79
4	0.29	80
5	0.20	79
6	0.22	80
7	0.23	79
8	0.23	80
	0.22	80

[illegible]

ET AIR QUALITY SERVICES
VELOCITY DETERMINATION

PLANT : Lake View Landfill
SAMPLE LOCATION : Flare Inlet

Run No:	LVL-F-V1	LVL-F-V2	LVL-F-V3	LVL-F-V4	AVERAGE
STACK PRESSURE, in Hg :	28.97	28.96	28.93	28.92	28.94
STACK TEMP., deg. F :	78	80	80	80	79
MOLECULAR WEIGHT, DRY : a	27.75	27.76	27.61	27.75	27.72
MOLECULAR WEIGHT, STACK : b	27.62	27.64	27.55	27.52	27.58
AVG. SQRT. VELOCITY HEAD : b	0.44	0.45	0.45	0.46	0.45
VELOCITY, fps : b	26.09	26.44	27.00	27.24	26.94
ACTUAL CUBIC FEET/MINUTE : b	1027	1064	1166	1098	1064
DRY STANDARD CUBIC FEET/MINUTE : b	1022	1054	1052	1093	1053

BAH
10/9/92

a See page A-8

b See pressure sheet calculation page B-4.

BAH
9/28/92

INTERNATIONAL TECHNOLOGY CORPORATION

By [illegible] Date [illegible] Subject Outlet Flowrate by Carbon Balance Sheet No. 1 of 1

Chkd. By [illegible] Date [illegible] Proj. No. [illegible]

0.5cm. X 0.5cm.

$$Q_{std_{out}} = Q_{std_{in}} \frac{HC_{in} + CO_{2\,in} + CO_{in}}{HC_{out} + CO_{2\,out} + CO_{out} - 300}$$

Where: $Q_{std_{out}}$ = volumetric flow rate of stack gas, dry standard cubic feet per minute, dscfm

$Q_{std_{in}}$ = volumetric flow rate of inlet gas measured by EPA method 2, dscfm (average flow before & after)

HC_{in} = concentration of hydrocarbon in inlet gas, ppm as methane (methane and NMVOC converted to methane)

$CO_{2\,in}$ = concentration of carbon dioxide in inlet gas, ppm

CO_{in} = concentration of carbon monoxide in inlet gas, ppm

HC_{out} = concentration of methane and NMVOC (as methane) in stack gas, ppm

$CO_{2\,out}$ = concentration of carbon dioxide in stack gas, ppm

CO_{out} = concentration of carbon monoxide in stack gas, ppm

300 = estimated concentration of carbon dioxide in ambient air, ppm

Run No. LVL-0-1

$$Q_{std_{out}} = (1038) \frac{541{,}080 + 391{,}000 + 0}{23.1 + 90{,}000 + 0 - 300} = 10{,}783 \text{ dscfm}$$

Run No. LVL-0-2

$$Q_{std_{out}} = (1053) \frac{522{,}220 + 401{,}000 + 0}{30.9 + 92{,}000 + 0 - 300} = 10{,}442 \text{ dscfm}$$

Run No. LVL-0-3

$$Q_{std_{out}} = (1068) \frac{557{,}290 + 395{,}000 + 0}{14 + 100{,}000 + 0 - 300} = 10{,}232 \text{ dscfm}$$

velhead 1/7/90

PT AIR QUALITY SERVICES
VELOCITY DETERMINATION

PLANT : Lake View Landfill
SAMPLE LOCATION : Flare Outlet
RUN NUMBER : LVL-O-V1

DATE :	7/29/92	BAROMETRIC PRES., in. Hg :	29.04
TIME(24-HR) :	1009	STATIC PRES., in. H2O :	-0.078
OPERATOR(S) :	DC/DC		
PERCENT MOISTURE :	16.6	PITOT TUBE, Cp :	0.84
STACK AREA, SQ. IN. :	10568.32	PERCENT CO2 :	10.4
NO. OF TRAVERSE PTS. :	16	PERCENT O2 :	5.8

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.003	1669
2	0.004	1679
3	0.007	1687
4	0.007	1703
5	0.007	1714
6	0.006	1718
7	0.004	1704
8	0.005	1676
9	0.006	1679
10	0.006	1681
11	0.006	1693
12	0.007	1702
13	0.008	1708
14	0.007	1685
15	0.005	1685
16	0.004	1674
	0.00[illegible]	[illegible]

DC
9/14/92

ET AIR QUALITY SERVICES
VELOCITY DETERMINATION

validated 12/7/00

PLANT :	Lake View Landfill
SAMPLE LOCATION :	Flare Outlet
RUN NUMBER :	LVL-O-V2

DATE :	7/29/99	BAROMETRIC PRESS., in. Hg :	29.9
TIME(24-HR) :	1355	STATIC PRESS., in. H2O :	-0.073
OPERATOR(S) :	DC/DC		
PERCENT MOISTURE :	16.1	PITOT TUBE, Cp :	0.84
STACK AREA, sq. in. :	10666.32	PERCENT CO2 :	1.0
NO. OF TRAVERSE PTS. :	16	PERCENT O2 :	6.1

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.005	1803
2	0.004	1811
3	0.006	1829
4	0.007	1846
5	0.007	1836
6	0.006	1820
7	0.004	1806
8	0.004	1799
9	0.005	1797
10	0.006	1805
11	0.007	1815
12	0.007	1828
13	0.008	1850
14	0.007	1831
15	0.005	1810
16	0.004	1804
	0.098	1816

TRADE QUALITY SERVICES
VELOCITY DETERMINATION

PLANT : Lake View Landfill
SAMPLE LOCATION : Flare Outlet
RUN NUMBER : LVL-C-V3

DATE :	7/29/02	BAROMETRIC PRES., In. Hg :	29.99
TIME(24-HR) :	1430	STATIC PRES., In. H2O :	-0.070
OPERATOR(S) :	DC/DC		
PERCENT MOISTURE :	14.1	PITOT TUBE, Cp :	0.84
STACK AREA, Sq. In. :	10668.32	PERCENT CO2 :	10.5
NO. OF TRAVERSE PTS. :	16	PERCENT O2 :	6.4

TRAVERSE PT. NO.	VELOCITY HEAD, In. H2O	STACK TEMP., deg. F
1	0.08 4	1802
2	0.08 5	1807
3	0.08 6	1821
4	0.08 6	1849
5	0.08 7	1862
6	0.08 5	1864
7	0.08 4	1810
8	0.08 5	1791
9	0.08 4	1796
10	0.08 4	1800
11	0.08 6	1827
12	0.08 7	1851
13	0.08 6	1846
14	0.08 5	1822
15	0.08 5	1814
16	0.08 4	1804
	0.085	1833

PT AIR QUALITY SERVICES
VELOCITY DETERMINATION

PLANT :	Lake View Landfill
SAMPLE LOCATION :	Flare Outlet
RUN NUMBER :	LVL-C-V4

DATE :	7/28/92	BAROMETRIC PRESS., in. Hg :	29.96
TIME(24-HR) :	1636	STATIC PRESS., in. H2O :	-0.070
OPERATOR(S) :	DC/DC		
PERCENT MOISTURE :	12.7	PITOT TUBE, Cp :	0.84
STACK AREA, sq. in. :	10668.32	PERCENT CO2 :	10.5
NO. OF TRAVERSE PTS. :	16	PERCENT O2 :	6.4

TRAVERSE PT. NO.	VELOCITY HEAD, in. H2O	STACK TEMP., deg. F
1	0.065	1804
2	0.076	1768
3	0.076	1903
4	0.076	1934
5	0.076	1920
6	0.065	1861
7	0.06 5	1822
8	0.06 5	1778
9	0.06 5	1798
10	0.082	1809
11	0.086	1815
12	0.086	1827
13	0.056	1846
14	0.096	1841
15	0.065	1819
16	0.06	1801
	0.065	1818

IT AIR QUALITY SERVICES
VELOCITY DETERMINATION

modified [illegible]

PLANT : Lake View Landfill
SAMPLE LOCATION : Flare Outlet

Run No:	LVL-O-V1	LVL-O-V2	LVL-O-V3	LVL-O-V4	AVERAGE
STACK PRESSURE, in Hg :	29.93	29.89	29.92	29.84	[illegible]
STACK TEMP., deg. F :	1602	1616	1622	1615	[illegible]
MOLECULAR WEIGHT, DRY :	29.90	29.91	29.93	29.94	[illegible]
MOLECULAR WEIGHT, STACK :	27.80	27.09	28.25	28.43	[illegible]
AVG. SQRT. VELOCITY HEAD :	0.07	0.07	0.07	0.07	0.07
VELOCITY, fps :	6.62	6.61	6.94	6.29	6.51
ACTUAL CUBIC FEET/ MINUTE :	37918	38790	36724	36517	37486
DRY STANDARD CUBIC FEET/ MINUTE :	7746	7682	7303	7408	[illegible]

validated 3/3/00

Moisture and Vmstd Calculations

Plant: Lake View Landfill

Date: 7/29/92

Run No.	Vm. cu.-ft	Y	Pbar in. Hg	ΔH in. H2O	Tm. ° F	Vlc ml	Vmstd scf	Moisture %
LVL-O-1	22.501	0.978	29.93	2.01	84	91.9	21.491	16.76
LVL-O-2	22.651	0.978	29.94	2.01	89	64.8	21.622	15.51
LVL-O-3	31.111	0.978	29.94	2.01	100	66.6	28.862	12.65
							23.991	14.97

Emission Rate Calc.

$$\text{Emission rate, lb/h} = \frac{(C_{NMOC})(100)(Q_{std})(60)}{(385.3)(10^6)}$$

lb/h = pound per hour

C_{NMOC} = concentration of nonmethane organic compounds, ppm as heptane

100 = molecular weight of heptane

Q_{std} = volumetric flow rate, dry standard cubic feet per minute

60 = conversion factor, minutes per hour

385.3 = molar volume, cubic feet/mole

10^6 = conversion factor

Inlet

LVL-I-1 $\frac{(440)(100)(1040)(60)}{(385.3)(10^6)}$ = 7.13 lb/h

LVL-I-2 $\frac{(460)(100)(1050)(60)}{(385.3)(10^6)}$ = 7.52 lb/h

LVL-I-3 $\frac{(470)(100)(1070)(60)}{(385.3)(10^6)}$ = 7.83 lb/h

Outlet

LVL-O-1 $\frac{(3.3)(100)(10,800)(60)}{(385.3)(10^6)}$ = 0.55 lb/h

LVL-O-2 $\frac{(4.4)(100)(10,900)(60)}{(385.3)(10^6)}$ = 0.75 lb/h

LVL-O-3 $\frac{(2.0)(100)(10,200)(60)}{(385.3)(10^6)}$ = 0.32 lb/h

INTERNATIONAL TECHNOLOGY CORPORATION

By [illegible] Date 9/21 Subject Destruction Efficiency (D.E.) Sheet No. 1 of 1
Chkd. By [illegible] Date [illegible] Proj. No. 232112
0.5cm. X 0.5cm.

$$\% \text{ D.E.} = \frac{(\text{Inlet, lb/h} - \text{Outlet, lb/h})}{\text{Inlet, lb/h}} \times 100$$

Run #1 $\frac{(7.13 - 0.55)}{7.13} \times 100 = 92.29\%$

Run #2 $\frac{(7.52 - 0.75)}{7.52} \times 100 = 90.03\%$

Run #3 $\frac{(7.83 - 0.32)}{7.83} \times 100 = 95.91\%$

Avg = 92.74 %

INTERNATIONAL TECHNOLOGY CORPORATION

By [illegible] Date [illegible] Subject Emission Rate Calc [illegible] Sheet No. 1 of 1

Chkd. By [illegible] Date [illegible] [illegible] Proj. No. [illegible]

0.5cm. X 0.5cm.

Inlet emission rates remain the same.

Outlet

LVL-0-1 $\frac{(3.3)(100)(2690)(60)}{(385.3)(10^6)} = 0.39$ lb/h

LVL-0-2 $\frac{(4.4)(100)(2480)(60)}{(385.3)(10^6)} = 0.51$ lb/h

LVL-0-3 $\frac{(2.0)(100)(2360)(60)}{(385.3)(10^6)} = 0.23$ lb/h

Destruction Efficiencies

Run #1 $\frac{(7.13 - 0.39)}{7.13} \times 100 = 94.5\%$

Run #2 $\frac{(7.52 - 0.51)}{7.52} \times 100 = 93.2\%$

Run #3 $\frac{(7.83 - 0.23)}{7.83} \times 100 = 97.1\%$

Avg = 94.9%

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Emission Rate Calc'n

By BG Date [illegible] Subject Removal Efficiency using measured flows and blank correction Sheet No. 1 of 1

Chkd. By [illegible] Date [illegible] Proj. No. 212190

0.5cm. X 0.5cm.

Inlet emission rates remain the same.

Blank correction data contained in Appendix C.

Outlet Emissions

		Outlet Emissions using calculated flow rates
LVL-0-1	$\frac{(0.4)(100)(7640)(60)}{(385.3)(10^6)} = 0.05$	0.06 lb/h
LVL-0-2	$\frac{(1.5)(100)(7420)(60)}{(385.3)(10^6)} = 0.17$	0.25 lb/h
LVL-0-3	$\frac{(0.0)(100)(7960)(60)}{(385.3)(10^6)} = 0.00$	0.00 lb/h

Destruction Efficiencies

		D.E. based on calculated rates
Run #1	$\frac{(7.13 - 0.05)}{7.13} \times 100 = 99.3\%$	99.2 %
Run #2	$\frac{(7.52 - 0.17)}{7.52} \times 100 = 97.7\%$	96.7 %
Run #3	$\frac{(7.83 - 0.0)}{7.83} \times 100 = 100\%$	100.0 %
	Average = 99.0 %	98.6 %

NOx Emissions Calculations

PLANT : Lake View Landfill
LOCATION : Flare Outlet
DATE : 7/20/92

	Final	Initial
Barometric Pressure(in. Hg):	29.55	29.95

Run No.	Test Time (24-hr)	Flask Volume ml	Final Pressure in. Hg.	Final Temp. ° F	Initial Pressure in. Hg	Initial Temp. ° F	Sample Volume ml	PNOx µg	OPPM ppm	Qstd dscfm	NOx Emissions lb/dscf	NOx Emissions lb/h
LVL-O-1A	1645	2049.2	3.1	73	27.20	87	1592.4	63	21	10500	2.45E-05	1.5 ✓
LVL-O-1B	1700	1988.3	1.1	74	27.00	87	1639.8	71	23	10500	2.70E-05	1.7
LVL-O-1C	1715	2057.6	3.1	74	27.00	87	1582.8	82	27	10500	3.23E-05	2.0
LVL-O-1D	1730	2020.4	3.5	75	27.00	89	1531.8	60	21	10500	2.46E-05	1.5
Average									22		2.71E-05	1.7
LVL-O-2A	1745	1992.9	3.1	73	27.20	88	1545.4	90	29	10500	3.48E-05	2.2
LVL-O-2B	1800	1959.6	1.2	74	26.80	88	1609.2	71	23	10500	2.70E-05	1.7
LVL-O-2C	1815	1933.5	3.5	74	27.00	89	1481.4	67	24	10500	2.85E-05	1.8
LVL-O-2D	1830	2054.2	4.5	73	27.00	90	1497.6	68	24	10500	2.85E-05	1.8
Average									25		2.98E-05	1.9
LVL-O-3A	1845	2014.9	3.3	74	27.20	89	1549.7	77	26	10500	3.09E-05	1.9
LVL-O-3B	1900	2053.0	0.9	73	27.20	89	1742.8	58	17	10500	2.06E-05	1.3
LVL-O-3C	1915	2094.8	3.5	74	27.20	90	1598.5	51	17	10500	1.97E-05	1.2
LVL-O-3D	1930	2051.0	1.1	74	27.00	90	1712.4	70	21	10500	2.56E-05	1.6
Average									20		2.42E-05	1.5
Overall Average									23		2.70E-05	1.7

$$\text{Conc, mg/dNm}^3 = \frac{\text{ppm (MW)}}{24.04}$$

Conc, mg/dNm³ = concentration of NMOC, milligrams per dry normal cubic meter
ppm = parts per million, ml/m³

