ENTROPY
ENVIRONMENTALISTS INC.

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STATIONARY SOURCE SAMPLING REPORT

REFERENCE NO. 6284A

NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
WEST PALM BEACH, FLORIDA

EMISSIONS TESTING FOR:

- Beryllium
- Carbon Monoxide
- Hydrogen Chloride
- Hydrogen Fluoride
- Lead
- Mercury
- Nitrogen Oxides
- Particulate
- Plume Opacity
- Sulfur Dioxide
- Sulfuric Acid Mist
- Total Hydrocarbons as Methane

UNIT NOS. 1 AND 2 DRY SCRUBBER INLETS AND ESP OUTLETS

PERFORMED FOR: THE BABCOCK & WILCOX COMPANY

OCTOBER 23 THROUGH 27, 1989

REPORT CERTIFICATION

DATE December 20, 1989

The sampling performed for this report was carried out under my direction and supervision.

Signature David G. Brintle

David G. Brintle

The analysis performed for this report was carried out under my direction and supervision.

Signature Bruce G. Hawks

Bruce G. Hawks

The preparation of this report was carried out under my direction and supervision.

Signature John T. Nash

John T. Nash

I have reviewed the contents of this report and hereby certify that it is authentic and accurate.

Signature

D. James Grove, P.E.

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INTRODUCTION

1.1 Outline of Test Program. Stationary source sampling was performed for The Babcock & Wilcox Company at the North County Regional Resource Recovery Facility in West Palm Beach, Florida, from October 23 through 27, 1989 at the Unit Nos. 1 and 2 dry scrubber inlets and electrostatic precipitator (ESP) outlets. Tables 1-1 and 1-2 are test logs which give the sampling locations, sampling parameters, sampling methods, test dates, and run numbers for Unit Nos. 1 and 2, respectively.

TABLE 1-1
UNIT NO. 1 TEST LOG

Sampling Locations	Sampling Parameters	Sampling Method	Test Date	Run Numbers		
Dry Scrubber Inlet	CO_2, O_2	EPA 3	10/23	1-SI-M3-1	1-SI-M3-2	1-SI-M3-3
	Particulate	EPA 5	10/23	1-SI-M5-1	1-SI-M5-2	1-SI-M5-3
	CO_2, O_2, SO_2	EPA 3A&6C	10/26	1-SI-CEM-1	1-SI-CEM-2*	
	"	"	10/27	1-SI-CEM-3	1-SI-CEM-4**	1-SI-CEM-5
	CO_2, O_2	EPA 3	10/26	1-SI-M3-1	1-SI-M3-2*	
	"	"	10/27	1-SI-M3-3	1-SI-M3-4	1-SI-M3-5
	H_2SO_4	EPA 8	10/26	1-SI-M8-1	1-SI-M8-2*	
	"	"	10/27	1-SI-M8-3*	1-SI-M8-4	1-SI-M8-5
	HCl, HF	EPA 13B	10/26	1-SI-M13B-1	1-SI-M13B-2*	
	"	"	10/27	1-SI-M13B-3	1-SI-M13B-4*	1-SI-M13B-5
ESP Outlet	CO_2, O_2	EPA 3	10/23	1-PO-M3-1	1-PO-M3-2	1-PO-M3-3
	Particulate and Lead	EPA 5&12	10/23	1-PO-M5&12-1	1-PO-M5&12-2	1-PO-M5&12-3
	Hg	EPA 101A	10/23	1-PO-M101A-1	1-PO-M101A-2	1-PO-M101A-3
	Be	EPA 104	10/23	1-PO-M104-1	1-PO-M104-2	1-PO-M104-3
	CO_2, CO, NO_x, O_2, SO_2	EPA 3A, 10 7E, 6C	10/26	1-PO-CEM-1	1-PO-CEM-2*	
	"	"	10/27	1-PO-CEM-3	1-PO-CEM-4**	1-PO-CEM-5
	CO_2, O_2	EPA 3	10/26	1-PO-M3-1	1-PO-M3-2*	
	"	"	10/27	1-PO-M3-3	1-PO-M3-4	1-PO-M3-5
	H_2SO_4	EPA 8	10/26	1-PO-M8-1	1-PO-M8-2*	
	"	"	10/27	1-PO-M8-3*	1-PO-M8-4	1-PO-M8-5
	HCl, HF	EPA 13B	10/26	1-PO-M13B-1	1-PO-M13B-2*	
	"	"	10/27	1-PO-M13B-3	1-PO-M13B-4*	1-PO-M13B-5
	THC as CH_4	EPA 25A	10/26	1-PO-M25A-1	1-PO-M25A-2*	
	"	"	10/27	1-PO-M25A-3	1-PO-M25A-4	
Stack	Plume Opacity	EPA 9	10/23	1-S-M9-1	1-S-M9-2	1-S-M9-3

* indicates aborted run.
** indicates spare back-up runs.

TABLE 1-2

UNIT NO. 2 TEST LOG

Sampling Locations	Emissions Measured	Sampling Method	Test Date	Run Numbers		
Dry Scrubber Inlet	CO_2, O_2	EPA 3	10/24	2-SI-M3-1	2-SI-M3-2	2-SI-M3-3
	Particulate	EPA 5	10/24	2-SI-M5-1	2-SI-M5-2	2-SI-M5-3
	CO_2, O_2, SO_2	EPA 3A&6C	10/25	2-SI-CEM-1	2-SI-CEM-2	2-SI-CEM-3
	CO_2, O_2	EPA 3	10/25	2-SI-M3-1	2-SI-M3-2	2-SI-M3-3
	H_2SO_4	EPA 8	10/25	2-SI-M8-1	2-SI-M8-2	2-SI-M8-3
	HCl, HF	EPA 13B	10/25	2-SI-M13B-1	2-SI-M13B-2	2-SI-M13B-3
ESP Outlet	CO_2, O_2	EPA 3	10/24	2-PO-M3-1	2-PO-M3-2	2-PO-M3-3
	Particulate and Lead	EPA 5&12	10/24	2-PO-M5&12-1	2-PO-M5&12-2	2-PO-M5&12-3
	Hg	EPA 101A	10/24	2-PO-M101A-1	2-PO-M101A-2	2-PO-M101A-3
	Be	EPA 104	10/24	2-PO-M104-1	2-PO-M104-2	2-PO-M104-3
	CO_2, CO, NO_x, O_2, SO_2	EPA 3A, 10, 7E, 6C	10/25	2-PO-CEM-1	2-PO-CEM-2	2-PO-CEM-3
	CO_2, O_2	EPA 3	10/25	2-PO-M3-1	2-PO-M3-2	2-PO-M3-3
	H_2SO_4	EPA 8	10/25	2-PO-M8-1	2-PO-M8-2	2-PO-M8-3
	HCl, HF	EPA 13B	10/25	2-PO-M13B-1	2-PO-M13B-2	2-PO-M13B-3
	THC as CH_4	EPA 25A	10/25	2-PO-M25A-1	2-PO-M25A-2	2-PO-M25A-3
Stack	Plume Opacity	EPA 9	10/24	2-S-M9-1	2-S-M9-2	2-S-M9-3

1.2 Test Participants. Table 1-3 lists the personnel involved in the test program.

TABLE 1-3

TEST PARTICIPANTS

Solid Waste Authority of Palm Beach County	Marc C. Bruner Test Observer
	Amanda Krupa Test Observer
The Babcock & Wilcox Company	Douglas E. Burnham Test Coordinator
	Eric Wells Test Coordinator
Florida Department of Environmental Regulation	Tom Tittle Test Observer
Entropy Environmentalists Inc.	David G. Brintle Project Manager
	Neill M. Harden Sampling Team Leader

TABLE 1-3 (continued)

TEST PARTICIPANTS

Entropy Environmentalists Inc.	Dennis D. Holzschuh Sampling Team Leader
	Anthony L. Mastrianni Sampling Team Leader
	Leslie C. Murray Sampling Team Leader
	Barry F. Rudd Sampling Team Leader
	Kent Spears CEM Sampling Team Leader
	Mark Winter CEM Engineering Technician
	Duane D. Peters Engineering Technician
	Patrick F. Daley Laboratory Technician
	Stuart R. Davis Laboratory Technician
	Joseph R. Winslow Laboratory Technician
	James B. Winegar Plume Opacity Observer
	Mary Ellen Jackson Laboratory Supervisor
	Marshall Cannon Report Writer
Oxford Laboratories, Inc.	Bruce Babson Project Manager
	Roger Oxford Chemist
	Ken Smith Laboratory Technician
	Richard Roth Laboratory Technician
	Letha Davis Laboratory Technician

SUMMARY OF RESULTS

2.1 Presentation. Tables 2-1 and 2-2 present the compliance summaries for the testing performed from October 23 through 27, 1989, at Unit Nos. 1 and 2, respectively. Tables 2-3 through 2-24 present run-by-run test results. Refer to the "List of Tables and Figures" on pages v and vi of the "Table of Contents" for a cross reference. Detailed test results are presented in Appendix A; field and analytical data are given in Appendix B.

2.2 Discussion

2.2.1 Plume Opacity. Due to the near absence of a visible plume for Unit Nos. 1 and 2, the results of the plume opacity observations are not summarized in this section. The majority of the readings were zero, with the highest single reading at 5%. Plume opacity field data can be found in Appendix B.

2.2.2 Aborted Runs. On October 26, the second test set run on Unit No. 1 was aborted due to operating problems with the dry scrubber (atomizer pluggage). All aborted runs on 10/26 as noted in Table 1-1 were repeated.

On October 27, run 1-SI-M8-3 failed to leak check and was aborted. Since one of the test objectives was to run simultaneous inlet and outlet sampling for H_2SO_4, the outlet run 1-PO-M8-3 was also aborted. These aborted M8 inlet and outlet runs were repeated and replaced by runs 1-SI-M8-4 and 1-PO-M8-4. All remaining method runs from test set 3 on 10/27 were utilized as valid runs.

Test set run 4 on 10/27 was initiated as a full test run with simultaneous M8, M13B, and M6C runs at the inlet and outlet locations, along with M7E, M10, and M25A outlet runs. However, the inlet run 1-SI-M13B-4 failed to leak check and was aborted along with the corresponding outlet run 1-PO-M13B-4 due to the inability to calculate a HCl/HF removal efficiency. The remainder of the method runs from test set 4 were considered valid, however, it was a desired objective of the testing to try and conduct the various sampling runs together in the same time frame. As such, it was decided to utilize only the M8 inlet and outlet runs as a make-up for test set 3, and to repeat a full complement of the method runs during test set 5. Therefore, test set 4 runs on 10/27 were handled as follows:

1-SI-M13B-4	aborted due to failed leak test
1-PO-M13B-4	aborted due to need for removal efficiency

(continued on page 2-32)

TABLE 2-1

UNIT NO. 1 COMPLIANCE SUMMARY

Dry Scrubber Inlet and ESP Outlet

	Repetition				State Conditions of Certification and/or	
	1	2	3	Average	PSD Permit Limits	
Dry Scrubber Inlet						
Concen., gr/DSCF at 12% CO_2						
Particulate	1.92	4.20	1.87	2.66	-	
Emission Rate, lb/MMBtu						
Hydrogen Chloride	0.606	1.03	1.08	0.905	-	
Hydrogen Fluoride	0.00597	0.0129	0.0107	0.00986	-	
Sulfur Dioxide	0.332	0.319	0.279	0.310	-	
Sulfuric Acid	0.00305	0.00567	0.0109	0.00654	-	
ESP Outlet						
Concen., gr/DSCF at 12% CO_2						
Particulate	7.04E-004	2.79E-003	3.48E-004	1.28E-003	1.50E-002	
Concen., ppmvd at 12% CO_2						
Carbon Monoxide	24	29	22	25	400	
Emission Rate, lb/MMBtu						
Beryllium	<2.00E-007	<1.90E-007	<1.97E-007	<1.96E-007	7.3E-007	
Hydrogen Chloride	0.0231	0.0185	0.0117	0.0178	-	
Hydrogen Fluoride	2.72E-004	1.11E-004	9.74E-005	1.60E-004	3.2E-003	
Lead	7.12E-005	4.22E-005	2.07E-005	4.47E-005	4E-004	
Mercury	2.93E-005	5.26E-005	6.56E-005	4.92E-005	2.4E-004	*
Nitrogen Oxides as NO_2	0.372	0.325	0.361	0.353	0.32	
Sulfur Dioxide	0.098	0.072	0.049	0.073	0.32	
Sulfuric Acid	0.00486	0.00395	0.00336	0.00406	0.000032	
THC as Methane	0.00107	0.000408	0.00102	0.000833	0.016	**
Removal Efficiency, %						
Sulfur Dioxide	70%	77%	82%	76%	65%	
Hydrogen Chloride	96%	98%	99%	98%	-	
Hydrogen Fluoride	95%	99%	99%	98%	-	
Sulfuric Acid	-59%	30%	69%	13%	-	
Σ Acid Gases HCl, HF, H2SO4	95%	98%	99%	97%	90%	Design

* Or a facility Mercury limit of 3200 grams/day.

