



CleanSoils Inc. 84 2nd Avenue S.E., New Brighton, MN 55112 • (612) 639-8811 • FAX (612) 639-8813

April 1, 1991

Mr. Willard Hanks  
Bureau of Air Quality Management  
F1-DER  
2600 Blair Stone Rd.  
Twin Towers Office Bldg.  
Tallahassee, FL 32301

Dear Mr. Hanks:

Here is the remainder of our stack test results from February 8 and 9, 1991. I apologize for the delay in getting this to you. I received the report the afternoon of March 28 from Interpoll.

I have attached a summary of results and comments with respect to our permit requirements. If you have any questions, please do not hesitate to call. Again our phone number is 1-800-279-7645. My main contact at Interpoll is Kathy Eickstadt. For really technical feedback, I go to Perry Lonnes, Ph.D., President of Interpoll. Their phone number is in the report. I will be submitting our application to "operate" in the near future. I am uncertain of the fee that is needed at that time.

Again, if you have any questions, please do not hesitate to call.

Sincerely,

A handwritten signature in cursive script that reads "Robert A. Wills".

Robert A. Wills, Ph.D.  
Vice President of Engineering

RAW:dkd

cc: report/letter with attachment-  
Robert Soich  
Hillsborough County, FL  
EPA

RECEIVED  
APR 4 1991  
DER-BAQM

CleanSoils Inc.  
(612) 639-8811

Florida Department of Environmental Regulation

	<u>Permit Requirements</u>	<u>Tested 2/8-9/91</u>
Benzene	5.6 lb/Hr	(Max) 0.029 lb/Hr (p. 7)
VOC	36 lb/Hr	11.3 lb/Hr*
Particulate	0.08 gr/dscf @ 50% xs	0.064 gr/dscf (p. 4)
	3.0 lb/Hr	5.4 lb/Hr **
Visible Emissions	<5% opacity	0 (p. 15)

*Need to verify PM in 1-1-91*

\* 213 ppm C (p.4) x 52839 lb/Hr (p A-1) = 11.3 lb/Hr

\*\*On a routine inspection of the baghouse the evening of 2/8/91, dust was found on the exit side of the bags. While no visible emissions were noted on 2/8/91, (Bob Soich of the Hillsborough County EPA was present for all testing 2/8/91) it was determined by Wills that we should replace the bags in the baghouse. This was done between 0800 and 1000 hours 2/9/91. While bags are normally permitted to build a filter layer of dust for two weeks before particulate testing, there were only two hours before testing began. This is the reason for the high values. One can see by the decreases over the days testing that the particulates would level off below the required 3.0 lb/Hrs. Further, we submit stack testing performed the previous year on the same unit. With several months of operation on these bags the average particulate level was 1.8 lb/Hr (see attached).

Interpoll Report No. 0-2956  
Clean Soils Inc  
Elm Grove, Wisconsin

Test No. 1  
Rotary Soil Incinerator Stack

**Results of Particulate Loading Determinations-----Method 5**

	Run 1	Run 2	Run 3
Date of run	02-20-90	02-20-90	02-20-90
Time run start/end.....(HRS)	1050/1214	1250/1415	1450/1611
Static pressure.....(IN.WC)	-0.12	-0.12	-0.12
Cross sectional area (SQ.FT)	32.34	32.34	32.34
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	239.0	252.0	229.0
desiccant.....(GRAMS)	14.0	9.0	6.0
total.....(GRAMS)	253.0	261.0	235.0
Total particulate material.. .....collected(grams)	0.0570	0.0807	0.0431
Gas meter coefficient.....	0.9972	0.9972	0.9972
Barometric pressure..(IN.HG)	29.79	29.79	29.79
Avg. orif.pres.drop..(IN.WC)	0.73	0.70	0.76
Avg. gas meter temp..(DEF-F)	58.8	59.7	60.3
Volume through gas meter....			
at meter conditions...(CF)	33.74	33.03	34.25
standard conditions.(DSCF)	34.14	33.36	34.56
Total sampling time....(MIN)	72.00	72.00	72.00
Nozzle diameter.....(IN)	.619	.619	.619
Avg.stack gas temp ..(DEG-F)	1430	1371	1349
Volumetric flow rate.....			
actual.....(ACFM)	36796	34856	35197
dry standard.....(DSCFM)	7582	7309	7742
Isokinetic variation.....(%)	96.8	98.2	96.0
Particulate concentration...			
actual.....(GR/ACF)	0.00531	0.00782	0.00423
dry standard.....(GR/DSCF)	0.02576	0.03732	0.01924
Particle mass rate...(LB/HR)	1.67	2.34	1.28

*2-35616*

Interpoll Laboratories, Inc.  
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Circle Pines, Minnesota 55014-1819

TEL: (612) 786-6020  
FAX: (612) 786-7854

RESULTS OF THE FEBRUARY 8 AND 9, 1991  
AIR EMISSION PERFORMANCE TEST OF THE  
CLEANSOILS INC. PORTABLE CONTAMINATED SOIL  
TREATMENT SYSTEM IN TAMPA, FLORIDA


Submitted to:

CLEANSOILS, INC.  
84 Second Avenue S.E.  
New Brighton, Minnesota 55112

Attention: Bob Wills

Reviewed by:

Report Number 1-3240  
March 21, 1991  
DD/djd

  
Daniel J. Despen  
Manager  
Field Testing Support Group

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## ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F ( <sup>0</sup> F)	degrees Fahrenheit
DIA.	diameter
FP	finished product for plant
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard cubic meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10 <sup>6</sup> BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
LTPD	long tons per day
MW	megawatt
mg/DSCM	milligrams per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
ohm-cm	ohm-centimeter
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
ug	micrograms
v/v	percent by volume
w/w	percent by weight
<	≤ (when following a number)

Standard conditions are defined as 68 <sup>0</sup>F (20 <sup>0</sup>C) and 29.92 IN. of mercury pressure.

1 INTRODUCTION

On February 8 and 9, 1991, Interpoll Laboratories personnel conducted an air emission performance test on the No.101 Portable Soil Roasting Unit (SRU 101) owned and operated by CleanSoils, Inc. The unit was located in Tampa, Florida at the time of the test. On-site testing was performed by Mark Kaehler, Curt Mosser and Jeff Bergstrom. Coordination between testing activities and plant operation was provided by Bob Wills of CleanSoils, Inc. The test was witnessed by Bob Soich of the Hillsborough County Environmental Protection Agency.

The SRU 101 system is used to clean soil which has been contaminated with petroleum based products. The system consists of rotary drum dryer followed by a baghouse and afterburner for pollution control. The unit has a maximum rated capacity of 60 TPH. During these tests the unit was processing at an average rate of 8.2 TPH.

Particulate evaluations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1990). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a heated glass-lined probe. Due to the high temperature of the exhaust gas stream (1400 °F) a water-cooled sampling probe was substituted for the standard EPA Method 5 sampling probe and high temperature inconel nozzles were substituted for the standard Method 5 stainless steel nozzles. To minimize radiant heat loss error, the thermocouple used to measure gas temperature was not attached to the water-cooled probe. Wet catch samples were collected in the back half of the Method 5 sampling train and analyzed as per Florida Protocol.

*AO*

*AO*

The total hydrocarbon (THC) concentrations were measured simultaneously at the afterburner inlet and outlet in accordance with EPA Method 25A (Ibid). A Ratfisch Model RS55 Heated Total Hydrocarbon Analyzer (Heated Flame Ionization Detector) was used to measure THC concentrations in the exhaust gas stream. The hydrocarbon analyzer was calibrated with zero gas and low, mid and high level calibration gases (propane in nitrogen) prior to and after each testing period. A strip chart recorder was used to record the analyzer response.

At the inlet site the THC analyzer was used to analyze for noncondensable hydrocarbons by extracting a slip stream of sample gas after the last impinger of a Method 5 sampling train. This was done to prevent fouling of the THC analyzer by condensible hydrocarbons. The condensible hydrocarbons were captured in the probe, filter and impinger set of the Method 5 train. The weight of the condensible compounds was then determined in the laboratory and converted to a carbon only basis by analyzing each of the samples for carbon content. A diagram of this sampling system is included in the Procedures appendix of this report and a summary of the necessary calculations can be found in the Calculations appendix.

Benzene, toluene, ethylbenzene, and xylene (BTEX) samples were collected in accordance with EPA Method 18 (Section 7.4 - Absorption Tube Procedure) using 800/200 mg charcoal tubes with analysis by Modified NIOSH Method 1501.

An integrated flue gas sample was extracted simultaneously with each particulate sample using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags housed in a protective aluminum container. After sampling was complete, the bags were sealed and returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded. The Stack site integrated bag samples were also analyzed for propane by GC as



per ASTM procedure.

Testing on the SRU 101 System was conducted from four test ports oriented at 90 degrees on the stack and located 2.96 stack diameters downstream of any flow disturbance and approximately 0.7 diameters upstream of the stack exit. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 2.5 minutes to give a total sampling time of 60 minutes per run. THC, BTEX sampling was conducted using a single point traverse and sampling for 60 minutes. A visible emission determination was performed by Curt Mosser, an EPA-certified reader.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

## 2 SUMMARY AND DISCUSSION

The results of the particulate emission compliance test are summarized in Table 1. As will be noted, the particulate concentration averaged 0.064 GR/DSCF and the particulate emission rate averaged 5.4 LB/HR. Opacity was 0%. Total hydrocarbon results are presented in Table 2. The total hydrocarbon concentration averaged 2027 ppmC at the afterburner inlet and 213 ppmC at the stack. The removal efficiency averaged 90.0%. The BTEX results are summarized in Table 3.

No difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values which existed at the time the test was performed.

Table 1. Summary of the Results of the February 9, 1991 Particulate Emission Engineering Test on the Cleansoils, Inc. SRU101 Soil Remediation Unit in Tampa, Florida.

ITEM	Run 1	Run 2	Run 3
Date of test	02-09-91	02-09-91	02-09-91
Time runs were done (HRS)	1235/1356	1425/1620	1707/1817
Process rate (TON/HR)	8.2	8.5	7.8
Volumetric flow			
actual (ACFM)	46322	48194	52111
standard (DSCFM)	9516	10241	10705
Gas temperature (DEG-F)	1401	1408	1431
Moisture content (%V/V)	27.78	24.99	26.63
Gas composition (%V/V,dry)			
carbon dioxide	7.40	6.00	7.10
oxygen	9.90	11.70	9.80
nitrogen	82.70	82.30	83.10
Isokinetic variation (%)	98.4	95.2	99.3
Particulate concentration			
actual (GR/ACF)	.0203	.0109	.00840
standard (GR/DSCF)	.0989	.0511	.0409
Part. emission rate (LB/HR)	8.07	4.49	3.76

Note: Dry + Organic Wet Catch

Table 2 Summary of the Results of the February 8, 1991 Total Hydro-Carbon Determinations on the CleanSoils, Inc. SRU 101 System located in Tampa, Florida.

Test/Run	Time (HRS)	Concentration (ppm,C)		Removal Efficiency %
		Inlet	Stack	
1/1	1222-1323	1150	87	92.4
1/2	1530-1652	2320	279	88.0
1/3	1837-1935	2610	274	89.5
Avg		2027	213	90.0

Table 3 Summary of the February 8, 1991 BTEX Determinations on the CleanSoils, Inc. SRU 101 System located in Tampa, Florida.

Test/Run		Concentration (ppm,d)	Emission Rate (LB/HR)
2/1	Benzene	≤0.027	≤0.0029
	Toluene	≤0.023	≤0.0020
	Ethylbenzene	≤0.020	≤0.0020
	Xylene	≤0.020	≤0.0020
2/2	Benzene	0.40	0.029
	Toluene	0.35	0.030
	Ethylbenzene	≤0.021	≤0.0021
	Xylene	≤0.021	≤0.0021
2/3	Benzene	≤0.027	≤0.0020
	Toluene	≤0.023	≤0.0020
	Ethylbenzene	≤0.020	≤0.0020
	Xylene ≤0.02	≤0.020	≤0.0020

### 3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (Orsat and moisture) are presented first followed by the computer printout of the particulate and opacity results. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on an IBM PC Computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs.

The particulate emission rate has been calculated using the product of the concentration times flow method.

3.1 Results of Orsat and Moisture Analyses

Test No. 1  
 Soil Remediation Unit - Inlet to Afterburner

**Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)**

Date of run	Run 1 02-08-91	Run 2 02-08-91	Run 3 02-08-91
<b>Dry basis (orsat)</b>			
carbon dioxide.....	8.20	7.50	8.30
oxygen.....	9.10	9.90	8.90
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	82.70	82.60	82.80
<b>Wet basis (orsat)</b>			
carbon dioxide.....	4.70	4.76	4.90
oxygen.....	5.22	6.29	5.25
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	47.44	52.44	48.84
water vapor.....	42.64	36.51	41.02
Dry molecular weight.....	29.68	29.60	29.68
Wet molecular weight.....	24.70	25.36	24.89
Specific gravity.....	0.853	0.876	0.860
FO	1.439	1.467	1.446



Test No. 3  
 Soil Remediation Unit Stack

**Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)**

Date of run	Run 1 02-09-91	Run 2 02-09-91	Run 3 02-09-91
<b>Dry basis (orsat)</b>			
carbon dioxide.....	7.40	6.00	7.10
oxygen.....	9.90	11.70	9.80
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	82.70	82.30	83.10
<b>Wet basis (orsat)</b>			
carbon dioxide.....	5.34	4.50	5.21
oxygen.....	7.15	8.78	7.19
carbon monoxide.....	0.00	0.00	0.00
nitrogen.....	59.73	61.73	60.97
water vapor.....	27.78	24.99	26.63
Dry molecular weight.....	29.58	29.43	29.53
Wet molecular weight.....	26.36	26.57	26.46
Specific gravity.....	0.911	0.918	0.914
Water mass flow.....(LB/HR)	10267	9573	10896

3.2 Results of Particulate Loading Determinations

Test No. 3  
Soil Remediation Unit Stack

**Results of Particulate Loading Determinations-----Method 5**

	Run 1	Run 2	Run 3
Date of run	02-09-91	02-09-91	02-09-91
Time run start/end.....(HRS)	1235/1356	1425/1620	1707/1817
Static pressure.....(IN.WC)	-0.08	-0.08	-0.08
Cross sectional area (SQ.FT)	32.34	32.34	32.34
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	280.0	255.0	300.0
desiccant.....(GRAMS)	17.0	13.0	18.0
total.....(GRAMS)	297.0	268.0	318.0
Total particulate material..			
.....collected(grams)	0.2334	0.1257	0.1096
Gas meter coefficient.....	0.9942	0.9942	0.9942
Barometric pressure..(IN.HG)	30.00	30.00	30.00
Avg. orif.pres.drop..(IN.WC)	1.19	1.29	1.54
Avg. gas meter temp..(DEF-F)	71.2	72.4	76.8
Volume through gas meter....			
at meter conditions...(CF)	36.65	38.25	42.00
standard conditions.(DSCF)	36.41	37.92	41.32
Total sampling time....(MIN)	60.00	60.00	60.00
Nozzle diameter.....(IN)	.620	.620	.620
Avg.stack gas temp ..(DEG-F)	1401	1408	1431
Volumetric flow rate.....			
actual.....(ACFM)	46322	48194	52111
dry standard.....(DSCFM)	9516	10241	10705
Isokinetic variation.....(%)	98.4	95.2	99.3
Particulate concentration...			
actual.....(GR/ACF)	0.02031	0.01086	0.00840
dry standard.....(GR/DSCF)	0.09892	0.05115	0.04093
Particle mass rate...(LB/HR)	8.069	4.490	3.755

3.3 Results of Opacity Observations

Test No. 1  
Afterburner Stack

Results of Opacity Observations ----- EPA Method 9

PERCENT OPACITY	OPTICAL DENSITY	RELATIVE FREQUENCY (%)
0	0.0000	100.00
5	0.0223	0.00
10	0.0458	0.00
15	0.0706	0.00
20	0.0969	0.00
25	0.1249	0.00
30	0.1549	0.00
35	0.1871	0.00
40	0.2219	0.00
45	0.2596	0.00
50	0.3010	0.00
55	0.3468	0.00
60	0.3979	0.00
65	0.4559	0.00
70	0.5229	0.00
75	0.6021	0.00
80	0.6690	0.00
85	0.8239	0.00
90	1.0000	0.00
95	1.3010	0.00
99	2.0000	0.00
Avg Opac 0.00	Avg OD 0.0000	Time average

Observer: C. Mosser  
Cert. Date: 10-17-90  
Date of Observation: 02-09-91  
Time of Observation: 1430/1625

Note: The Burner was down from 1440-1540 and from 1600-1605.

**APPENDIX A**

**RESULTS OF VOLUMETRIC FLOW RATE DETERMINATIONS**

Test No. 2  
Soil Remediation Unit Stack

**Results of Volumetric Flow Rate Determination-----Method 2**

Date of Determination.....	02-08-91
Time of Determination.....(HRS)	1410
Barometric pressure.....(IN.HG)	29.94
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	77
Duct area.....(SQ.FT)	32.34
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.1
Avg. gas temp.....(DEG-F)	1419
Moisture content.....(% V/V)	26.50
Avg. linear velocity.....(FT/SEC)	23.5
Gas density.....(LB/ACF)	.01932
Molecular weight.....(LB/LBMOLE)	29.51
Mass flow of gas.....(LB/HR)	52839
Volumetric flow rate.....	
actual.....(ACFM)	45588
dry standard.....(DSCFM)	9420

Test No. 2  
Soil Remediation Unit Stack

**Results of Volumetric Flow Rate Determination-----Method 2**

Date of Determination.....	02-08-91
Time of Determination.....(HRS)	1443
Barometric pressure.....(IN.HG)	29.94
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	77
Duct area.....(SQ.FT)	32.34
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.08
Avg. gas temp.....(DEG-F)	1443
Moisture content.....(% V/V)	26.50
Avg. linear velocity.....(FT/SEC)	23.6
Gas density.....(LB/ACF)	.01907
Molecular weight.....(LB/LBMOLE)	29.51
Mass flow of gas.....(LB/HR)	52516
Volumetric flow rate.....	
actual.....(ACFM)	45886
dry standard.....(DSCFM)	9362



Test No. 2  
Soil Remediation Unit Stack

**Results of Volumetric Flow Rate Determination-----Method 2**

Date of Determination.....	02-08-91
Time of Determination.....(HRS)	1655
Barometric pressure.....(IN.HG)	29.94
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	16
Shape of duct.....	Round
Stack diameter.....(IN)	77
Duct area.....(SQ.FT)	32.34
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.08
Avg. gas temp.....(DEG-F)	1428
Moisture content.....(% V/V)	26.50
Avg. linear velocity.....(FT/SEC)	22.5
Gas density.....(LB/ACF)	.01923
Molecular weight.....(LB/LBMOLE)	29.51
Mass flow of gas.....(LB/HR)	50350
Volumetric flow rate.....	
actual.....(ACFM)	43647
dry standard.....(DSCFM)	8976

Test No. 3  
Soil Remediation Unit Stack

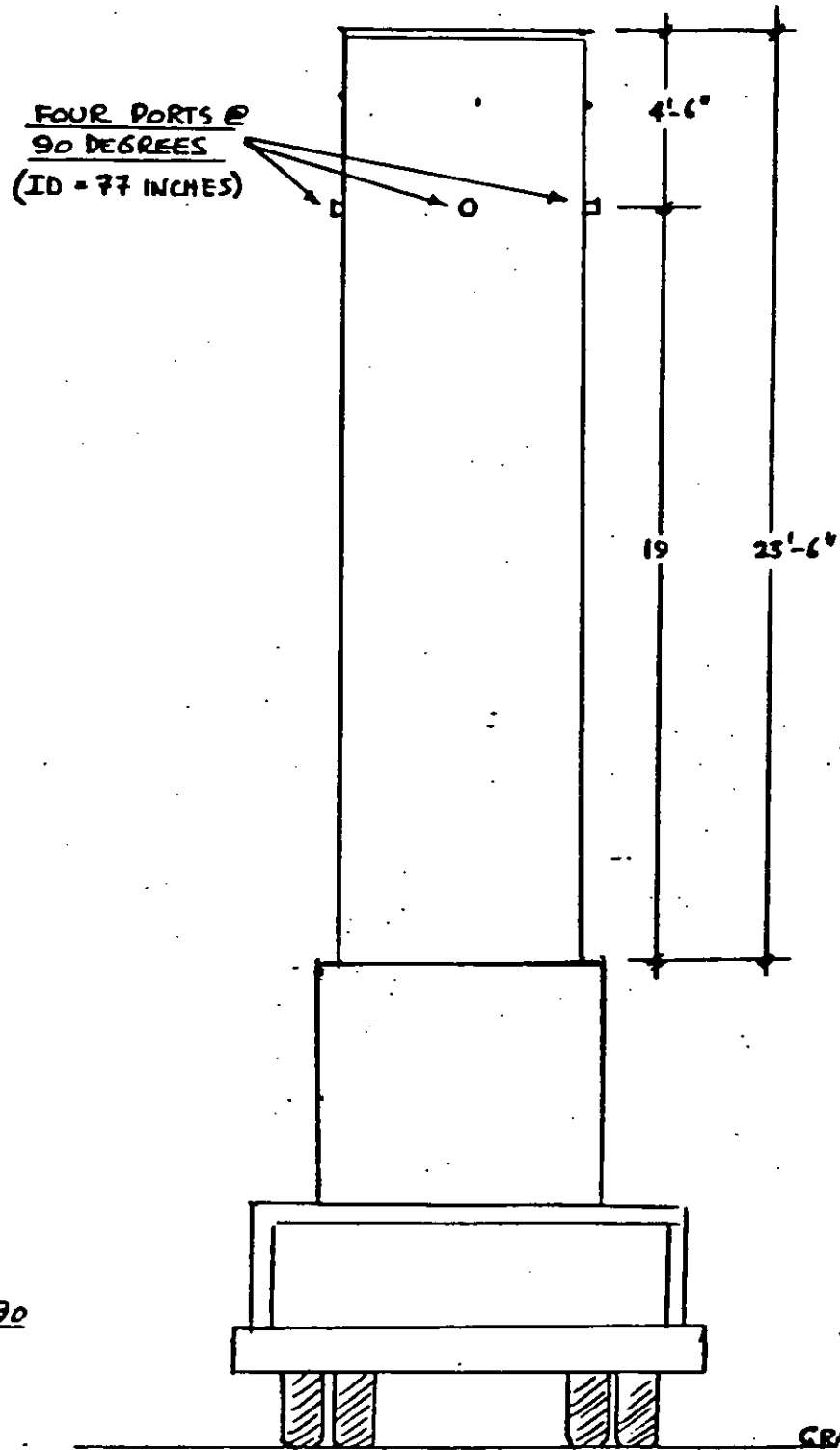
**Results of Volumetric Flow Rate Determination-----Method 2**

Date of Determination.....	02-09-91
Time of Determination.....(HRS)	1150
Barometric pressure.....(IN.HG)	30
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	24
Shape of duct.....	Round
Stack diameter.....(IN)	77
Duct area.....(SQ.FT)	32.34
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.08
Avg. gas temp.....(DEG-F)	1403
Moisture content.....(% V/V)	27.78
Avg. linear velocity.....(FT/SEC)	23.0
Gas density.....(LB/ACF)	.01945
Molecular weight.....(LB/LBMOLE)	29.58
Mass flow of gas.....(LB/HR)	52009
Volumetric flow rate.....	
actual.....(ACFM)	44564
dry standard.....(DSCFM)	9144

**APPENDIX B**

LOCATION OF TEST PORTS

CLEAN SOILS  
AFTERBURNER STACK



LF 1/90

NOT TO SCALE

GRADE ELEV

**APPENDIX C**

**FIELD DATA SHEETS**

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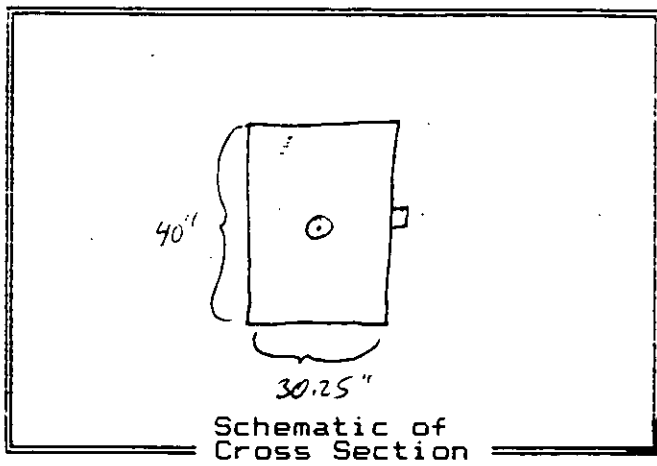
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INTERPOL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Steam Soils / Tampa Bay Fl  
 Source Soil Remediation Cont / Apptburna Inlet  
 Test 1 Run 1,2,3 Date 2-8-91  
 Stack dimen. 30.25 X 40 IN.  
 Dry bulb NA °F Wet bulb NA °F  
 Manometer:  Reg.  Exp.  Elec.  
 Barometric pressure 29.94 in Hg  
 Static pressure NA in WC  
 Operators M. Raehler, C. Masser  
 Pitot No. 21V-4 Cp BY



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: <u>5</u> in.		Time start: _____ hrs	
	<u>1/6</u>	<u>5.04</u>	<u>10.04</u>		
<u>2</u>	<u>3/6</u>	<u>15.12</u>	<u>20.12</u>		
<u>3</u>	<u>5/6</u>	<u>25.21</u>	<u>30.21</u>		
Temp. meas. tool & S/N: <u>PDT-9 / TC</u>				Time end: _____ hrs	

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Clean Soils / Tampa Bay Fl Date 2-8-91 Test 1 Run 1  
 Source Soil Remediation Unit / Sidel No. of traverse points 3  
 Method - Filter holder: 4" Glass Filter type: 4" G.F.