MW = molecular weight of specific voc as NMOC, gm/g-mole
100 as heptane
24.04 = molar volume, ml/g-mole

NMOC concentration

		ppm	MW	mg/dNm³
Run No. 1	Inlet	440	100	1830
	Outlet	3.3	100	13.7
Run No. 2	Inlet	460	100	1913
	Outlet	4.4	100	18.3
Run No. 3	Inlet	470	100	1955
	Outlet	2.0	100	8.3
Average	Inlet	457		1896
	Outlet	3.2		13.4

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By [illegible] Date [illegible] Subject Specific Organic Conc. calculation Sheet No. 1 of 1

Chkd. By [illegible] Date [illegible] Proj. No. [illegible]

0.5cm. X 0.5cm.

$$\text{Conc, } \mu g/dNm^3 = \frac{ppb\ (MW)}{24.04}$$

Conc, µg/dNm³ = Concentration, micrograms per dry normal cubic meter

ppb = parts per billion, nl/m³

MW = molecular weight, µg/µg-mole

24.04 = molar volume, µl/µmole

		ppb	MW	µg/dNm³
Run No. 1	Methylene Chloride	710	85	2510
	1,1,1-Trichloroethane	5.5	133	30
Run No. 2	Methylene chloride	450	85	1591
	1,1,1-Trichloroethane	3.8	133	21
Run No. 3	Methylene chloride	330	85	1167
	1,1,1-Trichloroethane	<5.2	133	<29
Average	Methylene chloride	497		1756
	1,1,1-Trichloroethane	<4.8		<27

INTERNATIONAL TECHNOLOGY CORPORATION

By [illegible] Date [illegible] Subject Emission Rate calc. [illegible] Sheet No. 1 of 1
Chkd. By [illegible] Date [illegible] Specific Compound VOC Proj. No. [illegible]
0.5cm. X 0.5cm.

$$E, lb/h = \frac{(ppb)(MW)(Q_{std})(60)}{(385.3)(10^9)}$$

E, lb/h = Emission rate, pound per hour

ppb = parts per billion volume

MW = molecular weight, lb/lb-mole

Q_{std} = volumetric flow rate, dry standard cubic feet per minute

60 = minutes per hour

385.3 = molar volume, cubic feet per lb-mole

10^9 = conversion factor

Methylene chloride (MW = 85)

Run No. 1 $E, lb/h = \frac{(710)(10,800)(85)(60)}{(385.3)(10^9)} = 0.101$

Run No. 2 $E, lb/h = \frac{(450)(10,900)(85)(60)}{(385.3)(10^9)} = 0.065$

Run No. 3 $E, lb/h = \frac{(310)(10,800)(85)(60)}{(385.3)(10^9)} = 0.045$

1,1,1-Trichloroethane (MW = 133)

Run No. 1 $E, lb/h = \frac{(5.5)(10,800)(133)(60)}{(385.3)(10^9)} = 0.0012$

Run No. 2 $E, lb/h = \frac{(3.8)(10,900)(133)(60)}{(385.3)(10^9)} = 0.0009$

Run No. 3 $E, lb/h = \frac{(4.9)(10,800)(133)(60)}{(385.3)(10^9)} = 0.0011$

APPENDIX B

FIELD DATA

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant Lake View Landfill

Date 2/28/92

Sampling location Flare Inlet

Inside of far wall to outside of nipple 17¼"

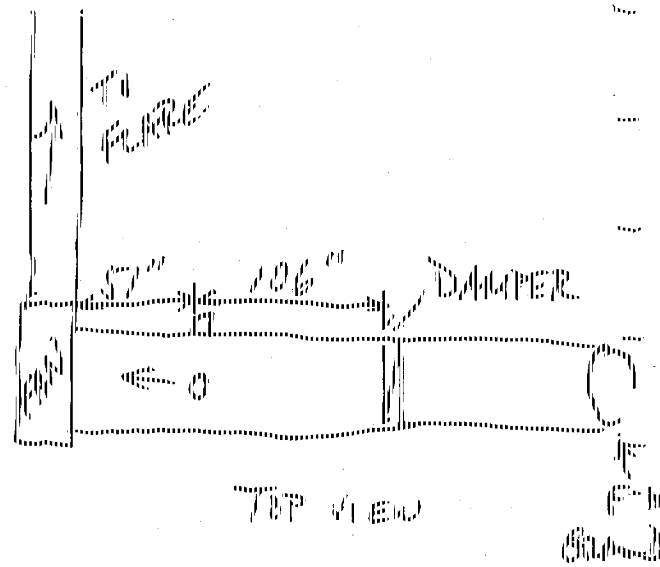
Inside of near wall to outside of nipple (nipple length): 6"

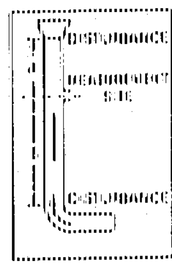
Stack inside diameter, inches 11¼"

Distance downstream from flow disturbance (Distance B):
106 inches / diameter = 9.2 dd

Distance upstream from flow disturbance (Distance A):
57 inches / diameter = 5.1 dd

Calculated by DW





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)	NIPPLE LENGTH	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	.067	11¼		6	6¾
2	.250				8¾
3	.750				[illegible]
4	.933				[illegible]

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View [illegible] Date: [illegible]

Sampling Location: [illegible] Clock Time: 1100

Run No.: LVL-I-V1 Operator: DO

Barometric Pressure, in.Hg: 29.96 Static Pressure, in.H_2O: -21.6

Moisture, %: 2.32 Molecular wt., Dry: [illegible] 27.85 Pitot Tube, Cp: .84

Stack Dimension, in. Diameter or Side 1: [illegible] Side 2: ——

[illegible]

Md = [illegible]

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in.H_2O	STACK TEMP., °F
1 - 1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]
2 - 1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]

CALCULATIONS

$M_s = M_d \times (1 - \frac{\% H_2O}{100}) + 18 (\frac{\% H_2O}{100})$

M_s = (27.85) × (1 - 2.32/100) + 18 (2.32/100)

M_s = 27.62

T_s = 79 °F = 539 °R °R = (°F + 460)

$P_s = P_b + \frac{P_g}{13.6}$ = (29.96) + (-21.6 / 13.6)

P_s = 28.37 in.Hg

$\sqrt{\Delta p}$ = 0.438

$V_s = 85.49 \times C_p \times \sqrt{\Delta p} \times \sqrt{\frac{T_s}{P_s \times M_s}}$

V_s = 85.49 × (.84) × (.438) × $\sqrt{\frac{539}{28.37 \times 27.62}}$

V_s = 26.09 fps

A_s = 0.72 ft²

$Q_s = V_s \times A_s \times 60$

Q_s = 26.09 × 0.72 × 60

Q_s = 1127 acfm

$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{\% H_2O}{100})$

$Q_{s_{std}}$ = 1127 × 17.647 × $\frac{28.37}{539}$ × (1 - 2.32/100)

$Q_{s_{std}}$ = 1022 dscfm

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View Landfill [illegible] Date: [illegible]

Sampling Location: [illegible] Clock Time: [illegible]

Run No.: [illegible] Operator: [illegible]

Barometric Pressure, in.Hg: 29.90 Static Pressure, in.H_2O: -21.0

Moisture, %: [illegible] 2.24 Molecular wt., Dry: [illegible] Pitot Tube, Cp: .84

Stack Dimension, in. Diameter or Side 1: [illegible] Side 2:

WB 69 F
DB 77 F

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in.H_2O	STACK TEMP. (T_s), °F
1-1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]
2-1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]

CALCULATIONS

$M_s = M_d \times (1 - \frac{H_2O}{100}) + 18 (\frac{H_2O}{100})$

$M_s = ($ [illegible] $) \times (1 - \frac{2.24}{100}) + 18 (\frac{2.24}{100})$

M_s = [illegible] 27.64

T_s = 80 °F = 540 °R = (°F + 460)

$P_s = P_b + \frac{S.P.}{13.6} = (29.90) + \frac{-21.0}{13.6}$

P_s = 29.36 in.Hg

$\sqrt{\Delta P}$ = 0.452

$V_s = 85.49 \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{T_s}{P_s \times M_s}}$

$V_s = 85.49 \times (0.84) \times (0.452) \times \sqrt{\frac{540}{29.36 \times 27.64}}$

V_s = [illegible] ft/s 26.64

A_s = 0.72 ft²

$Q_s = V_s \times A_s \times \frac{60\ s}{m}$

Q_s = 26.64 × 0.72 × 60

Q_s = [illegible] acfm 1164

$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{H_2O\ \%}{100})$

$Q_{s_{std}}$ = 1164 × 17.647 × $\frac{29.36}{540}$ × (1 − $\frac{2.24}{100}$)

$Q_{s_{std}}$ = [illegible] dscfm

1054 [illegible]

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View, LA [illegible] Date: 7/29/92

Sampling Location: Stack Clock Time: 1553

Run No.: LV-I-13 Operator: DD

Barometric Pressure, in.Hg: 29.94 Static Pressure, in.H_2O: -.21

Moisture, %: 2.63 Molecular wt., Dry: 27.90 Pitot Tube, Cp: .84

Stack Dimension, in. Diameter or Side 1: 11.5 Side 2:

WB 73F
DB 80F

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in.H_2O	STACK TEMP., °F
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

CALCULATIONS

$$M_s = M_d \times \left(1 - \frac{B_{ws}}{100}\right) + 18\left(\frac{B_{ws}}{100}\right)$$

$$M_s = (27.90) \times \left(1 - \frac{2.63}{100}\right) + 18\left(\frac{2.63}{100}\right)$$

$$M_s = 27.55$$

T_s = 80 °F = 540 °R $(T_s + 460)$

$$P_s = P_b + \frac{S.P.}{13.6} = (29.94) + \frac{-.21}{13.6}$$

P_s = 29.93 in.Hg

$\sqrt{\Delta P}$ = 0.452

$$v_s = 85.49 \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{T_s}{P_s \times M_s}}$$

$$v_s = 85.49 \times (.84) \times (0.452) \times \sqrt{\frac{540}{29.93 \times 27.55}}$$

v_s = 27.06 ft/s

A_s = 0.72 ft²

$$Q_s = v_s \times A_s \times 60$$

$$Q_s = 27.06 \times 0.72 \times 60$$

Q_s = 1166 acfm

$$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times \left(1 - \frac{B_{ws}}{100}\right)$$

$$Q_{s_{std}} = 1166 \times 17.647 \times \frac{29.93}{540} \times \left(1 - \frac{2.63}{100}\right)$$

$Q_{s_{std}}$ = [illegible] dscfm

1052 [illegible]

checked [illegible]

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View [illegible] Date: [illegible]

Clock Time: [illegible]

Sampling Location: [illegible]

Operator: [illegible]

Run No.: [illegible]

Static Pressure, in. H_2O: -21.9

Barometric Pressure, in. Hg: 29.93

Pitot Tube, Cp: .84

Molecular wt., Dry: [illegible] 27.75

Moisture, %: [illegible]

Stack Dimension, in. Diameter or Side 1: [illegible] Side 2: [illegible]

Md = [illegible]

WB 70

DB 77

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in. H_2O	STACK TEMP., °F
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

CALCULATIONS

$M_s = M_d (1 - \frac{H_2O}{100}) + 18 (\frac{H_2O}{100})$

$M_s = ($ [illegible] $) \times (1 - \frac{2.34}{100}) + 18 (\frac{2.34}{100})$

$M_s = 27.52$

$T_s = 80$ °R = 540 °R = (°F + 460)

$P_s = P_b + \frac{SP}{13.6} = (29.93) + \frac{-21.9}{13.6}$

$P_s = 28.32$ in. Hg

$\sqrt{\Delta P} = 0.464$

$V_s = 85.49 \times Cp \times \sqrt{\Delta P} \times \sqrt{\frac{T_s, °R}{P_s \times M_s}}$

$V_s = 85.49 \times (0.84) \times (0.464) \times \sqrt{\frac{540}{28.32 \times 27.52}}$

$V_s =$ [illegible] ft/s 27.74

$A_s = 0.72$ ft^2

$Q_s = V_s \times A_s \times \frac{60 s}{m}$

$Q_s = 27.74 \times 0.72 \times 60$

$Q_s =$ [illegible] acfm 1198

$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{H_2O\ \%}{100})$

$Q_{s_{std}} = 1198 \times 17.647 \times \frac{28.32}{540} \times (1 - \frac{2.34}{100})$

$Q_{s_{std}} =$ [illegible] dscfm

1083

[illegible] 9/24/92

[illegible]

Method 25 Field Data

Plant: Lake View Landfill | City: Erie PA | Date: 7/29/92

Run No.: LVL-I-1 | Sample Location: Inlet

Operator: JD

Tank No.: CY 1130 | Tank Volume, Liters: 6.

Trap No.: NA | Sealed cap / ~~Rotameter No.~~: #8

Sampling Rate: 100. cc/min. | Filter Type: ______ in stack; glass wool out of stack

Sample Train Data

	Barometric Pressure, mm Hg	Ambient Temperature, °F °C	Sample Tank Gauge Vacuum, mm Hg
Pre-Test	744.	85.	721.
Post-Test	740.0	85.	72.

Front-Half - Leak Check Data

Time	Initial Vacuum, mm Hg	Time	Final Vacuum, mm Hg	ΔP, mm Hg	Leak Rate,* cc/min

Sampling Data

Time: Clock	Time: Sampling, min	Gauge Vacuum, mm Hg	Temperatures, °F: Probe	Temperatures, °F: Filter Box
1133	0.	721.		
	10	575		
	20	555		
	30	414	NA	NA
	40	205		
	50	135		
1233	60	72		

$$\text{* Leak Rate, cc/min} = \frac{\Delta P\text{, mm} \times \text{Volume, cm}^3}{P_b\text{, mm} \times \text{Time, min}}$$

Leak rate must be ≤0.01 x sampling rate
(0.6 cc/min leak rate at sampling rate of 60 cc/min)
(volume = 100 cm³ for less than 4 ft probe)

Method 25 Field Data

Plant [illegible] City Erie PA Date 2/28/12

Run No. [illegible] Sample Location [illegible]

Operator [illegible]

Tank No. [illegible] Tank Volume, Liters 6

Trap No. [illegible] Rotameter No. [illegible]

Sampling Rate 100. cc/min. Filter Type ______ in stack; [illegible] out of stack

Sample Train Data

	Barometric Pressure, mm Hg	Ambient Temperature, °F °C	Sample Tank Gauge Vacuum, mm Hg
Pre-Test	740	86	721
Post-Test	740	91	26

Front-Half - Leak Check Data

Time	Initial Vacuum, mm Hg	Time	Final Vacuum, mm Hg	ΔP, mm Hg	Leak Rate,* cc/min

Sampling Data

Time: Clock	Time: Sampling, min	Gauge Vacuum, mm Hg	Temperatures, °F: Probe	Temperatures, °F: Filter Box
1332	0	721		
	10	[illegible]		
	20	[illegible]	118	104
	30	510		
	40	[illegible]		
	50	115		
1432	60	26		

$$\text{* Leak Rate, cc/min} = \frac{\Delta P\text{, mm} \times \text{Volume, cm}^3}{\text{Pb, mm} \times \text{Time, min}}$$

Leak rate must be <0.01 x sampling rate (0.6 cc/min leak rate at sampling rate of 60 cc/min) (volume = 100 cm^3 for less than 4 ft probe)

JP-1405-3

Method 25 Field Data

Plant	Lake View Landfill	City	Erie PA	Date	7/28/92
Run No.	LVL-1-3	Sample Location	Stack		
Operator	DO				
Tank No.	1361	Tank Volume, liters	6.		
Trap No.	UL	~~Rotameter No.~~ Cold trap	48		
Sampling Rate	100. cc/min.	Filter Type		in stack	
			[illegible]	out of stack	

Sample Train Data

	Barometric Pressure, mm Hg	Ambient Temperature, °F °C	Sample Tank Gauge Vacuum, mm Hg
Pre-Test	741.	91.	722.
Post-Test	740.	88.	54.