** The PSD permit has an allowable emission rate of 0.024 lb/MMBtu.

TABLE 2-2

UNIT NO. 2 COMPLIANCE SUMMARY

Dry Scrubber Inlet and ESP Outlet

	Repetition				State Conditions of Certification and/or
	1	2	3	Average	PSD Permit Limits
Dry Scrubber Inlet					
Concen., gr/DSCF at 12% CO_2					
Particulate	3.38	3.60	2.33	3.10	-
Emission Rate, lb/MMBtu					
Hydrogen Chloride	0.770	0.867	0.805	0.814	-
Hydrogen Fluoride	0.0107	0.00474	0.00839	0.00794	-
Sulfur Dioxide	0.327	0.246	0.277	0.283	-
Sulfuric Acid	0.00115	0.00322	0.0102	0.00486	-
ESP Outlet					
Concen., gr/DSCF at 12% CO_2					
Particulate	1.73E-003	1.08E-002	7.70E-004	0.004430	1.50E-002
Concen., ppmvd at 12% CO_2					
Carbon Monoxide	15	24	16	18	400
Emission Rate, lb/MMBtu					
Beryllium	<2.18E-007	<2.10E-007	<2.03E-007	<2.10E-007	7.3E-007
Hydrogen Chloride	0.0238	0.0233	0.0253	0.0241	-
Hydrogen Fluoride	8.15E-005	6.95E-005	6.79E-005	7.30E-005	3.2E-003
Lead	2.45E-005	2.60E-005	1.36E-005	2.14E-005	4E-004
Mercury	2.60E-005	1.42E-005	2.20E-005	2.07E-005	2.4E-004 *
Nitrogen Oxides as NO_2	0.351	0.371	0.339	0.354	0.32
Sulfur Dioxide	0.099	0.087	0.070	0.085	0.32
Sulfuric Acid	0.00201	0.00309	0.00589	0.00366	0.000032
THC as Methane	0.000413	0.000676	0.000559	0.000549	0.016 **
Removal Efficiency, %					
Sulfur Dioxide	70%	65%	75%	70%	65%
Hydrogen Chloride	97%	97%	97%	97%	-
Hydrogen Fluoride	99%	99%	99%	99%	-
Sulfuric Acid	-75%	4%	42%	-10%	-
Σ Acid Gases HCl, HF, H2SO4	97%	97%	96%	97%	90% Design

* Or a facility Mercury limit of 3200 grams/day.

** The PSD permit has an allowable emission rate of 0.024 lb/MMBtu.

TABLE 2-3

CARBON DIOXIDE, OXYGEN, AND SULFUR DIOXIDE TESTS SUMMARY

Unit No. 1 Dry Scrubber Inlet

	1-SI-CEM-1	1-SI-CEM-3	1-SI-CEM-5	Average
Test Date	10/26/89	10/27/89	10/27/89	
Run Start Time	935	1151	1845	
Run Finish Time	1035	1251	1945	
Carbon Dioxide Results				
Concentration, Percent by Volume, Dry	13.6	14.0	13.7	13.8
Oxygen Results				
Concentration, Percent by Volume, Dry	6.0	5.7	6.0	5.9
Sulfur Dioxide Results				
Concentration, ppmvd	151	148	127	142
Concentration, ppmvd corr. to 7% O2	141	135	119	132
Concentration, ppmvd corr. to 12% CO2	133	127	111	124
Emission Rate, lb/MMBtu	0.332	0.319	0.279	0.310

TABLE 2-4

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 1 Dry Scrubber Inlet

	1-SI-M13B-1	1-SI-M13B-3	1-SI-M13B-5	Average
Run Date	10/26/89	10/27/89	10/27/89	
Run Start Time	935	1150	1845	
Run Finish Time	1037	1307	2002	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	26.624	28.758	30.053	
Percent Isokinetic	101.0	102.0	105.1	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.5	12.2	12.6	12.4
O2, Percent By Volume, Dry	6.5	6.7	6.5	6.6
Temperature, °F	351	347	358	352
Air Flow Rate, Dry SCFM *	86,293	79,985	81,152	82,477
Air Flow Rate, Wet ACFM	161,112	153,184	157,229	157,175
Approx. Heat Input, 10^6Btu/hr	378	345	355	359
Hydrogen Fluoride:				
Concentration, ppmvd	8.39	17.9	15.0	13.8
Concentration, ppmvd @ 12% CO2	8.05	17.6	14.3	13.3
Concentration, ppmvd @ 7% O2	8.10	17.5	14.5	13.4
Emission Rate, lb/hr	2.26	4.46	3.80	3.51
Emission Rate, lb/10^6Btu	0.00597	0.0129	0.0107	0.00986

* 68° F -- 29.92 Inches of Mercury (Hg).

(Continued next page)

TABLE 2-4 (Continued)

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 1 Dry Scrubber Inlet

	1-SI-M13B-1	1-SI-M13B-3	1-SI-M13B-5	Average
Hydrogen Chloride:				
Concentration, ppmvd	467	782	834	694
Concentration, ppmvd @ 12% CO2	448	769	794	670
Concentration, ppmvd @ 7% O2	451	766	805	673
Emission Rate, lb/hr	229	356	385	323
Emission Rate, lb/10^6Btu	0.606	1.03	1.08	0.905

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* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-5

PARTICULATE TESTS SUMMARY

Unit No. 1 Dry Scrubber Inlet

	1-SI-M5-1	1-SI-M5-2*	1-SI-M5-3	Average
Run Date	10/23/89	10/23/89	10/23/89	
Run Start Time	930	1400	1700	
Run Finish Time	1154	1523	1822	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	51.350	49.384	46.260	
Percent Isokinetic	97.4	104.1	101.7	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	13.3	11.6	12.2	12.4
O2, Percent By Volume, Dry	5.5	7.4	6.8	6.6
Temperature, °F	350	358	344	351
Air Flow Rate, Dry SCFM **	92,056	92,511	84,743	89,770
Air Flow Rate, Wet ACFM	172,664	180,657	161,145	171,489
Approx. Heat Input, 10^6Btu/hr	431	380	363	391
Filterable Particulate:				
Concentration, grains/DSCF **	2.13	4.06	1.90	2.70
Concentration, gr/DSCF @ 12% CO2	1.92	4.20	1.87	2.66
Concentration, gr/DSCF @ 7% O2	1.92	4.18	1.87	2.66
Emission Rate, lb/hr	1,682	3,219	1,379	2,093
Emission Rate, lb/10^6Btu	3.90	8.47	3.79	5.39

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-6

SULFURIC ACID MIST TESTS SUMMARY

Unit No. 1 Dry Scrubber Inlet

	1-SI-M8-1	1-SI-M8-4	1-SI-M8-5	Average
Run Date	10/26/89	10/27/89	10/27/89	
Run Start Time	935	1545	1845	
Run Finish Time	1045	1700	2000	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	35.668	31.770	36.151	
Percent Isokinetic	101.6	105.5	100.7	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.5	13.2	12.6	12.8
O2, Percent By Volume, Dry	6.5	5.7	6.5	6.2
Temperature, °F	356	359	360	358
Air Flow Rate, Dry SCFM *	83,655	78,789	85,532	82,659
Air Flow Rate, Wet ACFM	160,109	153,929	164,089	159,376
Approx. Heat Input, 10^6Btu/hr	366	364	375	368
Sulfuric Acid Mist (incl. SO3):				
Concentration, ppmvd	0.874	1.72	3.14	1.91
Concentration, ppmvd @ 12% CO2	0.839	1.56	2.99	1.80
Concentration, ppmvd @ 7% O2	0.844	1.57	3.03	1.81
Emission Rate, lb/hr	1.12	2.07	4.10	2.43
Emission Rate, lb/10^6Btu	0.00305	0.00567	0.0109	0.00654

* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-7

BERYLLIUM TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M104-1	1-PO-M104-2*	1-PO-M104-3	Average
Run Date	10/23/89	10/23/89	10/23/89	
Run Start Time	930	1335	1630	
Run Finish Time	1251	1557	1851	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	83.628	87.332	79.405	
Percent Isokinetic	111.8	104.5	102.7	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	11.2	11.3	12.0	11.5
O2, Percent By Volume, Dry	7.9	7.8	7.0	7.6
Temperature, °F	261	260	260	260
Air Flow Rate, Dry SCFM **	92,500	94,241	95,574	94,105
Air Flow Rate, Wet ACFM	159,381	164,374	164,505	162,753
Approx. Heat Input, 10^6Btu/hr	366	375	404	382
Beryllium:				
Concentration, ppmvd	< 5.64E-004	< 5.40E-004	< 5.94E-004	< 5.66E-004
Concentration, grains/DSCF **	< 9.23E-008	< 8.84E-008	< 9.72E-008	< 9.26E-008
Concentration, gr/DSCF @ 12% CO2	< 9.89E-008	< 9.39E-008	< 9.72E-008	< 9.67E-008
Concentration, gr/DSCF @ 7% O2	< 9.86E-008	< 9.38E-008	< 9.72E-008	< 9.65E-008
Emission Rate, lb/hr	< 7.32E-005	< 7.14E-005	< 7.96E-005	< 7.47E-005
Emission Rate, lb/10^6Btu	< 2.00E-007	< 1.90E-007	< 1.97E-007	< 1.96E-007

* Soot blow run.

< Indicates the value is below the detection limit.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-8

CARBON DIOXIDE, CARBON MONOXIDE, NITROGEN OXIDES, OXYGEN, AND SULFUR DIOXIDE TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-CEM-1	1-PO-CEM-3	1-PO-CEM-5	Average
Test Date	10/26/89	10/27/89	10/27/89	
Run Start Time	935	1151	1845	
Run Finish Time	1035	1251	1945	
Volumetric Air Flow Rate, SCFM*	89,768	85,654	88,176	87,866
Carbon Dioxide Results				
Concentration, Percent by Volume, Dry	13.0	13.5	13.1	13.2
Carbon Monoxide Results				
Concentration, ppmvd	26	34	24	28
Concentration, ppmvd corr. to 7% O2	25	30	23	26
Concentration, ppmvd corr. to 12% CO2	24	29	22	25
Emission Rate, lb/hr	10.3	12.2	9.1	10.5
Emission Rate, lb/MMBtu	0.026	0.031	0.023	0.027
Nitrogen Oxides, as NO_2 Results				
Concentration, ppmvd	229	208	222	220
Concentration, ppmvd corr. to 7% O2	220	192	213	208
Concentration, ppmvd corr. to 12% CO2	211	185	203	200
Emission Rate, lb/hr	147.3	127.6	140.3	138.4
Emission Rate, lb/MMBtu	0.372	0.325	0.361	0.353
Oxygen Results				
Concentration, Percent by Volume, Dry	6.4	5.8	6.4	6.2
Sulfur Dioxide Results				
Concentration, ppmvd	43	33	22	33
Concentration, ppmvd corr. to 7% O2	41	31	21	31
Concentration, ppmvd corr. to 12% CO2	40	29	20	30
Emission Rate, lb/hr	38.8	28.5	19.2	28.8
Emission Rate, lb/MMBtu	0.098	0.072	0.049	0.073

* From runs 1-PO-M13B-1, 1-PO-M13B-3, and 1-PO-M13B-5, respectively.

TABLE 2-9

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M13B-1	1-PO-M13B-3	1-PO-M13B-5	Average
Run Date	10/26/89	10/27/89	10/27/89	
Run Start Time	935	1150	1845	
Run Finish Time	1038	1259	1955	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	36.506	33.990	36.585	
Percent Isokinetic	103.0	100.5	102.6	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.3	12.7	12.7	12.6
O2, Percent By Volume, Dry	6.8	6.2	6.5	6.5
Temperature, °F	260	265	259	261
Air Flow Rate, Dry SCFM *	89,768	85,616	88,176	87,853
Air Flow Rate, Wet ACFM	158,794	148,253	155,563	154,203
Approx. Heat Input, 10^6Btu/hr	385	383	386	385
Hydrogen Fluoride:				
Concentration, ppmvd	0.374	0.160	0.137	0.224
Concentration, ppmvd @ 12% CO2	0.365	0.151	0.129	0.215
Concentration, ppmvd @ 7% O2	0.369	0.151	0.132	0.217
Emission Rate, lb/hr	0.105	0.0426	0.0376	0.0617
Emission Rate, lb/10^6Btu	2.72E-004	1.11E-004	9.74E-005	1.60E-004

* 68° F -- 29.92 Inches of Mercury (Hg).