**Sample Train Leak Check:**

Pretest: ( 0.02 cfm at 15 in. Hg. (vac)   
 Posttest: 0 cfm at 15 in. Hg. (vac)

**Particulate Catch Data:**

No.s of filters used: 2987 Recovery solvent(s)  
 acetone \_\_\_\_\_  
 other(s) \_\_\_\_\_

No. of probe wash bottles: 1  
 Sample recovered by: M. Kaehler, C. Mosser

**Condensate Data:**

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant			
<b>Total</b>			

**Integrated Gas Sampling Data:**

Bag Pump No. B11 Box No. 26 Bag No. 1  
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L  
 Pretest leak check: 0 cc/min at 20 in. Hg.  
 Time start: 1223 (HRS) Time end: 1323 (HRS)  
 Sampling rate: 400 cc/min Operator: M. Kaehler  
 S/N of O<sub>2</sub> Analyzer used to monitor train outlet: 9

CF-023

INTERPOL LABORATORIES  
EPA Method 4 and 6 Field Data Sheet

Job Clean Soils / Pump #1  
 Source Soil Remediation Unit / Outlet  
 Date 2-8-91 Test 1 Run 1

Operator(s) M. Kaehler, C. Mosser  
 Meter Box No. 9 Gasmeter coef. .9942  
 $\Delta H$  1.80 in.WC Bar. press 29.94 in.Hg

Sample Train Leak Check:  
 Pretest: < 0.02 cfm at 15 in. Hg.   
 Posttest: 0 cfm at 15 in. Hg.

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Drif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)	Stn. Temp
					Probe	Oven	Impg.	Gas/In	Gas/Out		
	1223	539.60									
3	5	543.22	1.80	8	249	242	43	69	66	10.7	33
3	10	546.86	1.80	10				70	67	10.6	
3	15	550.48	1.80	11				71	67	10.6	
3	20	554.10	1.80	11	256	238	45	73	68	10.7	34
2	25	557.80	1.80	12				74	69	10.6	
2	30	561.51	1.80	11				76	70	10.1	
2	35	565.16	1.80	11	245	255	45	76	70	9.8	34
2	40	568.78	1.80	11				77	70	9.8	
1	45	572.42	1.80	11				77	71	9.4	
1	50	576.08	1.80	12	250	250	44	78	72	9.3	33
1	55	579.95	1.80	12				78	72	9.8	
1	60	583.42	1.80	12				79	73	9.8	
	(1323)										
	$\theta = 60$	$V_m = 43.82$	$(\Delta H)_{ave} = 1.80$					$(t_m)_{ave} = 72$			

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers	1438	800	638
Condenser			
Desiccant	1470	1422	48
		Total	686

Preliminary results of SO <sub>2</sub> concentration determination	
V <sub>std</sub>	= 43.46 DSCF
Moisture	= 42.64 %v/v
SO <sub>2</sub> , dry	= ppm
SO <sub>2</sub> , wet	= ppm
LB/MMBtu	=



INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Clean Soils / Tampa Bay, FL Date 2-8-91 Test 1 Run 2  
 Source Soil Remediation Co. F / Afterburner Inlet No. of traverse points 3  
 Method Filter holder: 4" Glass Filter type: 4" G.F.

**Sample Train Leak Check:**

Pretest: ( 0.02 cfm at 15 in. Hg. (vac)   
 Posttest: 0 cfm at 15 in. Hg. (vac)

**Particulate Catch Data:**

No.s of filters used: 2988 Recovery solvent(s)  
 acetone \_\_\_\_\_  
 other(s) \_\_\_\_\_  
 No. of probe wash bottles: 1  
 Sample recovered by: M. Kaehler, C. Mosser

**Condensate Data:**

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant			
<b>Total</b>			

**Integrated Gas Sampling Data:**

Bag Pump No. B 11 Box No. 26 Bag No. 2  
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L  
 Pretest leak check: 0 cc/min at 20 in. Hg.  
 Time start: 1525 (HRS) Time end: 1632 (HRS)  
 Sampling rate: 400 cc/min Operator: M. Kaehler  
 S/N of O<sub>2</sub> Analyzer used to monitor train outlet: 9

CF-023

INTERPOL LABORATORIES  
EPA Method 4 and 6 Field Data Sheet

Job Clean Soils / Tampa Bay Fl  
Source Soil Remediation Unit / Inlet  
Date 2-8-91 Test 1 Run 2

Operator(s) M. Kaehler, C. Mosser  
Meter Box No. 9 Gasmeter coef. .9942  
 $\Delta$ Hg 1.80 in.WC Bar. press 29.94 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg.   
Posttest: 0 cfm at 15 in. Hg.

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)
					Probe	Oven	Impg.	Gas/In	Gas/Out	
	(1525)	583.70								
3	5	587.31	1.80	8	253	240	42	70	67	10.6
3	10	590.97	1.80	9				71	67	10.3
3	15	594.61	1.80	10				74	68	10.1
3	20	598.34	1.80	10	244	250	44	75	69	10.0
2	25	602.02	1.80	9				77	70	11.3
2	30	605.75	1.80	10				78	71	10.4
2	35	609.49	1.80	10	247	253	45	79	72	11.2
2	40	613.12	1.80	9				79	72	11.4
1	45	616.75	1.80	9.5				80	73	11.2
1	50	620.52	1.80	10				80	73	12.3
1	55	624.20	1.80	10				80	74	12.4
1	60	627.88	1.80	10				80	74	12.3
	(1632)									
	$\theta = 60$	$V_m = 44.18$	$(\Delta H)_{avg} = 1.80$					$(t_m)_{avg} = 74$		

Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers	1300	800	500
Condenser			
Desiccant	1489	1456	33
		Total	533

Preliminary results of SO <sub>2</sub> concentration determination	
$V_{std}$	= 43.65 DSCF
Moisture	= 36.51 %v/v
SO <sub>2</sub> , dry	= ppm
SO <sub>2</sub> , wet	= ppm
LB/MMBtu	=

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Clean Soils / Tampa Bay, FL Date 2-8-91 Test 1 Run 3  
 Source Soil Remediation Unit / Afterburner Tail No. of traverse points 3  
 Method \_\_\_\_\_ Filter holder: 4" Glass Filter type: 4" G.F.

**Sample Train Leak Check:**

Pretest: ( 0.02 cfm at 15 in. Hg. (vac)   
 Posttest: 0 cfm at 15 in. Hg. (vac)

**Particulate Catch Data:**

No.s of filters used: \_\_\_\_\_ Recovery solvent(s)  
 \_\_\_\_\_  acetone \_\_\_\_\_  
 \_\_\_\_\_  other(s) \_\_\_\_\_  
 No. of probe wash bottles: 1  
 Sample recovered by: M. Kaehler, C. Mosser

**Condensate Data:**

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1			
Impinger No. 2			
Impinger No. 3			
Condenser			
Desiccant			
Total			

**Integrated Gas Sampling Data:**

Bag Pump No. B11 Box No. 26 Bag No. 3  
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L  
 Pretest leak check: 0 cc/min at 20 in. Hg.  
 Time start: 1837 (HRS) Time end: 1935 (HRS)  
 Sampling rate: 400 cc/min Operator: M. Kaehler  
 S/N of O<sub>2</sub> Analyzer used to monitor train outlet: 9

CF-023

INTERPOL LABORATORIES  
EPA Method 4 and 6 Field Data Sheet

Job Clean Soils / Tampa Bay Fl Operator(s) M. Kachler, C. Mosser  
 Source Soil Remediation Unit / Inlet Meter Box No. 9 Gasmeter coef. 9942  
 Date 2-8-91 Test 1 Run 3  $\Delta H$  1.80 in.WC Bar. press 29.94 in.Hg

Sample Train Leak Check:

Pretest: < 0.02 cfm at 15 in. Hg.   
 Posttest: \_\_\_\_\_ cfm at \_\_\_\_\_ in. Hg.

Trav. Point No.	Samp. Time (min)	Sample Volume (cf)	Orif. Meter (inWC)	VAC. inHg	Temperatures (°F)					Oxygen (%v/v)	Flow Temp.
					Probe	Oven	Impg.	Gas/In	Gas/Out		
	(1837)	628.14									
3	5	631.81	1.80	8	245	251	40	61	61	9.8	327
3	10	635.48	1.80	10				64	62	9.4	
3	15	639.15	1.80	10				66	62	9.8	
3	20	642.85	1.80	10	247	255	41	68	63	9.9	321
2	25	646.60	1.80	10.5				69	64	9.6	
2	30	650.28	1.80	10				70	64	9.3	
2	35	654.10	1.80	10	252	249	43	71	65	9.9	325
2	40	657.92	1.80	10				72	66	9.7	
1	45	661.40	1.80	10.5				72	66	9.2	
1	50	665.06	1.80	10.5				72	66	9.1	
1	55	668.72	1.80	10.5				73	66	9.0	
1	60	672.38	1.80	11				73	67	8.6	
	(1935)										
	$\theta = 60$	$V_m = 44.24$	$(\Delta H)_{ave} = 1.80$					$(t_m)_{ave} = 67$			

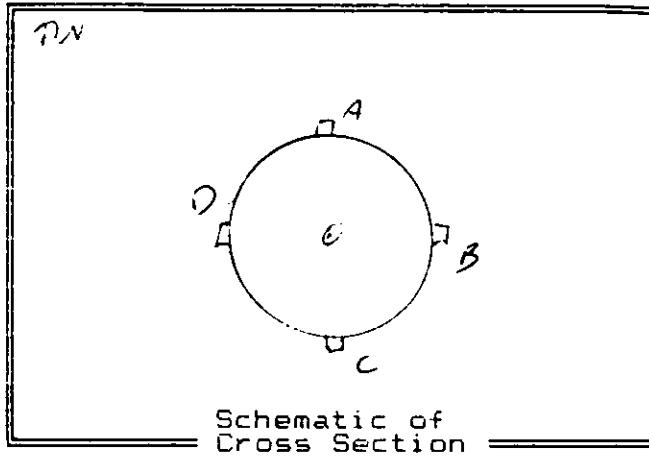
Condensate Data:

Item	Weight (g)		
	Final	Tare	Difference
Impingers	1417	800	617.
Condenser			
Desiccant	1254	1217	37
		Total	654

Preliminary results of SO <sub>2</sub> concentration determination	
V <sub>std</sub>	= 44.29 DSCF
Moisture	= 41.02 %v/v
SO <sub>2</sub> , dry	= ppm
SO <sub>2</sub> , wet	= ppm
LB/MMBtu	=

INTERPOL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Clean Soils / Tampa Fl  
 Source Soil Remediation Unit / Guch  
 Test 2 Run 1 Date 2-8-91  
 Stack dimen. 77 IN.  
 Dry bulb \_\_\_\_\_ °F Wet bulb \_\_\_\_\_ °F  
 Manometer:  Reg.  Exp.  Elec.  
 Barometric pressure 29.97 in Hg  
 Static pressure -7.10 in WC  
 Operators M. Kuchler, J. Bergstrom  
 Pitot No. WCPC Cp .94



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
Port length: <u>10</u> in.				Time start: <u>1410</u> hrs	
A - 1	.032	2.46	12.46	.035	1419
2	.105	8.09	18.09	.045	
3	.194	14.94	24.94	.045	
4	.323	24.87	34.87	.050	
B - 1				.040	
2				.040	
3				.050	
4				.045	
C - 1				.035	
2				.045	
3				.050	
4				.050	
D - 1				.040	
2				.050	
3				.055	
4				.050	
Temp. meas. tool & S/N: <u>PDT-9 / TC</u>				Time end: _____ hrs	

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Field Data Sheet For BTX

Job Clean Soils / Tampa Bay, FL  
Test Location Soil Remediation Unit  
Stack

Date 2-8-91

Operator(s) McKaeher, J. Bergstrom

Test 2 Run 1

Console No. 15

Bar. Pressure 29.94 in. Hg.

$\gamma$  1.0033

Pretest Leak Check  
(0 cc/min at 12 IN.HG. VAC)

Post Test Leak Check  
(0 cc/min at 12 IN.HG. VAC)

Sampling Time (min.)	Sample Volume (CF)	Flow Rate (cc/min)		Vacuum (in. Hg.)	meter Temp		
(1410)	844.000	111111	111111	111111	111111	111111	111111
5	844.191	1000		3	73		
10	844.380	1000		3	74		
15	844.556	980		3	74		
20	844.733	980		5	76		
25	844.915	960		6	78		
30	845.078	940		6	79		
35	845.241	920		6	80		
40	845.404	900		6	80		
45	845.575	880		6.5	82		
50	845.732	880		6.5	83		
55	845.895	880		6.5	84		
60	846.058	880		6.5	86		

(1513)  $v_m$  2.058 CF

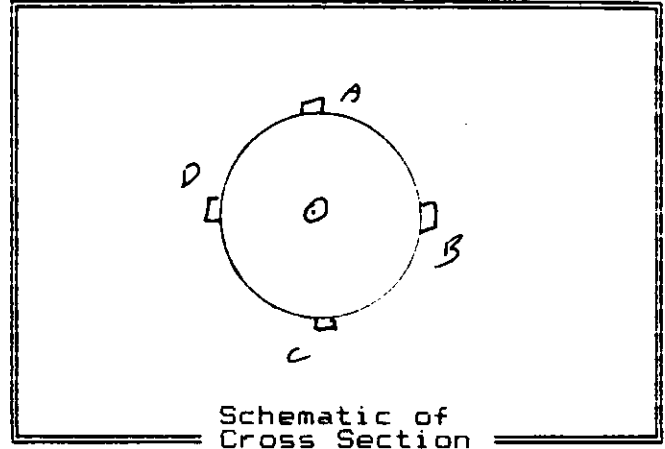
$i_m$  79 °F

$V_{STD} = 2.024$

C-9

INTERPOL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Clean Soils / Tampa Fl  
 Source Soil Remediation Unit / Stack  
 Test 2 Run 2 Date 2-8-91  
 Stack dimen. 77 IN.  
 Dry bulb        °F Wet bulb        °F  
 Manometer:  Reg.  Exp.  Elec.  
 Barometric pressure 29.94 in Hg  
 Static pressure -.08 in WC  
 Operators M. Kuehler, J. Bergstrom  
 Pitot No. WCP Cp .84



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
			Port length: <u>10</u> in.	Time start: <u>1655</u> hrs	
A-1	.032	2.46	12.46	.025	1428
2	.105	8.09	18.09	.030	
3	.194	14.94	24.94	.035	
4	.323	24.87	34.87	.035	
B-1				.045	
2				.040	
3				.045	
4				.050	
C-1				.040	
2				.040	
3				.035	
4				.045	
D-1				.050	
2				.050	
3				.055	
4				.045	
Temp. meas. tool & S/N: <u>PDT-9 / TC</u>				Time end: _____ hrs	

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Field Data Sheet For BTX

Job CLEAN SOILS  
 Test Location AFTERBURNER STACK  
 Date 2-8-91  
 Operator(s) M.K.  
 Test 2 Run 2  
 Console No. 15  
 Bar. Pressure 29.94 in. Hg.  
 $\gamma$  1.0033

Pretest Leak Check  
 (0 cc/min at 12 IN.HG. VAC)  
 Post Test Leak Check  
 (0 cc/min at 12 IN.HG. VAC)

Sampling Time (min.)	Sample Volume (CF)	Flow Rate (cc/min)	Vacuum (in. Hg)	Meter Temp
(1655)	846.161	111111	111111	111111
5	846.321	1000	3	79
10	846.875	1000	3	79
15	846.729	970	5	79
20	846.888	880	5	80
25	847.047	880	5	80
30	847.202	880	5	80
35	847.360	880	5	80
40	847.521	860	5.5	80
45	847.671	860	5.5	82
50	847.827	840	6	83
55	847.970	820	6	84
60	848.113	820	6	84

(1755)  $v_m$  7.952 CF

$i_m$  81 °F

$v_{STD} = 1.913$

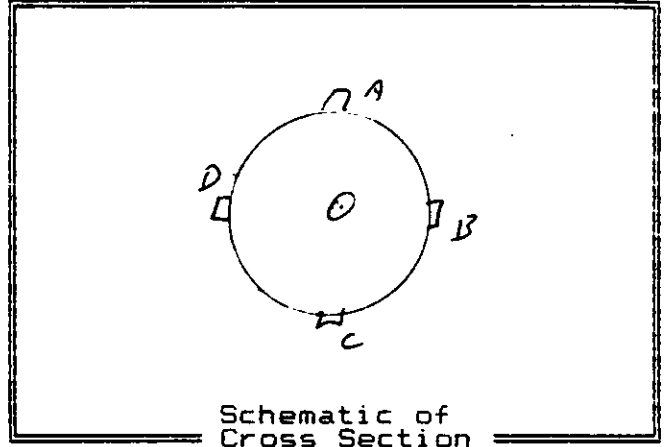
Afterburner went down 1708  
 Back up 1723

C-11



INTERPOL LABORATORIES EPA METHOD 2 FIELD DATA SHEET

Job Clean Soils / Tampa F1  
 Source Soil Remediation Unit / Stack  
 Test 2 Run 3 Date 2-8-91  
 Stack dimen. 77 IN.  
 Dry bulb      °F Wet bulb      °F  
 Manometer:  Reg.  Exp.  Elec.  
 Barometric pressure 29.94 in Hg  
 Static pressure - .08 in WC  
 Operators M. Kuehler, J. Bergstrom  
 Pitot No. WCP Cp .84



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: <u>10</u> in.		Time start: <u>    </u> hrs	
A - 1	<u>.032</u>	<u>2.46</u>	<u>12.46</u>	<u>.040</u>	<u>1443</u>
2	<u>.105</u>	<u>8.09</u>	<u>18.09</u>	<u>.045</u>	
3	<u>.194</u>	<u>14.94</u>	<u>24.94</u>	<u>.045</u>	
4	<u>.323</u>	<u>24.87</u>	<u>34.87</u>	<u>.050</u>	
B - 1				<u>.035</u>	
2				<u>.045</u>	
3				<u>.050</u>	
4				<u>.050</u>	
C - 1				<u>.045</u>	
2				<u>.045</u>	
3				<u>.050</u>	
4				<u>.055</u>	
D - 1				<u>.035</u>	
2				<u>.040</u>	
3				<u>.050</u>	
4				<u>.045</u>	
Temp. meas. tool & S/N: <u>PPT-9/TC</u>				Time end: <u>    </u> hrs	

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Field Data Sheet For BTX

Job CLEAN SOILS

Test Location AFTER BURNER STACK

Date 2-8-91

Operator(s) M.K.

Test 2 Run 3

Console No. 15

Bar. Pressure 29.94 in. Hg.

$\delta$  1.0033

Pretest Leak Check  
(0 cc/min at 12 IN.HG. VAC)

Post Test Leak Check  
(0 cc/min at 12 IN.HG. VAC)

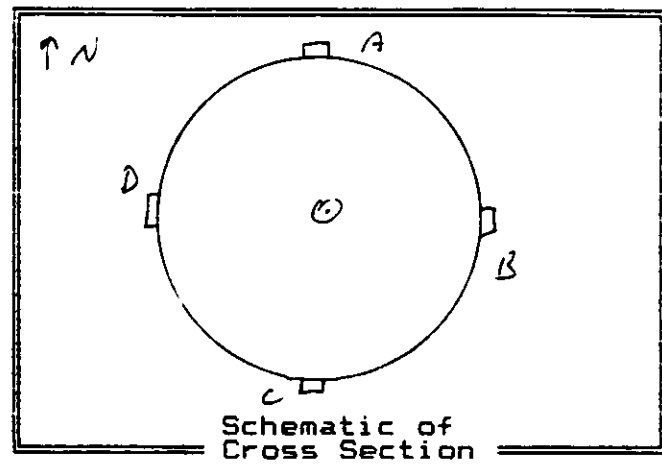
Sampling Time (min.)	Sample Volume (CF)	Flow Rate (cc/min)		Vacuum (in. Hg.)	Stack Temp. (°F)	Meter Temp. (°F)	
(2005)	848.137	1111111	1111111	1111111	1111111	1111111	1111111
5	848.325	1000		3.5		72	
10	848.513	1000		4.5		72	
15	848.680	1000		5.0		72	
20	848.856	940		6.0		72	
25	849.032	920		6.0		74	
30	849.200	920		6.0		74	
35	849.366	900		6.0		76	
40	849.532	900		6.0		78	
45	849.789	900		6.0		78	
50	849.851	880		6.0		79	
55	850.009	860		6.0		80	
60	850.167	860		6.0		80	

(2105)  $V_m$  2.030 CF  $i_m$  76 °F

$V_{std} = 2.008$

C-13

Job Clean Soils / Tampa Bay FL  
 Source Soil Remediation Unit / Stack  
 Test 3 Run 1,2,3 Date 2-9-91  
 Stack dimen. 77 IN.  
 Dry bulb \_\_\_\_\_ °F Wet bulb \_\_\_\_\_ °F  
 Manometer:  Reg.  Exp.  Elec.  
 Barometric pressure 30.00 in Hg  
 Static pressure - .09 in WC  
 Operators M. Kaehler, S. Bergstrom  
 Pitot No. WCP Cp .84



Traverse Point No.	Fraction of Diameter	Distance from Stack Wall (in)	Distance from End of Port (in)	Velocity Pressure (in WC)	Temperature of gas (°F)
		Port length: 10.0 in.		Time start: 1150 hrs	
B 1	.021	1.61	11.61	.040	
2	.067	5.16	15.16	.045	
3	.118	9.09	19.09	.045	
4	.177	13.63	23.63	.050	
5	.250	19.25	29.25	.050	
6	.356	26.95	36.95	.050	
A 1				.025	
2				.020	
3				.030	
4				.035	
5				.040	
6				.045	
D 1				.050	
2				.050	
3				.045	
4				.060	
5				.050	
6				.045	
C 1				.040	
2				.040	
3				.045	
4				.050	
5				.055	
6				.050	
					1403
Temp. meas. tool & S/N: PDT-9 / TC				Time end: _____ hrs	

R or nothing = reg. manometer; S = expanded; E = electronic S-392.1

INTERFOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Clean Soils / Tampa Bag FI Date 2-9-91 Test 3 Run 1  
 Source Soil Remediation Unit / stack No. of traverse points 24  
 Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

**Sample Train Leak Check:**

Pretest: ( 0.02 cfm at 15 in. Hg. (vac)   
 Posttest: 0 cfm at 2 in. Hg. (vac)

**Particulate Catch Data:**

No.s of filters used: 1814 Recovery solvent(s)  
 acetone \_\_\_\_\_  
 other(s) \_\_\_\_\_  
 No. of probe wash bottles: 1  
 Sample recovered by: M. Kaehler, C. Mosser

**Condensate Data:**

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	734	498	236
Impinger No. 2	189	145	44
Impinger No. 3			
Condenser			
Desiccant	1477	1460	17
Total			297

**Integrated Gas Sampling Data:**

Bag Pump No. B11 Box No. 22 Bag No. 1  
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L  
 Pretest leak check: 0 cc/min at 20 in. Hg.  
 Time start: 1235 (HRS) Time end: 1356 (HRS)  
 Sampling rate: 400 cc/min Operator: M. Kaehler  
 S/N of O<sub>2</sub> Analyzer used to monitor train outlet: 9

CF-023

INTERPOL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job Clean Soils / Tampa Bay, FL  
 Source Soil Remediation Unit / Stack  
 Date 2-9-91 TEST 3 RUN 1

Operator M. Kachler, J. Bergstrom  
 Meter Box No. 9 <sup>4</sup> HP 1.80 IN WC  
 Gas meter coeff. .9942

Pitot No. WCP Cp .84  
 Bar. Press. 30.00 inHg H<sub>2</sub>O 28 x  
 Nozzle No. 3M-10 Nozzle Dia. 600 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Drifted Meter (inWC)	Obs. Vol. (cf)	VAC. inHg	Temperatures (°F)						Oxygen (xv/v)	
							Stack	Probe	Dye	Inpg.	Gas/In	Gas/Out		
	(1235)	682.60												
B-6	2.5	684.15	.055	1.36	4.23	4	1402	258	250	42	66	63	9.0	
5	5	685.84	.055	1.36	5.86	4	1402				68	64	8.8	
4	7.5	687.53	.060	1.49	7.57	4.5	1400				70	65	8.5	
3	10	689.20	.055	1.37	9.22	4	1397	255	247	41	70	65	8.5	
2	12.5	690.67	.045	1.12	0.70	3.5	1397				71	66	8.4	
1	15	692.17	.045	1.13	2.20	4	1395				73	66	8.3	
A-6	17.5	693.95	.050	1.25	3.77	4.5	1398	261	243	42	72	66	8.0	
5	20	695.39	.055	1.37	5.42	5	1402				74	67	7.7	
4	22.5	697.11	.060	1.51	7.14	5.5	1400				74	67	7.4	
3	25	698.70	.050	1.25	8.71	5	1403	257	252	44	75	68	7.6	
2	27.5	700.25	.050	1.26	0.29	5	1400				75	68	7.5	
1	30	701.58	.035	.88	1.62	3	1399				75	68	7.9	
D-6	32.5	703.15	.050	1.26	3.19	5	1401	258	249	44	73	68	9.1	
5	35	704.75	.050	1.25	4.77	5	1403				76	69	8.5	
4	37.5	706.11	.035	.88	6.09	3	1405				76	69	8.5	
3	40	707.54	.045	1.13	7.59	4	1407	262	254	46	75	70	9.2	
2	42.5	708.97	.040	1.00	9.00	3.5	1407				76	70	8.2	
1	45	710.20	.030	.75	0.23	3	1405				76	70	8.6	
C-6	47.5	711.75	.050	1.26	1.81	4.5	1404	259	250	47	76	70	8.9	
5	50	713.24	.040	1.01	3.23	3.5	1399				78	71	8.3	
4	52.5	714.85	.050	1.26	4.81	5	1400				79	71	8.3	
3	55	716.33	.045	1.14	6.32	4	1398	254	253	49	79	72	8.2	
2	57.5	717.80	.045	1.14	7.83	4	1398				79	72	8.4	
1	60	719.25	.040	1.01	9.26	3.5	1398				79	72	8.9	
	(1356)													
	θ = 60	V <sub>s</sub> = 36.65		^H = 1.19									Avg. = 71.2	

C-16

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Clean Soils / Tampa Bay F1 Date 2-9-91 Test 3 Run 2  
 Source Soil Remediation Unit / Stack No. of traverse points 24  
 Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

**Sample Train Leak Check:**

Pretest: 0.02 cfm at 15 in. Hg. (vac)   
 Posttest: 0 cfm at 10 in. Hg. (vac)

**Particulate Catch Data:**

No.s of filters used: 295B Recovery solvent(s)  
 acetone  
 other(s)  
 No. of probe wash bottles: 1  
 Sample recovered by: M. Kaehler, C. Mosser

**Condensate Data:**

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	735	500	235
Impinger No. 2	211	195	20
Impinger No. 3			
Condenser			
Desiccant	1365	1352	13
Total			268

**Integrated Gas Sampling Data:**

Bag Pump No. B11 Box No. 22 Bag No. 2  
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L  
 Pretest leak check: 0 cc/min at 20 in. Hg.  
 Time start: 1425 (HRS) Time end: 1620 (HRS)  
 Sampling rate: 400 cc/min Operator: M. Kaehler  
 S/N of O<sub>2</sub> Analyzer used to monitor train outlet: 9

CF-023

INTERPOL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job Clean Socks / Tampa Bay FL  
 Source Sail Remediation Unit / Stack  
 Date 2-9-91 Test 3 Run 2

Operator M. Knicker, J. Bergstrom  
 Meter Box No. 9 <sup>HP</sup> 180 <sup>IN</sup> NC  
 Gas meter coeff. .9942

Pitot No. WCP Cp .84  
 Bar. Press. 30.00 inHg <sup>H2O</sup> 28 x  
 Nozzle No. 2AG-10 Nozzle Dia. .620 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Drifted Meter (inWC)	Obs. Vol. (cf)	VAC. inHg	Temperatures (°F)						Oxygen (xv/v)	
							Stack	Probe	Oven	Inpg.	Gas/In	Gas/Out		
	(1425)	719.50												
C-6	2.5	720.02	.045	1.13	0.99	4	1403	247	253	45	70	69	9.5	
5	5	722.52	.050	1.25	2.56	4	1402				72	69	9.1	
4	7.5	724.01	.045	1.13	4.06	4	1400		2		74	70	8.8	
3	10	725.52	.045	1.13	5.56	4	1401	255	257	43	75	70	9.3	
2	12.5	726.97	.040	1.00	6.97	3.5	1405				76	71	9.0	
1	15	728.50	.050	1.26	8.55	4.5	1403				77	71	8.4	
D-6	17.5	730.18	.055	1.39	0.22	4.5	1400	263	251	41	68	67	9.9	
5	20	731.71	.045	1.13	1.71	4	1392				69	68	9.8	
4	21.5	733.12	.040	1.00	3.11	3.5	1395				71	68	10.4	
3	25	734.50	.040	1.00	4.52	3.5	1395	258	247	42	72	69	10.1	
2	27.5	735.72	.030	.75	5.74	3	1396				74	69	9.6	
1	30	736.93	.030	.75	6.97	3	1400				74	70	10.1	
A-6	32.5	738.60	.055	1.38	8.62	5	1410	255	249	44	70	69	9.8	
5	35	740.37	.065	1.61	0.40	5.5	1417				73	69	10.5	
4	37.5	742.13	.065	1.61	2.19	5.5	1423				74	70	10.9	
3	40	743.88	.060	1.49	3.91	5.5	1430	260	252	45	75	70	10.4	
2	42.5	745.60	.060	1.50	5.63	5.5	1415				76	71	10.1	
1	45	747.33	.060	1.51	7.36	5.5	1406				77	71	10.8	
B-6	47.5	748.94	.050	1.26	8.94	4.5	1411	253	256	44	78	71	10.3	
5	50	750.64	.060	1.51	0.68	5	1408				78	72	9.4	
4	52.5	752.56	.075	1.88	2.61	7	1420				79	72	9.8	
3	55	754.37	.065	1.62	4.41	6	1431	259	252	42	80	73	9.7	
2	57.5	756.16	.060	1.50	6.14	5.5	1428				80	73	8.9	
1	60	757.75	.050	1.26	7.73	5	1409				80	73	8.7	
	(1620)													
	θ =	V <sub>s</sub> = 38.25		^H = 7.29									Avg. = 72.4	

C-18

INTERPOLL LABORATORIES EPA METHOD 5/17 SAMPLE LOG SHEET

Job Clean Soils / Tampa Bay F1 Date 2-9-91 Test 3 Run 3  
 Source Soil Remediation Unit / Stack No. of traverse points 24  
 Method 5 Filter holder: 4" Glass Filter type: 4" G.F.