Front-Half - Leak Check Data

Time	Initial Vacuum, mm Hg	Time	Final Vacuum, mm Hg	ΔP, mm Hg	Leak Rate,* cc/min

Sampling Data

Time: Clock	Time: Sampling, min	Gauge Vacuum, mm Hg	Temperatures, °F: Probe	Temperatures, °F: Filter Box
157P	0.	722.		
	10	[illegible]		
	20	[illegible]	104	104
	30	[illegible]		
	40	[illegible]		
	50	[illegible]		
[illegible]	60	54		

$$\text{* Leak Rate, cc/min} = \frac{\Delta P\text{, mm} \times \text{Volume, cm}^3}{\text{Pb, mm} \times \text{Time, min}}$$

Leak rate must be <0.01 x sampling rate
(0.6 cc/min leak rate at sampling rate of 60 cc/min)
(volume = 100 cm^3 for less than 4 ft probe)

JP-1 92-4

INTERNATIONAL TECHNOLOGY CORPORATION

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Lake View La. Mill

DATE 3/24/82 TEST NO LVL-I-1

SAMPLING TIME (24-hr CLOCK) [illegible]

SAMPLING LOCATION Inlet

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Int. bag

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE [illegible]

OPERATOR [illegible]

ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1 ACTUAL READING	1 NET	2 ACTUAL READING	2 NET	3 ACTUAL READING	3 NET	AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
CO_2	38.4	38.4	38.6	38.6			38.5	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	39.2	0.8	39.4	0.8			0.8	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

INTERNATIONAL TECHNOLOGY CORPORATION

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Lake View LandFill

DATE 7/29/92 TEST NO CVC-I-Z

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION Inlet

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Integ

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE

OPERATOR DPG

ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	20.5	20.5	20.5	20.5			20.5	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	20.2	0.7	20.4	0.9			0.8	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EPA 3

DRY MOLECULAR WEIGHT DETERMINATION

INTERNATIONAL TECHNOLOGY CORPORATION

PLANT Lake View Landfill

DATE 7/23/92 TEST NO CVL-I-3

SAMPLING TIME (24-hr CLOCK)

SAMPLING LOCATION Inlet

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Int. bag

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE 75

OPERATOR [illegible]

ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1 ACTUAL READING	1 NET	2 ACTUAL READING	2 NET	3 ACTUAL READING	3 NET	AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
CO_2	38.5	38.5	38.4	38.4			38.4	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	39.4	0.9	39.3	0.9			0.9	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

TRAVERSE POINT LOCATION FOR CIRCULAR DUCTS

Plant: Lake View Landfill

Date: 7/22/92

Sampling location: Flare outlet

Inside of far wall to outside of nipple: 123"

Inside of near wall to outside of nipple (nipple length): 7"

Stack inside diameter, inches: 116"

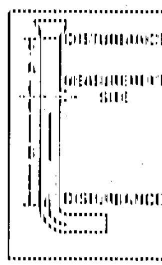
Distance downstream from flow disturbance (Distance B):

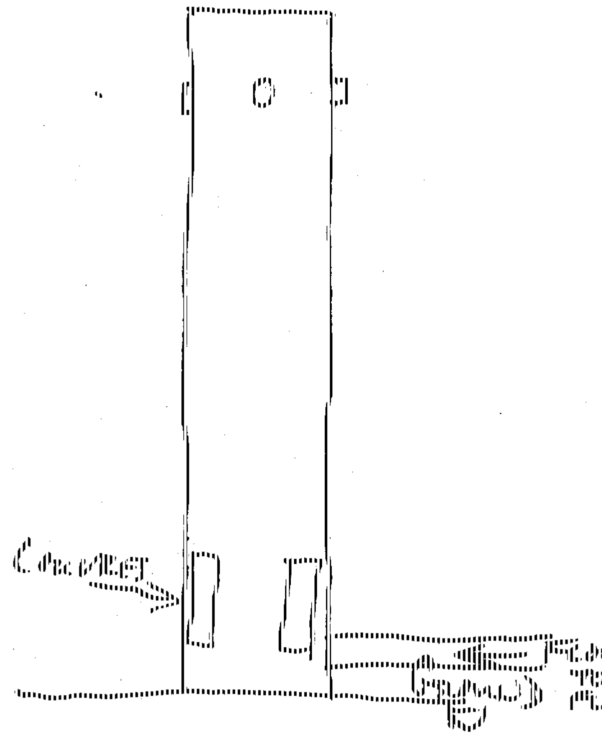
24'5" 257 inches / diameter = 2.1 dd

Distance upstream from flow disturbance (Distance A):

63 inches / diameter = .5 dd

Calculated by: (DLP)





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)	NIPPLE LENGTH	TRAVERSE POINT LOCATION FROM OUTSIDE OF NIPPLE (SUM OF COLUMNS 4 & 5)
1	.032	116		7	10 3/4
2	.105				19 1/4
3	.194				29 1/2
4	.323				44 1/2
5	.677				85 1/2
6	.806				100 1/2
7	.895				110 3/4
8	.968				119 1/4

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View Landfill — Date: 7/29/92

Sampling Location: Flare outlet — Clock Time: 1009

Run No.: LVL-O-V1 — Operator: [illegible]

Barometric Pressure, in.Hg: 29.54 — Static Pressure, in.H_2O: -.02

Moisture, %: 16.26 — Molecular wt., Dry: 28.88 — Pitot Tube, Cp: .84

Stack Dimension, in. Diameter or Side 1: 116 — Side 2: ______

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in.H_2O	STACK TEMP., °F
S-1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]
5	[illegible]	[illegible]
6	[illegible]	[illegible]
7	[illegible]	[illegible]
8	[illegible]	[illegible]
E-1	[illegible]	[illegible]
2	[illegible]	[illegible]
3	[illegible]	[illegible]
4	[illegible]	[illegible]
5	[illegible]	[illegible]
6	[illegible]	[illegible]
7	[illegible]	[illegible]
8	[illegible]	[illegible]

CALCULATIONS

$M_s = Md \times (1 - \frac{\%H_2O}{100}) + 18\ (\frac{\%H_2O}{100})$

$M_s = (\qquad) \times (1 - \frac{\qquad}{100}) + 18\ (\frac{\qquad}{100})$

$M_s =$

$T_s = \qquad °F + \qquad °R = (°F + 460)$

$P_s = P_b + \frac{S.P.}{13.6} = (\qquad) + \frac{\qquad}{13.6}$

$P_s = \qquad$ in.Hg

$\sqrt{\Delta P} =$

$v_s = 85.49 \times Cp \times \sqrt{\Delta P} \times \sqrt{\frac{T_s}{P_s \times M_s}}$

$v_s = 85.49 \times (\qquad) \times (\qquad) \times \sqrt{\frac{\qquad}{\qquad}}$

$v_s = \qquad$ ft/s

$A_s = \qquad$ ft²

$Q_s = v_s \times A_s \times \frac{60\ s}{m}$

$Q_s = \qquad \times \qquad \times 60$

$Q_s = \qquad$ acfm

$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{\%H_2O}{100})$

$Q_{s_{std}} = \qquad \times 17.647 \times \frac{\qquad}{\qquad} \times (1 - \frac{\qquad}{100})$

$Q_{s_{std}} = \qquad$ dscfm

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View Landfill Date: 7/24/92

Sampling Location: Outlet Clock Time: 1255

Run No.: LVL-O-V2 Operator: [illegible]

Barometric Pressure, in.Hg: 27.10 Static Pressure, in.H_2O: -.078

Moisture, %: 16.19 Molecular wt., Dry: [illegible] Pitot Tube, Cp: .84

Stack Dimension, in. Diameter or Side 1: 16 Side 2: ______

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in.H_2O	STACK TEMP., °F
S-1	.003	[illegible]
[illegible]	.005	[illegible]
[illegible]	.004	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
E-1	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	.004	[illegible]

CALCULATIONS

$M_s = M_d \times (1 - \frac{H_2O}{100}) + 18 (\frac{H_2O}{100})$

$M_s = (\quad) \times (1 - \frac{\quad}{100}) + 18 (\frac{\quad}{100})$

$M_s =$

$T_s =$ °F = °R = (°F + 460)

$P_s = P_b + \frac{S.P.}{13.6} = (\quad) + \frac{\quad}{13.6}$

$P_s =$ in.Hg

$\sqrt{\Delta P} =$

$V_s = 85.49 \times C_p \times \sqrt{\Delta P} \times \sqrt{\frac{T_s}{P_s \times M_s}}$

$V_s = 85.49 \times (\quad) \times (\quad) \times \sqrt{\frac{\quad}{\quad}}$

$V_s =$ ft/s

$A_s =$ ft²

$Q_s = V_s \times A_s \times \frac{60\ s}{m}$

$Q_s = \quad \times \quad \times 60$

$Q_s =$ acfm

$Q_{std} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{H_2O\%}{100})$

$Q_{std} = \quad \times 17.647 \times \frac{\quad}{\quad} \times (1 - \frac{\quad}{100})$

$Q_{std} =$ dscfm

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake [illegible] La. [illegible] Date: 7/28/92

Sampling Location: Outlet Clock Time: 1930

Run No.: LW-O-V3 Operator: [illegible]

Barometric Pressure, in.Hg: 29.93 Static Pressure, in.H_2O: -.074

Moisture, %: [illegible] Molecular wt., Dry: 29.3[illegible] Pitot Tube, Cp: .84

Stack Dimension, in. Diameter or Side 1: 76 Side 2:

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in.H_2O	STACK TEMP., °F
R-1	.004	[illegible]
2	.003	[illegible]
3	.004	[illegible]
4	.003	[illegible]
5	.004	[illegible]
6	.003	[illegible]
7	.002	[illegible]
8	.003	[illegible]
S-1	.004	[illegible]
2	.005	[illegible]
3	.004	[illegible]
4	.004	[illegible]
5	.004	[illegible]
6	.004	[illegible]
7	.005	[illegible]
8	.004	[illegible]

CALCULATIONS

$M_s = Md \times (1 - \frac{H_2O}{100}) + 18 (\frac{H_2O}{100})$

$M_s = ($ $) \times (1 -$ ——— $/100) + 18$ (——— $/100)$

$M_s =$

$T_s =$ °F + 460 = °R

$P_s = P_b + \frac{S.P.}{13.6} = ($ $) +$ ——— $/13.6$

$P_s =$ in.Hg

$\sqrt{\Delta P} =$

$V_s = 85.49 \times Cp \times \sqrt{\Delta P} \times \sqrt{\frac{T_s}{P_s \times M_s}}$

$V_s = 85.49 \times ($ $) \times ($ $) \times \sqrt{\quad}$

$V_s =$ ft/s

$A_s =$ ft²

$Q_s = V_s \times A_s \times 60$

$Q_s =$ × × 60

$Q_s =$ acfm

$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{H_2O}{100})$

$Q_{s_{std}} =$ × 17.647 × ——— × (1 − ———/100)

$Q_{s_{std}} =$ dscfm

GAS VELOCITY AND VOLUMETRIC FLOW RATE

Plant and City: Lake View Landfill Date: 7/22/92
Sampling Location: Outlet Clock Time: 1635
Run No.: LVL-O-V4 Operator: [illegible]
Barometric Pressure, in.Hg: 29.15 Static Pressure, in.H_2O: -.079
Moisture, %: [illegible] Molecular wt., Dry: [illegible] Pitot Tube, Cp: .84
Stack Dimension, in. Diameter or Side 1: 16 Side 2:

FIELD DATA

TRAVERSE POINT NUMBER	VELOCITY HEAD (ΔP_s), in.H_2O	STACK TEMP., °F
A-1	.003	[illegible]
2	.005	[illegible]
3	.006	[illegible]
4	.004	[illegible]
5	.004	[illegible]
6	.004	[illegible]
7	.003	[illegible]
8	.003	[illegible]
B-1	.003	[illegible]
2	.003	[illegible]
3	.006	[illegible]
4	.004	[illegible]
5	.002	[illegible]
6	.005	[illegible]
7	.005	[illegible]
8	.004	150

CALCULATIONS

$M_s = M_d \times (1 - \frac{H_2O}{100}) + 18 (\frac{H_2O}{100})$

$M_s = ($ $) \times (1 - \frac{\quad}{100}) + 18 (\frac{\quad}{100})$

$M_s =$

$T_s =$ °F = °R = (°F + 460)

$P_s = P_b + \frac{S.P.}{13.6} = ($ $) + \frac{\quad}{13.6}$

$P_s =$ in.Hg

$\sqrt{\Delta P} =$

$V_s = 85.49 \times Cp \times \sqrt{\Delta P} \times \sqrt{\frac{T_s}{P_s \times M_s}}$

$V_s = 85.49 \times ($ $) \times ($ $) \times \sqrt{\frac{\quad}{\quad}}$

$V_s =$ ft/s

$A_s =$ ft²

$Q_s = V_s \times A_s \times 60$

$Q_s =$ x x 60

$Q_s =$ cfm

$Q_{s_{std}} = Q_s \times 17.647 \times \frac{P_s}{T_s} \times (1 - \frac{H_2O\ \%}{100})$

$Q_{s_{std}} =$ x 17.647 x ——— x (1 - $\frac{\quad}{100}$)

$Q_{s_{std}} =$ dscfm

Method 25 Field Data

Plant [illegible] City Erie PA Date 7-22-92

Run No. LVL-2-1 Sample Location [illegible]

Operator D. [illegible]

Tank No. 04391 Tank Volume, Liters ~6.

Trap No. N/A ~~Rotameter~~ [illegible] No. S-520

Sampling Rate ~142 cc/min. Filter Type ______ in stack

Sintered SS out of stack

Sample Train Data

	Barometric Pressure, mm Hg	Ambient Temperature, °F °C	Sample Tank Gauge Vacuum, mm Hg
Pre-Test	760.	[illegible] °F	722.
Post-Test	760.	122. °F	248.

Front-Half - Leak Check Data

Time	Initial Vacuum, mm Hg	Time	Final Vacuum, mm Hg	ΔP, mm Hg	Leak Rate,* cc/min
1120	722.	1121	722.	0.	0.00

Sampling Data

Time		Gauge Vacuum, mm Hg	Temperatures, °F	
Clock	Sampling, min		Probe	Filter Box
1123	0.	722.	NA.	NA.
1143	10	626		
1153	20	510		
1203	30	422		
1213	40	376		
1223	50	264		
1233	60	248		

$$\text{* Leak Rate, cc/min} = \frac{\Delta P\text{, mm x Volume, cm}^3}{\text{Pb, mm x Time, min}}$$

Leak rate must be <0.01 x sampling rate
(0.6 cc/min leak rate at sampling rate of 60 cc/min)
(volume = 100 cm³ for less than 4 ft probe)

JP-11-90-2

Method 25 Field Data

Plant [illegible] City [illegible] Date [illegible]

Run No. [illegible] Sample Location [illegible]

Operator [illegible]

Tank No. 04226 Tank Volume, Liters ~6.

Trap No. N/A Rotameter No. S-500

Sampling Rate ~1000 cc/min. Filter Type ______ in stack

[illegible] out of stack

Sample Train Data

	Barometric Pressure, mm Hg	Ambient Temperature, °F °C	Sample Tank Gauge Vacuum, mm Hg
Pre-Test	760.	96.	723.
Post-Test	760.	127.	116.

Front-Half - Leak Check Data

Time	Initial Vacuum, mm Hg	Time	Final Vacuum, mm Hg	ΔP, mm Hg	Leak Rate,* cc/min
1325	723.	1326	723.	0.	000

Sampling Data

Time: Clock	Time: Sampling, min	Gauge Vacuum, mm Hg	Temperatures, °F: Probe	Temperatures, °F: Filter Box
1332	0.	723.	N/A.	N/A.
1342	10	602		
1352	20	446		
1402	30	325		
1412	40	279		
1422	50	170		
1432	60	116		

$$\text{* Leak Rate, cc/min} = \frac{\Delta P\text{, mm} \times \text{Volume, cm}^3}{\text{Pb, mm} \times \text{Time, min}}$$

Leak rate must be ≤0.01 x sampling rate
(0.8 cc/min leak rate at sampling rate of 80 cc/min)
(volume = 100 cm³ for less than 4 ft probe)

Method 25 Field Data

Plant [illegible] City [illegible] Date 7-22-92

Run No. [illegible]-0-3 Sample Location [illegible] OUTLET

Operator [illegible]

Tank No. [illegible] Tank Volume, Liters ~6.