(Continued next page)

TABLE 2-9 (Continued)

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M13B-1	1-PO-M13B-3	1-PO-M13B-5	Average
Hydrogen Chloride:				
Concentration, ppmvd	17.4	14.5	9.04	13.6
Concentration, ppmvd @ 12% CO2	17.0	13.7	8.54	13.1
Concentration, ppmvd @ 7% O2	17.2	13.7	8.73	13.2
Emission Rate, lb/hr	8.88	7.06	4.53	6.82
Emission Rate, lb/10^6Btu	0.0231	0.0185	0.0117	0.0178

* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-10

PARTICULATE AND LEAD TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M5&12-1	1-PO-M5&12-2*	1-PO-M5&12-3	Average
Run Date	10/23/89	10/23/89	10/23/89	
Run Start Time	930	1335	1630	
Run Finish Time	1251	1557	1851	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	75.145	78.674	75.415	
Percent Isokinetic	103.6	104.8	101.2	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	11.2	11.3	12.0	11.5
O2, Percent By Volume, Dry	7.9	7.8	7.0	7.6
Temperature, °F	260	265	261	262
Air Flow Rate, Dry SCFM **	89,666	95,084	92,185	92,312
Air Flow Rate, Wet ACFM	154,127	166,365	158,892	159,795
Approx. Heat Input, 10^6Btu/hr	355	379	390	375
Filterable Particulate:				
Concentration, grains/DSCF **	6.57E-004	2.63E-003	3.48E-004	0.00121
Concentration, gr/DSCF @ 12% CO2	7.04E-004	2.79E-003	3.48E-004	0.00128
Concentration, gr/DSCF @ 7% O2	7.02E-004	2.79E-003	3.48E-004	0.00128
Emission Rate, lb/hr	0.505	2.14	0.275	0.973
Emission Rate, lb/10^6Btu	1.42E-003	5.65E-003	7.05E-004	0.00259

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

(Continued next page)

TABLE 2-10 (Continued)

PARTICULATE AND LEAD TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M5&12-1	1-PO-M5&12-2*	1-PO-M5&12-3	Average
Lead:				
Concentration, ppmvd	0.00873	0.00521	0.00272	0.00555
Concentration, grains/DSCF **	3.29E-005	1.96E-005	1.02E-005	2.09E-005
Concentration, gr/DSCF @ 12% CO2	3.52E-005	2.08E-005	1.02E-005	2.21E-005
Concentration, gr/DSCF @ 7% O2	3.52E-005	2.08E-005	1.02E-005	2.21E-005
Emission Rate, lb/hr	0.0253	0.0160	0.00808	0.0165
Emission Rate, lb/10^6Btu	7.12E-005	4.22E-005	2.07E-005	4.47E-005

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-11

MERCURY TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M101A-1	1-PO-M101A-2*	1-PO-M101A-3	Average
Run Date	10/23/89	10/23/89	10/23/89	
Run Start Time	930	1335	1630	
Run Finish Time	1251	1557	1851	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	80.538	75.097	83.797	
Percent Isokinetic	103.9	107.3	104.8	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	11.2	11.3	12.0	11.5
O2, Percent By Volume, Dry	7.9	7.8	7.0	7.6
Temperature, °F	259	259	261	260
Air Flow Rate, Dry SCFM **	89,402	96,115	92,213	92,577
Air Flow Rate, Wet ACFM	154,388	167,735	159,446	160,523
Approx. Heat Input, 10^6Btu/hr	353	383	390	375
Mercury:				
Concentration, ppmvd	0.00371	0.00671	0.00889	0.00644
Concentration, grains/DSCF **	1.35E-005	2.45E-005	3.24E-005	2.35E-005
Concentration, gr/DSCF @ 12% CO2	1.45E-005	2.60E-005	3.24E-005	2.43E-005
Concentration, gr/DSCF @ 7% O2	1.44E-005	2.60E-005	3.24E-005	2.43E-005
Emission Rate, lb/hr	0.0104	0.0201	0.0256	0.0187
Emission Rate, lb/10^6Btu	2.93E-005	5.26E-005	6.57E-005	4.92E-005

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-12

SULFURIC ACID MIST TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M8-1	1-PO-M8-4	1-PO-M8-5	Average
Run Date	10/26/89	10/27/89	10/27/89	
Run Start Time	905	1515	1815	
Run Finish Time	1115	1726	2026	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	84.363	70.907	78.128	
Percent Isokinetic	99.6	100.1	101.3	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.3	12.5	12.7	12.5
O2, Percent By Volume, Dry	6.8	6.6	6.5	6.6
Temperature, °F	261	261	269	264
Air Flow Rate, Dry SCFM *	95,524	87,598	86,917	90,013
Air Flow Rate, Wet ACFM	165,451	151,810	155,433	157,565
Approx. Heat Input, 10^6Btu/hr	410	381	381	391
Sulfuric Acid Mist (incl. SO3):				
Concentration, ppmvd	1.37	1.12	0.964	1.15
Concentration, ppmvd @ 12% CO2	1.34	1.08	0.911	1.11
Concentration, ppmvd @ 7% O2	1.35	1.09	0.931	1.12
Emission Rate, lb/hr	1.99	1.50	1.28	1.59
Emission Rate, lb/10^6Btu	0.00486	0.00395	0.00336	0.00406

* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-13

TOTAL HYDROCARBONS, AS METHANE TESTS SUMMARY

Unit No. 1 ESP Outlet

	1-PO-M25A-1	1-PO-M25A-3	1-PO-M25A-4
Test Date	10/26/89	10/27/89	10/27/89
Run Start Time	935	1206	1546
Run Finish Time	1035	1305	1645
Volumetric Air Flow Rate, SCFM*	89,768	85,616	87,598
CO2, Percent By Volume, Dry*	12.3	12.7	12.5
O2, Percent By Volume, Dry*	6.8	6.2	6.6
<u>Total Hydrocarbons, as Methane Results</u>			
Concentration, ppmvd	1.83	0.730	1.78
Concentration, ppmvd @ 7% O2	1.81	0.691	1.73
Concentration, ppmvd @ 12% CO2	1.79	0.690	1.71
Emission Rate, lb/hr	0.321	0.125	0.311
Emission Rate, lb/MMBtu	0.00107	0.000408	0.00102

* From Runs 1-PO-M13B-1, 1-PO-M13B-3, and 1-PO-M8-4, Respectively.

TABLE 2-14

CARBON DIOXIDE, OXYGEN, AND SULFUR DIOXIDE TESTS SUMMARY

Unit No. 2 Dry Scrubber Inlet

	2-SI-CEM-1	2-SI-CEM-2	2-SI-CEM-3	Average
Test Date	10/25/89	10/25/89	10/25/89	
Run Start Time	1300	1600	1920	
Run Finish Time	1400	1700	2020	
Carbon Dioxide Results				
Concentration, Percent by Volume, Dry	13.6	12.7	13.6	13.3
Oxygen Results				
Concentration, Percent by Volume, Dry	6.1	6.9	6.0	6.3
Sulfur Dioxide Results				
Concentration, ppmvd	148	105	126	126
Concentration, ppmvd corr. to 7% O2	139	104	118	120
Concentration, ppmvd corr. to 12% CO2	131	99	111	114
Emission Rate, lb/MMBtu	0.327	0.246	0.277	0.283

TABLE 2-15

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 2 Dry Scrubber Inlet

	2-SI-M13B-1	2-SI-M13B-2	2-SI-M13B-3	Average
Run Date	10/25/89	10/25/89	10/25/89	
Run Start Time	1300	1600	1920	
Run Finish Time	1420	1758	2026	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	36.580	29.413	28.694	
Percent Isokinetic	101.9	99.4	94.5	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.1	12.2	12.1	12.1
O2, Percent By Volume, Dry	7.1	7.1	7.1	7.1
Temperature, °F	349	354	348	350
Air Flow Rate, Dry SCFM *	85,517	88,957	81,112	85,195
Air Flow Rate, Wet ACFM	159,462	169,008	152,117	160,196
Approx. Heat Input, 10^6Btu/hr	359	373	340	357
Hydrogen Fluoride:				
Concentration, ppmvd	14.4	6.38	11.3	10.7
Concentration, ppmvd @ 12% CO2	14.3	6.28	11.2	10.6
Concentration, ppmvd @ 7% O2	14.5	6.43	11.4	10.8
Emission Rate, lb/hr	3.84	1.77	2.85	2.82
Emission Rate, lb/10^6Btu	0.0107	0.00474	0.00839	0.00794

* 68° F -- 29.92 Inches of Mercury (Hg).

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TABLE 2-15 (Continued)

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 2 Dry Scrubber Inlet

	2-SI-M13B-1	2-SI-M13B-2	2-SI-M13B-3	Average
Hydrogen Chloride:				
Concentration, ppmvd	569	641	595	602
Concentration, ppmvd @ 12% CO2	564	630	590	595
Concentration, ppmvd @ 7% O2	573	646	599	606
Emission Rate, lb/hr	276	324	274	291
Emission Rate, lb/10^6Btu	0.770	0.867	0.805	0.814

* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-16

PARTICULATE TESTS SUMMARY

Unit No. 2 Dry Scrubber Inlet

	2-SI-M5-1	2-SI-M5-2*	2-SI-M5-3	Average
Run Date	10/24/89	10/24/89	10/24/89	
Run Start Time	1225	1522	1824	
Run Finish Time	1348	1642	1945	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	50.646	48.521	45.043	
Percent Isokinetic	100.7	105.5	102.8	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	10.7	13.4	12.7	12.3
O2, Percent By Volume, Dry	8.5	5.5	6.3	6.8
Temperature, °F	361	345	350	352
Air Flow Rate, Dry SCFM **	98,063	85,725	85,462	89,750
Air Flow Rate, Wet ACFM	183,148	168,846	159,850	170,615
Approx. Heat Input, 10^6Btu/hr	370	402	380	384
Filterable Particulate:				
Concentration, grains/DSCF **	3.01	4.02	2.47	3.17
Concentration, gr/DSCF @ 12% CO2	3.38	3.60	2.33	3.10
Concentration, gr/DSCF @ 7% O2	3.37	3.63	2.35	3.12
Emission Rate, lb/hr	2,530	2,953	1,811	2,431
Emission Rate, lb/10^6Btu	6.84	7.34	4.76	6.31

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-17

SULFURIC ACID MIST TESTS SUMMARY

Unit No. 2 Dry Scrubber Inlet

	2-SI-M8-1	2-SI-M8-2	2-SI-M8-3	Average
Run Date	10/25/89	10/25/89	10/25/89	
Run Start Time	1250	1600	1920	
Run Finish Time	1420	1803	2030	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	38.272	32.258	31.809	
Percent Isokinetic	100.4	103.7	101.6	
Flue Gas Parameters:				
CO2, **Percent By** Volume, Dry	12.1	12.2	12.1	12.1
O2, **Percent By** Volume, Dry	7.1	7.1	7.1	7.1
Temperature, °F	355	357	357	356
Air Flow Rate, Dry SCFM *	86,537	88,282	88,814	87,878
Air Flow Rate, Wet ACFM	160,368	165,189	165,189	163,582
Approx. Heat Input, 10^6Btu/hr	363	371	373	369
Sulfuric Acid Mist (incl. SO3):				
Concentration, ppmvd	0.317	0.886	2.80	1.33
Concentration, ppmvd @ 12% CO2	0.314	0.871	2.78	1.32
Concentration, ppmvd @ 7% O2	0.319	0.892	2.82	1.34
Emission Rate, lb/hr	0.419	1.19	3.80	1.80
Emission Rate, lb/10^6Btu	0.00115	0.00322	0.0102	0.00486

* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-18

BERYLLIUM TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M104-1	2-PO-M104-2*	2-PO-M104-3	Average
Run Date	10/24/89	10/24/89	10/24/89	
Run Start Time	1145	1440	1750	
Run Finish Time	1400	1655	2011	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	86.904	74.992	76.954	
Percent Isokinetic	97.4	103.2	98.7	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	10.0	12.0	12.2	11.4
O2, Percent By Volume, Dry	9.4	7.1	7.0	7.8
Temperature, °F	259	260	260	260
Air Flow Rate, Dry SCFM **	100,554	89,883	87,894	92,777
Air Flow Rate, Wet ACFM	173,283	160,784	152,561	162,209
Approx. Heat Input, 10^6Btu/hr	352	377	372	367
Beryllium:				
Concentration, ppmvd	< 5.42E-004	< 6.29E-004	< 6.13E-004	< 5.95E-004
Concentration, grains/DSCF **	< 8.88E-008	< 1.03E-007	< 1.00E-007	< 9.73E-008
Concentration, gr/DSCF @ 12% CO2	< 1.07E-007	< 1.03E-007	< 9.84E-008	< 1.03E-007
Concentration, gr/DSCF @ 7% O2	< 1.07E-007	< 1.04E-007	< 1.00E-007	< 1.04E-007
Emission Rate, lb/hr	< 7.65E-005	< 7.93E-005	< 7.55E-005	< 7.71E-005
Emission Rate, lb/10^6Btu	< 2.18E-007	< 2.10E-007	< 2.03E-007	< 2.10E-007

* Soot blow run.

< Indicates the value is below the detection limit.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-19

CARBON DIOXIDE, CARBON MONOXIDE, NITROGEN OXIDES, OXYGEN, AND SULFUR DIOXIDE TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-CEM-1	2-PO-CEM-2	2-PO-CEM-3	Average
Test Date	10/25/89	10/25/89	10/25/89	
Run Start Time	1300	1600	1920	
Run Finish Time	1400	1700	2020	
Volumetric Air Flow Rate, SCFM*	94,721	92,893	88,794	92,136
Carbon Dioxide Results				
Concentration, Percent by Volume, Dry	13.0	12.3	13.1	12.8
Carbon Monoxide Results				
Concentration, ppmvd	16	25	17	19
Concentration, ppmvd corr. to 7% O2	15	25	17	19
Concentration, ppmvd corr. to 12% CO2	15	24	16	18
Emission Rate, lb/hr	6.4	10.1	7.0	7.83
Emission Rate, lb/MMBtu	0.015	0.026	0.018	0.020
Nitrogen Oxides, as NO_2 Results				
Concentration, ppmvd	218	217	211	215
Concentration, ppmvd corr. to 7% O2	208	219	200	209
Concentration, ppmvd corr. to 12% CO2	201	212	193	202
Emission Rate, lb/hr	147.7	144.6	134.5	142.3
Emission Rate, lb/MMBtu	0.351	0.371	0.339	0.354
Oxygen Results				
Concentration, Percent by Volume, Dry	6.3	7.1	6.2	6.5
Sulfur Dioxide Results				
Concentration, ppmvd	44	37	32	38
Concentration, ppmvd corr. to 7% O2	42	37	30	36
Concentration, ppmvd corr. to 12% CO2	41	36	29	35
Emission Rate, lb/hr	41.7	33.8	28.0	34.5
Emission Rate, lb/MMBtu	0.099	0.087	0.070	0.085

* From runs 2-PO-M13B-1, 2-PO-M13B-2, and 2-PO-M13B-3, respectively.