**Sample Train Leak Check:**

Pretest: ( 0.02 cfm at 15 in. Hg. (vac)   
 Posttest: ( 0 cfm at 10 in. Hg. (vac)

**Particulate Catch Data:**

No.s of filters used: 2960 Recovery solvent(s)  
 acetone \_\_\_\_\_  
 other(s) \_\_\_\_\_

No. of probe wash bottles: 1  
 Sample recovered by: M. Kaehler, C. Mosser

**Condensate Data:**

Item	Weight (g)		
	Final	Tare	Difference
Impinger No. 1	730	498	232
Impinger No. 2	261	193	68
Impinger No. 3			
Condenser			
Desiccant	1495	1477	18
<b>Total</b>			<b>318</b>

**Integrated Gas Sampling Data:**

Bag Pump No. B11 Box No. 22 Bag No. 3  
 Bag Material: 5-layer Aluminized Tedlar Size: 44 L  
 Pretest leak check: 0 cc/min at 20 in. Hg.  
 Time start: 1707 (HRS) Time end: 1817 (HRS)  
 Sampling rate: 400 cc/min Operator: M. Kaehler  
 S/N of O<sub>2</sub> Analyzer used to monitor train outlet: 9

CF-023



INTERPOL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job Clean Sails / Tampa Bay, FL  
 Source Soil Remediation Unit / Stack  
 Date 2-9-91 1991 3 3

Operator McKeeley J. Berstrom  
 Meter Box No. 5 1.80 IN WC  
 Gas meter coeff. 9972

Pitot No. WCP Cp .81  
 Bar. Press. 30.00 inHg H2O 26 x  
 Nozzle No. INC-10 Nozzle Dia .620 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inWC)	Drifted Water (inWC)	Des. Vol. (cf)	VAC. inHg	Temperatures (°F)						Oxygen (xv/v)	
							Stack	Probe	Duct	Inpg.	Gas/In	Gas/Out		
	(1707)	758.03												
B - 6	2.5	760.47	.055	1.44	0.52	5	1410	248	253	44	72	70	9.6	
	5	762.24	.060	1.57	2.28	5	1413				75	71	9.1	
	4	764.03	.060	1.58	4.05	5.5	1407				77	72	8.4	
	3	765.84	.065	1.71	5.89	6	1407	250	248	41	78	72	8.0	
	2	767.72	.065	1.72	7.74	6	1403				79	72	7.9	
	1	769.40	.055	1.45	9.44	5	1416				79	72	7.7	
A - 6	17.5	771.06	.050	1.31	1.05	4.5	1428	253	256	42	80	73	7.4	
	5	772.77	.055	1.43	2.75	4.5	1441				80	73	7.7	
	4	774.45	.055	1.41	4.43	5	1462				80	73	7.7	
	3	776.25	.065	1.66	6.25	5.5	1471	254	253	44	81	73	9.2	
	2	777.94	.055	1.42	7.94	5	1452				81	74	8.8	
	1	779.58	.055	1.43	9.63	5	1441				81	74	8.4	
D - 6	32.5	781.15	.045	1.17	1.22	4.5	1436	261	249	43	81	74	8.4	
	5	782.83	.055	1.44	2.97	5	1425				81	74	8.4	
	4	784.60	.060	1.57	4.64	5.5	1434				82	74	9.8	
	3	786.27	.055	1.45	6.34	5.5	1421	255	251	45	82	74	9.5	
	2	787.98	.055	1.46	8.05	5.5	1412				82	75	9.4	
B	45	789.59	.050	1.32	9.68	5	1420				82	75	9.3	
C - 6	47.5	791.40	.060	1.58	1.45	5.5	1428	252	255	46	82	75	9.7	
	5	793.25	.070	1.83	3.37	7	1437				82	75	10.5	
	4	795.37	.080	2.06	5.40	8	1461				82	75	10.3	
	3	797.31	.075	1.95	7.37	7.5	1450	257	251	48	82	75	10.0	
	2	799.11	.060	1.57	9.15	6	1432				82	75	9.7	
	1	800.83	.055	1.44	0.95	5.5	1428				82	75	9.6	
	(1817)													
	θ = 60	V <sub>0</sub> = 42.00		^H = 2.54									Avg. = 76.8	

C-20

Visible Emissions Form

SOURCE NAME <i>CLEAN SOILS</i>			OBSERVATION DATE <i>2-9-91</i>				START TIME <i>1430</i>		STOP TIME <i>1625</i>			
ADDRESS			SEC	0	15	30	45	SEC	0	15	30	45
CITY <i>TAMPA</i>			MIN	0	15	30	45	MIN	0	15	30	45
STATE <i>FLA.</i>			1	0	0	0	0	31	0	0	0	0
ZIP			2	0	0	0	0	32	0	0	0	0
PHONE			3	0	0	0	0	33	0	0	0	0
SOURCE ID NUMBER <i>AFTERBURNER STACIL</i>			4	0	0	0	0	34	0	0	0	0
PROCESS EQUIPMENT			5	0	0	0	0	35	0	0	0	0
OPERATING MODE			6	0	0	0	0	36	0	0	0	0
CONTROL EQUIPMENT <i>BAGHOUSE</i>			7	0	0	0	0	37	0	0	0	0
OPERATING MODE <i>8-10 to n/h.r.</i>			8	0	0	0	0	38	0	0	0	0
DESCRIBE EMISSION POINT			9	0	0	0	0	39	0	0	0	0
START <i>NONDETECTABLE</i> STOP <input checked="" type="checkbox"/>			10	0	0	0	0	40	0	0	0	0
HEIGHT ABOVE GROUND LEVEL START <i>35'</i> STOP <input checked="" type="checkbox"/>			11	0	0	0	0	41	0	0	0	0
HEIGHT RELATIVE TO OBSERVER START <i>100'</i> STOP <input checked="" type="checkbox"/>			12	0	0	0	0	42	0	0	0	0
DISTANCE FROM OBSERVER START <i>75'</i> STOP <input checked="" type="checkbox"/>			13	0	0	0	0	43	0	0	0	0
DIRECTION FROM OBSERVER START <i>N.E.</i> STOP			14	0	0	0	0	44	0	0	0	0
DESCRIBE EMISSIONS			15	0	0	0	0	45	0	0	0	0
START <i>NONDETECTABLE</i> STOP <input checked="" type="checkbox"/>			16	0	0	0	0	46	0	0	0	0
EMISSION COLOR			17	0	0	0	0	47	0	0	0	0
START <i>NONE</i> STOP <input checked="" type="checkbox"/>			18	0	0	0	0	48	0	0	0	0
PLUME TYPE: CONTINUOUS <input checked="" type="checkbox"/>			19	0	0	0	0	49	0	0	0	0
FUGITIVE <input type="checkbox"/> INTERMITTENT <input type="checkbox"/>			20	0	0	0	0	50	0	0	0	0
WATER DROPLETS PRESENT: NO <input checked="" type="checkbox"/> YES <input type="checkbox"/>			21	0	0	0	0	51	0	0	0	0
IF WATER DROPLET PLUME: ATTACHED <input type="checkbox"/> DETACHED <input type="checkbox"/>			22	0	0	0	0	52	0	0	0	0
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED			23	0	0	0	0	53	0	0	0	0
START <i>STACK EXIT</i> STOP <input checked="" type="checkbox"/>			24	0	0	0	0	54	0	0	0	0
DESCRIBE BACKGROUND			25	0	0	0	0	55	0	0	0	0
START <i>SKY</i> STOP <input checked="" type="checkbox"/>			26	0	0	0	0	56	0	0	0	0
BACKGROUND COLOR			27	0	0	0	0	57	0	0	0	0
START <i>BLUE</i> STOP <input checked="" type="checkbox"/>			28	0	0	0	0	58	0	0	0	0
SKY CONDITIONS			29	0	0	0	0	59	0	0	0	0
START <i>CLEAR</i> STOP <input checked="" type="checkbox"/>			30	0	0	0	0	60	0	0	0	0
WIND SPEED			AVERAGE OPACITY FOR HIGHEST PERIOD <i>0</i>									
START <i>10-15</i> STOP <input checked="" type="checkbox"/>			NUMBER OF READINGS ABOVE 20% WERE <i>6</i>									
WIND DIRECTION			RANGE OF OPACITY READINGS									
START <i>NW</i> STOP <input checked="" type="checkbox"/>			<i>0</i> MINIMUM <i>0</i> MAXIMUM									
AMBIENT TEMP.			OBSERVER'S NAME (PRINT) <i>CURTIS MOSSER</i>									
START <i>70</i> STOP <i>72</i>			OBSERVER'S SIGNATURE <i>Curtis Mosser</i>									
WET BULB TEMP			DATE <i>2-9-91</i>									
RH. percent			ORGANIZATION <i>INTERPOLL LABS</i>									
SOURCE LAYOUT SKETCH			I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS									
DRAW NORTH ARROW			SIGNATURE									
Sun → Wind →			CERTIFIED BY <i>ETA/MPCA</i>									
Plume and Stack			DATE <i>10-17-90</i>									
Observers Position			VERIFIED BY									
Sun Location Line			DATE									
140°												

**APPENDIX D**

**INTERPOLL LABS ANALYTICAL DATA**

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EPA Method 3 Data Reporting Sheet  
Orsat Analysis

Job Clean Soils  
 Team Leader MK  
 Date Submitted 2-10-91  
 Test No. 3  
 Date of Analysis 2-11-91

Source Soil Remediation Unit  
 Test Site Philetto afterburner  
 Date of Test 2-8-91  
 No. of Runs Completed 3  
 Technician R. Edm.

Test/Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO <sub>2</sub> %v/v Dry	Conc. O <sub>2</sub> %v/v Dry	F <sub>o</sub>
			Zero Pt.	After CO <sub>2</sub>	After O <sub>2</sub>			
111	2323-05	1	0.00	8.20	17.30	8.20	9.10	1.44
		2	0.00	8.20	17.3	8.20	9.10	1.44
		Avg	████████████████████			8.20	9.10	████
112	-06	1	0.00	7.50	17.40	7.50	9.90	1.47
		2	0.00	7.50	17.40	7.50	9.90	1.47
		Avg	████████████████████			7.50	9.90	████
113	-07	1	0.00	8.30	17.20	8.30	8.90	1.45
		2	0.00	8.30	17.20	8.30	8.90	1.45
		Avg	████████████████████			8.30	8.90	████
	□ B □ F	1						
		2						
		Avg	████████████████████					████
	□ B □ F	1						
		2						
		Avg	████████████████████					████
	□ B □ F	1						
		2						
		Avg	████████████████████					████
	□ B □ F	1						
		2						
		Avg	████████████████████					████
	□ B □ F	1						
		2						
		Avg	████████████████████					████

- Ambient Air QA Check
- Orsat Analyzer System Leak Check
- F<sub>o</sub> Within EPA M-3 Guidelines for fuel type.

Where  $F_o = \frac{20.9 - O_2}{CO_2}$

EPA Method 3 Guidelines  
Fuel Type F<sub>o</sub> Range

Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130

F=Flask (250 cc all glass)  
B=Tedlar Bag (5-layer)

EPA Method 3 Data Reporting Sheet  
Orsat Analysis

Job Clean Soils Source Soil Remediation Unit  
 Team Leader MK Test Site Stack  
 Date Submitted 2-10-91 Date of Test 2-9-91  
 Test No. 3 No. of Runs Completed 3  
 Date of Analysis 2-11-91 Technician R. Sullivan

Test/Run	Sample Log Number and Type	No. of An.	Buret Readings (ml)			Conc. CO <sub>2</sub>	Conc. O <sub>2</sub>	F <sub>0</sub>
			Zero Pt.	After CO <sub>2</sub>	After O <sub>2</sub>	%v/v Dry	%v/v Dry	
3/1	2323-18 <input checked="" type="checkbox"/> B <input type="checkbox"/> F	1	0.00	7.40	17.30	7.40	9.90	1.49
		2	0.00	7.40	17.30	7.40	9.90	1.49
		Avg	██			7.40	9.90	████
3/2	-22 <input checked="" type="checkbox"/> B <input type="checkbox"/> F	1	0.00	6.00	17.70	6.00	11.70	1.53
		2	0.00	6.00	17.70	6.00	11.70	1.53
		Avg	██			6.00	11.70	████
3/3	-26 <input checked="" type="checkbox"/> B <input type="checkbox"/> F	1	0.00	7.10	16.90	7.10	9.80	1.56
		2	0.00	7.10	16.90	7.10	9.80	1.56
		Avg	██			7.10	9.80	████
	<input type="checkbox"/> B <input type="checkbox"/> F	1						
		2						
		Avg	██					████
	<input type="checkbox"/> B <input type="checkbox"/> F	1						
		2						
		Avg	██					████
	<input type="checkbox"/> B <input type="checkbox"/> F	1						
		2						
		Avg	██					████
	<input type="checkbox"/> B <input type="checkbox"/> F	1						
		2						
		Avg	██					████
	<input type="checkbox"/> B <input type="checkbox"/> F	1						
		2						
		Avg	██					████

- Ambient Air QA Check
- Orsat Analyzer System Leak Check
- F<sub>0</sub> Within EPA M-3 Guidelines for fuel type.

Where F<sub>0</sub> =  $\frac{20.9 - O_2}{CO_2}$

EPA Method 3 Guidelines

Fuel Type	F <sub>0</sub> Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130

F=Flask (250 cc all glass)  
B=Tedlar Bag (5-layer)

Interpoll Laboratories  
(612) 786-6020

EPA Method 5 Data Reporting Sheet  
Impinger Catch ~~Minnesota~~ Protocol

Job Clean Soils Source Soil Remediation Unit  
 Team Leader MK Test Site Stack  
 Date Submitted 2-10-91 Date of Test 2-9-91  
 Test No. 3 No. of Runs Completed 3  
 Date of Analysis 2-13-91 Technician R. Gulen

0	Test <u>    </u> Run <u>0</u> Field Blank Log Number <u>    </u> Comments <u>    </u>	Dish No. <u>    </u> Dish Tare Wt. <u>    </u> g Dish+Sample Wt. <u>    </u> g Sample Wt. <u>    </u> g
1	Test <u>3</u> Run <u>1</u> Log Number <u>2323-17</u> Comments <u>    </u>	Dish No. <u>68</u> Dish Tare Wt. <u>48.0369</u> g Dish+Sample Wt. <u>48.0546</u> g Sample Wt. <u>0.0177</u> g
2	Test <u>3</u> Run <u>2</u> Log Number <u>-21</u> Comments <u>    </u>	Dish No. <u>69</u> Dish Tare Wt. <u>47.9886</u> g Dish+Sample Wt. <u>48.0014</u> g Sample Wt. <u>0.0128</u> g
3	Test <u>3</u> Run <u>3</u> Log Number <u>-25</u> Comments <u>    </u>	Dish No. <u>90</u> Dish Tare Wt. <u>49.7417</u> g Dish+Sample Wt. <u>49.7528</u> g Sample Wt. <u>0.0111</u> g
4	Test <u>    </u> Run <u>    </u> Log Number <u>    </u> Comments <u>    </u>	Dish No. <u>    </u> Dish Tare Wt. <u>    </u> g Dish+Sample Wt. <u>    </u> g Sample Wt. <u>    </u> g
5	Test <u>    </u> Run <u>    </u> Log Number <u>    </u> Comments <u>    </u>	Dish No. <u>    </u> Dish Tare Wt. <u>    </u> g Dish+Sample Wt. <u>    </u> g Sample Wt. <u>    </u> g

Blank Solvent Wt. 0.0003 g

Results:

Field Blk.      Run 1      Run 2      Run 3      Run 4      Run 5

	0.0174	0.0125	0.0108	D-3	
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EPA Method 5 Data Reporting Sheet  
Probe/Cyclone Wash

Job Clean Soils Source Soil Remediation Unit  
 Team Leader MK Test Site Stack  
 Date Submitted 2-10-91 Date of Test 2-9-91  
 Test No. 3 No. of Runs Completed 3  
 Date of Analysis 2-12-91 Technician R. Gulim  
 Transport Leakage  None  \_\_\_\_\_ ml Solvent Acetone

0	Test _____ Run <u>0</u> Field Blank Log Number _____ Vol. of Solvent _____ ml *Solvent Residue <u>2.0</u> ug/ml	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
1	Test <u>3</u> Run <u>1</u> Vol. of Solvent <u>140</u> ml Log Number _____ - <u>15</u> Comments _____	Dish No. <u>3</u> Dish Tare Wt. <u>57.8073</u> g Dish+Sample Wt. <u>58.0008</u> g Sample Wt. <u>0.1935</u> g
2	Test <u>3</u> Run <u>2</u> Vol. of Solvent <u>120</u> ml Log Number _____ - <u>19</u> Comments _____	Dish No. <u>7</u> Dish Tare Wt. <u>48.7954</u> g Dish+Sample Wt. <u>48.8859</u> g Sample Wt. <u>0.0905</u> g
3	Test <u>3</u> Run <u>3</u> Vol. of Solvent <u>100</u> ml Log Number _____ - <u>23</u> Comments _____	Dish No. <u>26</u> Dish Tare Wt. <u>48.3841</u> g Dish+Sample Wt. <u>48.4623</u> g Sample Wt. <u>0.0782</u> g
4	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Vol. of Solvent _____ ml Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

\*Solvent Residue \_\_\_\_\_ ug/ml = [(Sample Wt. \_\_\_\_\_ g) (10<sup>6</sup>)] / Vol. of Sol. \_\_\_\_\_ ml

EPA-M5 Acetone Residue Blank Spec. { 7.3 ug/ml

Results:

Field Blk.      Run 1      Run 2      Run 3      Run 4      Run 5

	0.1932	0.0903	0.0780	D-4	
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EPA Method 5 Data Reporting Sheet  
Filter Gravimetrics

Job Clean Soils Source Soil Remediation Unit  
 Team Leader MK Test Site Stack  
 Date Submitted 2-11-91 Date of Test 2-9-91  
 Test No. 3 No. of Runs Completed 3  
 Date of Analysis 2-11-91 Technician B. D. [Signature]

0	Test <u>Run 0</u> Field Blank Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____ g Filter+Sample Wt. _____ g Sample Wt. _____ g
1	Test <u>3</u> Run <u>1</u> Log Number <u>-16</u> Comments _____	Filter No. <u>1814</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>0.9422</u> g Filter+Sample Wt. <u>0.9650</u> g Sample Wt. <u>0.0228</u> g
2	Test <u>3</u> Run <u>2</u> Log Number <u>-20</u> Comments _____	Filter No. <u>2958</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>0.9361</u> g Filter+Sample Wt. <u>0.9590</u> g Sample Wt. <u>0.0229</u> g
3	Test <u>3</u> Run <u>3</u> Log Number <u>-24</u> Comments _____	Filter No. <u>2960</u> Filter Type <u>4"GF</u> Filter Tare Wt. <u>0.9332</u> g Filter+Sample Wt. <u>0.9540</u> g Sample Wt. <u>0.0208</u> g
4	Test <u>Run</u> Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____ g Filter+Sample Wt. _____ g Sample Wt. _____ g
5	Test <u>Run</u> Log Number _____ Comments _____	Filter No. _____ Filter Type _____ Filter Tare Wt. _____ g Filter+Sample Wt. _____ g Sample Wt. _____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0228	0.0229	0.0208		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.2334	0.1257	0.1096		



EPA Method 18/NIOSH Sampling  
Data Reporting Sheet

Job/Project Stack/Clean Soils  
Source Soil Remediation Unit  
Test Site Stack

Date of Sampling 2-8-91  
Analyst RJD  
Date of Analysis 2/28/91  
Method of Analysis NIOSH 1501

Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-08	Test <u>2</u> Run <u>0</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	<5.0	<1.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	<5.0	<1.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	<5.0	<1.5
		<input type="checkbox"/> XAD-2	<input checked="" type="checkbox"/> 800/200	Xylenes	<5.0	<1.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.1 Field Blank</u>						

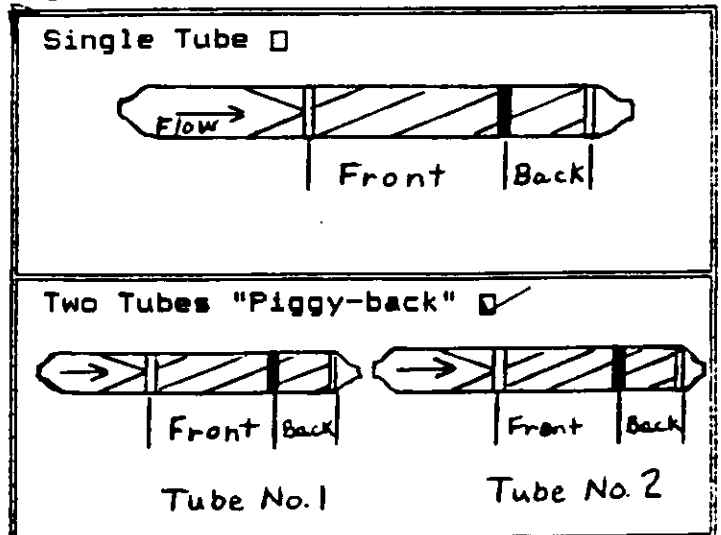
Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-08	Test <u>2</u> Run <u>0</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	<5.0	<1.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	<5.0	<1.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	<5.0	<1.5
		<input type="checkbox"/> XAD-2	<input checked="" type="checkbox"/> 800/200	Xylenes	<5.0	<1.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.2 Field Blank</u>						

Detection Limits:

Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
<u>Benzene</u>	<u>5.0</u>	<u>1.5</u>
<u>Toluene</u>	<u>5.0</u>	<u>1.5</u>
<u>E-Benzene</u>	<u>5.0</u>	<u>1.5</u>
<u>Xylenes</u>	<u>5.0</u>	<u>1.5</u>

C/C Coal = Coconut Charcoal  
P/C Coal = Petroleum Charcoal  
S. Gel = Silica Gel

Tube Schematics:



EPA Method 18/NIOSH Sampling  
Data Reporting Sheet

Job/Project Stack/Clean Soils  
Source Soil Remediation Unit  
Test Site Stack

Date of Sampling 2-8-91  
Analyst APD  
Date of Analysis 2/28/91  
Method of Analysis NIOSH 1501