Trap No. [illegible] Rotameter No. S-502

Sampling Rate 100 cc/min. Filter Type ______ in stack

[illegible] out of stack

Sample Train Data

	Barometric Pressure, mm Hg	Ambient Temperature, °F °C	Sample Tank Gauge Vacuum, mm Hg
Pre-Test	761.	118. °	722.
Post-Test	760.	126. °	122.

Front-Half - Leak Check Data

Time	Initial Vacuum, mm Hg	Time	Final Vacuum, mm Hg	ΔP, mm Hg	Leak Rate,* cc/min
1505	722.	1506	722.	0	0.00

Sampling Data

Time: Clock	Time: Sampling, min	Gauge Vacuum, mm Hg	Temperatures, °F: Probe	Temperatures, °F: Filter Box
1518	0	722.	n/a.	n/a.
1528	10	608		
1538	20	500		
1548	30	394		
1558	40	285		
1608	50	191		
1618	60	122		

$$\text{* Leak Rate, cc/min} = \frac{\Delta P\text{, mm} \times \text{Volume, cm}^3}{Pb\text{, mm} \times \text{Time, min}}$$

Leak rate must be ≤0.01 x sampling rate (0.6 cc/min leak rate at sampling rate of 60 cc/min) (volume = 100 cm^3 for less than 4 ft probe)

JP-1003.2

EMISSION TESTING FIELD DATA

(Mozgwe?) 2

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Lake View Co. [illegible]	7/29/92	Flare outlet	MoVent	LVL-O-M1

OPERATOR(S)	BAR. PRESS. (in. Hg)	STATIC PRESS. (in. H_2O)	AMB. TEMP. (°F)	FILTER NUMBER(S)	STACK INSIDE DIA. (in.)		PITOT TUBE Cp	PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NUMBER
DW/DC	29.92	-.078	85		116		.84	4' Quartz		

MOISTURE (%)	METER BOX NO.	METER ΔH@	METER CAL FACTOR (Y)	THERM. NO.	PITOT NO.	IMP. THERM. NO.	ORSAT NO.	TRAIN LEAK CHECK (INITIAL) in. Hg	TRAIN LEAK CHECK (INITIAL) CFM	TRAIN LEAK CHECK (FINAL) in. Hg	TRAIN LEAK CHECK (FINAL) CFM	K FACTOR	PROBE HEAT (°F)	BOX HEAT (°F)	PITOT LEAK CHECK INIT.	PITOT LEAK CHECK FINAL
	P7-10	2.01	.978			I-1		10	.000	3	.000		250	—		

TRAVERSE POINT NUMBER	SAMPLING TIME, min.	CLOCK TIME (24-hr CLOCK)	GAS METER READING (Vm), ft³	VELOCITY HEAD (Δ Ps), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMP. (Ts), °F	DRY GAS METER TEMPERATURE INLET (Tm in), °F	DRY GAS METER TEMPERATURE OUTLET (Tm out), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMP., °F	IMPINGER TEMP., °F
	0	1136	390.696									
	10		398.11		[illegible]	2.01		82	82	2		66
	20		405.52			2.01		84	82	2		66
	30	1206	412.197			2.01		87	83	2		67

MOISTURE
SAMPLE RECOVERY AND INTEGRITY SHEET

Plant Lake View Landfill Sample date 7/29/92
Sample location Flare Outlet Recovery date 7/29/92
Run number LVL-2-M1 Recovered by CKB

MOISTURE

Balance #422

Impingers	1st, 2nd, and 3rd		4th silica gel	
Final volume	246 ml	Final weight	265.1 g	
Initial volume	200 ml	Initial weight	200.0 g	
Net Gain	46 ml	Net gain	65.1 g	

Total moisture 111.1 g

EMISSION TESTING FIELD DATA

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Lake View Co. NY	7/29/92	Outlet	Hg	LVL-O-Hg

OPERATOR(S)	BAR. PRESS. (in. Hg)	STATIC PRESS. (in. H_2O)	AMB. TEMP. (°F)	FILTER NUMBER(S)	STACK INSIDE DIA. (in.)		PITOT TUBE Cp	PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NUMBER
DB/DC	29.94	-.073	86		116		.84	4' Quartz		

MOISTURE (%)	METER BOX NO.	METER ΔH@	METER CAL FACTOR (Y)	THERM. NO.	PITOT NO.	IMP. THERM. NO.	ORSAT NO.	TRAIN LEAK CHECK (INITIAL) in. Hg	TRAIN LEAK CHECK (INITIAL) CFM	TRAIN LEAK CHECK (FINAL) in. Hg	TRAIN LEAK CHECK (FINAL) CFM	K FACTOR	PROBE HEAT (°F)	BOX HEAT (°F)	PITOT LEAK CHECK INIT.	PITOT LEAK CHECK FINAL
	FT-10	2.01	.978			I-1		10	.002	3	.000		250			

TRAVERSE POINT NUMBER	SAMPLING TIME, min.	CLOCK TIME (24-hr CLOCK)	GAS METER READING (Vm), ft^3	VELOCITY HEAD (Δ Pi), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (Δ H), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL ACTUAL	STACK TEMP. (Ts), °F	DRY GAS METER TEMPERATURE INLET (T_m in), °F	DRY GAS METER TEMPERATURE OUTLET (T_m out), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMP., °F	IMPINGER TEMP., °F
	0	1533	417.344									
	10		420.86			2.01		88	87	1		67
	20		428.50			2.01		90	87	1		65
	30	1603	436.195			2.01		93	88	1.5		67
												66

MOISTURE
SAMPLE RECOVERY AND INTEGRITY SHEET

Plant [illegible] Sample date [illegible]
Sample location [illegible] Recovery date [illegible]
Run number [illegible] Recovered by [illegible]

MOISTURE

Impingers	1st, 2nd, and 3rd		4th silica gel
Final volume	237 ml	Final weight	222.3 g
Initial volume	200 ml	Initial weight	200.0 g
Net Gain	37 ml	Net gain	22.3 g

Total moisture 59.3 g

EMISSION TESTING FIELD DATA

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Lake View La AM	7/29/92	Outlet	Mercury	LVC-0-H3

OPERATOR(S)	BAR. PRESS. (in. Hg)	STATIC PRESS. (in. H_2O)	AMB. TEMP. (°F)	FILTER NUMBER(S)	STACK INSIDE DIA. (in.)		PITOT TUBE Cp	PROBE LENGTH AND TYPE	NOZZLE I.D.	NOZZLE NUMBER
YoJDC	29.9	-.07	91		116		.84	4' Quartz		

MOISTURE (%)	METER BOX NO.	METER ΔH@	METER CAL FACTOR (Y)	THERM. NO.	PITOT NO.	IMP. THERM. NO.	ORSAT NO.	TRAIN LEAK CHECK (INITIAL) in. Hg	TRAIN LEAK CHECK (INITIAL) CFM	TRAIN LEAK CHECK (FINAL) in. Hg	TRAIN LEAK CHECK (FINAL) CFM	K FACTOR	PROBE HEAT (°F)	BOX HEAT (°F)	PITOT LEAK CHECK INIT.	PITOT LEAK CHECK FINAL
	FT-10	2.01	.97			I-1		10	.002	4	.000		250			

TRAVERSE POINT NUMBER	SAMPLING TIME, min.	CLOCK TIME (24-hr CLOCK)	GAS METER READING (Vm), ft³	VELOCITY HEAD (ΔP), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMP. (Ts), °F	DRY GAS METER TEMPERATURE INLET (Tm in), °F	DRY GAS METER TEMPERATURE OUTLET (Tm out), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMP., °F	IMPINGER TEMP., °F
	0	1521	436.410									
	10		444.18			2.01		99	98	1		68
	20		451.95			2.01		100	98	1.5		67
	30	1551	459.70			2.01		102	98	1.5		68
	40	1601	467.521			2.01		104	99	1.5		67

MOISTURE
SAMPLE RECOVERY AND INTEGRITY SHEET

Plant: Lake View Landfill   Sample date: [illegible]

Sample location: Flare outlet   Recovery date: [illegible]

Run number: LV-O-1   Recovered by: [illegible]

MOISTURE

Impingers	1st, 2nd, and 3rd		4th silica gel
Final volume	240 ml	Final weight	248.8 g
Initial volume	200 ml	Initial weight	200.0 g
Net Gain	40 ml	Net gain	48.8 g

Total moisture: 88.8 g

INTERNATIONAL TECHNOLOGY CORPORATION

DRY MOLECULAR WEIGHT DETERMINATION

PLANT: Lake View Landfill

DATE: 7/29/92 TEST NO: LVL-0-1

SAMPLING TIME (24-hr CLOCK):

SAMPLING LOCATION: Outlet

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS): AF bag

ANALYTICAL METHOD: Orsat

AMBIENT TEMPERATURE: 65

OPERATOR: KW

ORSAT LEAK CHECKED: ✓

COMMENTS: Orsat #423

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	10.3	10.3	10.5	10.5	10.4	10.4	10.4	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.0	5.7	16.3	5.8	16.3	5.9	5.8	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

INTERNATIONAL TECHNOLOGY CORPORATION

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Lake View Load #1

DATE 7/14/92 TEST NO LVL-D-2

SAMPLING TIME (DAY CLOCK) [illegible]

SAMPLING LOCATION OUTLET

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) INT BAG

ANALYTICAL METHOD ORSAT

AMBIENT TEMPERATURE 85 F

OPERATOR [illegible]

ORSAT LEAK CHECKED ✓

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	10.5	10.5	10.4	10.4			10.4	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	17.0	6.5	16.8	6.4			6.4	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

INTERNATIONAL TECHNOLOGY CORPORATION

DRY MOLECULAR WEIGHT DETERMINATION

PLANT Lake View LandFill

DATE 7/29/92 TEST NO LVL-0-3

SAMPLING TIME (24-hr CLOCK) AM

SAMPLING LOCATION Orsat

SAMPLE TYPE (BAG, INTEGRATED, CONTINUOUS) Yes Bag

ANALYTICAL METHOD Orsat

AMBIENT TEMPERATURE 70's F

OPERATOR (DRJ)

ORSAT LEAK CHECKED ~

COMMENTS:

GAS \ RUN	1		2		3		AVERAGE NET VOLUME	MULTIPLIER	MOLECULAR WEIGHT OF STACK GAS (DRY BASIS) M_d, lb/lb-mole
	ACTUAL READING	NET	ACTUAL READING	NET	ACTUAL READING	NET			
CO_2	10.5	10.5	10.5	10.5			10.5	44/100	
O_2 (NET IS ACTUAL O_2 READING MINUS ACTUAL CO_2 READING)	16.9	6.4	17.0	6.5			6.4	32/100	
CO (NET IS ACTUAL CO READING MINUS ACTUAL O_2 READING)								28/100	
N_2 (NET IS 100 MINUS ACTUAL CO READING)								28/100	
								TOTAL	

EPA

NITROGEN OXIDE FIELD DATA SHEET

PLANT: NORTH AMERICAN WASTE MANAGEMENT OF PA CITY: ERIE, PA

SAMPLE LOCATION: FLARE OUTLET DATE: 7-29-92

OPERATOR: D. CAMEL INITIAL BAROMETRIC PRESSURE: 29.96 in. Hg

REAGENT VOLUME: 25 ml FINAL BAROMETRIC PRESSURE: 29.55 in. Hg

	RUN NO.	SAMPLE TIME (24 hr.)	FLASK AND VALVE NOs	VOLUME OF FLASK AND VALVE, ml	FLASK TEMP. (INITIAL), °F	INITIAL FLASK PRESSURE		FLASK TEMP. (FINAL) °F	FINAL FLASK PRESSURE	
						LEG 1 in. Hg	LEG 2 in. Hg		LEG 1 in. Hg	LEG 2 in. Hg
LVL-N-O-1A	1C	1645	AA	2049.2	87	13.6	13.6	73	1.6	1.5
"	1B	1700	MM	1964.3	87	13.5	13.5	74	0.6	0.5
"	1C	1715	BB	2052.6	87	13.5	13.5	74	1.6	1.5
"	1D	1730	2HD	2029.4	89	13.5	13.5	75	1.8	1.7
LVL-N-O-2A	1A	1745	10G	1992.9	89	13.6	13.6	73	1.6	1.5
"	2B	1800	5KB	1959.6	88	13.4	13.4	74	0.7	0.6
"	2C	1815	2KB	1983.6	89	13.5	13.5	74	1.8	1.7
"	2D	1830	22	2064.2	90	13.5	13.5	73	2.3	2.2
LVL-N-O-3A	1A	1845	6C	2014.9	89	13.6	13.6	74	1.7	1.6
	2B	1900	IR	2052.0	89	13.6	13.6	73	0.5	0.4
	3C	1915	2A	2094.8	90	13.6	13.6	74	1.8	1.7
BLK	3D	1930	MN	2051.0	90	13.5	13.5	74	0.6	0.5
			4C							

FIELD AUDIT REPORT: DRY GAS METER BY CRITICAL ORIFICE

DATE: 7-28-92 CLIENT: Waste Mgmt

BAROMETRIC PRESSURE (P_{bar}): 29.92 in.Hg METER BOX NO. EF-10

ORIFICE NO. 3 PRETEST Y: .978 ΔH@ 2.07 in.H_2O

ORIFICE K FACTOR: 5.545×10^{-4} AUDITOR: D Casaus

Orifice manometer reading ΔH_o, in.H_2O	Dry gas meter reading V_f/V_i, ft³	Temperatures: Ambient T_{af}/T_{ai}, °F	Ambient Average T_a, °F	Dry gas meter Inlet T_{if}/T_{ii}, °F	Dry gas meter Outlet T_{of}/T_{oi}, °F	Dry gas meter Average T_m, °F	Duration of run @ min.
2.55	394.80	80	80	86	83	86	16 [illegible] 60
	380.00	80		90	86		

Dry gas meter V_m, ft³	$V_{m_{std}}$, ft³	$V_{m_{act}}$, ft³	Audit, Y	Y deviation, %	Audit ΔH@, in.H_2O	ΔH@ Deviation, in.H_2O
15.20	[illegible] 14.922	[illegible]	.986	0.82	1.90	0.17

$$V_{m_{std}} = \frac{17.647 (V_m)(P_{bar} + \Delta H/13.6)}{(T_m + 460)} = [illegible] \text{ ft}^3$$

$$V_{m_{act}} = \frac{1203(\theta)(K)(P_{bar})}{(T_a + 460)} = [illegible] \text{ ft}^3$$

$$\text{Audit Y} = \frac{V_{m_{act}}}{V_{m_{std}}} = .986 \qquad \text{Y deviation} = \frac{\text{Audit Y} - \text{Pretest Y}}{\text{Pretest Y}} \times 100 = .82\%$$

$$\text{Audit } \Delta H@ = (0.0317)(\Delta H)(P_{bar})(T_m + 460) \left[\frac{\theta}{Y(V_m)(P_{bar} + \Delta H/13.6)}\right]^2 = 1.90 \text{ in.}H_2O$$

Audit Y must be in the range, pretest Y ±0.05 Y.
Audit ΔH@ must be in the range pretest ΔH@ ±0.15 inches H_2O.

THERMOCOUPLE DIGITAL INDICATOR AUDIT DATA SHEET

Date 7-23-92 Indicator No. E7-10 Operator [illegible]

Test Point No.	Millivolt signal*	Equivalent temperature, °F*	Digital indicator temperature reading, °F	Difference, %
1		1600	1591	0.44
2		1700	1690	0.46
3		1800	1784	0.49
4		1900	1885	0.50

Percent difference must be less than or equal to 0.5%.