TABLE 2-20

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M13B-1	2-PO-M13B-2	2-PO-M13B-3	Average
Run Date	10/25/89	10/25/89	10/25/89	
Run Start Time	1300	1600	1920	
Run Finish Time	1412	1710	2030	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	37.672	37.343	35.982	
Percent Isokinetic	98.4	101.8	102.6	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.5	12.4	12.2	12.4
O2, Percent By Volume, Dry	6.6	7.3	7.1	7.0
Temperature, °F	262	260	259	260
Air Flow Rate, Dry SCFM *	94,721	92,893	88,794	92,136
Air Flow Rate, Wet ACFM	158,696	162,710	153,866	158,424
Approx. Heat Input, 10^6Btu/hr	412	384	373	390
Hydrogen Fluoride:				
Concentration, ppmvd	0.114	0.0922	0.0914	0.0992
Concentration, ppmvd @ 12% CO2	0.109	0.0892	0.0899	0.0960
Concentration, ppmvd @ 7% O2	0.111	0.0942	0.0921	0.0991
Emission Rate, lb/hr	0.0336	0.0267	0.0253	0.0285
Emission Rate, lb/10^6Btu	8.15E-005	6.95E-005	6.79E-005	7.30E-005

* 68° F -- 29.92 Inches of Mercury (Hg).

(Continued next page)

TABLE 2-20 (Continued)

HYDROGEN CHLORIDE AND HYDROGEN FLUORIDE TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M13B-1	2-PO-M13B-2	2-PO-M13B-3	Average
Hydrogen Chloride:				
Concentration, ppmvd	18.2	17.0	18.7	18.0
Concentration, ppmvd @ 12% CO2	17.5	16.5	18.4	17.5
Concentration, ppmvd @ 7% O2	17.7	17.4	18.8	18.0
Emission Rate, lb/hr	9.81	8.95	9.43	9.40
Emission Rate, lb/10^6Btu	0.0238	0.0233	0.0253	0.0241

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* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-21

PARTICULATE AND LEAD TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M5&12-1	2-PO-M5&12-2*	2-PO-M5&12-3	Average
Run Date	10/24/89	10/24/89	10/24/89	
Run Start Time	1145	1440	1755	
Run Finish Time	1400	1655	2011	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	77.110	72.705	68.979	
Percent Isokinetic	99.3	102.2	101.1	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	10.0	12.0	12.2	11.4
O2, Percent By Volume, Dry	9.4	7.1	7.0	7.8
Temperature, °F	265	258	267	263
Air Flow Rate, Dry SCFM **	98,361	87,988	86,404	90,918
Air Flow Rate, Wet ACFM	170,379	156,183	152,006	159,523
Approx. Heat Input, 10^6Btu/hr	344	369	365	359
Filterable Particulate:				
Concentration, grains/DSCF **	1.44E-003	1.08E-002	7.83E-004	0.00434
Concentration, gr/DSCF @ 12% CO2	1.73E-003	1.08E-002	7.70E-004	0.00443
Concentration, gr/DSCF @ 7% O2	1.74E-003	1.09E-002	7.83E-004	0.00447
Emission Rate, lb/hr	1.21	8.16	0.580	3.32
Emission Rate, lb/10^6Btu	0.00353	0.0221	0.00159	0.00907

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

(Continued next page)

TABLE 2-21 (Continued)

PARTICULATE AND LEAD TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M5&12-1	2-PO-M5&12-2*	2-PO-M5&12-3	Average
Lead:				
Concentration, grains/DSCF **	1.00E-005	1.27E-005	6.71E-006	9.80E-006
Concentration, gr/DSCF @ 12% CO2	1.20E-005	1.27E-005	6.60E-006	1.04E-005
Concentration, gr/DSCF @ 7% O2	1.21E-005	1.28E-005	6.71E-006	1.05E-005
Emission Rate, lb/hr	0.00844	0.00960	0.00497	0.00767
Emission Rate, lb/10^6Btu	2.45E-005	2.60E-005	1.36E-005	2.14E-005

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

(Continued next page)

TABLE 2-22

MERCURY TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M101A-1	2-PO-M101A-2*	2-PO-M101A-3	Average
Run Date	10/24/89	10/24/89	10/24/89	
Run Start Time	1145	1440	1755	
Run Finish Time	1400	1655	2011	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF **	73.195	77.772	64.844	
Percent Isokinetic	103.1	103.6	103.8	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	10.0	12.0	12.2	11.4
O2, Percent By Volume, Dry	9.4	7.1	7.0	7.8
Temperature, °F	262	265	263	263
Air Flow Rate, Dry SCFM **	97,541	86,622	85,830	89,998
Air Flow Rate, Wet ACFM	169,693	155,955	147,013	157,554
Approx. Heat Input, 10^6Btu/hr	341	364	363	356
Mercury:				
Concentration, ppmvd	0.00291	0.00191	0.00298	0.00260
Concentration, grains/DSCF **	1.06E-005	6.96E-006	1.09E-005	9.49E-006
Concentration, gr/DSCF @ 12% CO2	1.27E-005	6.96E-006	1.07E-005	1.01E-005
Concentration, gr/DSCF @ 7% O2	1.28E-005	7.01E-006	1.09E-005	1.02E-005
Emission Rate, lb/hr	0.00887	0.00517	0.00798	0.00734
Emission Rate, lb/10^6Btu	2.60E-005	1.42E-005	2.20E-005	2.07E-005

* Soot blow run.

** 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-23

SULFURIC ACID MIST TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M8-1	2-PO-M8-2	2-PO-M8-3	Average
Run Date	10/25/89	10/25/89	10/25/89	
Run Start Time	1230	1530	1850	
Run Finish Time	1442	1743	2102	
Test Train Parameters:				
Volume Of Dry Gas Sample, SCF *	72.655	81.849	74.419	
Percent Isokinetic	97.6	96.8	99.2	
Flue Gas Parameters:				
CO2, Percent By Volume, Dry	12.5	12.4	12.2	12.4
O2, Percent By Volume, Dry	6.6	7.3	7.1	7.0
Temperature, °F	258	260	264	261
Air Flow Rate, Dry SCFM *	92,004	95,354	92,780	93,379
Air Flow Rate, Wet ACFM	155,955	164,570	160,784	160,436
Approx. Heat Input, 10^6Btu/hr	400	394	389	394
Sulfuric Acid Mist (incl. SO3):				
Concentration, ppmvd	0.572	0.836	1.62	1.01
Concentration, ppmvd @ 12% CO2	0.549	0.809	1.59	0.983
Concentration, ppmvd @ 7% O2	0.556	0.854	1.63	1.01
Emission Rate, lb/hr	0.804	1.22	2.29	1.44
Emission Rate, lb/10^6Btu	0.00201	0.00309	0.00589	0.00366

---

* 68° F -- 29.92 Inches of Mercury (Hg).

TABLE 2-24

TOTAL HYDROCARBONS, AS METHANE TESTS SUMMARY

Unit No. 2 ESP Outlet

	2-PO-M25A-1	2-PO-M25A-2	2-PO-M25A-3
Test Date	10/25/89	10/25/89	10/25/89
Run Start Time	1301	1601	1921
Run Finish Time	1400	1700	2020
Volumetric Air Flow Rate, SCFM*	94,721	92,893	88,794
CO2, Percent By Volume, Dry*	12.5	12.4	12.2
O2, Percent By Volume, Dry*	6.6	7.3	7.1
<u>Total Hydrocarbons, as Methane Results</u>			
Concentration, ppmvd	0.720	1.12	0.939
Concentration, ppmvd @ 7% O2	0.700	1.14	0.946
Concentration, ppmvd @ 12% CO2	0.691	1.08	0.924
Emission Rate, lb/hr	0.170	0.260	0.208
Emission Rate, lb/MMBtu	0.000413	0.000676	0.000559

* From Runs 2-PO-M13B-1, 2-PO-M13B-2, and 2-PO-M13B-3, Respectively.

1-SI-M8-4 used for makeup (aborted run-3)
1-PO-M8-4 used for makeup (aborted run-3)

1-SI-CEM-4 spare back-up run (repeated in test set 5)
1-PO-CEM-4 spare back-up run (repeated in test set 5)
The spare back-up run data is presented in Appendix F. This data was not utilized in calculating the average 3-run compliance test results.

2.2.3 F-factor. An F-factor of 9,570 dscf/MMBtu was utilized for Municipal Solid Waste (ref: CFR 40, PART 60, Appendix A, Method 19) and used during the sampling to provide real -time estimates of emission rates in Lb/MMBtu. All final test results and calculations presented in this report are based on a F-factor of 9,439 dscf/MMBtu. This selected F-factor was determined from actual fuel sample analyses. A summary of the as-fired fuel analyses are presented in Appendix D.

2.2.4 Overisokinetic Sample Rate. Run 1-PO-M104-1 was performed at an isokinetic sampling rate of 111.8%, which is slightly higher than the acceptable upper limit of 110%. If the results are adjusted using the procedures outlined by the EPA document A Guideline For Evaluating Compliance Test Results, the three-run average emission rate (lb/MMBtu) would change from < 1.96E-07 to < 2.04E-07. This adjusted value is still below the allowable limit of 7.3E-07 lb/MMBtu.

2.2.5 Soot Blow Weighted Average. Soot blow procedures were conducted during test set 2. According to Mr. Doug Burnham of The Babcock & Wilcox Company, soot blow procedures are conducted at Unit Nos. 1 and 2 two times per 24 hours. Soot blow was conducted during runs 1-PO-M5&12-2 and 2-PO-M5&12-2, with weighted averages of 0.00186 and 0.00596 lb/MMBtu, respectively. The calculations used to determine the soot blow weighted average were those recommended by the U.S. EPA. Refer to Appendix A.3 for an example calculation.

2.2.6 Sulfuric Acid. The sulfuric acid removal efficiencies range from 69% to -75%. The apparent cause for such low and sometimes negative removal efficiencies could possibly be explained as follows. Lime, used as the scrubbing agent, converts sulfur dioxide to calcium sulfate in the dry scrubber. Calcium sulfate entering the ESP could be emitted to the atmosphere as particulate matter and therefore would be collected in the EPA Method 8 outlet sampling train.

EPA Method 8 sampling and analysis cannot distinguish between calcium sulfate and sulfuric acid. Any calcium sulfate emissions would bias the sulfuric emission rates high and possibly result in low or negative removal efficiencies.

2.2.7 Heat Input Calculations. The State Conditions of Certifications specify that the compliance tests for each unit be performed at ±10% of the maximum heat input rate of 360 MMBtu per hour.

Average heat input rates were calculated based on flue gas flow measurements from the individual method runs as presented below:

$$\text{MMBtu/hr} = 60 * \frac{\text{Qsd}}{\text{F-factor}} * \frac{(20.9 - \%O_2)}{20.9}$$

Table 2-25

Heat Input Rates

Test Day	Unit	Average Heat Input (MMBtu/hr)	Average RDF Input* (MLb/hr)
10/23	No. 1	381	81
10/24	No. 2	367	78
10/25	No. 2	378	81
10/26 &27	No. 1	376	80

(*) The corresponding RDF input rates were calculated by dividing the average daily heat input rate (MMBtu/hr) by the average as-fired RDF analytical heating value of 4,698 Btu per pound.

2.2.8 Abbreviated EPA Method 13B Runs At Scrubber Inlets. Runs 1-SI-M13B-1, 2-SI-M13B-2, and 2-SI-M13B-3 were abbreviated to 52, 51, and 53.5 minutes, respectively, due to filter plugging problems.

PROCESS DESCRIPTION AND OPERATION

3.1 General. As part of its long-term plan for the management of solid waste, the Solid Waste Authority of Palm Beach County, Florida, contracted for the construction and operation of a resource recovery facility in the northern part of the county. The facility, which burns refuse-derived fuel (RDF) was constructed by Babcock & Wilcox and Bechtel Civil, Inc. The design and procurement of the RDF processing system was performed by National Ecology, Inc. the long-term operation and maintenance of the facility has been contracted by the Solid Waste Authority to Palm Beach Resource Recovery Corporation, a Babcock & Wilcox Company.

The resource recovery facility itself consists of three major plants: the refuse-derived fuel plant, the boiler plant, and the electric generating plant.

The facility is designed to process 2,000 tons/day of municipal solid waste (MSW) with an annual throughput of 624,000 tons. The facility can handle a wide range of MSW composition and heating value. The facility is equipped with three RDF lines, any two of which can handle 2,000 tons/day of MSW. Two boilers are provided, each with a capacity to burn 900 tons/day of RDF, which is the equivalent of 1085 tons/day of MSW. The turbine-generator capacity is matched to the full output of the boilers. In addition, a steam dump condenser is provided to permit full load boiler operation in the event of a turbine-generator outage.

3.2 Source Air Flow. Figure 3-1 is an air flow schematic showing the passage of flue gases exhausted from the Unit Nos. 1 and 2 boilers.

3.3 Operation During Testing. All testing was conducted with the units operating in the automatic control mode under normal design operating conditions. The electrostatic precipitators were operated in the normal design mode with one spare field out of service. A normal soot blowing cycle was performed at both Unit Nos. 1 and 2 during the second particulate and opacity test sets. Table 3-1 summarizes the operating data for Unit Nos. 1 and 2 during the test program.