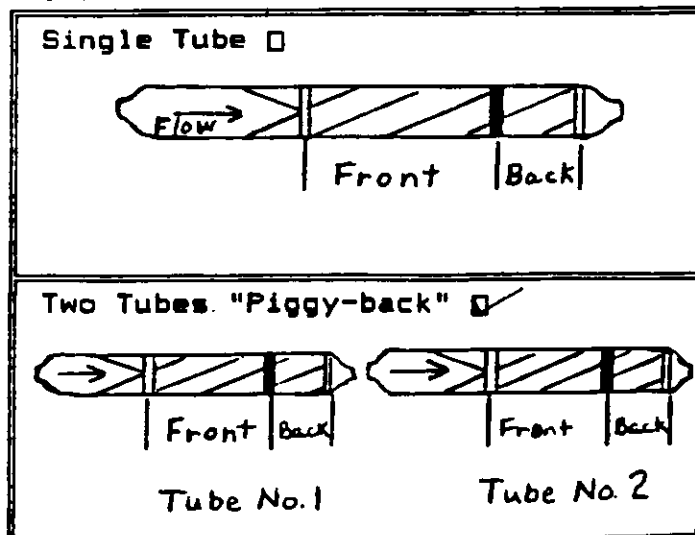
Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-09	Test <u>2</u> Run <u>1</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	5.0	1.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	5.0	1.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	5.0	1.5
		<input type="checkbox"/> XAD-2	<input checked="" type="checkbox"/> 800/200	Xylenes	5.0	1.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.1</u>						

Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-09	Test <u>2</u> Run <u>1</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	5.0	1.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	5.0	1.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	5.0	1.5
		<input type="checkbox"/> XAD-2	<input checked="" type="checkbox"/> 800/200	Xylenes	5.0	1.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.2</u>						

Detection Limits:

Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
<u>Benzene</u>	<u>5.0</u>	<u>1.5</u>
<u>Toluene</u>	<u>5.0</u>	<u>1.5</u>
<u>Ethylbenzene</u>	<u>5.0</u>	<u>1.5</u>
<u>Xylenes</u>	<u>5.0</u>	<u>1.5</u>

Tube Schematics:



C/C Coal = Coconut Charcoal  
P/C Coal = Petroleum Charcoal  
S. Gel = Silica Gel

EPA Method 18/NIOSH Sampling  
Data Reporting Sheet

Job/Project Stack/Clean Soils Date of Sampling 2-8-91  
 Source Soil Remediation Unit Analyst MS  
 Test Site Stack Date of Analysis 2/28/91  
 Method of Analysis NIOSH 1501

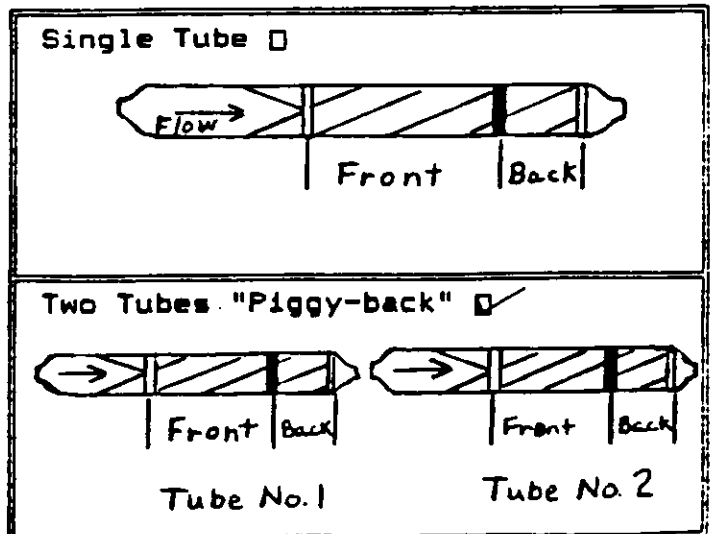
Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-10	Test <u>2</u> Run <u>2</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	70	11.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	72	11.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	15.0	11.5
		<input type="checkbox"/> XAD-2	<input checked="" type="checkbox"/> 800/200	Xylene	15.0	11.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.1</u>						

Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-10	Test <u>2</u> Run <u>2</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	15.0	11.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	15.0	11.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	15.0	11.5
		<input type="checkbox"/> XAD-2	<input checked="" type="checkbox"/> 800/200	Xylene	15.0	11.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.2</u>						

Detection Limits:

Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
<u>Benzene</u>	5.0	1.5
<u>Toluene</u>	5.0	1.5
<u>E. Benzene</u>	5.0	1.5
<u>Xylenes</u>	5.0	1.5

Tube Schematics:



C/C Coal = Coconut Charcoal  
 P/C Coal = Petroleum Charcoal  
 S. Gel = Silica Gel

EPA Method 18/NIOSH Sampling  
Data Reporting Sheet

Job/Project Stack/Clean Soils  
Source Soil Remediation Unit  
Test Site Stack

Date of Sampling 2-8-91  
Analyst KDD  
Date of Analysis 2/28/91  
Method of Analysis NIOSH 1501

Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-11	Test <u>2</u> Run <u>3</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	< 5.0	< 1.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	< 5.0	< 1.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	< 5.0	< 1.5
		<input type="checkbox"/> XAD-2	<input type="checkbox"/> 800/200	Xylenes	< 5.0	< 1.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.1</u>						

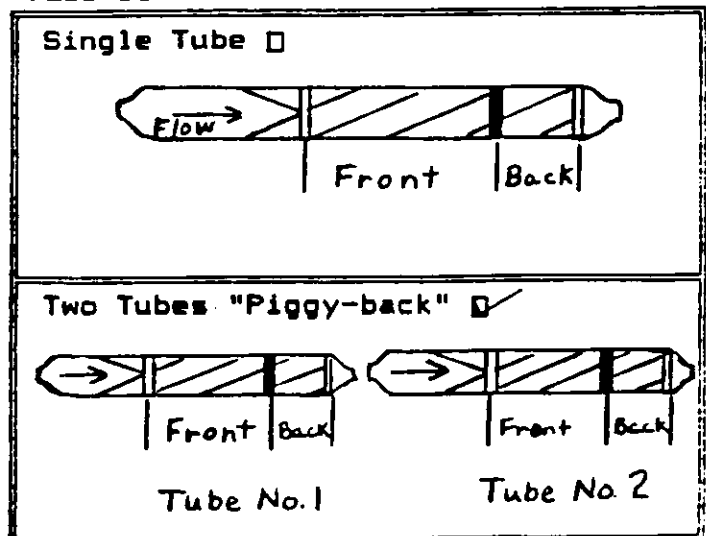
Sample Log Number	Test/Run	Sampling Media	Sample Tube Size	Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
2323-11	Test <u>2</u> Run <u>3</u>	<input type="checkbox"/> C/C Coal	<input type="checkbox"/> 100/50	Benzene	< 5.0	< 1.5
		<input checked="" type="checkbox"/> P/C Coal	<input type="checkbox"/> 300/150	Toluene	< 5.0	< 1.5
		<input type="checkbox"/> S. Gel	<input type="checkbox"/> 400/200	Ethylbenzene	< 5.0	< 1.5
		<input type="checkbox"/> XAD-2	<input type="checkbox"/> 800/200	Xylenes	< 5.0	< 1.5
		<input type="checkbox"/>	<input type="checkbox"/> 1060/240			
		<input type="checkbox"/>	<input type="checkbox"/> 1800/200			
Comments: <u>Tube No.2</u>						

Detection Limits:

Analytes:	Mass Front Section (Total ug)	Mass Back Section (Total ug)
<u>Benzene</u>	<u>5.0</u>	<u>1.5</u>
<u>Toluene</u>	<u>5.0</u>	<u>1.5</u>
<u>E-Benzene</u>	<u>5.0</u>	<u>1.5</u>
<u>Xylenes</u>	<u>5.0</u>	<u>1.5</u>

C/C Coal = Coconut Charcoal  
P/C Coal = Petroleum Charcoal  
S. Gel = Silica Gel

Tube Schematics:



EPA Method 5 Data Reporting Sheet  
Impinger Catch/ Probe Wash / Filter Composite

Job Clean Soils Source Afterburner  
 Team Leader MK Test Site Inlet  
 Date Submitted 3-15-91 Date of Test 2-8-91  
 Test No. 1 No. of Runs Completed 3  
 Date of Analysis 3-15-91 Technician B. Decker

0	Test <u>1</u> Run <u>0</u> Field Blank Log Number <u>2323-36</u> Comments _____	Dish No. <u>78</u> Dish Tare Wt. <u>85.5463</u> g Dish+Sample Wt. <u>85.5470</u> g Sample Wt. <u>0.0007</u> g
1	Test <u>1</u> Run <u>1</u> Log Number <u>-37</u> Comments _____	Dish No. <u>82</u> Dish Tare Wt. <u>60.7616</u> g Dish+Sample Wt. <u>60.9960</u> g Sample Wt. <u>0.2344</u> g
2	Test <u>1</u> Run <u>2</u> Log Number <u>-38</u> Comments _____	Dish No. <u>87</u> Dish Tare Wt. <u>73.3499</u> g Dish+Sample Wt. <u>73.6490</u> g Sample Wt. <u>0.3491</u> g
3	Test _____ Run _____ Log Number <u>-39</u> Comments _____	Dish No. <u>88</u> Dish Tare Wt. <u>55.9073</u> g Dish+Sample Wt. <u>56.2714</u> g Sample Wt. <u>0.3641</u> g
4	Test _____ Run _____ Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g
5	Test _____ Run _____ Log Number _____ Comments _____	Dish No. _____ Dish Tare Wt. _____ g Dish+Sample Wt. _____ g Sample Wt. _____ g

Blank Solvent Wt. 0.0007g

Results:

Field Blk.      Run 1      Run 2      Run 3      Run 4      Run 5

	0.2337	0.3484	0.3634	D-10	
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Interpoll Laboratories  
(612) 786-6020

Chain of Custody  
Sample Deposition Sheet

Job Clean Soils / Tampa Bay FL  
Team Leader M. Kaehler  
Date Submitted \_\_\_\_\_  
Test No. 1

Source Soil Remediation Unit  
Test Site Afterburner Sheet  
Date of Test 2-8-91  
No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
—	Probe Wash: <input checked="" type="checkbox"/> Acetone <input type="checkbox"/> D.I. Water	<input checked="" type="checkbox"/> As per EPA M-5 <input type="checkbox"/> Other _____	
—	Filter: <input checked="" type="checkbox"/> 4" G.F. <input type="checkbox"/> S.S. Thimble <input type="checkbox"/> 2.5" G.F. <input type="checkbox"/> 47 mm G.F.	<input checked="" type="checkbox"/> As per EPA M-5 <input type="checkbox"/> As per EPA M-17 <input type="checkbox"/> Other _____	
3	Impinger Catch: <input checked="" type="checkbox"/> D.I. Water <input type="checkbox"/> 3% H <sub>2</sub> O <sub>2</sub> <input type="checkbox"/> 4M5 Hg Only <input type="checkbox"/> 4M5 Metals <input type="checkbox"/> 1.0 N NaOH <input type="checkbox"/> Other _____	<input type="checkbox"/> MN Protocol <input type="checkbox"/> WI Protocol <input type="checkbox"/> EPA M-6 or 8 <input type="checkbox"/> Acid Gases <input type="checkbox"/> Formaldehyde <input type="checkbox"/> Metals <input checked="" type="checkbox"/> Other <u>THC</u>	
3	Integrated Gas sample	<input checked="" type="checkbox"/> As per EPA M-3? <input type="checkbox"/> As per EPA M-10 <input checked="" type="checkbox"/> Other <u>Propane + Methane</u>	
1	Oxides of Nitrogen (NO <sub>x</sub> )	<input type="checkbox"/> As per EPA M-7A <input type="checkbox"/> Other _____	Date _____ Time (HRS) _____
1	<input type="checkbox"/> Fuel Sample <input type="checkbox"/> Aggregate	<input type="checkbox"/> Attached fuel Form #S-0163RRR	
1	Particle Size	<input type="checkbox"/> X-Ray Sedigraph <input type="checkbox"/> Bahco Method <input type="checkbox"/> Other _____	
1	Audit Samples <input type="checkbox"/> Sulfur Dioxide <input type="checkbox"/> Oxides of Nit. <input type="checkbox"/> Other _____	<input type="checkbox"/> As per EPA M-6 <input type="checkbox"/> As per EPA M-7A <input type="checkbox"/> Other _____	

Source Information

- Type of Source:  Boiler  Asphalt Plant  Incinerator  Dryer  
 Other Soil Remediation Unit
- Fuel:  Coal  Wood  Gas  Oil  RDF  Other Propane
- Is sample combustible?  No  Yes
- Does sample need special handling?  No  Yes If yes, explain

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Chain of Custody  
Sample Deposition Sheet

Job Clean Soils / Tampa Fl Source Soil Remediation Unit  
 Team Leader M. Baehler Test Site Stack  
 Date Submitted \_\_\_\_\_ Date of Test 2-8-91  
 Test No. 2 No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
371	<del>Fuel Sample</del> : <u>BTX</u> <input type="checkbox"/> Acetone <input type="checkbox"/> D.I. Water	<input type="checkbox"/> As per EPA M-5 <input checked="" type="checkbox"/> Other <u>Be T X</u>	<u>Charcoal Tube</u> <u>with Black Band</u> <u>is Second Tube</u>
—	Filter: <input type="checkbox"/> 4" G.F. <input type="checkbox"/> S.S. Thimble <input type="checkbox"/> 2.5" G.F. <input type="checkbox"/> 47 mm G.F.	<input type="checkbox"/> As per EPA M-5 <input type="checkbox"/> As per EPA M-17 <input type="checkbox"/> Other _____	
—	Impinger Catch: <input type="checkbox"/> D.I. Water <input type="checkbox"/> 3% H <sub>2</sub> O <sub>2</sub> <input type="checkbox"/> 4MS Hg Only <input type="checkbox"/> 4MS Metals <input type="checkbox"/> 1.0 N NaOH <input type="checkbox"/> Other _____	<input type="checkbox"/> MN Protocol <input type="checkbox"/> WI Protocol <input type="checkbox"/> EPA M-6 or 8 <input type="checkbox"/> Acid Gases <input type="checkbox"/> Formaldehyde <input type="checkbox"/> Metals <input type="checkbox"/> Other _____	
—	Integrated Gas sample	<input type="checkbox"/> As per EPA M-3 <input type="checkbox"/> As per EPA M-10 <input type="checkbox"/> Other _____	
—	Oxides of Nitrogen (NO <sub>x</sub> )	<input type="checkbox"/> As per EPA M-7A <input type="checkbox"/> Other _____	Date _____ Time (HRS) _____
—	<input type="checkbox"/> Fuel Sample <input type="checkbox"/> Aggregate	<input type="checkbox"/> Attached fuel Form #S-0163RRR	
—	Particle Size	<input type="checkbox"/> X-Ray Sedigraph <input type="checkbox"/> Bahco Method <input type="checkbox"/> Other _____	
—	Audit Samples <input type="checkbox"/> Sulfur Dioxide <input type="checkbox"/> Oxides of Nit. <input type="checkbox"/> Other _____	<input type="checkbox"/> As per EPA M-6 <input type="checkbox"/> As per EPA M-7A <input type="checkbox"/> Other _____	

Source Information

- Type of Source:  Boiler  Asphalt Plant  Incinerator  Dryer  
 Other Soil Remediation Unit
- Fuel:  Coal  Wood  Gas  Oil  RDF  Other Propane
- Is sample combustible?  No  Yes
- Does sample need special handling?  No  Yes If yes, explain \_\_\_\_\_

Interpoll Laboratories  
(612) 786-6020

Chain of Custody  
Sample Deposition Sheet

Job Clean Soils / Tampa Bay FL Source Soil Remediation Unit  
 Team Leader M. Koehler Test Site Stack  
 Date Submitted \_\_\_\_\_ Date of Test 2-9-91  
 Test No. 3 No. of Runs Completed 3

No. of Samples	Type of Sample	Analysis Required	Comments
341	Probe Wash: <input checked="" type="checkbox"/> Acetone <input type="checkbox"/> D.I. Water	<input checked="" type="checkbox"/> As per EPA M-5 <input type="checkbox"/> Other _____	
341	Filter: <input checked="" type="checkbox"/> 4" G.F. <input type="checkbox"/> S.S. Thimble <input type="checkbox"/> 2.5" G.F. <input type="checkbox"/> 47 mm G.F.	<input checked="" type="checkbox"/> As per EPA M-5 <input type="checkbox"/> As per EPA M-17 <input type="checkbox"/> Other _____	
341	Impinger Catch: <input checked="" type="checkbox"/> D.I. Water <input type="checkbox"/> 3% H <sub>2</sub> O <sub>2</sub> <input type="checkbox"/> 4MS Hg Only <input type="checkbox"/> 4MS Metals <input type="checkbox"/> 1.0 N NaOH <input type="checkbox"/> Other _____	<input type="checkbox"/> MN Protocol <input type="checkbox"/> WI Protocol <input type="checkbox"/> EPA M-6 or 8 <input type="checkbox"/> Acid Gases <input type="checkbox"/> Formaldehyde <input type="checkbox"/> Metals <input checked="" type="checkbox"/> Other <u>Florida Protocol</u>	
3	Integrated Gas sample	<input checked="" type="checkbox"/> As per EPA M-3 <input type="checkbox"/> As per EPA M-10 <input checked="" type="checkbox"/> Other <u>Propane + Methane</u>	
—	Oxides of Nitrogen (NO <sub>x</sub> )	<input type="checkbox"/> As per EPA M-7A <input type="checkbox"/> Other _____	Date _____ Time (HRS) _____
—	<input type="checkbox"/> Fuel Sample <input type="checkbox"/> Aggregate	<input type="checkbox"/> Attached fuel Form #S-0163RRR	
—	Particle Size	<input type="checkbox"/> X-Ray Sedigraph <input type="checkbox"/> Bahco Method <input type="checkbox"/> Other _____	
—	Audit Samples <input type="checkbox"/> Sulfur Dioxide <input type="checkbox"/> Oxides of Nit. <input type="checkbox"/> Other _____	<input type="checkbox"/> As per EPA M-6 <input type="checkbox"/> As per EPA M-7A <input type="checkbox"/> Other _____	

Source Information

- Type of Source:  Boiler  Asphalt Plant  Incinerator  Dryer  
 Other Soil Remediation Unit
- Fuel:  Coal  Wood  Gas  Oil  RDF  Other Propane
- Is sample combustible?  No  Yes
- Does sample need special handling?  No  Yes If yes, explain



INTERPOLL LABORATORIES, INC.  
(612)786-6020

Clean Soils, Inc./Tampa Bay, FL  
Laboratory Log No. 2323

Results of Methane & Propane Analysis

Test: 3  
Source: Soil Remediation Unit Stack  
Sample Type: Integrated Bag Sample

Analyte		Method	Run 1	Run 2	Run 3
(Log No.)			(2323-18)	(2323-22)	(2323-26)
Methane	ppm	GC/FID	10.9	25.0	3.0
Propane	ppm	GC/FID	100	14.9	8.6

INTERPOLL LABORATORIES, INC.  
(612)786-6020

Clean Soils, Inc./Tampa Bay, FL  
Laboratory Log No. 2323

Results of CHO Analysis

Test: 1  
Source: Soil Remediation Unit Stack  
Sample Type: M-5 Train Composite

Sample Log No.	Run	Carbon %	Hydrogen %	Oxygen %
2323-36	1	78.80	7.61	10.45
2323-37	2	77.28	7.45	12.22
2323-38	3	79.93	7.23	11.05

**APPENDIX E**

**PROCESS RATE DATA**

## SRU 101 STACK TEST 2/8/91

<u>TIME</u> START #1	<u>TONS PER</u> <u>HOUR</u>	<u>SOIL TEMP.</u>	<u>AFTERBURNER</u>	<u>PRESSURE</u> <u>DROP</u>
1225	8.5	470	1432	8.25
1245	6.8	530	1434	8.75
1300	10.2	517	1446	8.75
1315	9.3	458	1502	8.75
1330	8.0	386	1532	8.75
1345	6.2	445	1516	8.75
1400	6.6	460	1511	8.9
1415	8.5	476	1518	9.2
1430	8.5	640	1458	9.5
1445	8.5	470	1561	9.2
1500	8.5	302	1527	9.5
1515	8.5	454	1585	9.7
1530	8.5	537	1597	9.5
1545	8.0	620	1546	9.75
1600	8.5	702	1589	9.75
1615	8.0	483	1608	10.0
1630	4.8	511	1501	9.75
1645	5.9	509	1510	9.75
1700	6.9	499	1499	9.75
1715	7.1	AFTERBURNER DOWN - BACK ON LINE 1720		9.5
1730	6.1	424	1413	9.5
1745	9.4	557	1505	7.5
1800	8.4	429	1490	7.75
1815	8.2	429	1469	8.0
1830	8.5	437	1459	8.0
1845	8.7	412	1507	8.25
1900	7.5	496	1472	8.25
1915	7.9	592	1462	8.5
1930	6.1	523	1477	8.5
1945	5.6	611	1484	8.5
2000	5.2	509	1495	8.5
2015	8.8	429	1479	8.5
2030	7.5	452	1482	8.5
2045	8.8	324	1471	9.0
2100	7.3	421	1423	9.0
2115	4.3	613	1470	7.5
2130	5.3	614	1445	3.75
2145	6.3	533	1422	1.75
2200	END SOIL	577	1496	1.5

## SRU 101 STACK TEST 2/9/91

## LOG SHEET

<u>TIME</u>	<u>TONS PER HOUR</u>	<u>SOIL TEMP.</u>	<u>AFTERBURNER TEMP.</u>	<u>PRESSURE DROP</u>
11:00	START SOIL			
11:15	7.8	480	1238	.5
11:30	8.8	453	1286	.5
11:45	7.5	574	1391	1.0
12:00	10.6	569	1411	1.0
12:15	AFTERBURNER DOWN SCANNER FAILURE			
12:30	9.2	423	1281	4.5
12:45	11.4	422	1416	5.5
13:00	12.2	442	1512	6.0
13:15	12.1	421	1491	5.0
13:23	AFTERBURNER DOWN SCANNER FAILURE			
13:30	11.8	418	1400	6.0
13:45	10.3	471	1461	6.0
	AFTERBURNER DOWN SCANNER FAILURE			
14:00	8.7	482	1498	6.25
14:15	9.8	560	1398	5.5
14:30	11.7	569	1374	6.0
14:45	DRIER BURNER PROBLEM (LEAKY FUEL NOZZLE)			
15:25	START SOIL			
15:45	8.8	451	1445	
16:00	9.6	503	1460	
16:15	8.7	512	1438	
16:30	8.9	462	1499	
16:45	9.8	489	1451	
17:00	9.4	496	1462	
17:15	7.1	372	1465	
17:30	9.6	586	1425	
17:45	9.4	581	1431	
18:00	9.1	433	1425	5.0
18:15	13.0	422	1454	6.0