Percent difference:

$$\frac{(\text{Equivalent temperature } °R - \text{Digital indicator temperature reading } °R)(100\%)}{(\text{Equivalent temperature } °R)}$$

Where °R = °F + 460°F

* These values are to be obtained from the calibration data sheet for the calibration device.

APPENDIX C

LABORATORY DATA

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYTICAL SERVICES

CERTIFICATE OF ANALYSIS

IT Corporation　　　　　　　　　　　　　　　　Date: September 30, 1992

Attn: Brian Carls

P.O. Number 332190

This is the Certificate of Analysis for the following samples:

Client Project ID:	North American Waste Management
Date Received:	July 31, 1992
Work Order:	X2-07-175
Number of Samples:	20
Sample Type:	Air

I. Introduction

Twenty samples arrived at ITAS Cincinnati on July 31, 1992. The samples were collected on July 29, 1992 and were labeled as follows:

Canister # LVL-O-1 Out	Flask # LVL-N-O-1A	Flask # LVL-N-O-2D
Canister # LVL-O-2 Out	Flask # LVL-N-O-1B	Flask # LVL-N-O-3A
Canister # LVL-O-3 Out	Flask # LVL-N-O-1C	Flask # LVL-N-O-3B
Canister # LVL-I-1 Inlet	Flask # LVL-N-O-1D	Flask # LVL-N-O-3C
Canister # LVL-I-2 Inlet	Flask # LVL-N-O-2A	Flask # LVL-N-O-3D
Canister # LVL-I-3 Inlet	Flask # LVL-N-O-2B	Flask # LVL-N-Blank
Canister # LVL-Blank	Flask # LVL-N-O-2C	

II. Analytical Results/Methodology

The analytical results for this report are presented by analytical test. The data will include sample identification information, the analytical results, and the appropriate detection limits.

The analyses requested included and methods used are listed on the following page.

Reviewed and Approved by:

Laurel Tomassoni
Project Manager
20715

II. Analytical Results/Methodology (cont.)

* Oxygen, Nitrogen, Carbon Monoxide, Methane, Carbon Dioxide and NMOC by EPA Method TO-12 by GC/FID

* Volatile Organics by Gas Chromatography/Mass Spectrometry, EPA Method TO-14

* NOx, EPA Method 7E

III. Quality Control

Immediately following the analytical data for the samples can be found the QA/QC information that pertains to these samples. The purpose of this information is to demonstrate that the data enclosed is scientifically valid and defensible. This QA/QC data is used to assess the laboratory's performance during the analysis of the samples it accompanies. All quantitations were performed within the calibrated range of the analytical instrument.

IV. Data Report Qualifiers

Following are descriptions of data report qualifiers which may have been used in this analytical report.

U The analyte was not detected in the sample or extract. The value reported with the "U" is the detection limit for that compound in that sample.

VALUE The result is a value equal to or greater than the detection limit for that compound.

J Indicates an estimated value. This flag is used when mass spectral data indicates the presence of the compound, but the result is less than the specified detection limit.

B This flag is used whenever the analyte is found in the blank as well as in the sample.

E This flag indicates that the quantity of this compound detected in this sample is above the linear range of the instrument. Results are probably lower than actual.

V. Comments

The samples were diluted in helium to accomodate the NMOC analysis. Therefore, the data for volatile organics may be biased high.

The report is being reformated to include ETAS additional subcontractor data for NMOC by EPA Method TO-12 GC/FID. EPA Methods ASTM D3416 and EPA Method 25 did not have adequate detection limits.

Client: ETHOS NAMM
Work Order: X2-07-175
2071750Z

IT ANALYTICAL SERVICES
CINCINNATI, OH

Analytical Results, Total ng

Client Sample ID	Lab No.	NOx 1st Run	NOx 2nd Run	NOx Average
Blank @ LVL-N-O-1A	08	60	66	63
Blank @ LVL-N-O-1B	09	74	68	71
Blank @ LVL-N-O-1C	10	83	81	82
Blank @ LVL-N-O-1D	11	60	61	60
Blank @ LVL-N-O-2A	12	88	84	86
Blank @ LVL-N-O-2B	13	71	71	71
Blank @ LVL-N-O-2C	14	65	69	67
Blank @ LVL-N-O-2D	15	70	67	68
Blank @ LVL-N-O-3A	16	77	76	77
Blank @ LVL-N-O-3B	17	56	60	58
Blank @ LVL-N-O-3C	18	50	51	51
Blank @ LVL-N-O-3D	19	71	69	70
Blank @ LVL-N-Blank	20	ND	ND	ND

Detection Limit = 26 Total ng

ND = Not detected at or above the reported detection limit

Client: ITRCS NAVM
Work Order: 92-07-175
20717540

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organics

Client ID: Cartridge # LVL-0-1 Cart

Lab No.: 92-07-175-01

Date Analyzed: 8/24/92, 8/26/92
Dilution Factor: 27

Compound	ppb v/v	Detection Limit
Vinyl Chloride	ND	5.4
Chloroethane	ND	5.4
1,1-Dichloroethene	ND	5.4
Methylene Chloride	210 - (1)	240
Chloroform	ND	5.4
Benzene	ND	5.4
1,2-Dichloroethane	ND	5.4
1,1,1-Trichloroethane	5.5 -	5.4
Carbon Tetrachloride	ND	5.4
Trichloroethene	ND	5.4
Tetrachloroethene	ND	5.4

(1) Dilution Factor = 1214

Client: IPAGS NAVM
Work Order: X2-07-175
2077541

ET ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organics

Client ID: Canister # LVL-C-2 Out

Date Analyzed: 8/28/92
Dilution Factor: 24

Lab No.: X2-01-175-02

Compound	ppb v/v	Detection Limit
Vinyl Chloride	ND	4.8
Chloromethane	ND	4.8
1,1-Dichloroethene	ND	4.8
Methylene Chloride	450 (1)	220
Chloroform	ND	4.8
Benzene	ND	4.8
1,2-Dichloroethane	ND	4.8
1,1,1-Trichloroethane	3.8 J (1)	220
Carbon Tetrachloride	ND	4.8
Trichloroethene	ND	4.8
Tetrachloroethene	ND	4.8

(1) Dilution Factor = 1000

ND = Not detected at or above the reported detection limit

Client: TTNUS NAVY
Work Order: 92-07-175
20717562

PT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organics

Client ID: Canister # 1WL-0-3 Out

Date Analyzed: 8/24/92
Dilution Factor: 26

Lab No.: 92-07-175-03

Compound	ppb v/v	Detection Limits
Vinyl Chloride	ND	5.2
Chloromethane	ND	5.2
1,1-Dichloroethene	ND	5.2
Methylene Chloride	330 (1)	240
Chloroform	ND	5.2
Benzene	ND	5.2
1,2-Dichloroethane	ND	5.2
1,1,1-Trichloroethane	ND	5.2
Carbon Tetrachloride	ND	5.2
Trichloroethene	ND	5.2
Tetrachloroethene	ND	5.2

(1) Dilution Factor = 1178

ND = Not detected at or above the reported detection limit

Client: ITAGS NAVY
Work Order: 92-07-175
207175A3

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organics

Client ID: Canister # LVL-Blank

Date Analyzed: 8/26/92
Dilution Factor: 10

Lab No.: 92-07-175-07

Compound	ppb v/v	Detection Limit
Vinyl Chloride	1.3 J	2
Chloroethane	ND	2
1,1-Dichloroethene	ND	2
Methylene Chloride	2.7	2
Chloroform	ND	2
Benzene	ND	2
1,2-Dichloroethane	ND	2
1,1,1-Trichloroethane	ND	2
Carbon Tetrachloride	ND	2
Trichloroethene	ND	2
Tetrachloroethene	1.2 J	2

ND = Not detected at or above the reported detection limit

Client: ITAQS NAAM
Work Order: 92-07-175
2071754d

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organics

Client ID: Method Blank

Date Analyzed: 8/24/92
Dilution Factor: 1

Lab No.: ABLKV1

Compound	ppb v/v	Detection Limit
Vinyl Chloride	ND	0.2
Chloromethane	ND	0.2
1,1-Dichloroethene	ND	0.2
Methylene Chloride	ND	0.2
Chloroform	ND	0.2
Benzene	ND	0.2
1,2-Dichloroethane	ND	0.2
1,1,1-Trichloroethane	ND	0.2
Carbon Tetrachloride	ND	0.2
Trichloroethene	ND	0.2
Tetrachloroethene	ND	0.2

ND = Not detected at or above the reported detection limit

Client: ITAGS NAVY
Work Order: 92-07-175
20017545

IT ANALYTICAL SERVICES
CINCINNATI, OH

Volatile Organics

Client ID: Method Blank

Date Analyzed: 8/28/92
Dilution Factor: 1

Lab No.: ABLK94

Compound	ppb w/w	Detection Limit
Vinyl Chloride	ND	0.2
Chloromethane	ND	0.2
1,1-Dichloroethene	ND	0.2
Methylene Chloride	ND	0.2
Chloroform	ND	0.2
Benzene	ND	0.2
1,2-Dichloroethane	ND	0.2
1,1,1-Trichloroethane	ND	0.2
Carbon Tetrachloride	ND	0.2
Trichloroethene	ND	0.2
Tetrachloroethene	ND	0.2

ND = Not detected at or above the reported detection limit

Client: ITAGS MASK
Work Orders: X2-07-175
20717503

IT ANALYTICAL SERVICES
CINCINNATI, OH

Analytical Results, % (1)

Client Sample ID	Canister # LVL-C-1 Can 01	Canister # LVL-C-2 Can 02	Canister # LVL-C-3 Can 03	Detection Limit
Lab No.				
Analyte				
Oxygen	11.2	11	9.6	0.1
Nitrogen	79.6	79.8	80.4	0.1
Carbon Monoxide	ND	ND	ND	0.1
Methane	ND	ND	ND	0.1
Carbon Dioxide	9.0	9.2	10	0.1

Client Sample ID	Canister # LVL-I-1 Inlet 04	Canister # LVL-I-2 Inlet 05	Canister # LVL-I-3 Inlet 06	Detection Limit
Lab No.				
Analyte				
Oxygen	1.3	0.6	0.8	0.3
Nitrogen	5.9	4.2	4.0	0.3
Carbon Monoxide	ND	ND	ND	0.3
Methane	53.8	54.9	55.4	0.3
Carbon Dioxide	39.1	40.1	39.8	0.3

Client Sample ID	Canister # LVL-Blank 07	Detection Limit
Lab No.		
Analyte		
Oxygen	ND	0.1
Nitrogen	ND	0.1
Carbon Monoxide	ND	0.1
Methane	ND	0.1
Carbon Dioxide	ND	0.1

ND = Not detected at or above the reported detection limits

(1) Results normalized to 100%

Client: ETMS NAMM
Work Order: X2-07-175
207117550

IT ANALYTICAL SERVICES
CINCINNATI, OH

Analytical Results, ppbv

Client Sample ID	Lab No.	TMOC *	Detection Limit
Canister # LVL-O-1 Out	01	3300	27
Canister # LVL-O-2 Out	02	4400	24
Canister # LVL-O-3 Out	03	2000	26
Canister # LVL-I-1 Inlet	04	460000	1200
	04 DUP	420000	1200
Canister # LVL-I-2 Inlet	05	460000	1300
Canister # LVL-I-3 Inlet	06	470000	1300
Canister # LVL-Blank	07	1100	10
Method Blank		ND	10

ND = Not detected at or above the reported detection limit

* Referenced to Heptane

INTERNATIONAL
TECHNOLOGY
CORPORATION

By [illegible] Date 1/9/92 Subject Calculation of Blank value at average sample volume Sheet No. 1 of 1

Chkd. By [illegible] Date 1/9/92 Proj. No. 222492

0.5cm. X 0.5cm.

LVL - Blank value = 1100 ppb

Avg Outlet Pressure initial absolute mm = 573.8 mm *

LVL-Blank Final Pressure, in psig = 15.4 * P_{bar} = 751 mm Hg *

LVL-Blank Final Pressure absolute, mm =

$$\left(15.4 \times \frac{760}{14.7}\right) + 751 = 1547.2$$

$$\text{Dilution factor} = \frac{P_{final},\ mmHg}{\text{Avg } P_{initial},\ mmHg} = \frac{1547.2}{573.8} = 2.650$$

Blank value to Avg sample volume = 1100 x 2.650 = 2915 ppb JP approx

Blank Corrected Outlet Concentrations

	Analytical Results, ppb	Blank value, ppb	Corrected Outlet concentration, ppb
Run # 1	3300	2900	400
Run # 2	4400	2900	1500
Run # 3	2,000	2900	0

* SEE ATTACHED DATA, Pressure Page. JP

Dilution Record of TT_AQS_NAWM
With HE AT 15 PSI

ANALYST: RWB

DATE: 07/5/92

ATMOSPHERIC PRESSURE (mm. HG) 751

Work order # 92-07-175

Pressure Dilution Table

Sample	Can #	P. initial in.inches	P. initial absolute.mm	P. final in.psig	P. final in.mmHg.	Dilution Factor
01A	04997	-7.00	573.2	15.6	1,557.0	2.716
02A	04326	-6.45	587.2	13.2	1,433.6	2.442
03A	04163	-6.30	591.0	15.6	1,557.0	2.636
04A	04170	-4.20	644.3	15.6	1,557.0	2.418
05A	04742	-4.60	694.2	16.4	1,599.1	2.303
06A	11961	-4.75	690.4	16.2	1,614.6	2.561
07A	02112	-29.60		15.9		1.000

Dilution Factor Table

Notebook Data Location #001 PAGE 35

APPENDIX D

SAMPLING AND ANALYTICAL PROCEDURES

DETERMINATION OF SELECTED VOLATILE ORGANIC COMPOUNDS AND TOTAL GASEOUS NONMETHANE ORGANIC EMISSIONS

Sampling and analysis for selected volatile organic compounds (VOC) and total gaseous nonmethane organic compounds (NMO) are conducted in accordance with sampling procedures described in U.S. Environmental Protection Agency (EPA) Method TO14* and proposed U.S. EPA Method 25C.** Since both methodologies required evacuated canisters as the collection media, one sample is obtained and analyzed by the respective procedures of each method for the required pollutants.

Sampling Apparatus

A schematic of the sampling apparatus used at the landfill gas flare inlet is shown in Figure D-1. Figure D-2 depicts the sampling apparatus used at the landfill gas flare outlet. The outlet sampling train differs from the inlet by the addition of a moisture knock-out jar, which is used to remove possible condensation produced by cooling the exhaust gases from the exit of the landfill gas flare. The sampling trains used in these tests meet design specifications established by the U.S. EPA. Assembled by IT personnel, the train consists of the following:

Gas Collection Tank: - 316 stainless steel tank with premeasured volume of approximately 6.0 liters. Tank is fitted with a valve and the interior surfaces are SUMMA™ passivated.

Sampling Regulator System - A mercury manometer to monitor changes in tank pressure during sampling, stainless steel flow shutoff valve to start and stop sample flow, 2-µm sintered stainless steel in-line filter, and calibrated preset stainless steel flow meter to maintain constant flow rate.

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* Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. EPA-600/4-84-041. April 1984.