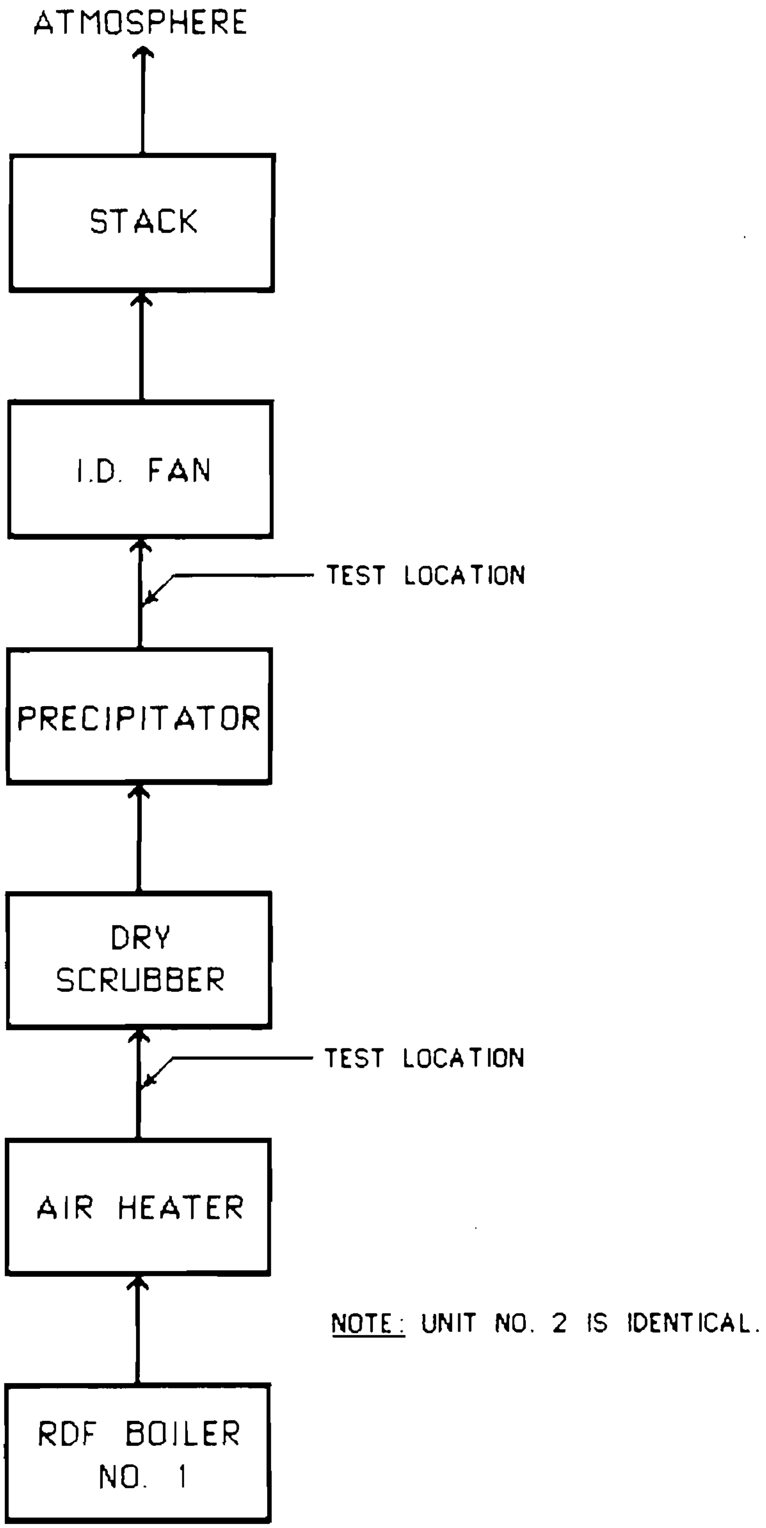

FIGURE 3-1. UNIT NO. 1 AIR FLOW SCHEMATIC.

TABLE 3-1
OPERATING PARAMETERS SUMMARY
Unit Nos. 1 and 2

SUMMARY OF UNIT OPERATING PARAMETERS DURING EPA M5/12, M101A, & M104 TESTS

		UNIT # 1			UNIT # 2		
	RUN #	1	2	3	1	2	3
	DATE	10/23/89	10/23/89	10/23/89	10/24/89	10/24/89	10/24/89
	TIME START	10:30	13:35	16:30	11:45	14:40	17:55
	TIME STOP	12:51	15:57	18:51	14:00	16:55	20:11
HP STEAM							
FLOW	MLB/HR	287.2	280.0	283.2	267.4	283.5	278.0
TEMP.	F	760.0	760.0	760.0	760.0	760.0	760.0
PRESS.	PSIG	737.0	735.0	736.0	730.0	734.0	734.0
COMBUSTION AIR							
UNDERGRATE FLOW	MLB/HR	128.6	144.8	134.6	142.9	142.2	121.2
TOTAL FLOW	MLB/HR	291.5	305.7	304.6	302.7	306.0	286.5
AIR TEMP.	F	395.0	398.0	390.0	414.0	394.0	392.0
O2 econ. outlet	%	5.2	5.6	5.5	6.6	4.8	4.7
SPRAY DRYER							
INLET TEMP.	F	353.0	360.0	352.0	370.0	352.0	344.0
OUTLET TEMP.	F	260.0	260.0	260.0	260.0	260.0	260.0
SLURRY FLOW	GPM	6.3	6.7	11.4	7.2	8.0	8.5
SLURRY SOLIDS	%	---	---	---	---	---	---
ELECTROSTATIC PRECIP.							
TR 1	ma/KVA	925/23	946/28	942/27	---	0/0.7	---
TR 2	ma/KVA	1096/28	1118/29	1123/29	---	1174/34	---
TR 3	ma/KVA	0/1.2	0/1.4	0/1.5	---	1245/28	---
TR 4	ma/KVA	1246/35	1248/35	1244/35	---	1080/31	---

(continued next page)

TABLE 3-1 (continued)
OPERATING PARAMETERS SUMMARY
Unit Nos. 1 and 2

SUMMARY OF UNIT OPERATING PARAMETERS DURING EPA M6C, M7E, M8, M10, M13B, & M25A TESTS

		UNIT # 2			UNIT # 1			
	RUN #	1	2	3	1	3	4	5
	DATE	10/25/89	10/25/89	10/25/89	10/26/89	10/27/89	10/27/89	10/27/89
	TIME START	12:30	15:30	18:50	9:05	9:05	15:15	18:15
	TIME STOP	14:42	18:03	21:02	11:15	13:31	17:26	20:26
HP STEAM								
FLOW	MLB/HR	283.9	282.4	276.0	283.0	270.2	265.3	265.7
TEMP.	F	760.0	760.0	760.0	760.0	759.0	760.0	760.0
PRESS.	PSIG	736.0	735.0	732.0	733.0	725.0	722.0	729.0
COMBUSTION AIR								
UNDERGRATE FLOW	MLB/HR	137.3	151.5	143.8	142.5	111.1	114.0	105.7
TOTAL FLOW	MLB/HR	316.1	328.9	320.9	307.2	282.0	284.9	270.4
AIR TEMP.	F	397.0	401.0	398.0	394.0	392.0	391.0	407.0
O2 econ. outlet	%	5.2	5.3	5.3	6.1	5.2	5.0	5.0
SPRAY DRYER								
INLET TEMP.	F	352.0	358.0	353.0	356.0	348.0	348.0	361.0
OUTLET TEMP.	F	260.0	260.0	260.0	260.0	263.0	260.0	260.0
SLURRY FLOW	GPM	8.4	8.0	8.5	7.1	12.2	10.3	12.2
SLURRY SOLIDS	%	17.0	17.0	17.0	20.8	17.0	17.0	16.5
ELECTROSTATIC PRECIP.								
TR 1	ma/KVA	0/0.7	0/0.7	---	964/28	---	---	---
TR 2	ma/KVA	1199/36	1112/34	---	1127/30	---	---	---
TR 3	ma/KVA	1297/34	1282/33	---	0/1.3	---	---	---
TR 4	ma/KVA	1092/34	1062/34	---	1245/34	---	---	---

SAMPLING AND ANALYTICAL PROCEDURES

4.1 General. All sampling and analytical procedures were those recommended by the United States Environmental Protection Agency and the Florida Department of Environmental Regulation. This section provides brief descriptions of the sampling and analytical procedures. Detailed descriptions of the procedures are provided in Appendix E.

4.2 Sampling Points. The number and location of the sampling points were determined according to EPA Method 1. The Unit Nos. 1 and 2 dry scrubber inlets cross sections were each divided into 15 equal areas with five sampling points on each of three traverse axes, as shown in Figure 4-1. The Unit Nos. 1 and 2 ESP outlet ducts cross sections were each divided into 25 equal areas with five sampling points on each of five traverse axes, as shown in Figure 4-2.

4.3 Volumetric Air Flow Rates

4.3.1 Flue Gas Velocity. EPA Method 2 was used to take the velocity measurements during the traverses of each of the ducts cross sections.

4.3.2 Flue Gas Composition. During each test set, a multipoint, integrated flue gas sample was collected at each of the Unit Nos. 1 and 2 dry srubber inlets and ESP outlets and analyzed according to the procedures outlined in EPA Method 3. The analytical results were used to determine the flue gas composition, molecular weight, excess air, and emissions correction factor.

4.3.3 Flue Gas Moisture Content. Moisture content was determined by analyzing each sampling train's impinger reagents according to the procedures outlined in the respective EPA Methods.

4.4 Emissions Determinations Table 4-1 outlines the sampling parameters used for the test program.

(continued on page 4-4)

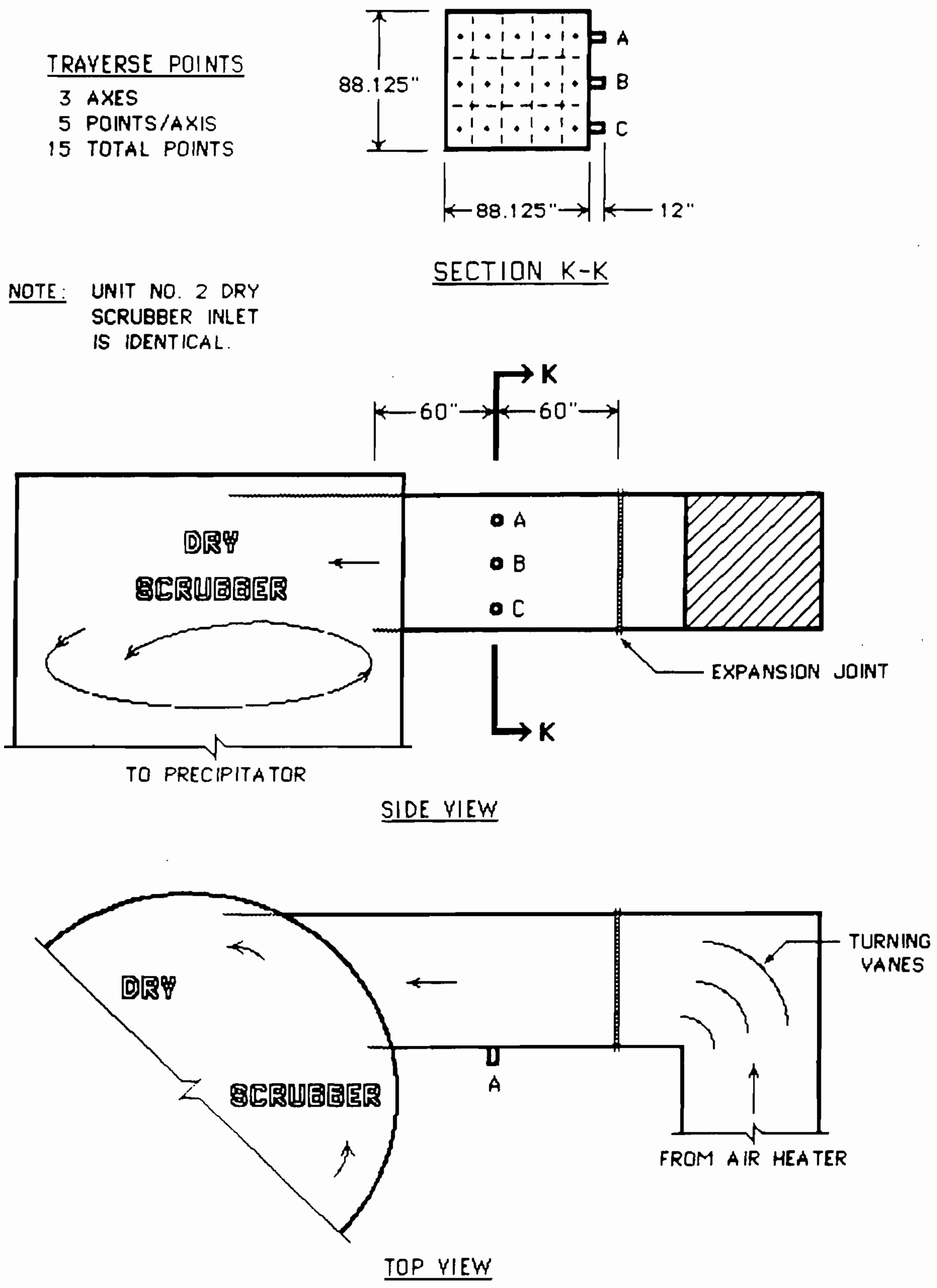

FIGURE 4-1. UNIT NO. 1 DRY SCRUBBER INLET TEST LOCATION.