**APPENDIX F**

THC STRIP CHARTS

T1/R1 0-1000 scale 1222  
Afterburner Inlet

30 ppm System Bus 0-100 scale

0 ppm System Bus 0-100 scale

30 ppm 0-100 scale

300 ppm 0-1000 scale

3,000 ppm 0-10,000 scale

0 ppm 0-100 scale

Clean Soils

Tampa FI

Soil Remediation Unit

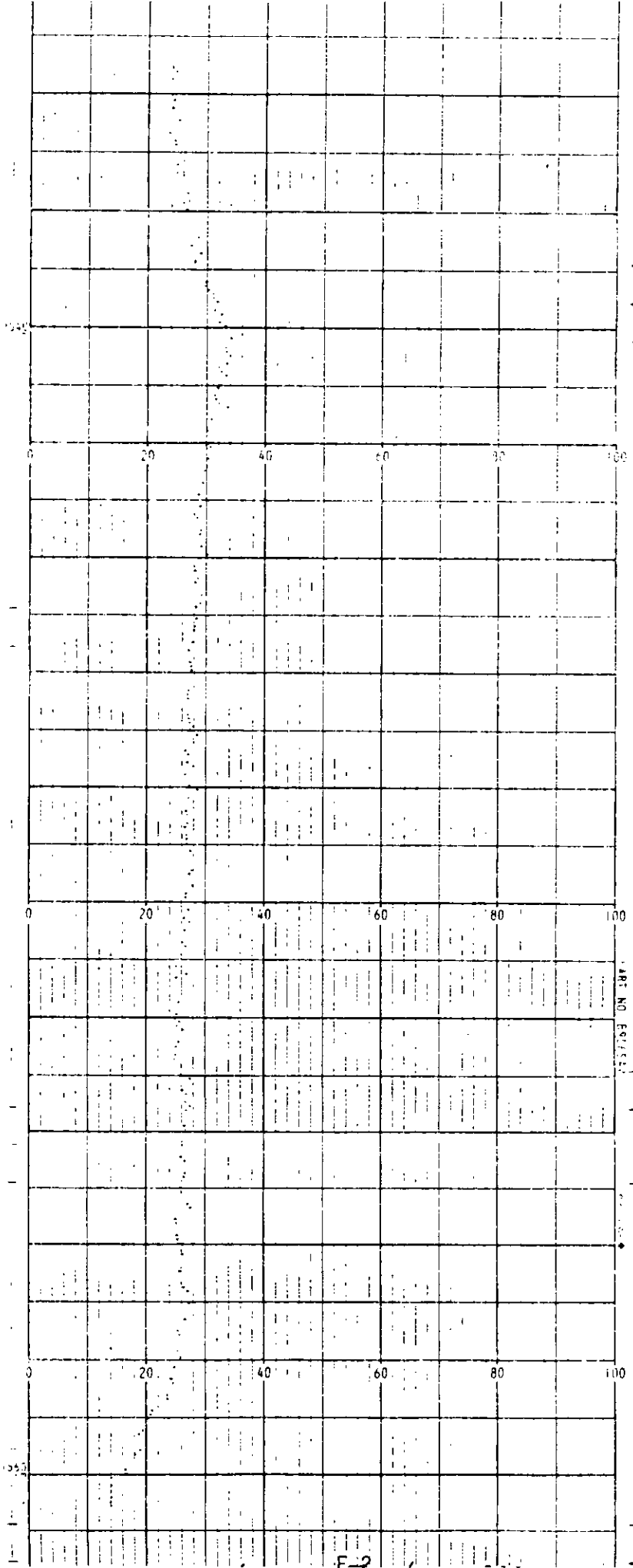
Afterburner Stack + Inlet

Chart Speed 500 mm/hr

Sample Rate 200 mbar

2-8-91

1540cm

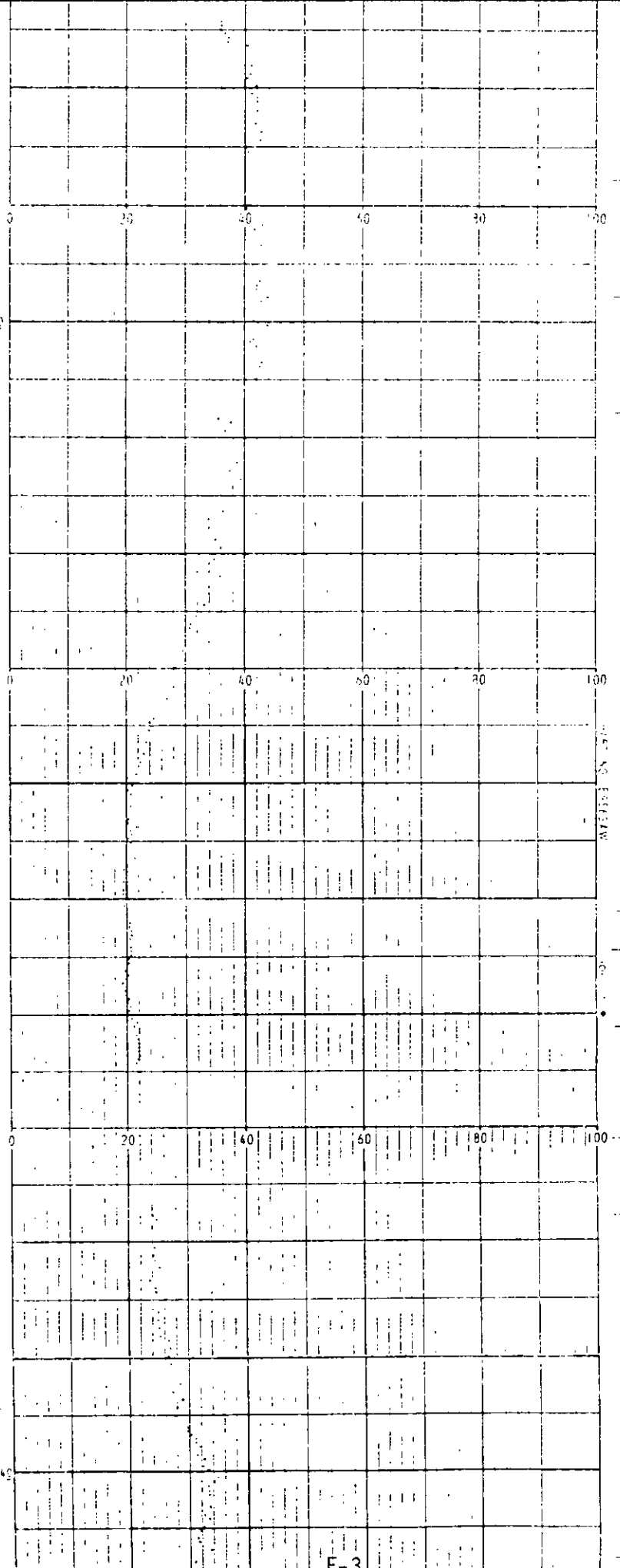


ART NO. EQ. 1540



1222  
T1/R1





↑  
t

1540 cm

0 20 40 60 80 100

T1/R1 1410 Afterburner Stack

30 ppm 0-100 scale

3000 ppm 0-10,000 scale

R-5  
EPC/H

0 20 40 60 80 100

30 ppm 0-100 scale

300 ppm 0-1000 scale

R-5  
EPC/H

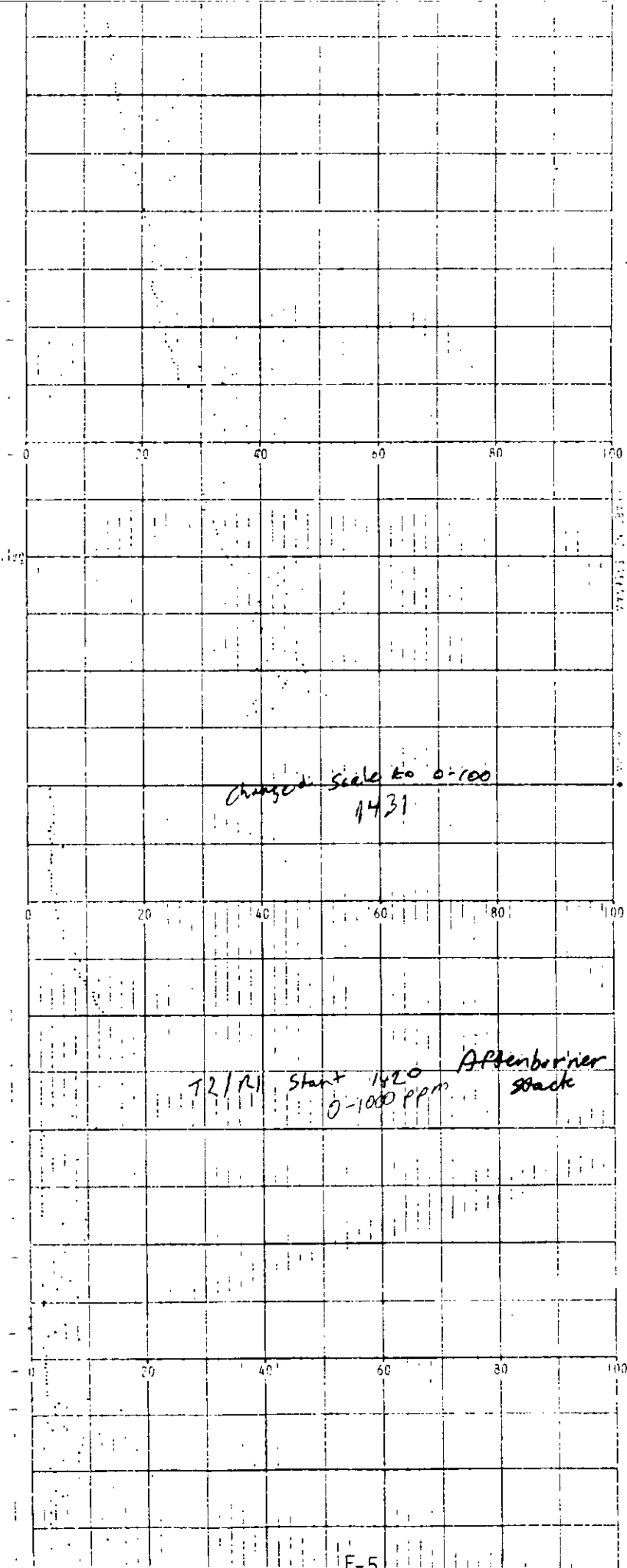
0 ppm 0-100 scale

System Bias  
500 ppm 0-1000 scale

End T1/R1 1323 R-5 EPC/H

Afterburner Inlet

0 20 40 60 80 100



END TRI 1520

Afterburner Stack

0 20 40 60 80 100

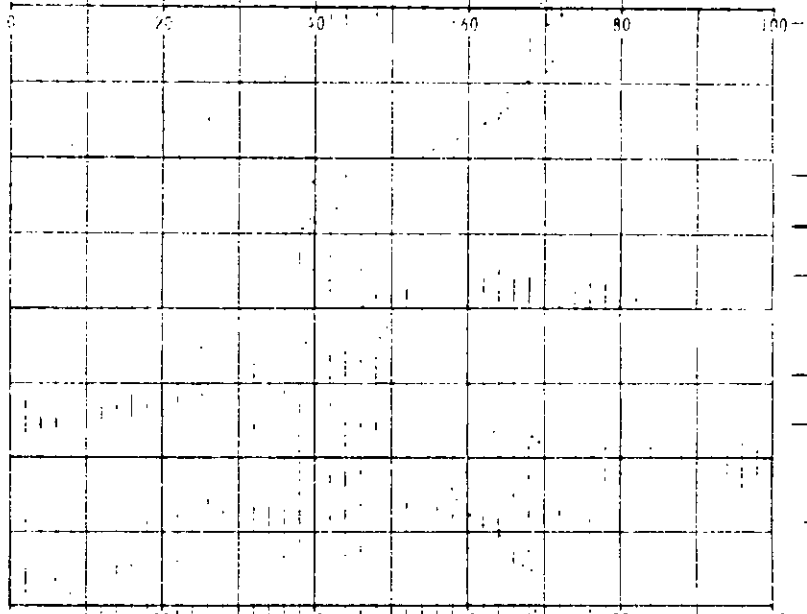
0 20 40 60 80 100

0 20 40 60 80 100

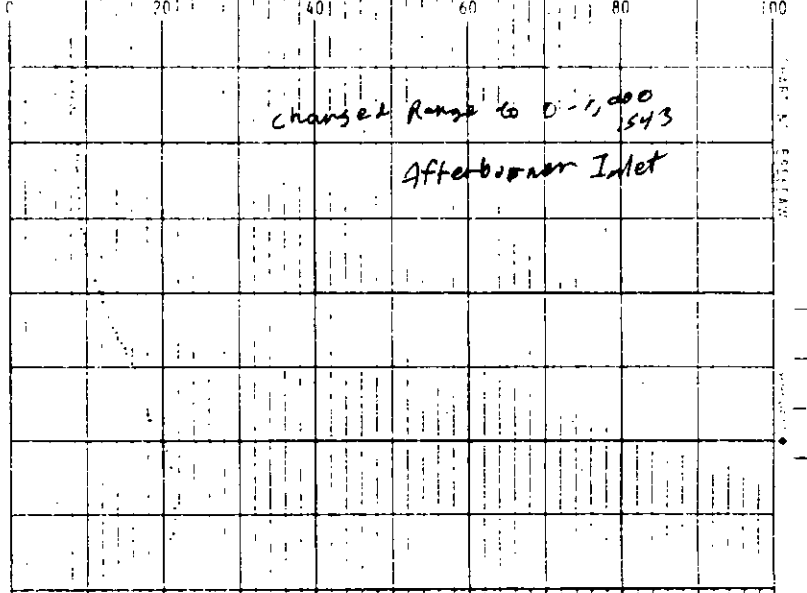
10  
20  
30  
40



problems  
changed to 0-10,000 scale  
1547

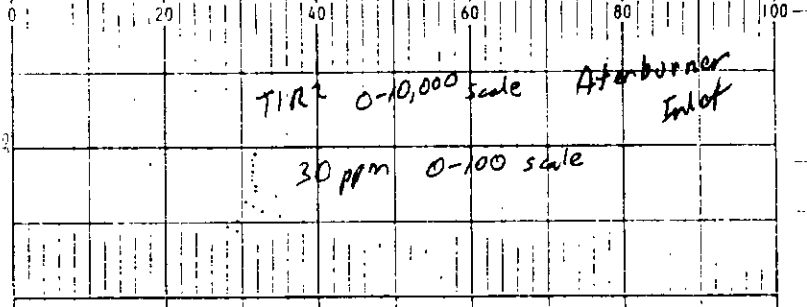


change range to 0-1,000  
1543  
Afterburner Inlet

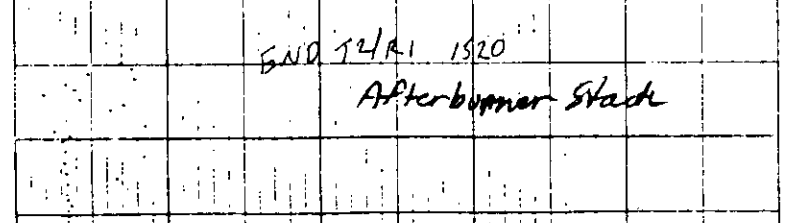


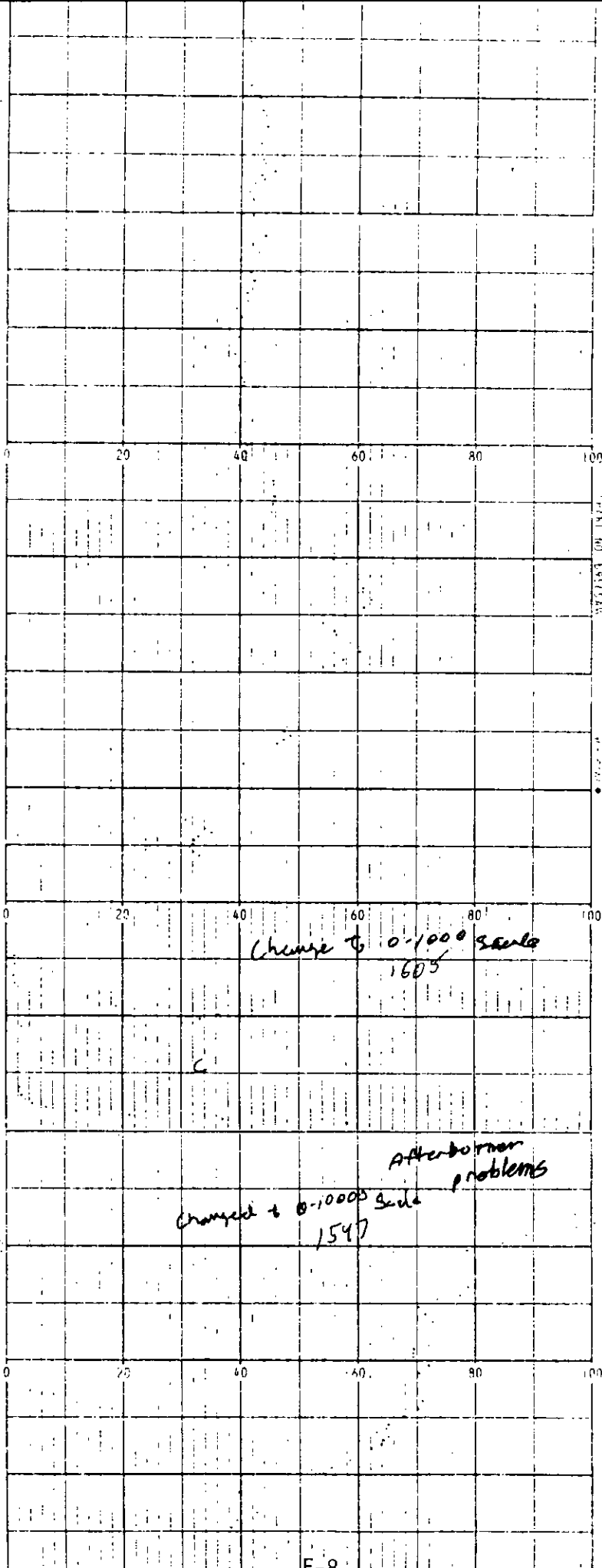
TIR 0-10,000 scale Afterburner Inlet

30 ppm 0-100 scale



END TIR 1520  
Afterburner Stack





Change to 0-1000 scale  
1605

Afterburner  
problems

Changed to 0-10000 scale  
1547

AS  
5-18  
SERIAL

Afterburner  
Problems

AS  
5-18

Changed to 0-1000 scale  
1702 Start 12/22  
Afterburner Start

12/22 10-100 ppm Scale 1655

300 ppm 0-1000 scale

End 11/22 1652  
Afterburner  
End

555  
175  
1714

0 20 40 60 80 100

1320

WISCONSIN STATE

0 20 40 60 80 100

After-burner went down 1708  
Balcon 1723

Scale  
0-100 ppm

0 20 40 60 80 100



Encl 12/12/1810

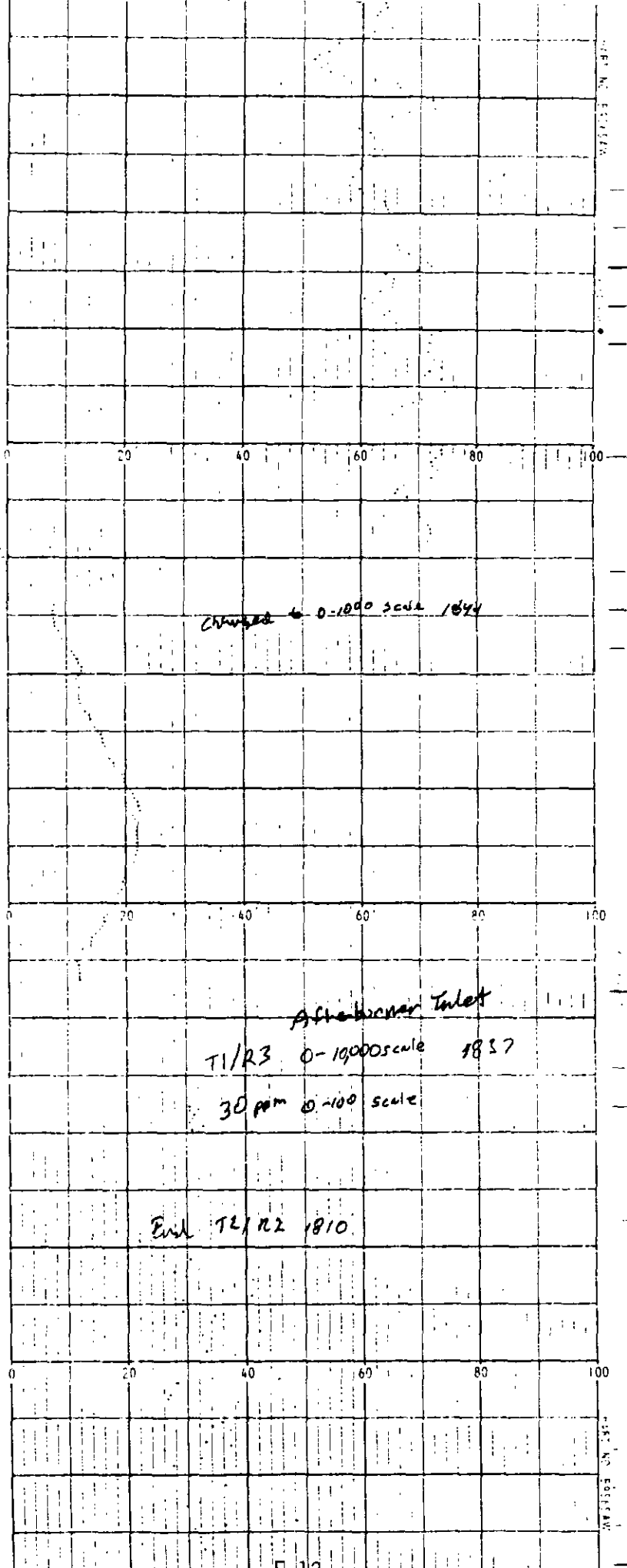
0 20 40 60 80 100

0 20 40 60 80 100

0 20 40 60 80 100

SEE  
PAGE  
10/11





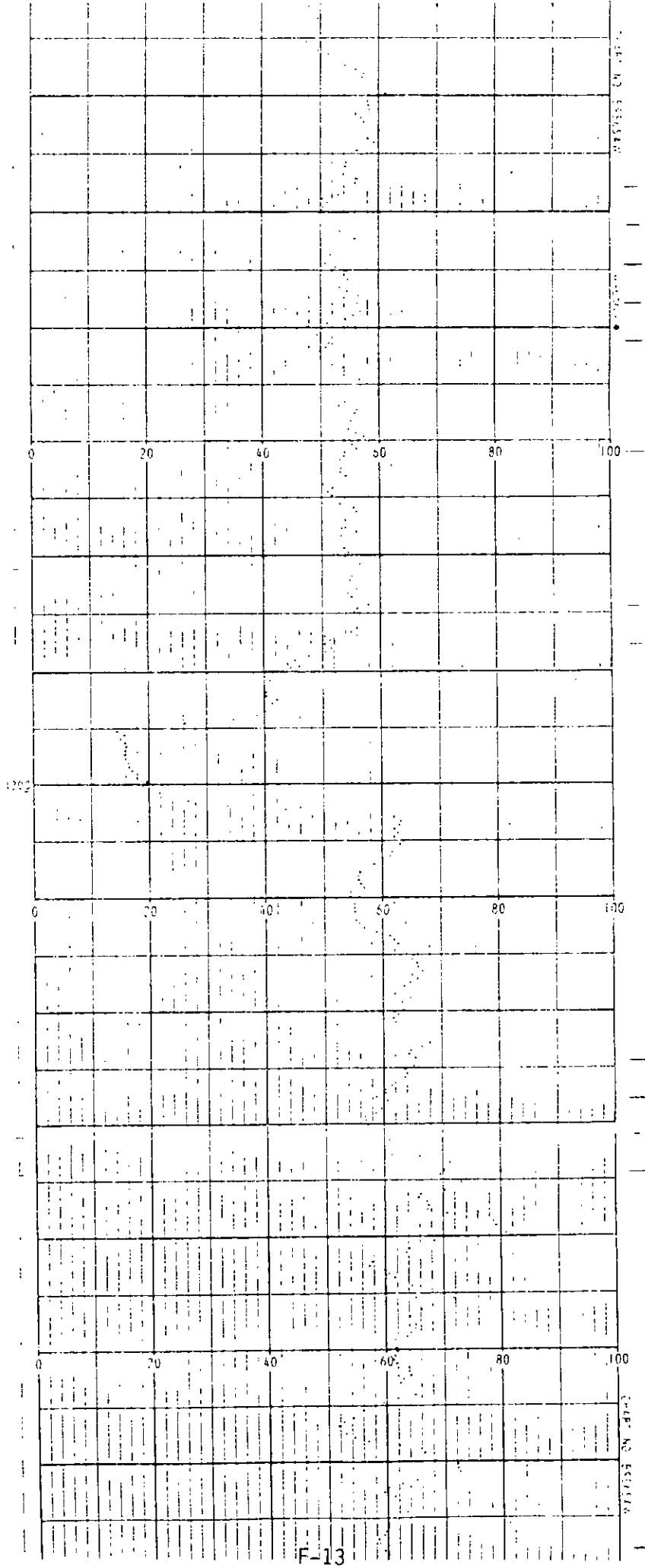
Changed to 0-1000 scale 1844

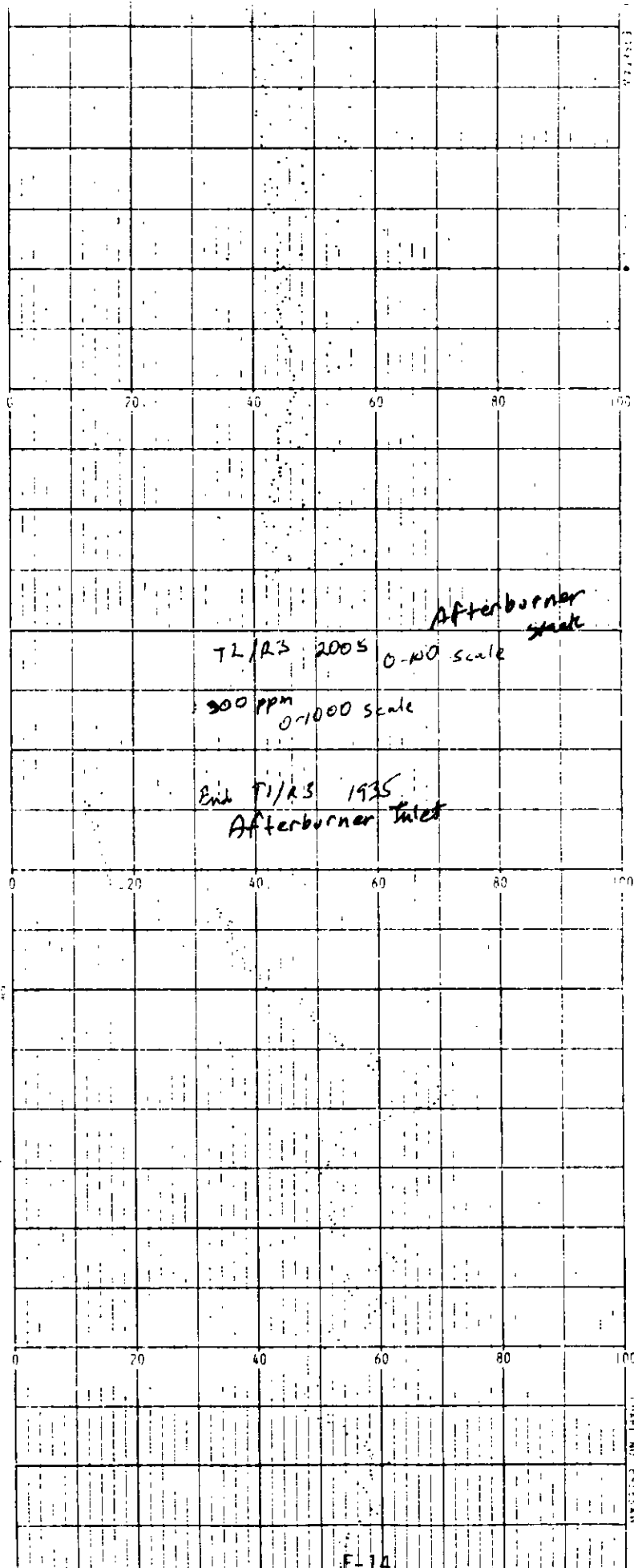
After burner Inlet

T1/R3 0-10000 scale 1837

30 ppm 0-100 scale

End T2/R2 1810





72/R3 2005

0-100 scale

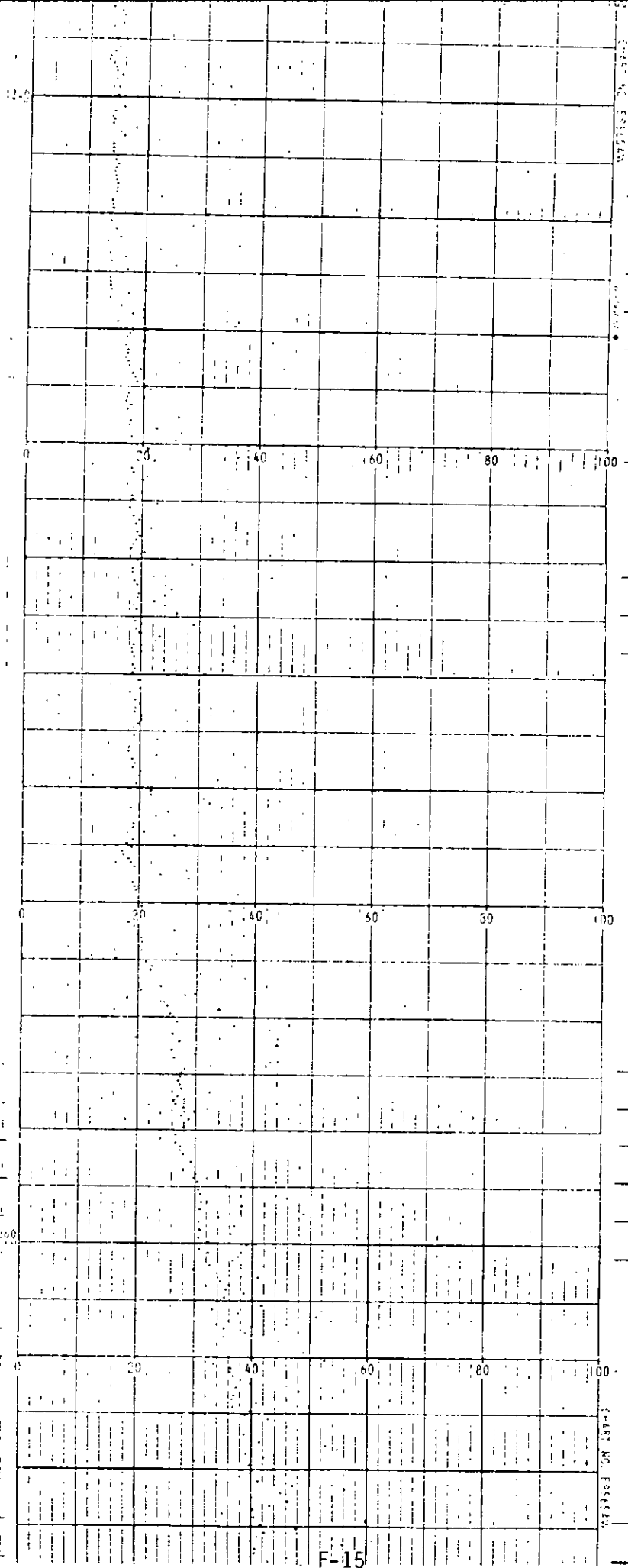
Afterburner stack

300 ppm

0-1000 scale

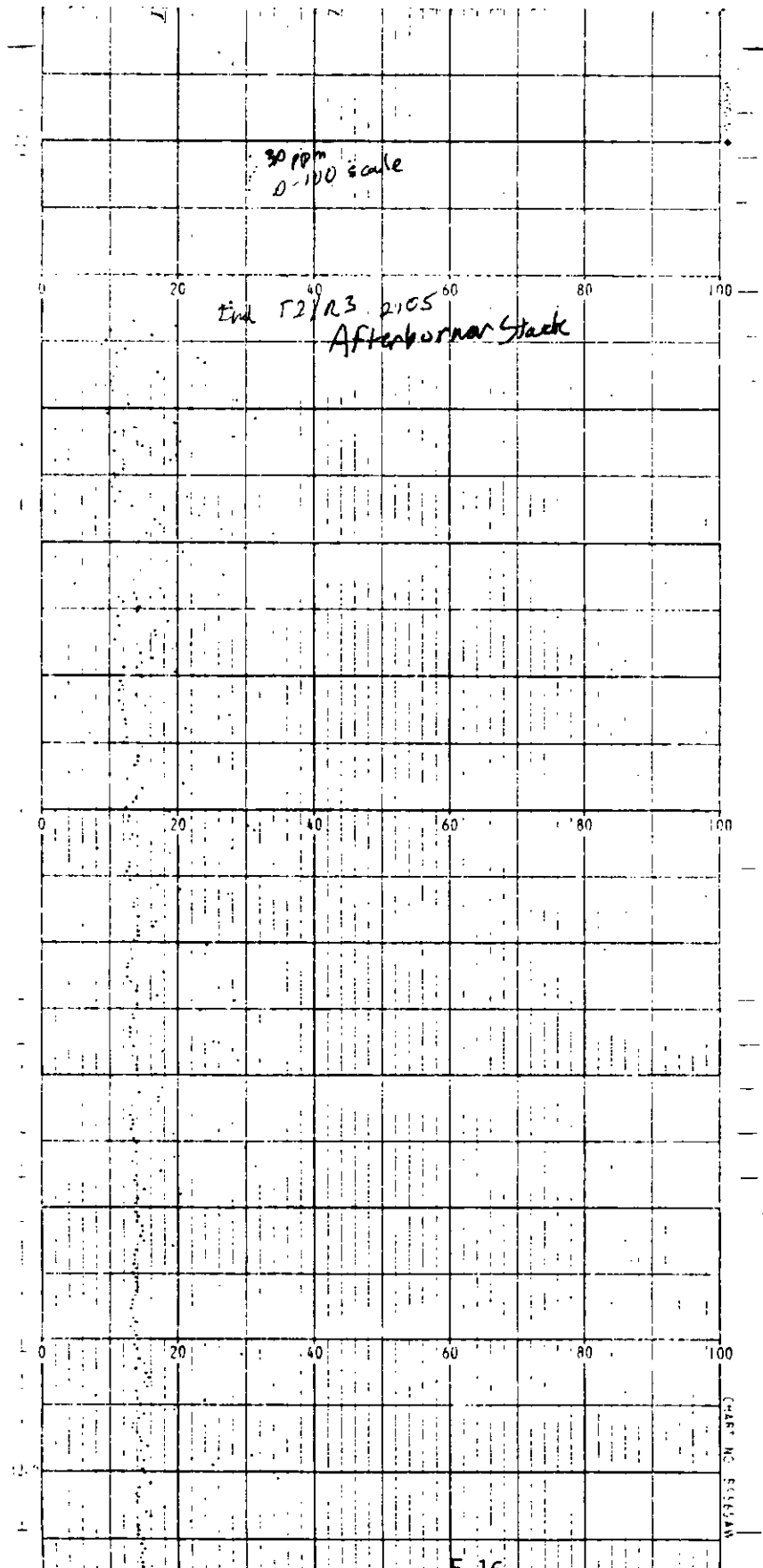
End P1/R3 1935

Afterburner Inlet



↑  
t

F-15



**APPENDIX G**

**MEASUREMENT SYSTEM PERFORMANCE CHECKS**

INTERPOLL LABORATORIES  
EPA Method 25A  
Calibration Error Check & Drift Determination

Job Clean Soils

Test 1 Run 123 Date 2-8-91  
Operator M. Kaehler

THC Calibration (Low Range):

Time (HRS) 1145

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0	0	0	100	0
Low level	30	28	2	100	2
Mid level	300	297	3	1000	.3
High level	3000	3002	2	10,000	.02

THC Calibration (High Range):

Time (HRS) \_\_\_\_\_

***	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	Percent of Span
Zero gas	0				
Span					

O<sub>2</sub> Calibration:

Time (HRS) \_\_\_\_\_

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

CO<sub>2</sub> Calibration:

Time (HRS) \_\_\_\_\_

***	Cylinder Value (%)	Analyzer Response (%)	Difference (%)	Span Value (%)	Percent of Span
Zero gas	0				
Mid level					
High level					

Must be within 2% of the span for each calibration gas

S-420-14



INTERPOLL LABORATORIES  
(612) 786-6020

System Bias Check

Job Clean Soils / Tampa Bay Fl Source Soil Remediation Unit  
 Test 2 Run 1,2,3 Date 2-8-91 Site Stack  
 Operator M. Daehler

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1400	Zero gas	0		0	0	100	0
		Upscale	30		30	0	100	0
2	1525	Zero gas	0		1	1	100	1
		Upscale	30		31	1	100	1
3	1820	Zero gas	0		2	2	100	2
		Upscale	30		31	1	100	1
4	2112	Zero gas	0		2	2	100	2
		Upscale	30		31	1	100	1
5		Zero gas	0					
		Upscale						
6		Zero gas	0					
		Upscale						
7		Zero gas	0					
		Upscale						
8		Zero gas	0					
		Upscale						
9		Zero gas	0					
		Upscale						
10		Zero gas	0					
		Upscale						
11		Zero gas	0					
		Upscale						
12		Zero gas	0					
		Upscale						

Must be within 5% of the span for the zero or upscale cal. gas.

INTERPOLL LABORATORIES  
(612) 786-6020

System Bias Check

Job Clean Soils / Tampa Bay F1 Source Sed. Remediation Unit  
 Test 1 Run 1,2,3 Date 2-8-91 Site Inlet Afterburner  
 Operator M. Kochler

Run	Time (HRS)	***	Cylinder Value (ppm)	Analyzer Resp (ppm)		Diff. CE-SB (ppm)	Span Val (PPM)	% of span
				Cal Err	Sys Bias			
1	1200	Zero gas	0		1	1	100	1
		Upscale	30		31	1	100	1
2	1330	Zero gas	0		1	1	1000	.01
		Upscale	300		306	6	1000	.06
3	1635	Zero gas	0		2	2	1000	.02
		Upscale	300		309	9	1000	.09
4	1942	Zero gas	0		4	4	1000	.04
		Upscale	300		307	7	1000	.07
5		Zero gas	0					
		Upscale						
6		Zero gas	0					
		Upscale						
7		Zero gas	0					
		Upscale						
8		Zero gas	0					
		Upscale						
9		Zero gas	0					
		Upscale						
10		Zero gas	0					
		Upscale						
11		Zero gas	0					
		Upscale						
12		Zero gas	0					
		Upscale						

Must be within 5% of the span for the zero or upscale cal. gas.

**APPENDIX H**

**PROCEDURES**

## Particulate Loading and Emission Rates

The particulate emission rates were determined per EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1988). In this procedure a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

The sampling train consists of a heated glass-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. The sampling module also houses the impinger case and a Drierite filled column. The sampling module is connected by means of an umbilical cord to the control module. The control module houses the dry test gas meter, the calibrated orifice, a leakless pump, two inclined manometers, and all controls required for operating the sampling train.

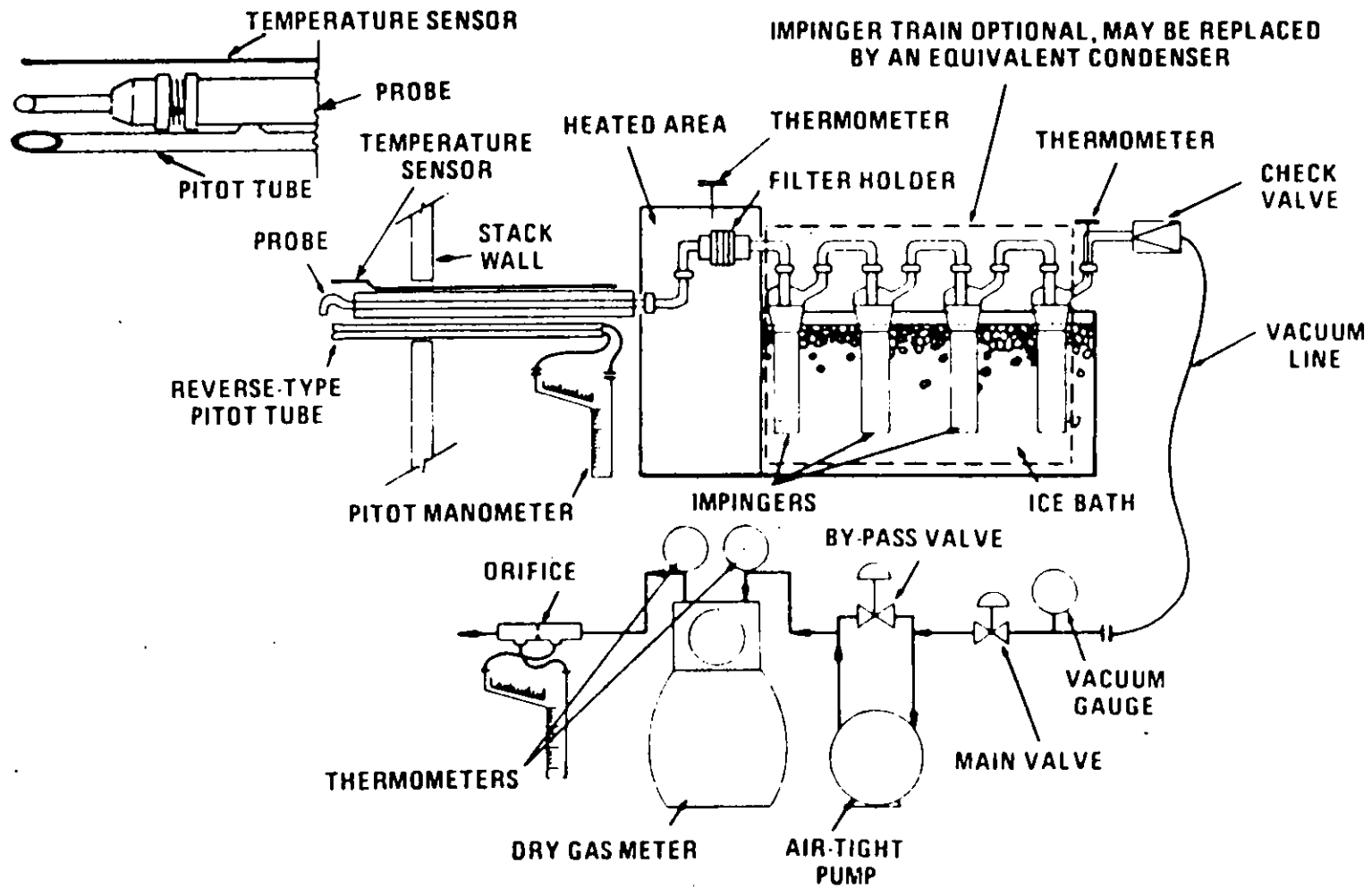
Particulate samples are collected as follows: The sample gas is drawn through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter where particulates are removed. The sample gas is then passed through an ice-cooled impinger train and a desiccant-packed column which absorbs remaining moisture. The sample gas then passes through a vacuum pump followed by a dry test gas meter. The gas meter integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gasmeter provides real time flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each test point maintaining isokinetic sampling conditions. Nomographs are used for rapid determination of the sampling rate.

After sampling is complete, the filter is removed and placed in a clean container. The nozzle and inlet side of the filter holder are quantitatively washed with acetone and the washings are stored in a second container. A brush is often used in the cleaning step to help dislodge deposits. The samples are returned to the laboratory where they are logged in and analyzed. The volume of the acetone rinse ("probe wash") is noted and then the rinse is quantitatively transferred to a tared 120 cc porcelain evaporating dish and the acetone evaporated off at 97-105 °F. This temperature is used to prevent condensation of atmospheric moisture due to the cooling effect induced by the evaporation of acetone. The acetone-free sample is then transferred to an oven and dried at 105 °C for 30 minutes, cooled in a desiccator over Drierite, and then weighed to the nearest .01 mg. The filter sample is quantitatively transferred to a 6-inch watch glass and dried in an oven at 105 °C for two hours. The filter and watch glass are then cooled in a desiccator and the filter weighed to the nearest .01 mg. All weighings are performed in a balance room where the relative humidity is hydrostatted to less than 50% relative humidity. Microscopic examination of the samples is performed if any unusual characteristics are observed. The weight of the acetone rinse is corrected for the acetone blank. The Drierite column is weighed on-site and the water collected by Drierite is added to the condensate so that the total amount of absorbed water may be ascertained.

Integrated gas samples for Orsat analysis were collected at a constant flow rate throughout each particulate run. The gas samples were analyzed using an all-glass Orsat analyzer. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen). In addition to the above, the oxygen content of the flue gas was measured at each traverse during the particulate determinations using a Teledyne Model 320P-4 Portable Oxygen Analyzer to sample the effluent from the Method 5 train.

3a P2(7)



IMPINGER TRAIN OPTIONAL, MAY BE REPLACED BY AN EQUIVALENT CONDENSER

Particulate-sampling train.

Condensable Organic Compounds Analysis

Method II-8672

**Equipment:** Separatory funnel - 500 cc with Teflon stopcock  
Powder funnel - 75 mm ID with a 17 mm stem  
Evaporating dish(es) - 200 cc or 250 cc beaker

**Reagents:** Diethyl ether - reagent grade  
Chloroform - reagent grade  
Sodium sulfate - (ACS) granular anhydrous  
Toluene - (if 3% hydrogen peroxide is used to collect the samples)  
Glass wool (Pyrex microfiber)

PREPARATION

1. Place 1 kg of granular anhydrous sodium sulfate in a shallow tray and heat to 200 °C for at least four hours. Store in a tightly sealed glass container.
2. Place a plug of clean glass wool in the stem of the powder funnel. The plug must be of sufficient size so that it is held snugly in place by its own pressure. Add a one-inch layer of dry sodium sulfate.