** 56 FR 24468, May 30, 1991.

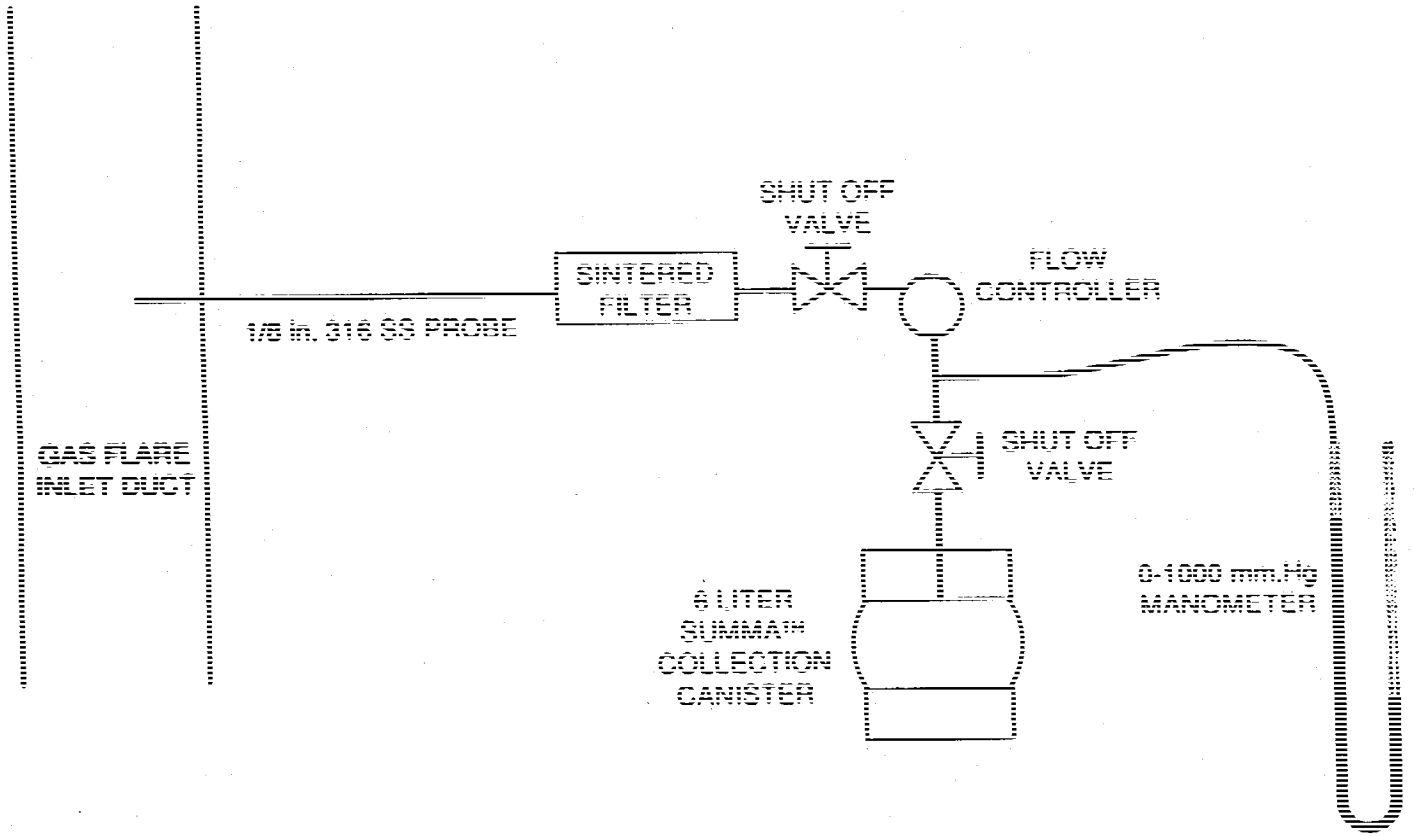

Figure D-1. VOC/NMO sampling train - flare inlet.

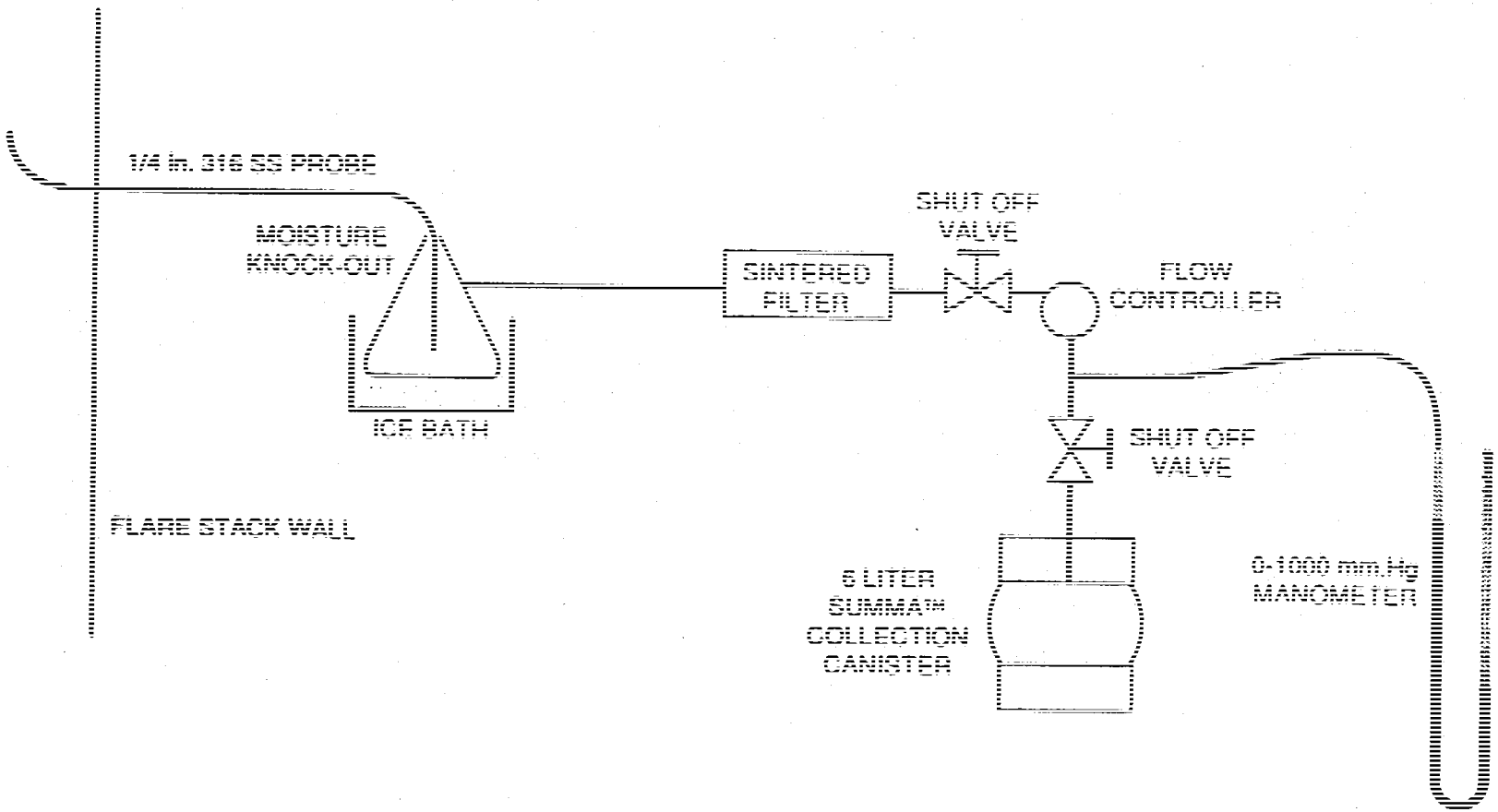

Figure D-2. VOC/NMO sampling train - flare outlet.

Pressure Gauge - U-tube mercury manometer with a range of 0 to 1000 millimeters of mercury (mmHg) to measure tank pressure to the nearest 1 mmHg.

Vacuum Pump - Single-stage vacuum pump to evacuate sample tanks to an absolute pressure of 10 mmHg.

Sampling Procedures

Prior to sampling, the collection tank is evacuated to 10 mmHg absolute pressure and the sampling train is allowed to sit for a predetermined period of time. An acceptable leak check is considered to be no change in pressure during this period. This procedure is conducted in the laboratory before transport to the sampling site. At the sampling site (prior to sampling) the internal pressure is checked and recorded to verify no leakage occurs during transport. Sampling proceeds if the tank pressure is within 10 mmHg of absolute pressure. If the canister fails this check, it is either discarded or reevacuated and observed to determine the movement within a predetermined period time. If at this time no change is observed, the canister is considered acceptable for use. The sampling trains are assembled as shown in Figures D-1 and D-2. The outlet sampling train is leak-checked from the probe inlet to the shutoff valve on the collection tank. This is conducted following procedures described in U.S. EPA Method 25.* The ambient temperature and barometric pressure are recorded.

After the leak check, the probe is inserted into the gas stream, the valve connected to the collection tank is closed, and the sampling train is purged with sample gas using the vacuum pump. At least two sample probe volumes are evacuated from the system at a flow rate similar to that of sampling. Once the purge is complete, sampling is begun by closing the vacuum pump valve and opening the collection tank valve. The flow is maintained at a constant rate by the preset flow controller. Manometer readings are recorded at 10-minute intervals throughout the sampling period.

After completion of the test, the collection tank pressure and temperature are measured and the train is disassembled and transported to the laboratory for the appropriate analyses.

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* 40 CFR 60, Appendix A, July 1991.

Analytical Procedure for Selected VOCs

Because the collection tanks are sampled down to near ambient pressures, the tanks are pressurized with humidified helium in the laboratory to facilitate sample travel from the canister as a result of positive pressure release. A dilution factor is calculated for each canister and is reported on the analytical data sheets presented in Appendix C. Analyses are performed for the pollutants listed in Table D-1 by removing an aliquot from the collection tank and injecting it into the gas chromatograph/mass spectroscopy (GC/MS) sample loop. Sample components are separated by GC utilizing fused silica capillary columns. Mass analysis is performed on each peak and ion counts are recorded for quantitation by GC/MS full scan.

TABLE D-1. VOC COMPOUNDS

Benzene	Perchloroethylene
Chloroform	Trichloroethylene
1,2-Dichloroethane	Carbon tetrachloride
Methyl chloride	Vinylidene chloride
Methylene chloride	Vinyl chloride

Each SUMMA™ polished collection is cleaned and batch blank-checked before sampling. The cleaning cycle consists of placing the tanks on a manifold system within a 150°C heated oven, then evacuating and pressurizing the tanks. The evacuation/pressurization cycles are conducted 25 times and then the canisters are removed under vacuum. One tank from each batch is blank-checked and the batch is considered clean if all target compounds are less than 0.2 ppb and there are no unknown peaks not already present in the direct analysis of the ultrapure air.

The analytical system is tuned daily with 4-bromofluorobenzene to meet the key ion and ion abundance criteria of TO14.

An initial minimum three-point calibration is conducted; check standards are run every 12 hours.

Sample identities are confirmed by Triple Plot mass spectra, which simultaneously display the enhanced target compound spectra, the unenhanced target compound spectra, and the library spectra of the target compound.

Analytical Procedures for Permanent Gases

Prior to analysis, the gas chromatograph/thermal conductivity detector (GC/TCD) is calibrated with at least three concentrations in the expected range of each compound of interest and the linearity of the detector is verified. An aliquot of the sample is extracted from the canister and injected into the GC. Each sample is analyzed in duplicate.

Analytical Procedures for NMVOCs (TO-12*)

Analytical System Leak Check

The analytical system is pressurized to approximately 50 psig with zero air. If after 3 hours the pressure does not drop more than 2 psig, the system is considered leak-tight.

System Calibration

The calibration curve is determined by injecting five or more gas standards on the range to be used. Each standard is analyzed three times. The relative standard deviation for the three analyses should be less than 3 percent. Linearity is expected and should be checked. If nonlinearity is observed, the problem is identified and corrected.

Sample Analysis

The NMVOC sample container is attached to the sample manifold. A vacuum reservoir draws the sample through the system where the NMVOCs are trapped in the cryogenic cooler. The system flow is then reversed and the trap is heated to 90°C. The NMVOCs volatilize and are directed to the gas chromatograph/flame ionization detector (GC/FID) for measurement. The GC/FID is calibrated using heptane standards; therefore, all results are stated as heptane.

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* Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA-600/4-84-041, June 1987.

DETERMINATION OF NITROGEN OXIDE EMISSIONS

This test program follows the sampling procedures described in EPA Method 7A.*

Sampling Apparatus

The nitrogen oxide (NO_x) sampling train used in these tests meets design specifications established by the Federal EPA. Assembled by ITACS personnel, it consists of the following:

Probe - Borosilicate glass tubing with a heating system capable of maintaining a gas temperature of approximately 250°F at the exit end to prevent water condensation. A glass-wool plug is placed in the end of the probe to remove particulate matter, as shown in Figure D-3.

Collection Flask - Two-liter borosilicate, round-bottom flask, with short neck and 24/40 standard taper opening, protected against implosion or breakage.

Flask Valve - Two-way stopcock connected to a 24/10 standard taper joint.

Manifold - Two- and three-way Teflon stopcock and connected 24/10 standard taper joints.

Temperature Gauge - Dial-type thermometer capable of measuring 2°F intervals from 25° to 125°F.

Vacuum Line - Tubing capable of withstanding a vacuum of 3 in.Hg absolute pressure, with "T" connection and T-bore stopcock.

Vacuum Gauge - U-tube manometer, 36 in.Hg with 0.1-in. divisions.

Pump - Capable of evacuating the collection flask to a pressure equal to or less than 3 in.Hg absolute.

Barometer - Aneroid type to measure atmospheric pressures to ±0.1 in.Hg.

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* 40 CFR 60, Appendix A, July 1990.

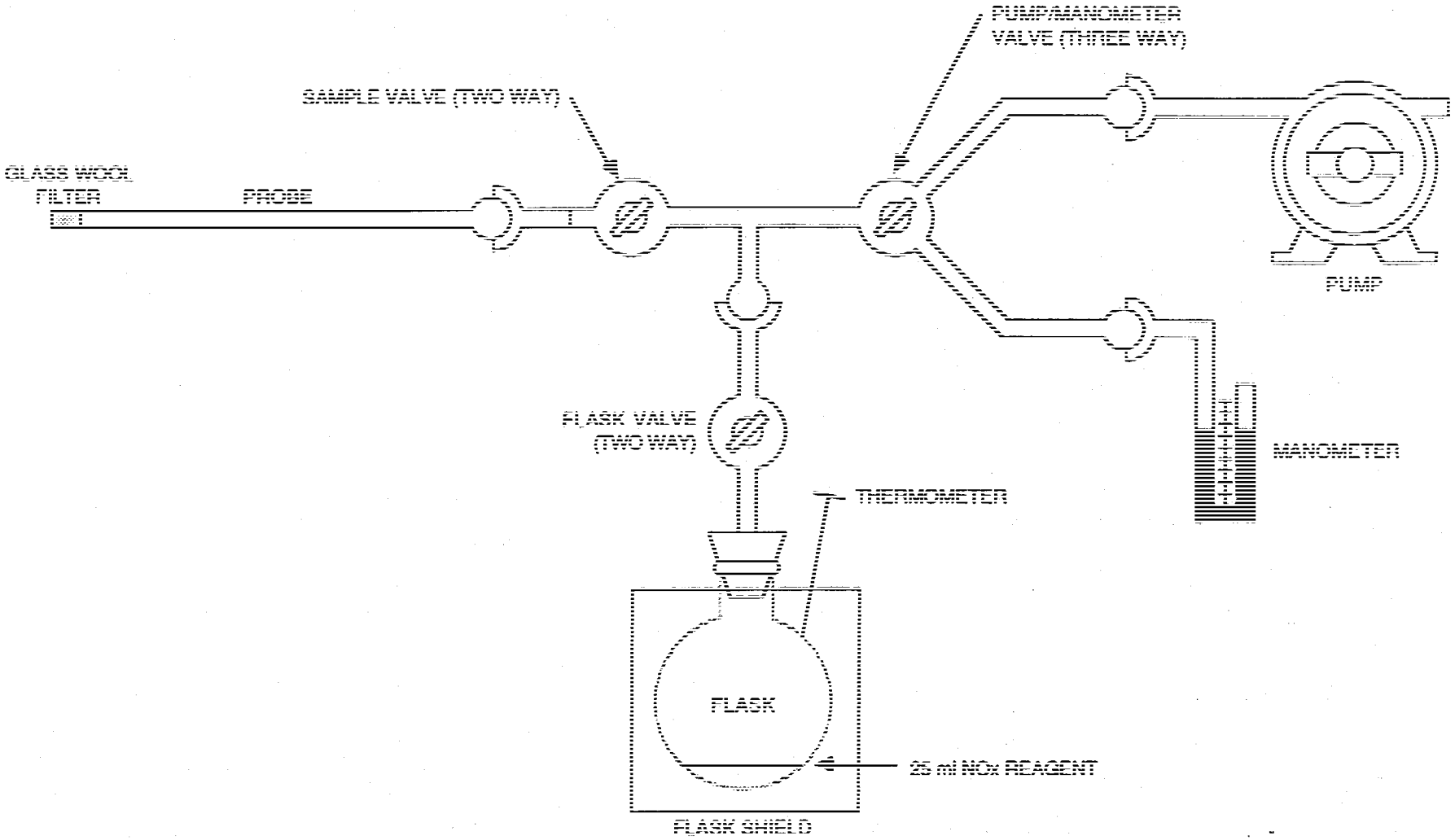


Figure D-3. Method 7 sampling train.