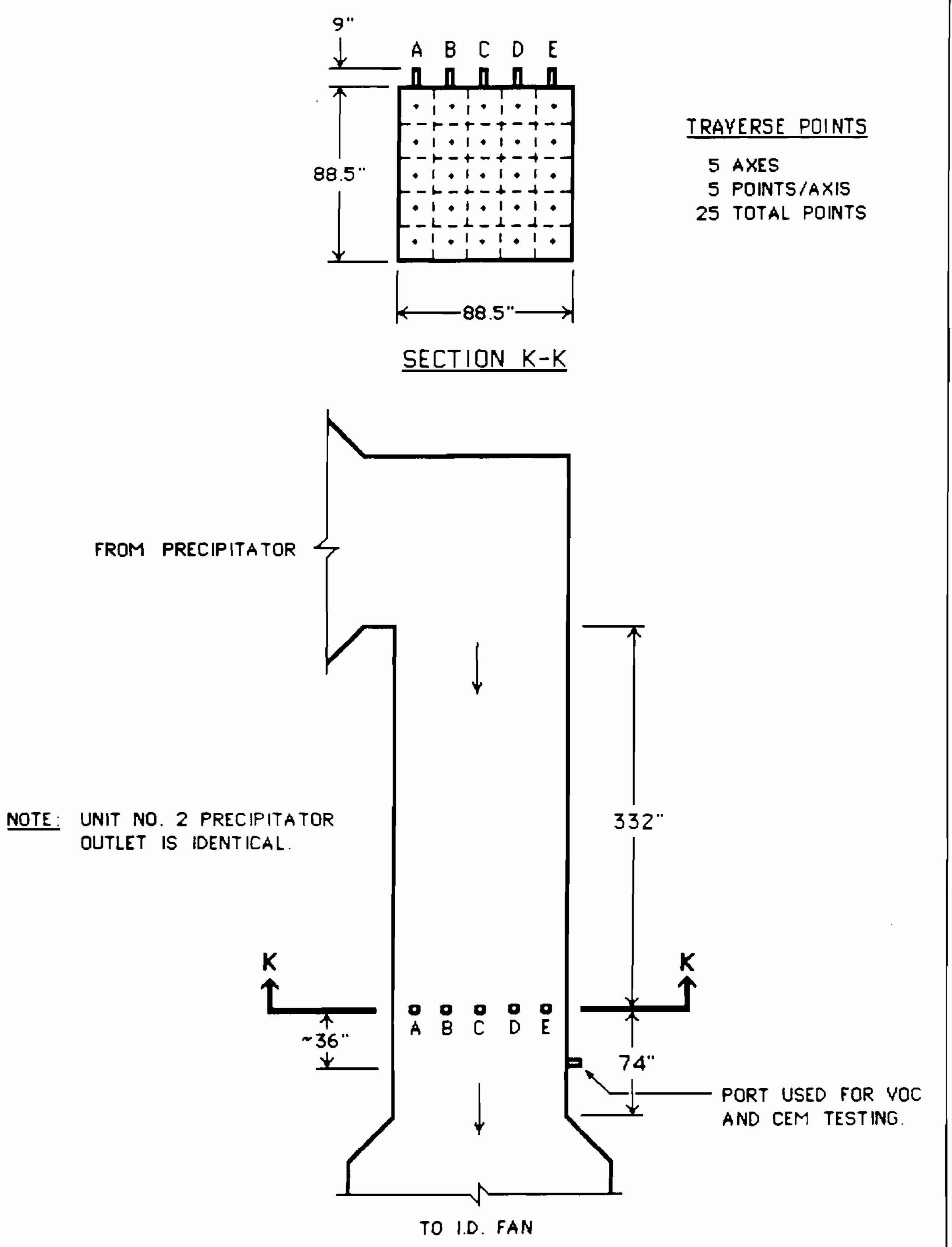

FIGURE 4-2. UNIT NO. 1 PRECIPITATOR OUTLET TEST LOCATION.

TABLE 4-1

TEST PROGRAM SAMPLING PARAMETERS

Sampling Location	Sampling Method	-- Number Of -- Axes	Points	Total Points	Minutes Per Point	Total Minutes
Dry Scrubber Inlets	EPA 3A	1	1	1	NA	NA
	EPA 13B	3	5	15	4	*
	EPA 5	2/3	5	10/15	8/5	80/75
	EPA 6C	1	1	1	NA	NA
	EPA 8	3	5	15	4	60
ESP Outlets	EPA 104	5	5	25	5	125
	EPA 3A, 10	1	1	1	NA	NA
	EPA 7E, 6C	1	1	1	NA	NA
	EPA 13B	5	5	25	2.5	62.5
	EPA 5&12	5	5	25	5	125
	EPA 101A	5	5	25	5	125
	EPA 8	5	5	25	5	125
	EPA 25A	1	1	1	NA	NA

* Run Times were 52, 60, 60, 60, 51, and 53.5 minutes for runs 1-SI-M13B-1, 1-SI-M13B-3, 1-SI-M13B-5, 2-SI-M13B-1, 2-SI-M13B-2, and 2-SI-M13B-3, respectively.

4.4.1 Beryllium. Emissions were determined according to the sampling and analytical procedures outlined in EPA Method 104. The isokinetic sampling rate was maintained below 28 l/min (1.0 CFM). A 2-hour minimum sample time per run was employed. Borosilicate glass probe liners were used. Prior to testing, all sample train glassware was cleaned by soaking in wash acid for two hours, followed by rinsing with water. Distilled water (100 ml) was placed in each of the first two impingers, the third impinger remained empty, and preweighed silica gel was placed in the fourth impinger. A Pallflex 2500QAT-UP quartz filter was placed between the probe exit and the first impinger.

Sample Preparation and Analysis. The filter was fumed in concentrated HNO_3 on a hotplate to destroy the organic matter. After cooling to room temperature, 5 ml of ternary acid was added. The reagent, rinse water, and acetone rinse were evaporated to dryness in a beaker on a hotplate. After cooling, concentrated HNO_3 was added and the sample was fumed on a hotplate to destroy the organic residue. After cooling to room temperature, 5 ml of ternary acid was added. The prepared filter and water samples were combined and evaporated to dryness on a hotplate. After preparation, the samples were analyzed with a Perkin Elmer 3030 atomic absorption analyzer at 234.8 nm using a nitrous oxide/acetylene flame.

4.4.2 Carbon Dioxide, Carbon Monoxide, Nitrogen Oxides, Oxygen, and Sulfur Dioxide. Continuous emissions monitoring (CEM) for carbon dioxide (CO_2), carbon monoxide (CO), nitrogen oxides (NO_x), oxygen (O_2), and sulfur dioxide (SO_2) was conducted. Sampling and analytical procedures for CO_2 and O_2, were in accordance with EPA Method 3A. Sampling and analytical procedures for CO, NO_x, and SO_2, were in accordance with EPA Methods 10, 7E, and 6C, respectively.

The extractive monitors require that the effluent gas sample be conditioned to eliminate any possible interference (i.e., water vapor and particulate matter) before being transported and injected into each analyzer.

All components of the sampling system which contact the sample are constructed of Type 316 stainless steel or Teflon. The system consists of: a heated probe with an in-stack glass wool particulate filter, heated sample lines, a moisture removal trap, an out-of-stack secondary particulate filter, a sample pump, and a distribution manifold board used to deliver a representative sample of flue gas to the analyzers.

The condenser consisted of a 30-foot coil of Teflon tubing followed by two Teflon condensate traps, all immersed in an ice bath to remove any moisture from the sample. The sample exiting the condenser passes through a heated 2-micron particulate filter. Then, the sample is transported through unheated 3/8-inch O.D. Teflon tubing by way of a Teflon-lined sample pump to the flow distribution manifold board, where the flow to the analyzers is monitored and controlled.

The outputs from the analyzers were connected to the computerized data acquisition system (DAS). The DAS integrated the real-time measurements and provided printouts of 1-minute, 15-minute, and hourly averaged emissions.

The calibration gas concentrations were determined by the vendor using EPA Protocol 1 procedures.

Two Fuji Model 3300 nondispersive infrared analyzers (NDIR) were used to determine the CO and CO_2 concentrations. The instruments consist of an infrared light source, chopper, measurement cell, and a detector.

A Beckman Model 951A NO/NO_x analyzer was used to determine the NO_x concentrations. This instrument uses the technique of chemiluminescence.

Oxygen concentrations were measured using a Teledyne Model 320P-4 analyzer. The analyzer uses a micro-fuel cell that consumes oxygen from the atmosphere surrounding the measuring probe. The consumption of oxygen generates a proportional electric current, which is then amplified and used to drive a built-in front panel meter with a scale of 0-25%.

Two Maihak UNOR nondispersive infrared (NDIR) analyzers were used to measure the SO_2 concentrations.

All pretest and posttest calibration procedures were performed as outlined in the specific EPA Methods. Outputs from each analyzer were continuously monitored and recorded by a computerized DAS consisting of a COMPAQ portable PC and an Epson dot matrix printer.

4.4.3 Hydrogen Chloride and Hydrogen Fluoride. The sampling train outlined in EPA Method 13B was used to determine the emissions of hydrogen chloride (HCl) and hydrogen fluoride (HF). The EPA Method 13B impinger reagents were replaced with 0.1N NaOH to facilitate chlorides collection and also to ensure that the HF was collected in a solution with a pH above 5. A Whatman 541 paper filter (with a Teflon frit) was placed between the third and fourth impingers. The isokinetic sampling rate was maintained below 28 l/min (1.0 CFM).

Sample Recovery. All components of the sampling train including the nozzle, probe, filter holder, and impingers were rinsed three times with deionized, distilled water. In preparation for HF analysis, the filters were washed with deionized, distilled water to dissolve particulate fluorides.

Sample Analyses. The impinger reagent was analyzed for HCl content using ion chromatography. The filter and impinger reagents were analyzed for HF content using the ion selective electrode method.

4.4.4 Lead and Particulate. Particulate emissions were determined at the dry scrubber inlets using EPA Method 5 sampling and analytical procedures. Lead and particulate emissions were determined at the ESP outlet using a combined EPA Methods 5 and 12 sampling train. The sampling train was modified by using 100 ml of 0.1 N nitric acid in the first and second impingers, the third was empty, the fourth contained preweighed silica gel. The particulate analysis was performed according to EPA Method 5. The lead analysis was performed according to EPA Method 12.

4.4.5 Mercury. The sampling and analytical procedures outlined in EPA Method 101A were used to determine the mercury emissions. The isokinetic sampling rate was maintained below 28 l/min (1.0 CFM), a 2-hour minimum sampling time was employed, and the samples were collected in 4% potassium permanganate ($KMnO_4$). Borosilicate glass probe liners were used and all sample train glassware was precleaned by rinsing with 10% nitric acid, tap water, 8N hydrogen chloride, tap water, and finally deionized, distilled water. The first impinger was charged with 50 mL of 4% $KMnO_4$ and the second and third impingers were charged with 100 mL of 4% $KMnO_4$. Preweighed silica gel was placed in the fourth impinger. A Pallflex 2500QAT-UP quartz filter was placed between the probe exit and the first impinger. A Teflon frit was used.

Sample Recovery. Mercury was quantitatively recovered as follows: the components were rinsed with a total of 250 to 400 ml of fresh 4% $KMnO_4$ solution; washings were added to 1000 ml glass sample jars; residual brown deposits on the glassware were removed using a minimal amount of 8N hydrochloric acid; and the hydrochloric acid rinse was added to the sample container. The filter was removed and placed in a glass jar. Approximately 20 to 40 ml of 4% potassium permanganate solution was added to the jar.

Sample Analysis. The samples were submitted to the laboratory for cold vapor atomic absorption (CVAA) analysis. Samples, standards, QA/QC materials, and blanks were prepared in the same matrix prior to analysis.

4.4.6 Plume Opacity. The procedures outlined in EPA Method 9 were followed in determining the plume opacity.

4.4.7 Sulfuric Acid Mist. The sampling and analytical procedures outlined in EPA Method 8 were followed to determine the sulfuric acid mist emissions. The sampling train was set up with 100 ml of 80% isopropyl alcohol in the first impinger, 100 ml of 5% hydrogen peroxide in each of the second and third impingers, and 200 grams of silica gel in the fourth impinger. A glass fiber filter was used between the first and second impingers. Multipoint, isokinetic sampling was conducted. The filter and the 80% isopropyl alcohol reagent were analyzed to determine the sulfuric acid mist

4.4.8 Total Hydrocarbons as Methane. Sampling and analysis for total hydrocarbons (THC) as methane was conducted according to the procedures outlined in EPA Method 25A. A continuous sample of the flue gas was obtained using a stainless steel probe, with analysis using a Ratfisch Model RS55 GC/FID which utilizes the principles of flame ionization detection.

4.5 Equipment Calibration. Pertinent calibration data are provided in Appendix C. All sampling equipment was manufactured by Entropy or Nutech Corporation.

QUALITY ASSURANCE/QUALITY CONTROL

5.1 General. Entropy Environmentalists Inc. (EEI) is committed to the continued implementation of a Quality Assurance Program to assure the quality of sampling and analytical procedures of environmental measurement data. The Quality Assurance measures taken during this test project equals or exceeds the minimum QA/QC recommendations as set forth by the U.S. Environmental Protection Agency (EPA) for a particular method.