## SAMPLING

An all-glass impinger assembly is used in the back half of the EPA Method 5 sampling train when an organic wet catch is to be collected. The impinger assembly consists of a modified impinger, a Greenburg Smith impinger followed by another modified impinger. The third impinger should have a temperature measuring device at the outlet upstream of a final impinger or desiccant column to monitor the temperature of the outlet gas stream. Prior to the start of the test, each of the first two impingers should be charged with 100 g of Class I water. The Method 5 train should be operated as provided for in EPA Method 5. Ice should be added to the impinger bath to keep the temperature of the gas at the outlet at or less than 68 °F. After the post test leak check, the impinger train is removed and impinger contents poured into a tared all-glass sample bottle and closed with a Teflon-lined cap. The sample bottle is then weighed and the total condensate calculated by subtraction of the bottle tare weight and the weight of initial water added to the impingers (200 g). A label is affixed and the sample is returned to the laboratory for analysis. The sample should be stored at 4 °C if the analysis is not conducted within 48 hours.



## ANALYSIS

### I. Organics

Caution! Work in vented hood!!!

#### A. Organic Blank Determination

1. Pour 125 mL of ethyl ether and 125 mL of chloroform into a tared beaker.
2. Evaporate solvent in hood at 70 °F or less until no solvent remains.
3. Desiccate the sample in dish for two hours.
4. Weigh the sample to nearest 0.1 mg, record and report on Form LSC-036.

#### B. Organic Sample Determination

1. Test for peroxide in sample ether using KI strips. (If KI strip shows positive, contact your supervisor before proceeding.)
2. Transfer the sample solution quantitatively to a 500 mL separatory funnel. Use the first of three 25 mL chloroform aliquots to rinse the sample container.
3. Extract with three 25 mL portions of chloroform. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Bottom layer is chloroform.) Draw off the bottom layer, transferring the solvent with a funnel containing a plug of sodium sulfate into a tared beaker. (Do not draw off any of the aqueous layer.)

4. After the three chloroform extractions, use two 25 mL portions of chloroform to rinse the sodium sulfate, collecting the rinses in the same tared beaker as the extracts.
5. Next extract the sample three times with 25 mL aliquots of ethyl ether. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Top layer is ethyl ether.) Draw off the bottom layer (aqueous) into another separatory funnel taking less than 1 mL of the ethyl ether layer with. Decant the ethyl ether, passing it through sodium sulfate and collecting the ethyl ether in the same tared dish as the chloroform.
6. After the three ethyl ether extractions, take two 25 mL portions of ethyl ether and rinse the sodium sulfate collecting the rinses in the same tared beaker as the extracts.
7. Evaporate the solvents (chloroform and ethyl ether) in the tared beaker in the hood at 70 °F or less until no solvent remains. (Use no heat and have no sources of ignition in the hood when doing this procedure.) Do not evaporate so quickly as to allow evaporative cooling to lower the temperature of the container below the dew point of water, otherwise, water will be condensed out in the container.
8. Desiccate to constant weight (two hours). Record and report the final weight to the nearest 0.1 mg on Form LSC-036.

## II. Inorganics

If inorganic residue information is required, the following procedure should be conducted:

### A. Inorganic Blank Determination

1. Vent the remaining aqueous phase from the organic extraction in the hood to remove residual organic solvents (usually overnight).
2. Decant the impinger catch into a tared evaporating dish.
3. Evaporate all of the water in the sample in an oven at 100 °C. Take care not to boil to prevent bumping and loss of sample.
4. Cool the dried sample in the desiccator and desiccate until a constant weight is obtained.
5. Report the results to the nearest 0.1 mg on Form LSC-036.

### B. Inorganic Sample Determination

Follow steps 1-5 in Section A above.

## NOTES

1. For the organics determination, in the rare event that the impinger catch resulted from a Modified Method 6 determination ( $\text{SO}_2$ ), whereby the solution contains dilute hydrogen peroxide ( $\geq 3\%$ ), do not use ether as an extraction solvent. Substitute toluene for ethyl ether in Section I. (Ether in the presence of peroxide forms explosive hydroperoxide.)
2. In the organics determination, more than three extractions may be required to extract all of the organics. Additional extractions should be performed if the aqueous phase is still cloudy.
3. Special state requirements:
  - Michigan - Total sample evaporated in tared evaporating dish on steam bath.
  - Iowa - Organics and inorganics separately, as required.
  - Wisconsin - Use Method II-8672-WI.
  - Rest of states - Organics only.

## REFERENCES

- Proposed Standards of Performance for New Stationary Sources, Federal Register 36(159) Part II, August 1, 1979.
- Minnesota Pollution Control Agency, Exhibit C.

**METHOD 25A—DETERMINATION OF TOTAL GASEOUS ORGANIC CONCENTRATION USING A FLAME IONIZATION ANALYZER**

**1. Applicability and Principle**

1.1 **Applicability.** This method applies to the measurement of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

1.2 **Principle.** A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

**2. Definitions**

2.1 **Measurement System.** The total equipment required for the determination of the gas concentration. The system consists of the following major subsystems:

2.1.1 **Sample Interface.** That portion of the system that is used for one or more of the following: sample acquisition, sample transportation, sample conditioning, or protection of the analyzer from the effects of the stack effluent.

2.1.2 **Organic Analyzer.** That portion of the system that senses organic concentration and generates an output proportional to the gas concentration.

2.2 **Span Value.** The upper limit of a gas concentration measurement range that is

specified for affected source categories in the applicable part of the regulations. The span value is established in the applicable regulation and is usually 1.5 to 2.5 times the applicable emission limit. If no span value is provided, use a span value equivalent to 1.5 to 2.5 times the expected concentration. For convenience, the span value should correspond to 100 percent of the recorder scale.

2.3 **Calibration Gas.** A known concentration of a gas in an appropriate diluent gas.

2.4 **Zero Drift.** The difference in the measurement system response to a zero level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

2.5 **Calibration Drift.** The difference in the measurement system response to a mid-level calibration gas before and after a stated period of operation during which no unscheduled maintenance, repair or adjustment took place.

2.6 **Response Time.** The time interval from a step change in pollutant concentration at the inlet to the emission measurement system to the time at which 95 percent of the corresponding final value is reached as displayed on the recorder.

2.7 **Calibration Error.** The difference between the gas concentration indicated by the measurement system and the known concentration of the calibration gas.

**3. Apparatus**

A schematic of an acceptable measurement system is shown in Figure 25A-1. The essential components of the measurement system are described below:

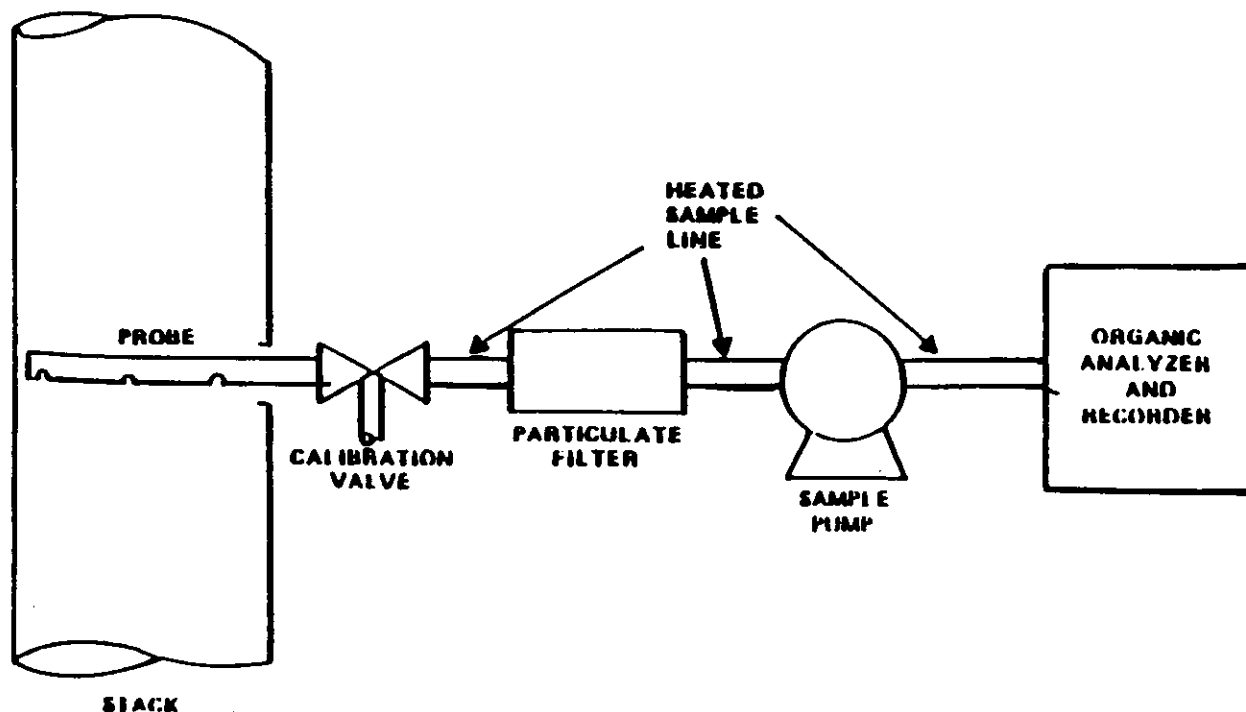


Figure 25A-1 Organic Concentration Measurement System.

3.1 Organic Concentration Analyzer. A flame ionization analyzer (FIA) capable of meeting or exceeding the specifications in this method.

3.2 Sample Probe. Stainless steel, or equivalent, three-hole rake type. Sample holes shall be 4 mm in diameter or smaller and located at 16.7, 50, and 83.3 percent of the equivalent stack diameter. Alternatively, a single opening probe may be used so that a gas sample is collected from the centrally located 10 percent area of the stack cross-section.

3.3 Sample Line. Stainless steel or Teflon\* tubing to transport the sample gas to the analyzer. The sample line should be heated, if necessary, to prevent condensation in the line.

3.4 Calibration Valve Assembly. A three-way valve assembly to direct the zero and calibration gases to the analyzers is recommended. Other methods, such as quick-connect lines, to route calibration gas to the analyzers are applicable.

3.5 Particulate Filter. An in-stack or an out-of-stack glass fiber filter is recommended if exhaust gas particulate loading is significant. An out-of-stack filter should be heated to prevent any condensation.

3.6 Recorder. A strip-chart recorder, analog computer, or digital recorder for recording measurement data. The minimum data recording requirement is one measurement value per minute. Note: This method is often applied in highly explosive areas. Caution and care should be exercised in choice of equipment and installation.