Sampling Procedure

Following the selection of the sampling site and minimum number of traverse points, the stack pressure, temperature, moisture, and range of velocity head are measured according to procedures described in EPA Methods 1 through 4.*

One sampling point, representing the average flow rate, is chosen. The sampling flask is charged with 25 mL of absorbing solution (made by mixing 1 liter of distilled water, 2.8 mL of concentrated H_2SO_4, and 6 mL of 3 percent H_2O_2). A portion of the reagent is retained for use in preparing the calibration standards.

With the sample valve closed, the flask valve open, and the pump/manometer valve open to pump, the flask is evacuated to less than 3 in.Hg absolute pressure. Flask vacuum is determined by moving the pump/manometer valve to manometer. Leakage is checked by observing the manometer for pressure fluctuation. Any variation greater than 0.4 in.Hg over a 1-minute period is corrected before sampling.

With the flask closed, the sample valve open, and the pump/manometer valve turned to pump, the sampling apparatus is purged for 5 minutes. The probe heater setting is adjusted to prevent any visible condensation. With the sample valve closed and the pump/manometer valve open to manometer, an initial flask vacuum is determined by opening the flask valve. The sample valve is then slowly opened, allowing stack gas to enter the flask. The vacuum is allowed to drop to 3 in.Hg (approximately 15 seconds), and then the sample flask valves are closed. The flask is shaken for 5 minutes to ensure contact between the sample and absorbing solution.

Sample Recovery Procedure

The collection flasks are transported to the laboratory for sample recovery. The flasks are set aside for a minimum of 16 hours. At the end of the period, the flasks are shaken for 2 minutes and the final flask pressure and temperatures are measured. All pertinent data are recorded on the recovery data sheets.

* 40 CFR 60, Appendix A, July 1990.

The contents of the flask are measured volumetrically and transferred to a polyethylene container. The flask is then rinsed with two separate 5-mL portions of deionized, distilled water, and the solution is added to the same container.

Analytical Procedure

The volume of absorbing solution is recorded and diluted to 50 mL with deionized, distilled water. A 5-mL aliquot of this solution is pipetted to a volumetric flask and diluted to 50 mL with deionized water. The samples from the second dilution are analyzed by ion chromatography. A calibration curve of μg NO_x versus peak area response is prepared using standards of known concentration.

APPENDIX E

CALIBRATION PROCEDURES AND RESULTS

CALIBRATION PROCEDURES AND RESULTS

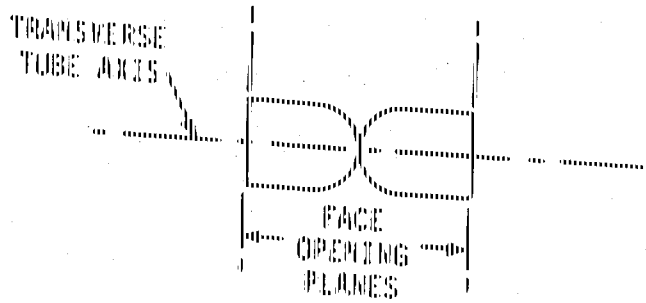
All of the equipment used is calibrated in accordance with the procedures outlined in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II.* The following pages describe these procedures and include the data sheets.

*EPA 600/4-77-027b.

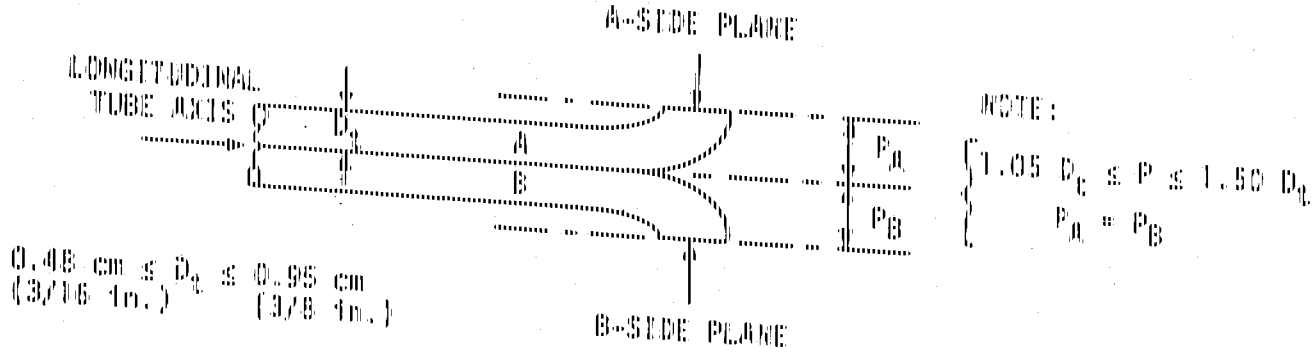
Pitot Tube Calibration

Each pitot tube used in sampling is constructed by ITACS and meets all requirements of EPA Method 2, Section 4.1.* Therefore, a baseline coefficient of 0.84 is assigned to each pitot tube. The following pages show the alignment requirements of Method 2 and the Pitot Tube Inspection Data Sheet(s) for each pitot tube used during the test program.

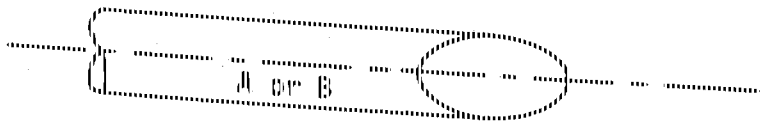
*40 CFR 60, Appendix A, July 1989.



(a) ENDVIEW

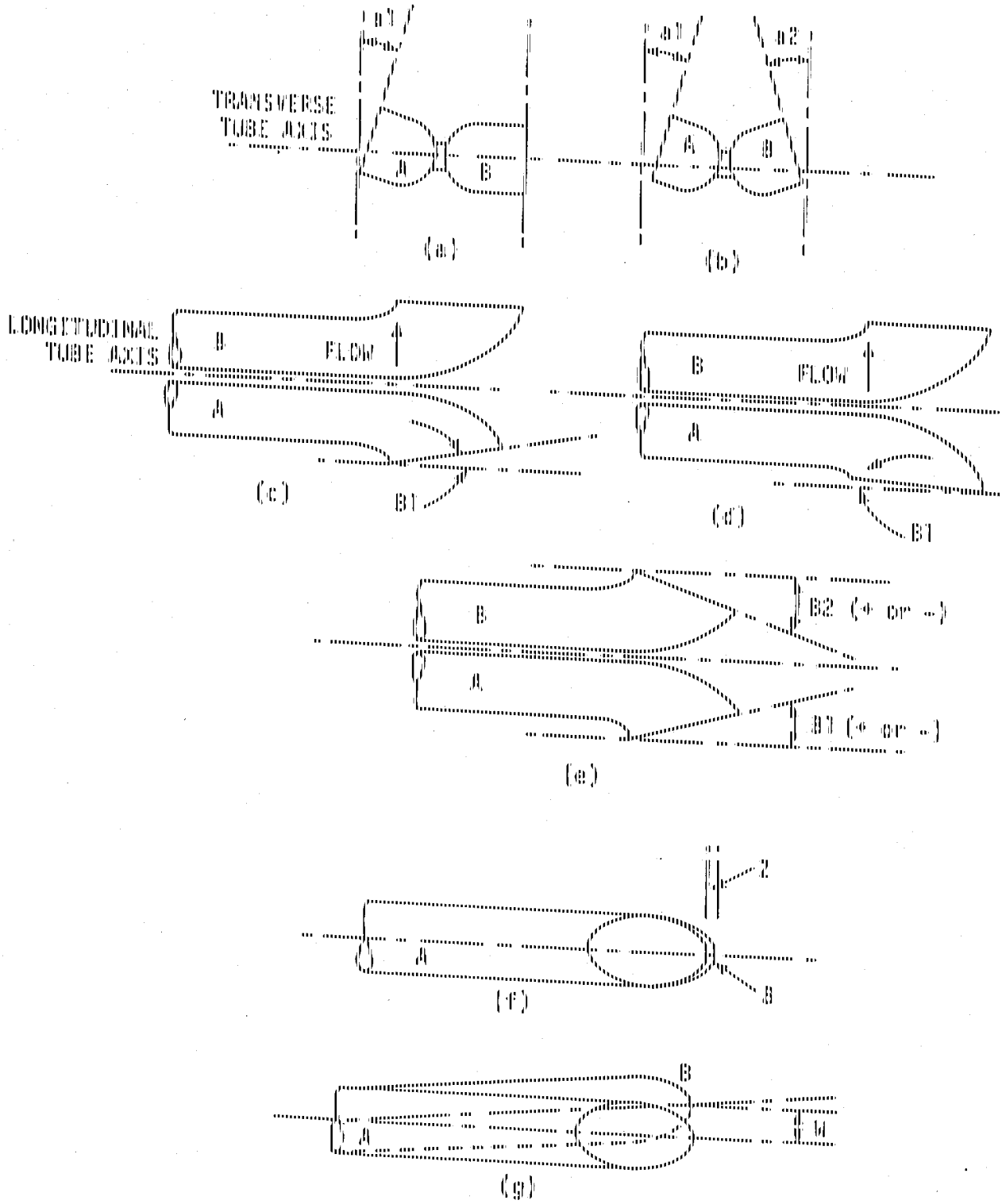


(b)



(c)

Properly constructed Type S pitot tubes shown in: (a) end view, face opening planes perpendicular to transverse axis; (b) top view, face opening planes parallel to longitudinal axis; (c) side view, both legs of equal length and centerlines coincident when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.



Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect Cp as long as a_1 and a_2 are $<10°$, B_1 and B_2 are $<5°$, z is <0.32 (1/8 in.), and w is <0.08 cm (1/32 in.).

INTERNATIONAL TECHNOLOGY CORPORATION

PITOT TUBE INSPECTION DATA SHEET

Pitot Tube No. S05-3' Date 12-9-91 Inspector T. Mahoney

α_1 degrees	α_2 degrees	β_1 degrees	β_2 degrees
2	3	2	3
<10°	<10°	<5°	<5°

D_t inches	P inches	1.05 D_t inches	1.50 D_t inches
.378	.926	.397	.567
0.185 ≤ D_t ≤0.380	"	"	"

γ degrees	φ degrees	$P_{\sin(\gamma)}$ inches	$P_{\sin(\varphi)}$ inches
2	1	.035	.017
"	"	≤0.125	≤0.09125

P_1 inches	P_2 inches	$\lvert P_1 - P_2 \rvert$ inches	Meet specifications
.485	.491	.004	✓
1.05 D_t ≤P_1 ≤1.50 D_t	1.05 D_t ≤P_2 ≤1.50 D_t	≤0.010	

Lower line in each table is limits for meeting specifications.

Checked by Doug Calvert Date 12/10/91

PITOT TUBE INSPECTION DATA SHEET

Pitot Tube No. [illegible] Date [illegible] Inspector [illegible]

α_1 degrees	α_2 degrees	β_1 degrees	β_2 degrees
1°	3°	2°	1°
<10°	<10°	<5°	<5°

D_t inches	P inches	1.05 D_t inches	1.50 D_t inches
.359	1.041	.376	.539
$0.185 \leq D_t < 0.380$	-	-	-

γ degrees	φ degrees	$P\sin(\gamma)$ inches	$P\sin(\varphi)$ inches
2°	1°	[illegible]	[illegible]
-	-	<0.125	<0.03125

P_1 inches	P_2 inches	$\lvert P_1 - P_2 \rvert$ inches	Meet specifications
.520	.521	[illegible]	✓
$1.05\ D_t < P_1 < 1.50\ D_t$	$1.05\ D_t < P_2 < 1.50\ D_t$	≤ 0.010	

Lower line in each table is limits for meeting specifications.

Checked by [illegible] Date [illegible]

Dry Gas Meter and Orifice Meter

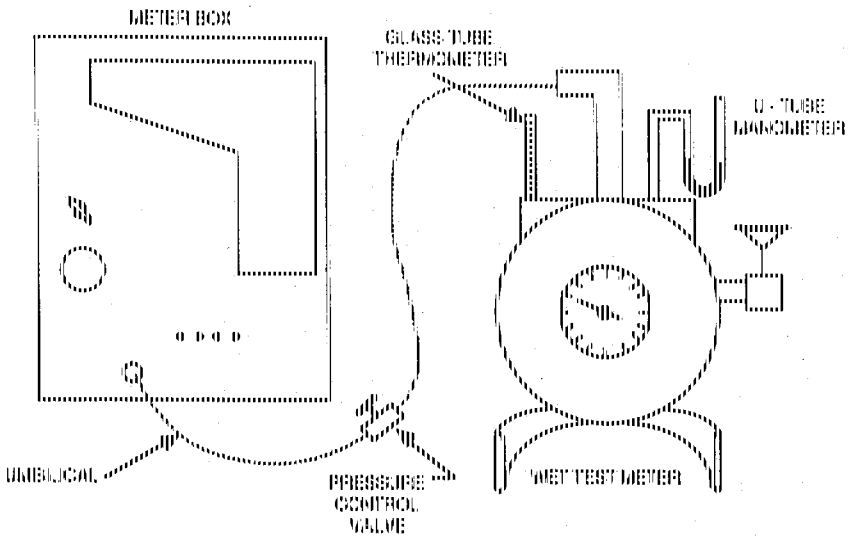
The following page shows the Calibration Setup used for the initial and post-test calibration. A wet-test meter with a 2-cubic-feet-per-minute capacity and ±1 percent accuracy is used. The pump is run for approximately 15 minutes at an orifice manometer setting of 0.5 in.H_2O to heat up the pump and wet the interior surface of the wet-test meter. The information in the following example Calibration Data Sheet is gathered for the initial calibration; the ratio of accuracy of the wet-test meter to the dry-test meter and the $\Delta H@$ are then calculated.

Post-Test Meter Calibration Check

A post-test meter calibration check is made on each meter box used during the test to check its accuracy against the last calibration check. This post-test calibration must be within ±5 percent of the initial calibration. The initial calibration is performed as described in APTD-0576. The post-test calibration is performed by the same method. Three calibration runs are made by using the average orifice setting obtained during each test run and setting the vacuum at the maximum value obtained during each test run. The post-test calibration check indicated that all three runs for each meter box were within the ± 5 percent range allowed by EPA Method 5.*

The Particulate Sampling Meter Box Initial Calibration and Post-Test Calibration data sheets are included in the following pages.

* 40 CFR 60, Appendix A, July 1990.



Calibration setup.

DATE ..... METER BOX NO. .....

BAROMETRIC PRESSURE, P_b = ... in. Hg DRY GAS METER NO. .....

ORIFICE MANOMETER SETTING ΔH in. H_2O	GAS VOLUME WET TEST METER V_w, ft³	GAS VOLUME DRY GAS METER V_d, ft³	WET TEST METER T_w, °F	DRY GAS METER			TIME (θ), min.	Y	$\Delta H@$
				INLET t_{di}, °F	OUTLET t_{do}, °F	AVERAGE t_d, °F			
0.5	5								
1.0	5								
1.5	10								
2.0	10								
3.0	10								
4.0	10								

AVERAGE .....