The following sections outline the QA program implemented by EEI to justify the validity of the test procedures. The QA system for this test program addresses the following areas:

- Project Organization
- Preventive Maintenance & Equipment Calibration
- QA Sample Processing
- Analytical Instrument Calibration
- Blanks and Spiked Samples
- Internal/External System Checks
- Data Reduction & Validation
- Continuous Emissions Monitoring
- QA/QC Summary

5.2 Project Organization. The organization of the project team, including QA functions, are shown in Figure 5-1. Note that the QA structure is independent of the organizational groups which generate measurement data during the test program.

5.3 Preventive Maintenance and Equipment Calibration. An effective preventive maintenance program decreases downtime and thus increases data completeness and quality. Pretest and posttest equipment calibrations are conducted in a manner and at a frequency which meets or exceeds U.S. EPA specifications.

Each item transported to the field is inspected to detect equipment problems which may originate during periods of storage. All equipment returning from the field are cleaned, repaired, reconditioned, and recalibrated as necessary. Routine maintenance on equipment (dry gas meters, pumps, magnehelics/manometers, pitot tubes, and nozzles) is carried out periodically for leaks, corrosion, dents, or any other damage. Table 5-1 shows the activities for equipment calibration.

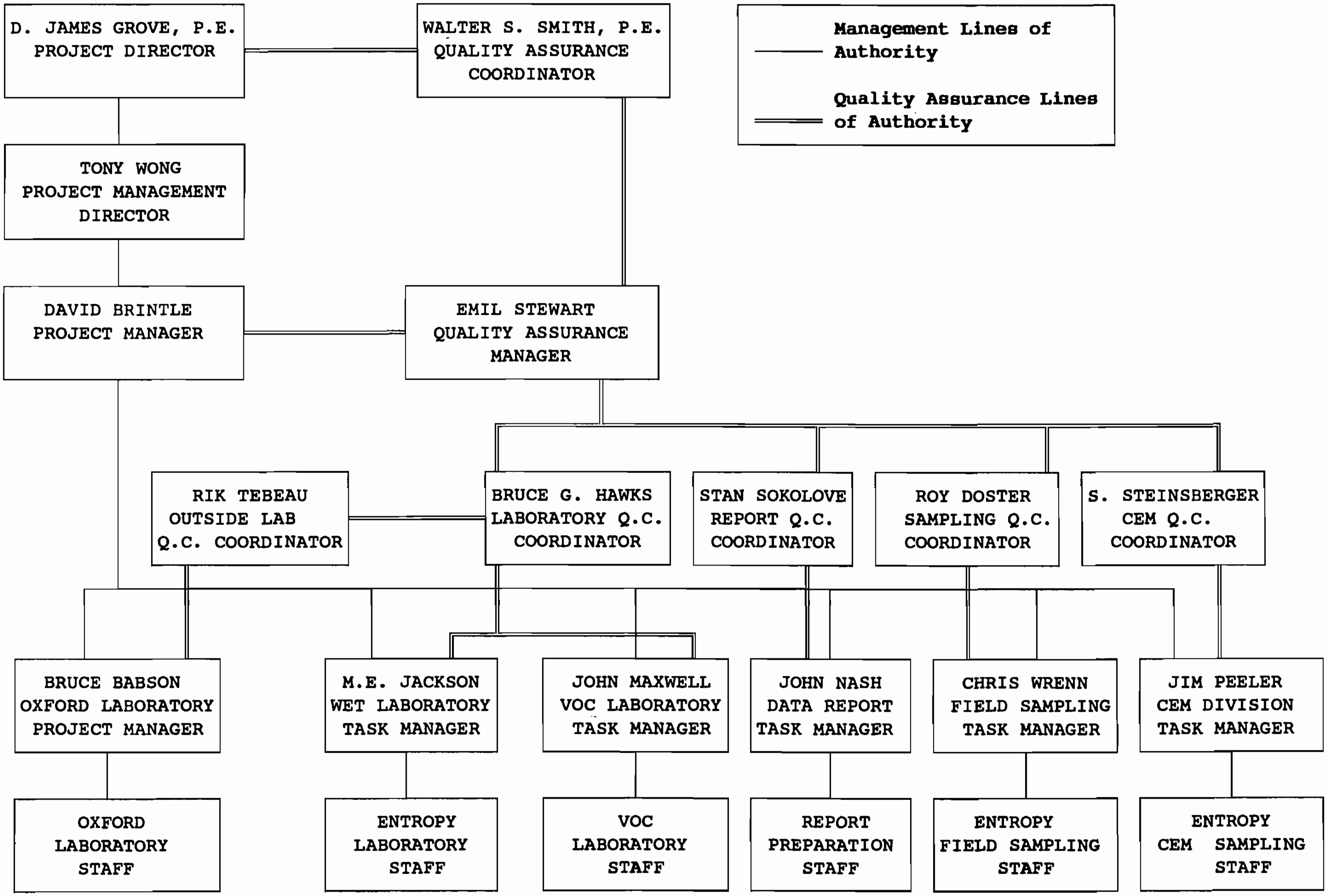

FIGURE 5-1 PROJECT ORGANIZATION

TABLE 5-1

IN-HOUSE EQUIPMENT CALIBRATION

Apparatus	Calibration Method And Frequency	Specifications	Corrective Action
Type S Pitot Tubes	Standards contained in EPA Method 2.	Coefficient of 0.84 ± 0.02	Refurbish or recalibrate.
	Visual inspection prior to shipment to test site and again prior to each day of testing.		
Manometers	Leak checked before and after each field use.		Repair or replace
Magnehelic Gauges	Initially calibrated over full range.	0-10" water column	
	After each field use, checked against inclined manometer at average settings encountered during testing.	Within ± 5%	Repair and Recalibrate.
Thermometers -Impinger -Dry Gas Meter -Filter Box	After purchase and prior to each field use, using ASTM mercury-in-glass thermometer.	Imp = ± 2°F DGM = ± 5.4°F FB = ± 5.4°F	Adjust, determine correction factor, or reject.
Thermocouple/ Potentiometer	After purchase. 3-point (ice bath, boiling water, (and hot oil) using ASTM mercury-in-glass thermometer.	± 1.5% of absolute temperature.	Adjust, determine correction factor, or reject.
	Before and after each field use compared to ASTM mercury-in-glass thermometer at ambient conditions.		
Dry Gas Meter and Orifice	Full calibration (every 6 months) over wide range of orifice settings to obtain calibration factor.	DGM = ± 2% of avg. factor for each calib. run. Ori. = ± 0.15" H20 over delta H range of 0.4" to 4.0".	Adjust or reject
	10-minute quick calibration before sending to test site and again prior to each day of field use.	± 3% of full. ± 5% of full.	Use if no backup. Do not use.
	Posttest (at average delta H and highest vacuum) to determine if meter gamma has changed.	± 5% of full calibration. Factor (initial or recalibration) that yields the lowest sample volume for the testing is used.	Meter calibration, meter coefficient
Dry Gas Meter Transfer Standard	Annual calibrations conducted in triplicate using EPA wet test meter. Calibrations conducted at 7 flow rates from 0.25 to 1.40 cfm.	± 2% of average factor for each calibration run.	Adjust and recalibrate.
Barometer	Before and after each field use against an ASTM mercury-in-glass barometer.	± 0.1" mercury.	Adjust to agree.
	Reference barometer adjusted for elevation differences.		
Probe Nozzle	Average of 5 I.D. measurements using a micrometer. Visual inspection before and after each field use.	Difference between high and low measurement < 0.004"	Repair and recalibrate.

5.4 Sample Processing. Entropy employs systems which ensure the integrity of an environmental sample from the time of acquisition, through analysis, and ultimately to proper disposal. These systems are necessary to allow valid conclusions to be drawn from analytical results separated in time and space from the sampling operation. In addition, these systems recognize that samples are occasionally of value even after analytical results have been reported.

Samples are collected, transported, and stored in clean containers which are constructed of materials inert to the analytical matrix. Containers are used which allow air tight seals. When necessary, containers are employed which prevent photochemical reactions. All sample containers are labeled with the following information:

- » Unique source identifier
- » Sample run identifier
- » Analyte identifier
- » Sample matrix identifier
- » Sample analyst identifier

Additional information relating to the sample is recorded on the data sheet for the sampling run that afforded the subject sample. Accordingly, the sampling data sheet contains all the information listed above, plus the date and time the sample was acquired and supplemental information such as observations pertinent to the quality of the sample. For condensed samples, e.g., samples in liquid media, the sample levels are marked on the outside of the container; this mark is used to indicate sample loss, and as such, may serve as a reference in adjusting results accordingly.

For transport from the field to the laboratory, samples are stored in locked boxes and secured in a fashion which minimizes movement and thus prevents breakage of containers. Boxes used for transporting glass containers are packed with foam.

Samples remain in the custody of the sampler from acquisition until conveyance to the laboratory analyst, if the analyst is different from the sampler. The sampler initiates a sample chain of custody record at the time of sample collection in the field. All custody transfers are documented on the chain of custody form, which remains with the sample at all times.

Analytical data are identified in a manner identical to that of the sampling data. Accordingly, all data generated from the analysis of samples are documented with the following information:

» Source identifier
» Sample run identifier
» Analyte identifier
» Sample matrix identifier
» Analyst identifier
» Analysis date

Portions of samples remaining after analysis are returned to their original sample containers. These samples are stored in designated storage areas until their destruction is authorized.

5.5 Instrument Calibration. Instrument calibration is one of the most important functions in generating precise and accurate quality data. A listing of major in-house instrumentation and the corresponding Quality Assurance program is given in Table 5-2.

All of the contract laboratories involved in the analytical testing for the test program maintained rigorous QA programs for instrument calibration.

5.6 Blanks and Spikes. Field blanks, method blanks, trip blanks, lab-proof blanks and filter blanks are obtained, digested and analyzed when applicable. The blanks reflect the background contamination obtained from the various sources during the sampling and analysis. Thus, data adjustment or correction can be made accordingly.

In most cases, it is not necessary to digest and analyze the method blanks, reagent blanks or the lab-proof blanks unless the field blank shows a high level of contamination. If a high level of contamination is present, it is imperative to individually analyze the above blanks to help determine the cause of contamination.

Spiked samples are used to check on the performance of a routine analysis or the recovery efficiency of a method. During spiking, a known amount of stock solutions of the substance of interest is added to the sample prior to sample extraction, digestion, and analysis.

TABLE 5-2

IN-HOUSE INSTRUMENT CALIBRATION

Apparatus	Calibration Method And Frequency	Specifications	Corrective Action
Analytical & Top Loading Balance	Daily and monthly checks with a series of class S weights. Balance serviced annually by a qualified service representative and checked with a series of NBS weights.	± 1 mg of class S weights.	Adjust or repair.
Gas Chromatograph	3-point calibration curve at the expected range. Duplicate injection of the sample until ± 5% variation is achieved. Calibration repeated at the end of each test series.		
HPLC/Ion Chromatograph	Calibrations conducted at the beginning, after the first injection, and after the second injection.		
Fisher Accument 925 pH/Selective Ion Meter	5-point calibration prior to analyzing the samples for the specific ions.		

5.7 Internal/External System Audit Checks. System and performance audits are routine elements of all Entropy QA/QC programs.

Internal Systems Audit: The following sampling equipment checks were conducted prior to sample collection.

- All sampling equipment was thoroughly checked to ensure clean and operable components.
- Equipment was inspected for possible damage from shipment.
- The oil manometers or Magnehelic gauges were leveled and zeroed.
- The temperature measurement systems were checked for damage and operability by measuring the ambient temperature.

Performance Audits: Performance audits of the laboratory are conducted prior to the processing of any compliance samples for analysis. Audit materials typically include samples available from the EPA prior to new source testing. Also, samples of known concentration are specially prepared in-house or obtained from the EPA for Internal QA checks.

External Systems Audits: Entropy is subject to a system audit each time a test is conducted for any Air Pollution Control agency. This procedure entails an EPA observer on-site to do qualitative evaluation of performance to demonstrate compliance with the applicable regulations.

5.8 Data Reduction and Validation. The test team leader is responsible for reviewing and validating data as they are acquired. Each team leader has extensive knowledge of sampling methodology and the characteristic of the process being measured and is capable of evaluating the accuracy, representativeness, and completeness of raw data on-site, where action to replace inadequate data can be taken immediately.

Data obtained during calibrations and test runs are recorded on standardized forms which are checked twice for completeness and accuracy by the QA Director. Data reduction and consistency are achieved by using the standardized forms and using Entropy's in-house computer facilities.

5.9 QA/QC Summary. The following discussions outline the most significant QA parameters used during this test program. All reagents used were American Chemical Society (ACS), High Purity Liquid Chromatography (HPLC), or pesticide grade. The distilled, deionized water utilized met or exceeded the American Society for Testing and Materials (ASTM) specifications for Type-I reagent water. Pretest and posttest leak checks were conducted on each sampling train. Refer to Table 5-3 for a list of blanks prepared and analyzed for the various sampling trains.

TABLE 5-3

BLANKS SUMMARY

Method	Field Blank	Reagent Blank	Filter Blank
EPA 104	Yes	Yes*	Yes*
EPA 13B	No	Yes*	Yes*
EPA 5&12	Yes	Yes*	Yes*
EPA 101A	Yes	Yes*	Yes*
EPA 8	No	Yes	No

* These blanks were collected but not analyzed.