#### 4. Calibration and Other Gases

Gases used for calibrations, fuel, and combustion air (if required) are contained in compressed gas cylinders. Preparation of calibration gases shall be done according to the procedure in Protocol No. 1, listed in Reference 9.2. Additionally, the manufacturer of the cylinder should provide a recommended shelf life for each calibration gas cylinder over which the concentration does not change more than  $\pm 2$  percent from the certified value. For calibration gas values not generally available (i.e., organics between 1 and 10 percent by volume), alternative methods for preparing calibration gas mixtures, such as dilution systems, may be used with prior approval of the Administrator.

Calibration gases usually consist of propane in air or nitrogen and are determined in terms of the span value. Organic compounds other than propane can be used following the above guidelines and making the appropriate corrections for response factor.

\* Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

4.1 Fuel. A 40 percent H<sub>2</sub>/60 percent He or 40 percent H<sub>2</sub>/60 percent N<sub>2</sub> gas mixture is recommended to avoid an oxygen synergism effect that reportedly occurs when oxygen concentration varies significantly from a mean value.

4.2 Zero Gas. High purity air with less than 0.1 parts per million by volume (ppmv) of organic material (propane or carbon equivalent) or less than 0.1 percent of the span value, whichever is greater.

4.3 Low-level Calibration Gas. An organic calibration gas with a concentration equivalent to 25 to 35 percent of the applicable span value.

4.4 Mid-level Calibration Gas. An organic calibration gas with a concentration equivalent to 45 to 55 percent of the applicable span value.

4.5 High-level Calibration Gas. An organic calibration gas with a concentration equivalent to 80 to 90 percent of the applicable span value.

#### 5. Measurement System Performance Specifications

5.1 Zero Drift. Less than  $\pm 3$  percent of the span value.

5.2 Calibration Drift. Less than  $\pm 3$  percent of span value.

5.3 Calibration Error. Less than  $\pm 5$  percent of the calibration gas value.

#### 6. Pretest Preparations

6.1 Selection of Sampling Site. The location of the sampling site is generally specified by the applicable regulation or purpose of the test; i.e., exhaust stack, inlet line, etc. The sample port shall be located at least 1.5 meters or 2 equivalent diameters upstream of the gas discharge to the atmosphere.

6.2 Location of Sample Probe. Install the sample probe so that the probe is centrally located in the stack, pipe, or duct and is sealed tightly at the stack port connection.

6.3 Measurement System Preparation. Prior to the emission test, assemble the measurement system following the manufacturer's written instructions in preparing the sample interface and the organic analyzer. Make the system operable.

FIA equipment can be calibrated for almost any range of total organics concentrations. For high concentrations of organics (>1.0 percent by volume as propane) modifications to most commonly available analyzers are necessary. One accepted method of equipment modification is to decrease the size of the sample to the analyzer through the use of a smaller diameter sample capillary. Direct and continuous measurement of organic concentration is a necessary consideration when determining any modification design.

6.4 Calibration Error Test. Immediately prior to the test series, (within 2 hours of the start of the test) introduce zero gas and

high-level calibration gas at the calibration valve assembly. Adjust the analyzer output to the appropriate levels, if necessary. Calculate the predicted response for the low-level and mid-level gases based on a linear response line between the zero and high-level responses. Then introduce low-level and mid-level calibration gases successively to the measurement system. Record the analyzer responses for low-level and mid-level calibration gases and determine the differences between the measurement system responses and the predicted responses. These differences must be less than 5 percent of the respective calibration gas value. If not, the measurement system is not acceptable and must be replaced or repaired prior to testing. No adjustments to the measurement system shall be conducted after the calibration and before the drift check (Section 7.3). If adjustments are necessary before the completion of the test series, perform the drift checks prior to the required adjustments and repeat the calibration following the adjustments. If multiple electronic ranges are to be used, each additional range must be checked with a mid-level calibration gas to verify the multiplication factor.

6.5 Response Time Test. Introduce zero gas into the measurement system at the calibration valve assembly. When the system output has stabilized, switch quickly to the high-level calibration gas. Record the time from the concentration change to the measurement system response equivalent to 95 percent of the step change. Repeat the test three times and average the results.

#### 7. Emission Measurement Test Procedure

7.1 Organic Measurement. Begin sampling at the start of the test period, recording time and any required process information as appropriate. In particular, note on the recording chart periods of process interruption or cyclic operation.

7.2 Drift Determination. Immediately following the completion of the test period and hourly during the test period, reintroduce the zero and mid-level calibration gases, one at a time, to the measurement system at the calibration valve assembly. (Make no adjustments to the measurement system until after both the zero and calibration drift checks are made.) Record the analyzer response. If the drift values exceed the specified limits, invalidate the test results preceding the check and repeat the test following corrections to the measurement system. Alternatively, recalibrate the test measurement system as in Section 6.4 and report the results using both sets of calibration data (i.e., data determined prior to the test period and data determined following the test period).

#### 8. Organic Concentration Calculations

Determine the average organic concentration in terms of ppmv as propane or other

calibration gas. The average shall be determined by the integration of the output recording over the period specified in the applicable regulation.

If results are required in terms of ppmv as carbon, adjust measured concentrations using Equation 25A-1.

$$C_c = K C_{\text{meas}} \quad \text{Eq. 25A-1}$$

Where:

$C_c$  = Organic concentration as carbon, ppmv.

$C_{\text{meas}}$  = Organic concentration as measured, ppmv.

$K$  = Carbon equivalent correction factor,

$K=2$  for ethane.

$K=3$  for propane.

$K=4$  for butane.

$K$  = Appropriate response factor for other organic calibration gases.

#### 9. Bibliography

9.1 Measurement of Volatile Organic Compounds—Guideline Series. U.S. Environmental Protection Agency, Research Triangle Park, NC. Publication No. EPA-450/2-78-041. June 1978. p. 46-54.

9.2 Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Continuous Source Emission Monitors (Protocol No. 1). U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Research Triangle Park, NC. June 1978.

9.3 Gasoline Vapor Emission Laboratory Evaluation—Part 2. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EMB Report No. 75-GAS-6. August 1975.

INTERPOLL LABORATORIES, INC.  
Method II-9002DETERMINATION OF TOTAL HYDROCARBON CONCENTRATIONS  
IN EXHAUST GAS STREAMS CONTAINING HIGH  
LEVELS OF CONDENSIBLE HYDROCARBONS

The wide range of volatility of the constituents in the gas stream at the Inlet to some afterburners requires the use of a specially-configured sampling system to accurately determine the total hydrocarbon concentration. The presence of high molecular weight compounds (high boiling points) has been shown to result in excessive condensation in the heated lines (250 °F) and the heated THC analyzer (250 °F) which causes gross underestimation of the THC concentration as well as severe contamination of the analyzer in several minutes.

For this reason, the concentration of THC at such Inlet test sites is determined using a sampling train consisting of an EPA Method 5 sampling train equipped with a sample tap immediately downstream of the third glass impinger just upstream of the desiccant column. This tap is connected to the sample inlet of a Ratfisch Model RS55 Total Hydrocarbon Analyzer (EPA Method 25A). The Method 5 sampling train is used to condense out and collect the high boiling point hydrocarbons which interfere with the THC analysis. The Method 5 sampling train is operated for 60 minutes as per EPA Method 5 except that a fixed flow rate of 0.75 CFM is employed. After sampling is completed, the train is quantitatively recovered (using methylene chloride for a final rinse). Vacuum grease is not used to eliminate contamination of the recovered hydrocarbon samples. The recovered M5 samples are returned to the laboratory where the wet catch is exhaustively extracted with methylene chloride. This solvent is then used to extract the filter and probe in a Soxhlet extractor. The extract is then dried over sodium sulfate; the methylene chloride evaporated at room temperature; and the total weight of condensed hydrocarbons determined gravimetrically. The carbon equivalent weight is calculated assuming an average composition of carbon of 85% in the condensed hydrocarbons or, if necessary, a carbon content determination can be made on the entire condensate sample by oxygen furnace.

The volume of gas sampled and recorded by the Method 5 dry test meter must be corrected for the volume of sample gas (6.79 DSCF) withdrawn by the THC analyzer which passes through the filter and condensing system but not through the dry test meter. The flow rate of the THC analyzer is determined after the test by reproducing the setting on the analyzer

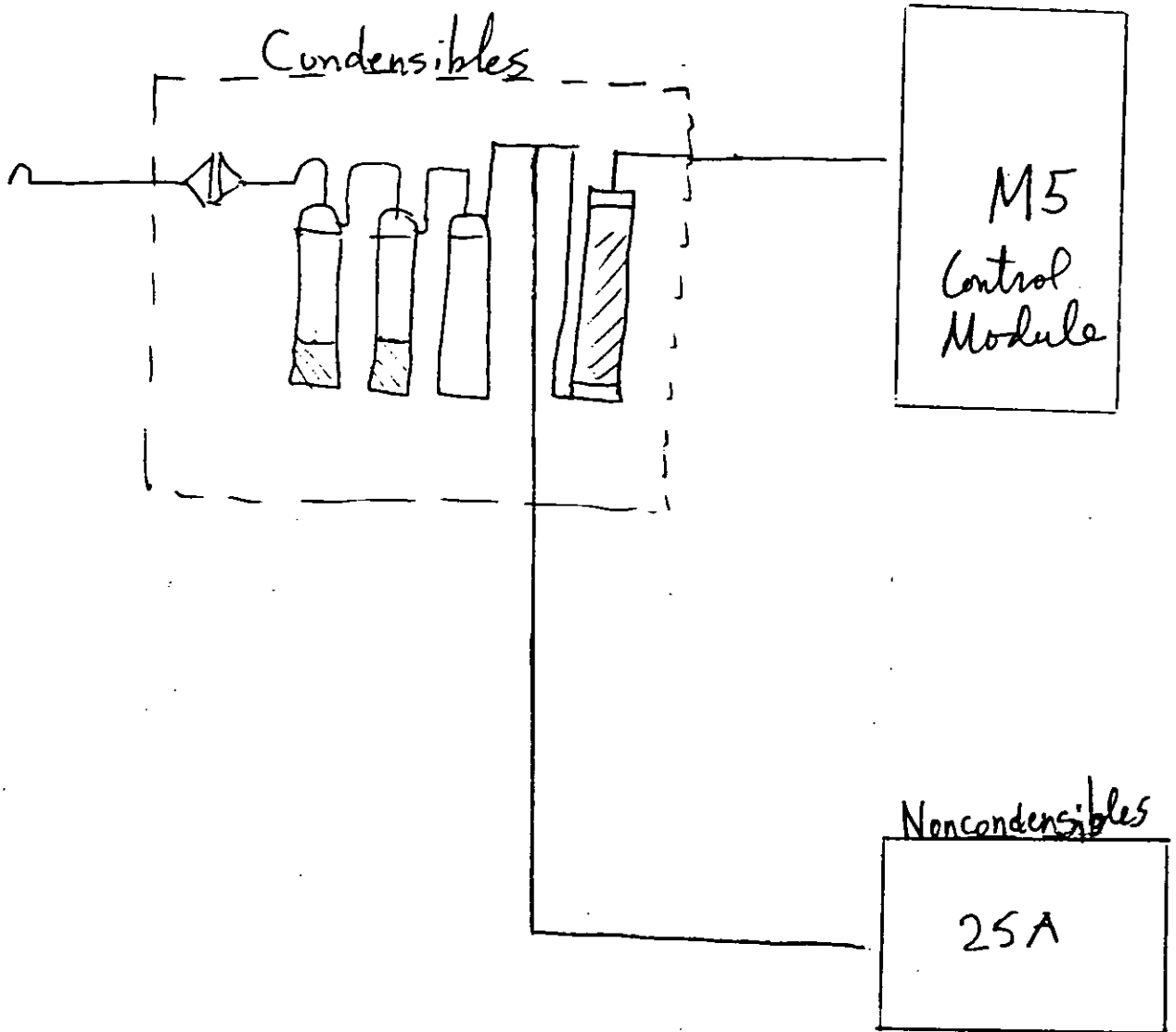


sampling vacuum regulator (200 mbar) and measuring the resulting flow against a wet test meter (0.113 SCFM).

The concentration of condensible hydrocarbons (as carbon) is then calculated from the recovered weight of hydrocarbons; the estimated carbon content of the samples; and the total dry standard volume of exhaust gas which passed through the Method 5 sampling train.

The concentration of noncondensable hydrocarbons is measured directly with the heated flame ionization detector which is calibrated on-site with propane in air gas standards. The observed concentrations are multiplied by 3 as per Method 25A to convert them to ppmC. The total hydrocarbon concentration is then calculated as the sum of the condensible + noncondensable hydrocarbons.

# After burner Inlet



7.4 Adsorption Tube Procedure (Alternative Procedure). It is suggested that the tester refer to the National Institute of Occupational Safety and Health (NIOSH) method for the particular organics to be sampled. The principal interferent will be water vapor. If water vapor is present at concentrations above 3 percent, silica gel should be used in front of the charcoal. Where more than one compound is present in the emissions, then develop relative adsorptive capacity information.

7.4.1 Additional Apparatus. In addition to the equipment listed in the NIOSH method for the particular organic(s) to be sampled, the following items (or equivalent) are suggested.

7.4.1.1 Probe (Optional). Borosilicate glass or stainless steel, approximately 6-mm ID, with a heating system if water condensation is a problem, and a filter (either in-stack or out-stack heated to stack temperature) to remove particulate matter. In most instances, a plug of glass wool is a satisfactory filter.

7.4.1.2 Flexible Tubing. To connect probe to adsorption tubes. Use a material that exhibits minimal sample adsorption.

7.4.1.3 Leakless Sample Pump. Flow controlled, constant rate pump, with a set of limiting (sonic) orifices to provide pumping rates from approximately 10 to 100 cc/min.

7.4.1.4 Bubble-Tube Flowmeter. Volume accuracy within  $\pm 1$  percent, to calibrate pump.

7.4.1.5 Stopwatch. To time sampling and pump rate calibration.

7.4.1.6 Adsorption Tubes. Similar to ones specified by NIOSH, except the amounts of adsorbent per primary/backup sections are 800/200 mg for charcoal tubes and 1040/260 mg for silica gel tubes. As an alternative, the tubes may contain a porous polymer adsorbent such as Tenax GC or XAD-2.

7.4.1.7 Barometer. Accurate to 5 mm Hg, to measure atmospheric pressure during sampling and pump calibration.

7.4.1.8 Rotameter. 0 to 100 cc/min, to detect changes in flow rate during sampling.

7.4.2 Sampling and Analysis. It is suggested that the tester follow the sampling and analysis portion of the respective NIOSH method section entitled "Procedure." Calibrate the pump and limiting orifice flow rate through adsorption tubes with the bubble tube flowmeter before sampling. The sample system can be operated as a "recirculating loop" for this operation. Record the ambient temperature and barometric pressure. Then, during sampling, use the ro-

tameter to verify that the pump and orifice sampling rate remains constant.

Use a sample probe, if required, to obtain the sample at the centroid of the duct, or at a point no closer to the walls than 1 m. Minimize the length of flexible tubing between the probe and adsorption tubes. Several adsorption tubes can be connected in series, if the extra adsorptive capacity is needed. Provide the gas sample to the sample system at a pressure sufficient for the limiting orifice to function as a sonic orifice. Record the total time and sample flow rate (or the number of pump strokes), the barometric pressure, and ambient temperature. Obtain a total sample volume commensurate with the expected concentration(s) of the volatile organic(s) present, and recommended sample loading factors (weight sample per weight adsorption media). Laboratory tests prior to actual sampling may be necessary to predetermine this volume. When more than one organic is present in the emissions, then develop relative adsorptive capacity information. If water vapor is present in the sample at concentrations above 2 to 3 percent, the adsorptive capacity may be severely reduced. Operate the gas chromatograph according to the manufacturer's instructions. After establishing optimum conditions, verify and document these conditions during all operations. Analyze the audit samples (see Section 7.4.4.3), then the emission samples. Repeat the analysis of each sample until the relative deviation of two consecutive injections does not exceed 5 percent.

**7.4.3 Standards and Calibration.** The standards can be prepared according to the respective NIOSH method. Use a minimum of three different standards; select the concentrations to bracket the expected average sample concentration. Perform the calibration before and after each day's sample analyses. Prepare the calibration curve by using the least squares method.

#### 7.4.4 Quality Assurance.

**7.4.4.1 Determination of Desorption Efficiency.** During the testing program, determine the desorption efficiency in the expected sample concentration range for each batch of adsorption media to be used. Use an internal standard. A minimum desorption efficiency of 50 percent shall be obtained. Repeat the desorption determination until the relative deviation of two consecutive determinations does not exceed 5 percent. Use the average desorption efficiency of these two consecutive determinations for the correction specified in Section 7.4.4.5. If the desorption efficiency of the compound(s) of interest is questionable under actual sampling conditions, use of the Method of Standard Additions may be helpful to determine this value.

**7.4.4.2 Determination of Sample Collection Efficiency.** For the source samples, ana-

lyze the primary and backup portions of the adsorption tubes separately. If the backup portion exceeds 10 percent of the total amount (primary and backup), repeat the sampling with a larger sampling portion.

**7.4.4.3 Analysis Audit.** Immediately before the sample analyses, analyze the two audits in accordance with Section 7.4.2. The analysis audit shall agree with the audit concentration within 10 percent.

**7.4.4.4 Pump Leak Checks and Volume Flow Rate Checks.** Perform both of these checks immediately after sampling with all sampling train components in place. Perform all leak checks according to the manufacturer's instructions, and record the results. Use the bubble-tube flowmeter to measure the pump volume flow rate with the orifice used in the test sampling, and the result. If it has changed by more than 5 but less than 20 percent, calculate an average flow rate for the test. If the flow rate has changed by more than 20 percent, recalibrate the pump and repeat the sampling.

**7.4.4.5 Calculations.** All calculations can be performed according to the respective NIOSH method. Correct all sample volumes to standard conditions. If a sample dilution system has been used, multiply the results by the appropriate dilution ratio. Correct all results by dividing by the desorption efficiency (decimal value). Report results as ppm by volume, dry basis.

**7.5 Reporting of Results.** At the completion of the field analysis portion of the study, ensure that the data sheets shown in Figure 18-11 have been completed. Summarize this data on the data sheets shown in Figure 18-15.

## 8. Bibliography

1. American Society for Testing and Materials. C, Through C, Hydrocarbons in the Atmosphere by Gas Chromatography. ASTM D 2820-72, Part 23. Philadelphia, Pa. 23:950-958. 1973.
2. Corazon, V. V. Methodology for Collecting and Analyzing Organic Air Pollutants. U.S. Environmental Protection Agency. Publication No. EPA-600/2-79-042. February 1979.
3. Dravnieks, A., B. K. Krotoszynski, J. Whitfield, A. O'Donnell, and T. Burgwald. Environmental Science and Technology. 5(12):1200-1222. 1971.
4. Eggertsen, F. T., and F. M. Nelsen. Gas Chromatographic Analysis of Engine Exhaust and Atmosphere. Analytical Chemistry. 30(6): 1040-1043. 1958.
5. Fearheller, W. R., P. J. Marn, D. H. Harris, and D. L. Harris. Technical Manual for Process Sampling Strategies for Organic Materials. U.S. Environmental Protection Agency. Research Triangle Park, NC. Publication No. EPA 600/2-76-122. April 1976. 172 p.

**APPENDIX I**

**CALCULATION EQUATIONS**

## CALCULATION EQUATIONS

### METHOD 2

$$\bar{V}_s = 35.48 C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

$$Q_{s,d} = 60(1 - B_{ws}) \bar{V}_s A \left(\frac{528}{T_{s(avg)}}\right) \left(\frac{P_s}{29.92}\right)$$

$$Q_a = 60 \bar{V}_s A$$

$$\dot{m}_g = \frac{4.995 Q_{s,d} G_d}{1 - B_{ws}}$$

$$RH^* = 100 (v_{p_{twb}} 0.0003641 P_s (T_{db} - T_{wb}))/v_{p_{tdb}}$$

$$B_{ws}^* = RH(v_{p_{tdb}})/P_s$$

$$= \frac{4.585 \times 10^{-2} P_s M_s}{T_s (avg)}$$

\*Alternate equations for calculating moisture content from wet bulb and dry bulb data.

## SYMBOLS

- A = Cross sectional area of stack, SQ. FT.
- $A_n$  = Cross sectional area of nozzle, SQ. FT.
- $B_{ws}$  = Water vapor in gas stream, proportion by volume
- $C_p$  = Pitot tube coefficient, dimensionless
- $C_a$  = Concentration of particulate matter in stack gas, wet basis, GR/ACF
- $C_s$  = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF
- EA = Excess air, percent by volume
- $\gamma$  = Dry test meter correction factor, dimensionless
- $G_d$  = Specific gravity (relative to air), dimensionless
- I = Isokinetic variation, percent by volume
- $M_d$  = Molecular weight of stack gas, dry basis, g/g - mole.
- $\dot{m}_g$  = Mass flow of wet flue gas, LB/HR
- $\dot{m}_p$  = Particulate mass flow, LB/HR
- $M_s$  = Molecular weight of stack gas, wet basis, g/g, mole.
- $M_p$  = Total amount of particulate matter collected, g
- $P_{bar}$  = Atmospheric pressure, IN. HG. (uncompensated)
- $P_g$  = Stack static gas pressure, IN. WC.

$P_s$  = Absolute pressure of stack gas, IN.HG.  
 $P_{std}$  = Standard absolute pressure, 29.92 IN. HG.  
 $A_a$  = Actual volumetric stack gas flow rate, ACFM  
 $Q_{s,d}$  = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM  
RH = Relative humidity, %  
 $T_{db}$  = Dry bulb temperature of stack gas, °F  
 $T_{wb}$  = Wet bulb temperature of stack gas, °F  
 $T_m(avg)$  = Absolute average dry gas meter temperature, °R  
 $T_s(avg)$  = Absolute average stack temperature, °F  
 $T_{std}$  = Standard absolute temperature, 528 °F (68 °F)  
 $\theta$  = Total sampling time, min.  
 $V_{lc}$  = Total volume of liquid collected in impingers and silica gel, ml  
 $V_m$  = Volume of gas sample as measured by dry gas meter, CF  
 $V_m(std)$  = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF  
 $V_w(std)$  = Volume of water vapor in the gas sample corrected to standard conditions, SCF  
 $\bar{V}_s$  = Average actual stack gas velocity, FT/SEC  
 $v_{p_{tdb}}$  = Vapor pressure at  $T_{db}$ , IN. HG.



- $v_{p_{twb}}$  = Vapor pressure at  $T_{wb}$ , IN. HG
- $\overline{\Delta H}$  = Average pressure differential across the orifice meter, IN. WC.
- $\Delta P$  = Velocity pressure of stack gas, IN. WC.
- $\gamma$  = Dry test meter correction coefficient, dimensionless
- $\rho$  = Actual gas density, LB/ACF

## CALCULATION EQUATIONS

### METHOD 3

$$\%EA = \frac{100(\%O_2 - ) .5\% CO)}{0.264\% N_2 - \%O_2 + 0.5\% CO}$$

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

$$M_s = M_d (I - B_{ws}) + 0.18 B_{ws}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

## CALCULATION EQUATIONS

### METHOD 5

$$V_{m(std)} = 17.65 V_m \gamma \left( \frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}} \right)$$

$$V_{w(std)} = 0.0472 V_{Is}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$I = 0.0944 \left( \frac{T_{s(avg)} V_{m(std)}}{P_s V_s A_n \theta (1 - B_{ws})} \right)$$

$$C_s = \frac{15.43 M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3 M_p P_s}{T_{s(avg)} (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714 \times 10^{-3} C_s Q_{s,d}$$

$$(\dot{m}_p)_2 = \frac{1.3228 \times 10^{-1} M_p A}{\theta A_n}$$

$$\dot{m}_p = \frac{(\dot{m}_p)_1 + (\dot{m}_p)_2}{2}$$

## SYMBOLS

- A = Cross sectional area of stack, SQ. FT.
- $A_n$  = Cross sectional area of nozzle, SQ. FT.
- $B_{ws}$  = Water vapor in gas stream, proportion by volume
- $C_p$  = Pitot tube coefficient, dimensionless
- $C_a$  = Concentration of particulate matter in stack gas, wet basis, GR/ACF
- $C_s$  = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, GR/DSCF
- EA = Excess air, percent by volume
- $\gamma$  = Dry test meter correction factor, dimensionless
- $G_d$  = Specific gravity (relative to air), dimensionless
- I = Isokinetic variation, percent by volume
- $M_d$  = Molecular weight of stack gas, dry basis, g/g - mole.
- $\dot{m}_g$  = Mass flow of wet flue gas, LB/HR
- $\dot{m}_p$  = Particulate mass flow, LB/HR
- $M_s$  = Molecular weight of stack gas, wet basis, g/g, mole.
- $M_p$  = Total amount of particulate matter collected, g
- $P_{bar}$  = Atmospheric pressure, IN. HG. (uncompensated)
- $P_g$  = Stack static gas pressure, IN. WC.

$P_s$  = Absolute pressure of stack gas, IN.HG.  
 $P_{std}$  = Standard absolute pressure, 29.92 IN. HG.  
 $A_a$  = Actual volumetric stack gas flow rate, ACFM  
 $Q_{s,d}$  = Dry volumetric stack gas flow rate corrected to standard conditions, DSCFM  
RH = Relative humidity, %  
 $T_{db}$  = Dry bulb temperature of stack gas, °F  
 $T_{wb}$  = Wet bulb temperature of stack gas, °F  
 $T_m(avg)$  = Absolute average dry gas meter temperature, °R  
 $T_s(avg)$  = Absolute average stack temperature, °F  
 $T_{std}$  = Standard absolute temperature, 528 °F (68 °F)  
 $\theta$  = Total sampling time, min.  
 $V_{lc}$  = Total volume of liquid collected in impingers and silica gel, ml  
 $V_m$  = Volume of gas sample as measured by dry gas meter, CF  
 $V_m(std)$  = Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF  
 $V_w(std)$  = Volume of water vapor in the gas sample corrected to standard conditions, SCF  
 $\bar{V}_s$  = Average actual stack gas velocity, FT/SEC  
 $v_{ptdb}$  = Vapor pressure at  $T_{db}$ , IN. HG.