		Y	$\Delta H@$	
ΔH	$\Delta H@$ "130"	$\frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\frac{0.0317\ \Delta H}{P_b (t_d + 460)}$	$\left[\frac{(t_w + 460)(2)}{V_w}\right]^2$
0.5	0.0968			
1.0	0.0737			
1.5	0.110			
2.0	0.107			
3.0	0.221			
4.0	0.294			

Y = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ± 0.05

$\Delta H@$ = Orifice pressure differential that gives 0.75 cfm of air at 70° F and 29.92 inches of mercury, in. H_2O. Tolerance = ± 0.15

Calibration data sheet.

METER BOX INITIAL CALIBRATION

Date: 11/19/91 | Meter Box No.: FT-10

Barometric Pressure, (Pbar): 29.68 | Calibration: BJ G.

Run No.	Orifice manometer setting* ΔH in. H2O	Wet test meter volume Vw ft3	Dry gas meter volume Vd ft3	Temperatures: Wet test meter Tw °F	Dry gas meter: Inlet Tdi °F	Dry gas meter: Outlet Tdo °F	Dry gas meter: Average Td °F	Vacuum setting** in. Hg	Duration of run, θ min.	Duration of run, θ sec
			641.499	71	77	76				
1	0.50	5.000	646.638	71	79	74	76.3	10	13	23
			647.119	71	79	74				
2	1.00	10.000	657.431	71	81	75	77.3	10	18	46
			658.144	71	81	75				
3	1.50	10.000	668.478	71	83	76	78.8	10	19	49
			668.812	71	83	76				
4	2.00	10.000	679.149	71	84	77	80.0	10	19	28
			679.669	71	84	77				
5	3.00	10.000	690.356	71	85	77	80.8	10	19	51
			691.496	71	85	77				
6	4.00	10.000	701.670	71	86	78	81.5	10	9	23

Run No.	Y	ΔH@
1	0.981	2.08
2	0.979	1.97
3	0.978	2.06
4	0.979	2.02
5	0.978	1.97
6	0.978	1.96
Pretest average	0.978	2.01
Difference*=	0.004	0.12

$$y = \frac{(Vw \times Pbar \times (Td+460))}{(Vd \times Pbar \times \Delta H/13.6 \times (Tw+460))}$$

$$\Delta H@ = \frac{(0.0317 \times \Delta H \times \theta)}{(Pbar \times (Td+460))} \left[\frac{(Tw+460)}{Vw} \right]^2$$

Date checked by: [signature]

Date: 01/24/91

* Y must not deviate by more than ±0.02Y.

ΔH@ must not deviate by more than ±0.15 ΔH@.

Stack Thermocouples

Each thermocouple is calibrated by comparing it with an ASTM-3F thermometer at approximately 32° F, ambient temperature, 100° F, and 500° F. The thermocouple read within 1.5 percent of the reference thermometer throughout the entire range when expressed in degrees Rankine. If the stack gas is saturated with moisture, the thermocouple is calibrated at 10° intervals between 70° and 180° F using a water bath. The thermocouple agreed within ±2° F of the reference thermometer over the entire range. The thermocouples may be checked at ambient temperature at the test site to verify the calibration. Calibration data are included in the following Thermocouple Calibration Data Sheet(s).

INTERNATIONAL TECHNOLOGY CORPORATION

THERMOCOUPLE CALIBRATION DATA SHEET

Date: 12-10-91 Thermocouple No: 101 3FT

Calibrator: J. Watkins Reference: ASTM

Range:

Reference point no.	Source*	Reference thermometer temperature °F	Thermocouple temperature °F	Difference %**
1	2	67	66	.19 %
2	1	35	35	0 %
3	3	213	213	0 %
4	4	460	459	.11 %

* Source: 1) Ice bath
2) Ambient
3) Water bath
4) Oil bath

** Percent difference.

$$\frac{\text{Reference temp. °R} - \text{thermocouple temp. °R}}{(\text{Reference temp. °R})} \times 100\%$$

where °R = °F + 460

Each percent difference must be less than or equal to 1.5%.

Checked by [illegible] Date [illegible]

THERMOCOUPLE CALIBRATION DATA SHEET

Date: 12-11-91 Thermocouple No: 245 - 12 FT

Calibrator: T. Williams Reference: AST M

Range:

Reference point no.	Source*	Reference thermometer temperature °F	Thermocouple temperature °F	Difference %**
1	2	71	71	0 %
2	1	34	34	0 %
3	3	212	212	0 %
4	4	194	194	0 %

* Source: 1) Ice bath
2) Ambient
3) Water bath
4) Oil bath

** Percent difference.

$$\frac{\text{Reference temp. °R} - \text{thermocouple temp. °R}}{\text{(Reference temp. °R)}} \times 100\%$$

where °R = °F + 460

Each percent difference must be less than or equal to 1.5%.

Checked by Doug Cadd Date 12/12/91

Digital Indicators for Thermocouple Readout

A digital indicator is calibrated by feeding a series of millivolt signals to the input and comparing the indicator reading with the reading the signal should have generated. Error did not exceed 0.5 percent when the temperatures were expressed in degrees Rankine. Calibration data are included in the following Thermocouple Digital Indicator Calibration Data Sheet(s).

DIGITAL INDICATOR CALIBRATION DATA SHEET

DATE: 11/9/91 INDICATOR: FI-10

OPERATOR: B. J. Gomes

Test Point Number	Equivalent Temperature, °F T_e	Digital Indicator Temperature, °F T_{di}	Difference,* %
1	0	0	0
2	100	99	.18%
3	200	201	.15%
4	300	299	.13%
5	400	398	.23%
6	500	499	.10%
7	1000	999	.07%
8	1300	1296	.23%
9	1600	1595	.24%
10	1900	1893	.30%

*PERCENT DIFFERENCE MUST BE LESS THAN OR EQUAL TO 0.5%

$$\%\text{DIFFERENCE} = \frac{(T_e\,°R - T_{di}\,°R)(100)}{T_e\,°R}$$

Where, °R = °F + 460

Checked By [illegible] Date 11-19-91

Dry Gas Thermocouples and Impinger Thermocouples

The dry gas thermocouples are calibrated by comparing them with an ASTM-3F thermometer at approximately 32°F, ambient temperature, and a higher temperature between approximately 100° and 200°F. The thermocouples agreed within 5°F of the reference thermometer. The impinger thermocouples are checked in a similar manner at approximately 32°F and ambient temperature, and they agreed within 2°F. The thermocouples may be checked at ambient temperature prior to the test series to verify calibration. Calibration data are included in the following Dry Gas Thermometer and Impinger Thermocouple Calibration Data Sheet(s).

DRY GAS THERMOCOUPLE CALIBRATION DATA SHEET

Date: 11/12/91 Thermocouple No: EC-10

Calibrator: BS Reference: 4574-3E

Inlet

Reference point no.	Source*	Reference thermometer temperature °F	Thermocouple temperature °F	Difference °F**
1	1	73	74	1
2	2	32	40	2
3	3	147	150	3

Outlet

Reference point no.	Source*	Reference thermometer temperature °F	Thermocouple temperature °F	Difference °F**
1	1	73	72	1
2	2	32	32	0
3	3	147	148	1

* Source: 1) Ambient
2) Ice bath
3) Water bath

** Difference must be less than 5°F at both points.

Checked by GR Date 12/3/91

IMPINGER THERMOCOUPLE CALIBRATION DATA SHEET

Date: 12/11/91 Thermocouple No: T-1

Calibrator: [illegible] Reference: ASTM

Reference point no.	Source*	Reference thermometer temperature °F	Thermocouple temperature °F	Difference °F**
1	1	69	69	0
2	2	34	34	0

* Sources: 1) Ambient
2) Ice bath

** Difference must be less than 2°F at both points.

Checked by Doug Cahill Date 12/13/91

Trip Balance

The trip balance is calibrated by comparing it with Class-S standard weights, and it agreed within 0.5 g. Calibration data are shown in the following Trip Balance Calibration Data Sheet(s).

TRIP BALANCE CALIBRATION DATA SHEET

Balance No.	Date	Calibrator	Mass determined for					
			5 g	Error	50 g	Error	100 g	Error
422 (circled)	12/6/91	Mark Ketts	5G	0	50G	0	100G	0
421	12/6/91	M. Ketts	5G	0	50G	0	100G	0
Mettler	12/6/91	M. Ketts	5G	.02	50G	.03	100G	.05
418	12/6/91	M. Ketts	5G	.2	50G	.3	100G	.2
199	12/6/91	M. Ketts	5G	.3	50G	.2	100G	0
198	12/6/91	M. Ketts	5G	.1	50G	.1	100G	0

Error must not exceed 0.5 grams at each point.

Checked by [illegible signature] Date 12/6/91

Barometer

The field barometer is calibrated to within 0.1 in.Hg of an NBS-traceable mercury-in-glass barometer before the test series. It is checked against the reference barometer after each test series to determine if it reads within 0.2 in.Hg. The barometer read within the allowable limits each time. Calibration data are included in the following Barometer Calibration Log(s).

BAROMETER CALIBRATION LOG

PRETEST

BAROMETER NO.	415	412	401	431	400	409	[illegible]
Client	Jefferson Smurfit	Allison	Allison	[illegible]	[illegible]	[illegible] Chemical	[illegible]
Project No.		332220	332220	332190	123178	332228	
BAROMETER READING	29.58	29.66	29.66	29.60	29.32	29.54	29.47
REFERENCE BAROMETER READING	29.58	29.67	29.67	29.59	29.37	29.53	29.47
DIFFERENCE*	0.00	0.01	0.01	.01	.05	.01	.04
DATE	7-13-92	7-20-92	7-20-92	7-21-92	7-27-92	7-29-92	7-31-92
CALIBRATOR	DC	DL	DC	[illegible]	[illegible]	[illegible]	[illegible]

POST-TEST

BAROMETER READING	29.66			29.36	29.45	29.50	
REFERENCE BAROMETER READING	29.67			29.39	29.50	29.57	
DIFFERENCE**	.01			0.03	.05	.01	
DATE	7-28-92			[illegible]	8-10-92	9/4/92	
CALIBRATOR	J. Mee[illegible]			[illegible]	[illegible]	[illegible]	

*Barometer is adjusted so that difference does not exceed 0.05 in. Hg.
**Barometer is not adjusted. If difference exceed 0.10 in. Hg, inform project manager immediately.

Orsat Analyzer

The Orsat analyzer is calibrated before the test series by determining the percentages of carbon dioxide and oxygen in a calibration gas containing known percentages of each. The analyzer read within 0.5 percent of the known values. Calibration data are shown in the following Orsat Calibration Data Sheets.

Reference Gas: Matheson Gas Products, Inc.
Cylinder No. 4
Control No.
Analysis: CO_2-5.0
O_2-10.0
CO- 3.0

ORSAT CALIBRATION DATA SHEET

Orsat No.: 423 Gas: CO_2

4.5 5.0 5.5

Calibrator	Date	PM	Value determined
[illegible]	4-1-12	[illegible]	4.8
[illegible]	5/16		4.9
[illegible]	6/3/12	[illegible]	5.0
[illegible]	6/14/12	[illegible]	5.0
[illegible]	6-19-12	[illegible]	5.0
[illegible]	6/20/12	[illegible]	5.0
[illegible]	7/2/12	[illegible]	5.0
[illegible]	7/12/12	[illegible]	5.0
[illegible]	7/19/12	[illegible]	5.0
[illegible]	7/26/12	[illegible]	5.0

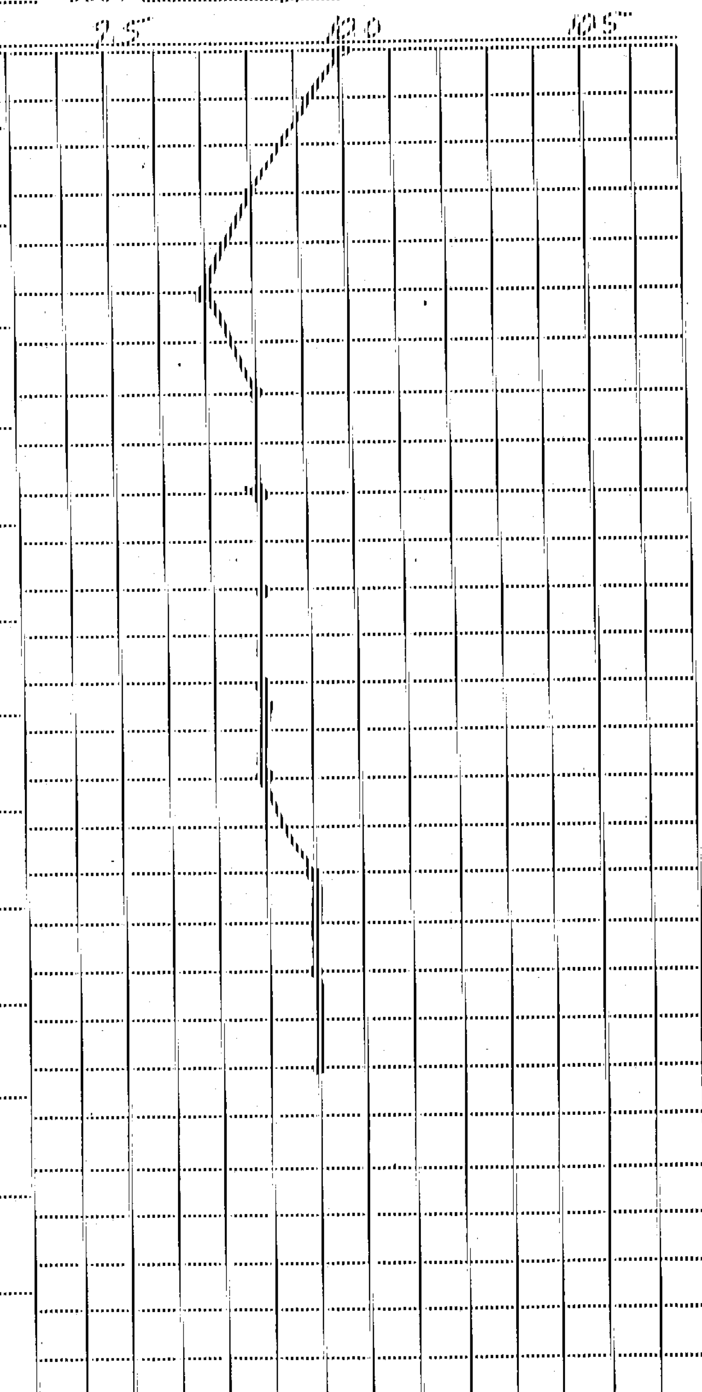
International Technology Corporation

Reference Gas: Matheson Gas Products, Inc.
Cylinder No. 4
Control No.
Analysis: CO_2-5.0
O_2-10.0
CO-2.0

ORSAT CALIBRATION DATA SHEET

Orsat No.: 523 Gas: O_2

Calibrator	Date	PM	Value determined
[illegible]	5-1-92	[illegible]	9.8
[illegible]	5/5/92		9.7
D. Cahill	6/1/92	[illegible]	9.8
[illegible]	6/2/92	[illegible]	9.8
[illegible]	6-17-92	[illegible]	9.8
[illegible]	6/30/92	[illegible]	9.8
D Cahill	[illegible]	[illegible]	9.8
[illegible]	[illegible]	[illegible]	9.9
D Cahill	[illegible]	[illegible]	9.9
D. Cahill	8/24/92	[illegible]	9.9



Reference Gas: Matheson Gas Products, Inc.
Cylinder No. 4
Control No.
Analysis: CO_2 - 5.0
O_2 - 10.0
CO - 2.0

ORSAT CALIBRATION DATA SHEET

Orsat No.: 423 Gas: CO

Calibrator	Date	PM	Value determined
[illegible]	4-1-92	[illegible]	2.0
M Keith	[illegible]		2.0
O. Calif	6/5/92	[illegible]	1.8
J. Nease	6/[illegible]/92	[illegible]	1.8
J Rhea	6-17-92	[illegible]	1.8
J Nease	6/30/92	[illegible]	1.8
O Calif	7/[illegible]/92	33390	1.8
J Rhea	[illegible]	[illegible]	1.8
O Calif	9/14/92	[illegible]	1.8