- $v_{ptwb}$  = Vapor pressure at  $T_{wb}$ , IN. HG
- $\overline{\Delta H}$  = Average pressure differential across the orifice meter, IN. WC.
- $\Delta P$  = Velocity pressure of stack gas, IN. WC.
- $\gamma$  = Dry test meter correction coefficient, dimensionless
- $\rho$  = Actual gas density, LB/ACF

## Method 25A

### Total Gaseous Organics Calculation Equations

$$\text{GR C/SCF} = 2.180 \times 10^{-4} \text{ (ppm,w)}$$

$$\text{GR C/DSCF} = 2.180 \times 10^{-4} \text{ (ppm,w)/(1-MC/100)}$$

$$\text{LB C/HR} = 8.5714 \times 10^{-3} \text{ (GR/DSCF) (DSCFM)}$$

where:

GR C/SCF = grains of total gaseous organics as carbon per actual (wet) standard cubic foot

GR C/DSCF = grains of total gaseous organics as carbon per dry standard cubic foot

LB C/HR = pounds of total gaseous organics as carbon emitted hour

Note 1: The Ratfisch Model RS 55 Heated FID Analyzer as normally operated with a heated filter, sample line and heated detector oven gives ppm,w.

Note 2: ppm,C = ppm as carbon = 3(ppm propane)

CLEAN SOILS AFTERBURNER TEST  
Summary of THC Calculations

Run	1	2	3
<u>INLET</u>			
Volume of Meter . (DSCF)	42.64	36.51	41.02
Volume of RS55 . (DSCF)	6.80	6.79	6.80
Volume Total . . (DSCF)	49.58	43.31	47.82
Condensibles . . . (g)	0.2337	0.3484	0.3634
Carbon Content . . (%)	78.80	77.28	79.93
Condensibles, as C . (g)	0.1842	0.2692	0.2905
<u>Condensible Hydrocarbons</u>			
Concentration			
. . . . . (g C/DSCF)	0.00371	0.00622	0.00607
. . . . . (GR C/DSCF)	0.0572	0.0960	0.0937
. . . . . (ppm C,d)	262	442	430
<u>Noncondensable Hydrocarbons</u>			
As measured by THC Analyzer			
. . . . . (ppm C,d)	885	1881	2181
Total Hydrocarbons			
. . . . . (ppm C,d)	1150	2320	2610
<u>OUTLET</u>			
Total Hydrocarbons			
. . . . . (ppm C,d)	87	279	274
Destruction Efficiency			
. . . . . (%v/v)	92.4	88.0	89.5



INTERPOLL LABORATORIES, INC.  
Circle Pines, Minnesota  
(612) 786-6020

DETERMINATION OF THE SAMPLE FLOW RATE  
OF THE RATFISCH MODEL RS55  
TOTAL HYDROCARBON ANALYZER

Set vacuum bypass flow regulator at setting used during determination.

Setting: 200 mbar

Attach the inlet of the THC Analyzer to the outlet of the small wet test meter (.05 CF/REV) and measure the time for four (4) revolutions or 0.2 CF:

$P_b$  30.01 IN HG       $t_m$  68 °F

time ( $\tau$ ) = 8 min 49 sec = 8.824 min

$$Q_A = \frac{0.200}{\tau} = \frac{0.200}{8.824} = 0.113 \text{ CFM}$$


$$Q_{std} = \frac{17.647 Q_A P_b}{(t_m + 460)} = \frac{0.113}{SCFM}$$

Cleansoils, Inc.  
 BTX Calculation

	Test/Run	Mass (ug)	Vstd (DSCF)	Concentration (ppm,d)	Gas Flow (LB/DSCF)	Gas Flow (DSCFM)	Mass Rate (LB/HR)
Benzene	2/1	< 5	2.024	< 0.0269	< 5.45E-09	8858	< 0.0029
	2/2	70	1.913	0.3985	8.07E-08	5990	0.0290
	2/3	< 5	2.008	< 0.0271	< 5.49E-09	6066	< 0.0020
Toluene	2/1	< 5	2.024	< 0.0228	< 5.45E-09	6049	< 0.0020
	2/2	72	1.913	0.3475	8.30E-08	5990	0.0298
	2/3	< 5	2.008	< 0.0230	< 5.49E-09	6066	< 0.0020
Xylene	2/1	< 5	2.024	< 0.0198	< 5.45E-09	6049	< 0.0020
	2/2	< 5	1.913	< 0.0209	< 5.76E-09	5990	< 0.0021
	2/3	< 5	2.008	< 0.0200	< 5.49E-09	6066	< 0.0020
Ethyl- Benzene	2/1	< 5	2.024	< 0.0198	< 5.45E-09	6049	< 0.0020
	2/2	< 5	1.913	< 0.0209	< 5.76E-09	5990	< 0.0021
	2/3	< 5	2.008	< 0.0199	< 5.49E-09	6066	< 0.0020

1-3240

# CALCULATION EQUATIONS FOR BENZENE

1. STRUCTURE   $C_6H_6$

2. MOLECULAR WEIGHT 78.11

3. MASS/VOLUME CONCENTRATION

$$C_{mg/Nm^3}^{C_6H_6} = \frac{m}{1000} \times \frac{1}{V_{STD}/35.31}$$

$$C_{mg/Nm^3}^{C_6H_6} = \frac{0.03531 m}{V_{STD}}$$

where  $m$  = total mass of benzene in sample in micrograms ( $\mu g$ ).

$V_{STD}$  = total volume of air or exhaust gas sampled in DSCF

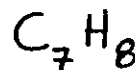
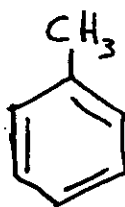
4. VOLUME/VOLUME CONCENTRATION

$$C_{ppmv}^{C_6H_6} = \left( \frac{mg}{Nm^3} \right) \times \left( \frac{24.054 mL}{78.11 mg} \right) = ppmv$$

$$C_{ppmv}^{C_6H_6} = 0.3080 \left( C_{mg/Nm^3}^{C_6H_6} \right)$$

# CALCULATION EQUATIONS FOR TOLUENE

1. STRUCTURE



2. MOLECULAR WEIGHT

92.14

3. MASS/VOLUME CONCENTRATION

$$C_{C_7H_8} \text{ mg/Nm}^3 = \frac{m}{1000} \times \frac{1}{V_{STD} / 35.31}$$

$$C_{C_7H_8} \text{ mg/Nm}^3 = \frac{0.03531 m}{V_{STD}}$$

where  $m$  = total mass of toluene in sample in micrograms ( $\mu\text{g}$ ).

$V_{STD}$  = total volume of air or exhaust gas sampled in DSCF

4. VOLUME/VOLUME CONCENTRATION

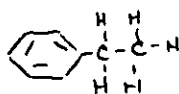
$$C_{C_7H_8} \text{ ppmv} = \left( \frac{\text{mg}}{\text{Nm}^3} \right) \times \left( \frac{24.054 \text{ mL}}{92.14 \text{ mg}} \right) = \text{ppmv}$$

molar volume

$$C_{C_7H_8} \text{ ppmv} = 0.2611 \left( C_{C_7H_8} \text{ mg/Nm}^3 \right)$$

Concentration Calculation Equations for Ethyl benzene

## 1. Structure:

 $C_8H_{10}$ 

## 2. Molecular weight:

106.16 g/g-mole

## 3. Mass/volume Concentration:

$$C_{ug/Nm^3} = \frac{35.314 \text{ m}}{V_{std}}$$

where m = Total mass of Ethylbenzene  
in sample in micrograms ( $\mu\text{g}$ ), and

$V_{std}$  = Total volume of exhaust gas or air  
sampled in dry standard cubic feet  
(DSCF).

## 4. Volume/volume Concentration:

$$C_{ppmv}^{C_8H_{10}} = \left( \frac{\mu\text{g}}{Nm^3} \right) \times \left( \frac{24.054 \text{ mL}}{106.16} \right) \times \frac{Nm^3}{10^3 L} = \frac{\mu L}{L} = ppm$$

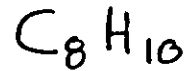
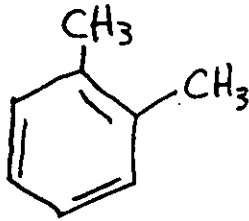
$$C_{ppmv}^{C_8H_{10}} = 2.266 \times 10^{-4} \left( \frac{C_8H_{10}}{C_{ug/Nm^3}} \right)$$

## 5. Notes:

Derived by: K. EickstadtDate: 2/91

CALCULATION EQUATIONS  
 FOR XYLENE(S)

1. STRUCTURE



2. MOLECULAR WEIGHT

106.17

3. MASS/VOLUME CONCENTRATION

$$C_{\substack{C_8H_{10} \\ \text{mg/Nm}^3}} = \frac{m}{1000} \times \frac{1}{V_{\text{std}} / 35.31}$$

$$C_{\substack{C_8H_{10} \\ \text{mg/Nm}^3}} = \frac{0.03531 m}{V_{\text{std}}}$$

where  $m$  = total mass of xylenes in sample  
 in micrograms ( $\mu\text{g}$ )

$V_{\text{std}}$  = total volume of air or exhaust gas  
 sampled in DSCF.

4. VOLUME/VOLUME CONCENTRATION

$$C_{\substack{C_8H_{10} \\ \text{ppmv}}} = \left( \frac{\text{mg}}{\text{Nm}^3} \right) \times \left( \frac{\text{molar volume}}{106.17 \text{ mg}} \right) = \text{ppmv}$$

$$C_{\substack{C_8H_{10} \\ \text{ppmv}}} = 0.2266 \left( C_{\substack{C_8H_{10} \\ \text{mg/Nm}^3}} \right)$$

**APPENDIX J**

**SAMPLING TRAIN CALIBRATION DATA**

Interpoll Laboratories, Inc.  
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: February 25, 1991

Meter Box No. : 9 (Rockwell Dry Test Meter Serial No. 949230)

Date of Last Calibration: January 18, 1991  
Calibration Technician: E. Trowbridge  
Wet Test Meter No.: American Meter AL-20

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
January 25-29, 1991	1-3233	172.86	405.03	232.17	232.17
February 4, 1991	1-3239	406.30	530.43	124.13	356.30
February 8, 1991	1-3240	532.10	800.83	268.73	625.03

\* Total volume through meter since last calibration.



Interpoll Laboratories, Inc.  
(612) 786-6020

Meter Box Calibration and Usage Status

Date of Report: February 13, 1991

Meter Box Number: 1-S (Rockwell Dry Test Meter Serial No. 69184)

Date of Last Calibration: November 8, 1990

Calibration Technician: E. Trowbridge

Wet Test Meter Number: American Meter AL-17 (0.05 CF/REV)

Date of Use	Report No.	Initial Meter Reading	Final Meter Reading	Volume/Job (cu. ft.)	Total Volume* (cu. ft.)
February 6, 1991	1-3239	837.310	843.954	6.644	6.644
February 8, 1991	1-3240	844.00	850.167	6.167	12.811

\* Total volume through meter since last calibration.

Interpoll Laboratories, Inc.

(612) 786-6020

**Nozzle Calibration  
Data Sheet**

Date of Calibration: 02-09-91

Nozzle Number INC-10

Technician: M. Kaehler

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

<u>Position</u>	<u>Diameter (inches)</u>
1	0.620
2	0.620
<u>3</u>	<u>0.619</u>
Average:	0.620

EPA Method 5 Gas Metering System  
Quality Control Check Data Sheet

Job Clean Soils / Tampa Florida

Date 2-8-91

Operator M. Kaehler

Module No. 9

Instructions: Operate the control module at a flow rate equal to  $\Delta H_0$  for 10 minutes before attaching the umbilical. Record the following data:

Bar press 29.94 in. Hg.  $\tau =$  .9942  $\Delta H_0$  1.80 in. W.C.

Time (min)	Volume (CF)	Meter Temp. ( $^{\circ}$ F)	
		Inlet	Outlet
	(532.10)		
2.5	533.94	65	64
5.0	535.77	68	65
7.5	537.61	69	66
10	539.46	71	66
	$V_m =$	Avg ( $t_m$ ) = 66.75 $^{\circ}$ F	

Calculate  $Y_{en}$  as follows:

$$Y_{en} = \frac{1.786}{\tau V_m} \left[ \frac{(t_m + 460)}{P_b} \right]^{0.5}$$

$$Y_{en} = \frac{1.786}{(.9942)(2.36)} \left[ \frac{(66.75) + 460}{(29.94)} \right]^{0.5}$$

$$Y_{en} = \underline{1.024}$$

If  $Y_{en}$  is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

EPA Method 5 Gas Metering System  
Quality Control Check Data Sheet

Job Clean Soils / Temp. Bay F1

Date 2-9-91

Operator M. Kaehler

Module No. 9

Instructions: Operate the control module at a flow rate equal to  $\Delta H$  for 10 minutes before attaching the umbilical. Record the following data:

Bar press 30.00 in. Hg.  $\tau =$  .9942  $\Delta H =$  1.80 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
	(672.80)		
2.5	674.64	58	58
5.0	676.49	60	58
7.5	678.35	61	59
10	680.17	63	59
	$V_m = 7.37$	Avg ( $t_m$ ) = 59.50 °F	

Calculate  $Y_{en}$  as follows:

$$Y_{en} = \frac{1.786}{\tau V_m} \left[ \frac{(t_m + 460)}{P_b} \right]^{0.5}$$

$$Y_{en} = \frac{1.786}{(.9942)(7.37)} \left[ \frac{(59.50) + 460}{(30.00)} \right]^{0.5}$$

$$Y_{en} = \underline{1.014}$$

If  $Y_{en}$  is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1





Interpoll Laboratories  
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitobe No. WCP-1

Pitot tube dimensions:

1. External tubing diameter ( $D_t$ ) .316 IN.
2. Base to Side A opening plane ( $P_A$ ) .462 IN.
3. Base to Side B opening plane ( $P_B$ ) .463 IN.

Alignment:

4.  $\alpha_1 < 10^\circ$  0
5.  $\alpha_2 < 10^\circ$  0
6.  $B_1 < 5^\circ$  10
7.  $B_2 < 5^\circ$  10
8.  $Z < .125"$  .02
9.  $W < .0625"$  .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3 IN.
12. Pitot to thermocouple (parallel to probe) \_\_\_\_\_ IN.
13. Pitot to thermocouple (perpendicular to probe) \_\_\_\_\_ IN.

Date of Inspection:

12-8-89

Inspected by:

*[Signature]*

S-348(1)

Interpoll Laboratories  
(612)786-6020

S-Type Pitot Tube Inspection Sheet

Pitot No. 4-21

Pitot tube dimensions:

1. External tubing diameter ( $D_t$ ) .316 IN.
2. Base to Side A opening plane ( $P_A$ ) .460 IN.
3. Base to Side B opening plane ( $P_B$ ) .462 IN.

Alignment:

4.  $\alpha_1 < 10^\circ$  0
5.  $\alpha_2 < 10^\circ$  0
6.  $B_1 < 5^\circ$  10
7.  $B_2 < 5^\circ$  10
8.  $Z < .125"$  .02
9.  $W < .0625"$  .02

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .760 IN.
11. Pitot to probe sheath 3.00 IN.
12. Pitot to thermocouple (parallel to probe) 3.00 IN.
13. Pitot to thermocouple (perpendicular to probe) .761 IN.

Date of Inspection:

12-8-89

Inspected by:

E. T. ...

S-348(1)



Interpoll Laboratories, Inc.

Temperature Measurement Device  
Calibration Sheet

Unit under test: \_\_\_\_\_  
 Vendor Gordon  
 Model 5310 -K Serial Number PDT # 9  
 Range -112 to 1999 °F °F Thermocouple Type K  
 Date of Calibration 12/14/90 Technician Duane Van Haver

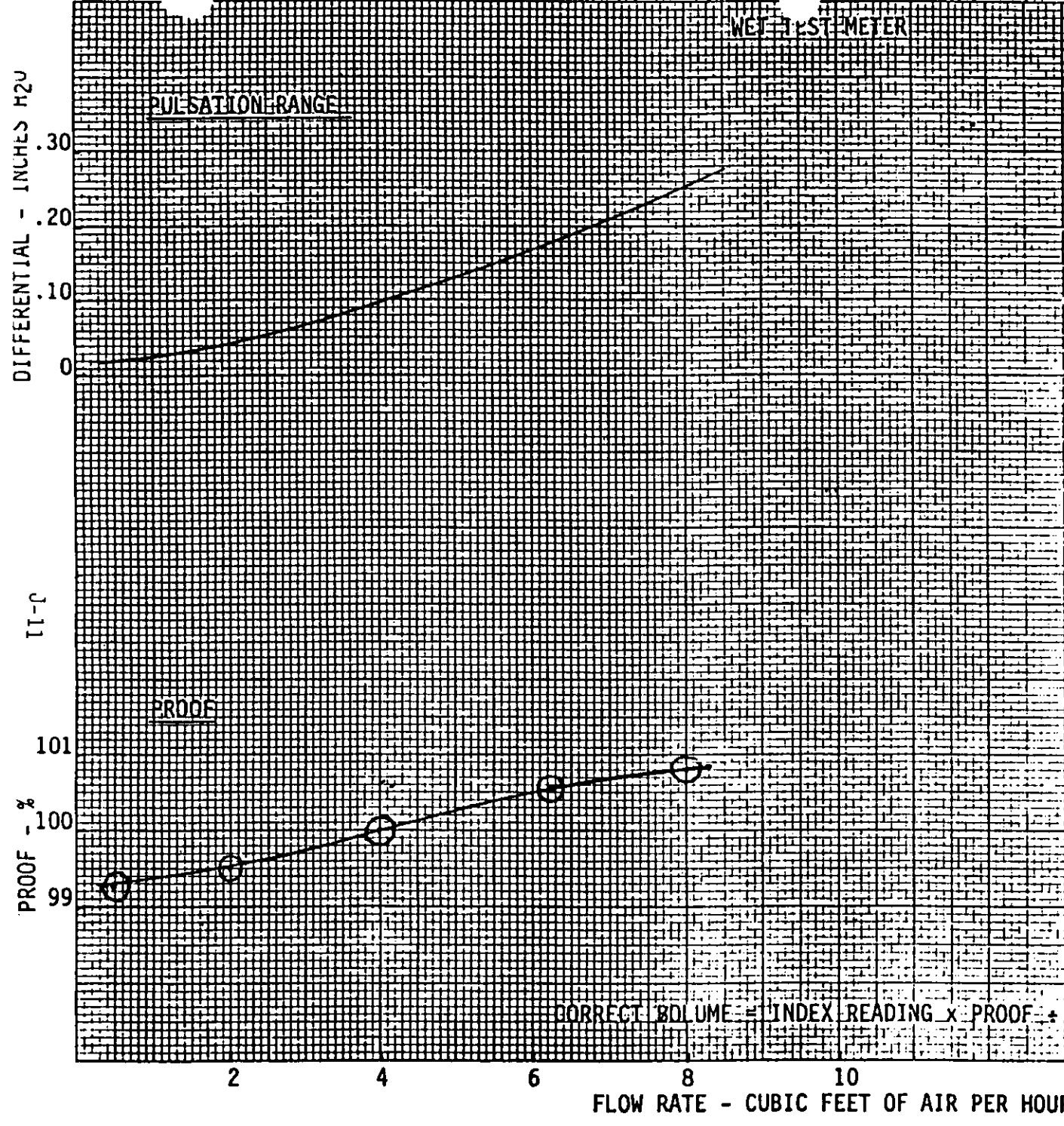
Method of Calibration:

- Comparison against ASTM mercury in glass thermometer using a thermostatted and insulated aluminum block designed to provide uniform temperature. The temperature is adjusted by adjusting the voltage on the block heater cartridge.
- Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is  $\pm 0.1\%$  of span (2100 °F)  $\pm 1$  degree (for negative temperatures add  $\pm 2$  degrees. The CL-300 simulates exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp (°F) Nominal	Temperature of Standard or Simulated Temp (°F)	Response of Unit Under Test (°F)	Deviation	
			$\Delta t$ (°F)	(%)
0	_____	-4.4	4.4	.96
100	_____	92.8	7.2	1.28
200	_____	197	3	.75
300	_____	294	6	.79
400	_____	390	10	1.16
500	_____	489	11	1.14
600	_____	591	9	.85
700	_____	690	10	.86
800	_____	794	6	.48
900	_____	895	5	.37
1000	_____	999	1	.06
1100	_____	1101	1	.06
1200	_____	1204	4	.24
1300	_____	1304	4	.22
1400	_____	1407	7	.38
1500	_____	1503	3	.15
1600	_____	1602	2	.1
1700	_____	1695	5	.23
1800	_____	1792	8	.35
1900	_____	1882	18	.70
2000	_____	1975	25	1.02
2100	_____	_____	_____	_____
		Averages:	7.12°	.57%

OF = off scale response by unit under test (°F)  
 % dev =  $100 \Delta t / (460 + t)$

- Unit in tolerance
- Unit was not in tolerance; recalibrated - See new calibration sheet.

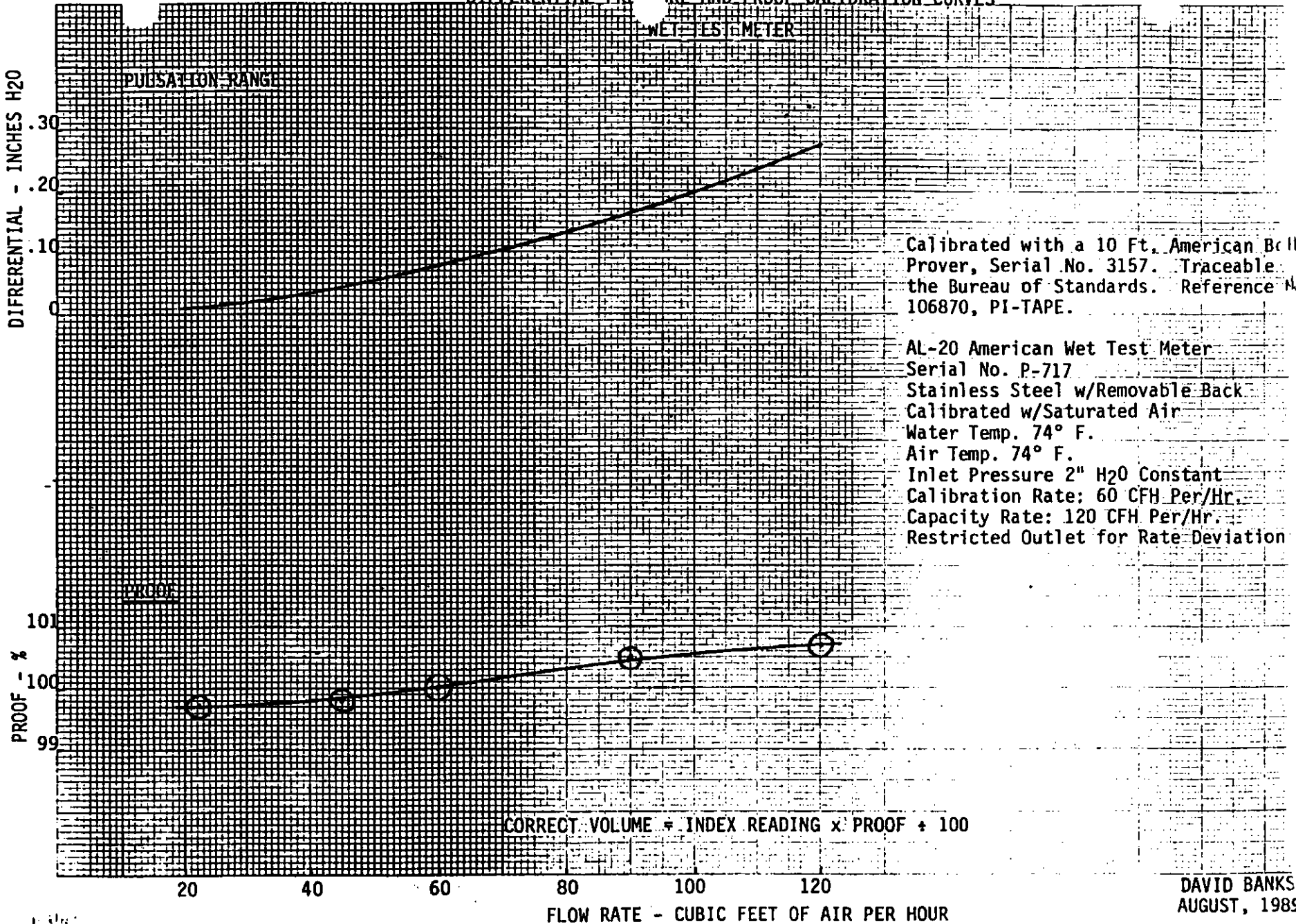


Data obtained on an American 5 Ft. Bell Prover, Serial No. 2260. Traceable to the Bureau of Standards. Reference No. 106870, PI-TAPE.

AL-17 American Wet Test Meter  
 Serial No. P-718  
 Stainless Steel w/Removable Back  
 Calibrated with Saturated Air  
 Water Temp. 74° F.  
 Air Temp. 74° F.  
 Inlet Pressure 2" H<sub>2</sub>O Constant  
 Calibration Rate: 4 CFH Air  
 Capacity Rate: 8 CFH Air  
 Restricted Outlet for Rate Deviation.

CORRECT VOLUME = INDEX READING x PROOF ÷ 100

DIFFERENTIAL PRESSURE AND PROOF CALIBRATION CURVES



J-12

DAVID BANKS  
 AUGUST, 1989

Data Reporting Sheet

CLIENT: Stack

JOB: Clean Soils, Inc. Tampa Bay, FL.

CLIENT NO: \_\_\_\_\_

P.O. NO: \_\_\_\_\_

PROJECT MGR: \_\_\_\_\_

PHONE: \_\_\_\_\_

DATE: \_\_\_\_\_

CONTACT: \_\_\_\_\_

Soil Remediation Unit Stack

LABORATORY REPORT #: 2323

SAMPLES COLLECTED: 2-9-91

SAMPLES RECEIVED: 2-11-91

Invoicing    Signature    Report  
                                            Routing

SAMPLE ID: \_\_\_\_\_

SAMPLE TYPE: \_\_\_\_\_

LOG NO: \_\_\_\_\_

PL  
Lab Mgr  
Ino Mgr  
Org Mgr

□  
□  
□  
□

□  
□  
□  
□

□  
□  
□  
□

T3R1	T3R2	T3R3	
Integrat	ed Gas	Sample	
(Tedho	Bag)		
2323-1B	-22	-26	

PARAMETER	ppm in air UNITS	DETECT LIMIT	ANALYSIS DATE & INITIALS	METHOD				
Methane	ul/L	1.4	3/21/91	GC/FID	x 10.9	x 25.0	x 3.0	
Propane	ul/L	1.0	3/21/91	GC/FID	x 100	x 14.9	x 8.6	

Footnotes:

J-13

In-House Comments:

K.E. Requested analysis 2-21-91 Bag Box #22