EPA Method 13B: Chloride and fluoride calibration curves were generated prior to sample analysis. A reagent blank was analyzed with < 0.08 mg HCl detected. Duplicate fluoride analyses were performed on run 1-SI-M13B-5, with a relative percent difference of 9.9%.

EPA M5&12. Field blanks were prepared and analyzed for lead with < 10.0 μg detected for each train at the Unit Nos. 1 and 2 ESP outlets. Duplicate lead analysis was conducted on run 1-PO-M5&12-2, with a relative percent difference of 0.0%.

EPA Method 101A: Field blanks for were analyzed with mercury results of < 2.50 μg detected at both units locations. Due to the insignificance of the results, the blank results were not subtracted from the sample catches.

EPA Method 8: An isopropanol reagent blank was analyzed for H_2SO_4, with none detected. The replicate titrant volumes agreed within 0.2 ml.

EPA Method 25A. Pretest and posttest calibrations were performed for each test run. The 3-point linearity checks were all within 3% of the known cylinder gas concentrations.

APPENDIX A.1.a.1

A. TEST RESULTS

    1. Unit No. 1

        a. Dry Scrubber Inlet

            1. Carbon Dioxide, Oxygen, and Sulfur Dioxide

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-SI-CEM-1 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/26/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	2.2	4.2	3.2
218.0 ppm SO2	215.3	212.5	213.9
0.00 % Oxygen	0.02	0.04	0.03
12.50 % Oxygen	12.44	12.27	12.36
0.00 % CO2	0.04	0.24	0.14
11.06 % CO2	11.00	11.11	11.06

Uncorrected Data:
149 ppm SO2
5.9 % Oxygen
13.6 % CO2

==

CORRECTED RESULTS

150.9 ppm SO2
13.6 % CO2
6.0 % Oxygen
0.332 lb SO2/MBtu

==

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-SI-CEM-3 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/27/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	2.9	4.0	3.5
218.0 ppm SO2	214.1	207.1	210.6
0.00 % Oxygen	0.05	0.04	0.05
12.50 % Oxygen	12.51	12.38	12.45
0.00 % CO2	0.02	0.22	0.12
11.06 % CO2	10.94	11.06	11.00

Uncorrected Data:
144 ppm SO2
5.7 % Oxygen
13.9 % CO2

==

CORRECTED RESULTS

147.9 ppm SO2
14.0 % CO2
5.7 % Oxygen
0.319 lb SO2/MBtu

==

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-SI-CEM-5 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/27/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	4.5	5.2	4.9
218.0 ppm SO2	209.6	216.3	213.0
0.00 % Oxygen	0.04	0.04	0.04
12.50 % Oxygen	12.46	12.41	12.44
0.00 % CO2	0.33	0.46	0.40
11.06 % CO2	11.13	11.19	11.16

Uncorrected Data:
126 ppm SO2
6.0 % Oxygen
13.8 % CO2

===

CORRECTED RESULTS

126.9 ppm SO2
13.7 % CO2
6.0 % Oxygen
0.279 lb SO2/MBtu

===

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

APPENDIX A.1.a.2

A. TEST RESULTS

- 1. Unit No. 1
  - a. Dry Scrubber Inlet
    - 2. Hydrogen Chloride and Hydrogen Fluoride

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-SI-M13B-1	10/26/89	Unit No. 1 Dry Scrubber Inlet	Neill M. Harden
1-SI-M13B-3	10/27/89	Unit No. 1 Dry Scrubber Inlet	Neill M. Harden
1-SI-M13B-5	10/27/89	Unit No. 1 Dry Scrubber Inlet	Neill M. Harden

		1-SI-M13B-1	1-SI-M13B-3	1-SI-M13B-5
	Run Start Time	935	1150	1845
	Run Finish Time	1037	1307	2002
	Net Traversing Points	15	15	15
Theta	Net Run Time, Minutes	52.00	60.00	60.00
Dia	Nozzle Diameter, Inches	0.241	0.241	0.241
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	1.0052	1.0052	1.0052
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	29.80
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.06	1.01	1.03
Vm	Volume Of Metered Gas Sample, Dry ACF	27.905	30.685	31.769
tm	Dry Gas Meter Temperature, Degrees F	99	109	100
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	26.624	28.758	30.053
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	119.5	151.5	151.5
Vwstd	Volume of Water Vapor, SCF*	5.625	7.131	7.131
%H_2O	Moisture Content, Percent by Volume	17.4	19.9	19.2
Mfd	Dry Mole Fraction	0.826	0.801	0.808
%CO_2	Carbon Dioxide, Percent By Volume, Dry	12.5	12.2	12.6
%O_2	Oxygen, Percent By Volume, Dry	6.5	6.7	6.5
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.26	30.22	30.28
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.13	27.79	27.92
Pg	Flue Gas Static Pressure, Inches H_2O	-2.75	-2.65	-2.60
Ps	Absolute Flue Gas Pressure, Inches Hg	29.80	29.81	29.61
ts	Flue Gas Temperature, Degrees F	351	347	358
Delta-p	Average Velocity Head, Inches H_2O	0.4968	0.4461	0.4628
vs	Flue Gas Velocity, Feet/Second	49.79	47.34	48.59
A	Stack/Duct Area, Square Inches	7,766	7,766	7,766
Qsd	Volumetric Air Flow Rate, Dry SCFM*	86,293	79,985	81,152
Qaw	Volumetric Air Flow Rate, Wet ACFM	161,112	153,184	157,229
%I	Isokinetic Sampling Rate, Percent	101.0	102.0	105.1
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	378	345	355

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-SI-M13B-1	1-SI-M13B-3	1-SI-M13B-5
	Hydrogen Fluoride			
fwt	Formula Weight, lb/lb-Mole	20.01	20.01	20.01
ug	Catch Weight, Micrograms	5265	12110	10636
ppmvd	Concentration, ppmvd	8.39	17.9	15.0
lb/hr	Emission Rate, lb/hr	2.26	4.46	3.80
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.00597	0.0129	0.0107
	Hydrogen Chloride			
fwt	Formula Weight, lb/lb-Mole	36.46	36.46	36.46
mg	Catch Weight, Micrograms	534.3	966.3	1077
ppmvd	Concentration, ppmvd	467	782	834
lb/hr	Emission Rate, lb/hr	229	356	385
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.606	1.03	1.08

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.1.a.3

A. TEST RESULTS
    1. Unit No. 1
        a. Dry Scrubber Inlet
            3. Particulate

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-SI-M5-1	10/23/89	Unit No. 1 Dry Scrubber Inlet	Neill M. Harden
1-SI-M5-2	10/23/89	Unit No. 1 Dry Scrubber Inlet	Neill M. Harden
1-SI-M5-3	10/23/89	Unit No. 1 Dry Scrubber Inlet	Neill M. Harden

		1-SI-M5-1	1-SI-M5-2	1-SI-M5-3
	Run Start Time	930	1400	1700
	Run Finish Time	1154	1523	1822
	Net Traversing Points	10	15	15
Theta	Net Run Time, Minutes	80.00	75.00	75.00
Dia	Nozzle Diameter, Inches	0.266	0.260	0.266
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	1.0052	1.0052	1.0052
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.77	1.82	1.56
Vm	Volume Of Metered Gas Sample, Dry ACF	54.977	53.421	49.726
tm	Dry Gas Meter Temperature, Degrees F	112	118	114
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	51.350	49.384	46.260
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	241.0	269.5	239.0
Vwstd	Volume of Water Vapor, SCF*	11.344	12.685	11.250
%H_2O	Moisture Content, Percent by Volume	18.1	20.4	19.6
Mfd	Dry Mole Fraction	0.819	0.796	0.804
%CO_2	Carbon Dioxide, Percent By Volume, Dry	13.3	11.6	12.2
%O_2	Oxygen, Percent By Volume, Dry	5.5	7.4	6.8
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.35	30.15	30.22
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.11	27.67	27.82
Pg	Flue Gas Static Pressure, Inches H_2O	-1.69	-2.50	-2.70
Ps	Absolute Flue Gas Pressure, Inches Hg	29.88	29.82	29.80
ts	Flue Gas Temperature, Degrees F	350	358	344
Delta-p	Average Velocity Head, Inches H_2O	0.5725	0.6097	0.4959
vs	Flue Gas Velocity, Feet/Second	53.36	55.83	49.80
A	Stack/Duct Area, Square Inches	7,766	7,766	7,766
Qsd	Volumetric Air Flow Rate, Dry SCFM*	92,056	92,511	84,743
Qaw	Volumetric Air Flow Rate, Wet ACFM	172,664	180,657	161,145
%I	Isokinetic Sampling Rate, Percent	97.4	104.1	101.7
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	431	380	363

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION

(Continued)

10

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-SI-M5-1	1-SI-M5-2	1-SI-M5-3
	Filterable Particulate			
mg	Catch Weight, Milligrams	7,094.1	12,989.4	5,691.4
gr/DSCF	Concentration, grains/DSCF *	2.13	4.06	1.90
gr@12%	Concentration, gr/DSCF @ 12% CO2	1.92	4.20	1.87
gr@7%	Concentration, gr/DSCF @ 7% O2	1.92	4.18	1.87
lb/hr	Emission Rate, lb/hr	1,682	3,219	1,379
lb/10^6Btu	Emission Rate, lb/10^6Btu	3.90	8.47	3.79

< Indicates the value is below the detection limit.

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

APPENDIX A.1.a.4

A. TEST RESULTS

  1. Unit No. 1

    a. Dry Scrubber Inlet

      4. Sulfuric Acid Mist

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-SI-M8-1	10/26/89	Unit No. 1 Dry Scrubber Inlet	Dennis D. Holzschuh
1-SI-M8-4	10/27/89	Unit No. 1 Dry Scrubber Inlet	Dennis D. Holzschuh
1-SI-M8-5	10/27/89	Unit No. 1 Dry Scrubber Inlet	Dennis D. Holzschuh

		1-SI-M8-1	1-SI-M8-4	1-SI-M8-5
	Run Start Time	935	1545	1845
	Run Finish Time	1045	1700	2000
	Net Traversing Points	15	15	15
Theta	Net Run Time, Minutes	60.00	60.00	60.00
Dia	Nozzle Diameter, Inches	0.263	0.251	0.263
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9938	0.9938	0.9938
Pbar	Barometric Pressure, Inches Hg	30.00	29.80	29.80
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.50	1.20	1.53
Vm	Volume Of Metered Gas Sample, Dry ACF	37.840	33.410	38.399
tm	Dry Gas Meter Temperature, Degrees F	100	91	97
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	35.668	31.770	36.151
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	176.5	167.0	171.0
Vwstd	Volume of Water Vapor, SCF*	8.308	7.861	8.049
$\%H_2O$	Moisture Content, Percent by Volume	18.9	19.8	18.2
Mfd	Dry Mole Fraction	0.811	0.802	0.818
$\%CO_2$	Carbon Dioxide, Percent By Volume, Dry	12.5	13.2	12.6
$\%O_2$	Oxygen, Percent By Volume, Dry	6.5	5.7	6.5
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.26	30.34	30.28
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.94	27.90	28.05
Pg	Flue Gas Static Pressure, Inches H_2O	-2.80	-2.40	-2.60
Ps	Absolute Flue Gas Pressure, Inches Hg	29.79	29.62	29.61
ts	Flue Gas Temperature, Degrees F	356	359	360
Delta-p	Average Velocity Head, Inches H_2O	0.4843	0.4428	0.5051
vs	Flue Gas Velocity, Feet/Second	49.48	47.57	50.71
A	Stack/Duct Area, Square Inches	7,766	7,766	7,766
Qsd	Volumetric Air Flow Rate, Dry SCFM*	83,655	78,789	85,532
Qaw	Volumetric Air Flow Rate, Wet ACFM	160,109	153,929	164,089
%I	Isokinetic Sampling Rate, Percent	101.6	105.5	100.7
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	366	364	375

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-SI-M8-1	1-SI-M8-4	1-SI-M8-5
	Sulfuric Acid Mist (incl. SO3)			
fwt	Formula Weight, lb/lb-Mole	98.08	98.08	98.08
mg	Catch Weight, Milligrams	3.6	6.3	13.1
ppmvd	Concentration, ppmvd	0.874	1.72	3.14
lb/hr	Emission Rate, lb/hr	1.12	2.07	4.10
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.00305	0.00567	0.0109

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.1.b.1

A. TEST RESULTS
  1. Unit No. 1
    b. ESP Outlet
      1. Beryllium

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-PO-M104-1	10/23/89	Unit No. 1 ESP Outlet	Dennis D. Holzschuh
1-PO-M104-2	10/23/89	Unit No. 1 ESP Outlet	Dennis D. Holzschuh
1-PO-M104-3	10/23/89	Unit No. 1 ESP Outlet	Dennis D. Holzschuh

		1-PO-M104-1	1-PO-M104-2	1-PO-M104-3
	Run Start Time	930	1335	1630
	Run Finish Time	1251	1557	1851
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.254	0.266	0.254
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9850	0.9850	0.9850
Pbar	Barometric Pressure, Inches Hg	30.10	30.10	30.10
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.58	1.76	1.52
Vm	Volume Of Metered Gas Sample, Dry ACF	87.448	92.611	84.406
tm	Dry Gas Meter Temperature, Degrees F	89	97	98
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	83.628	87.332	79.405
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	444.5	492.0	422.0
Vwstd	Volume of Water Vapor, SCF*	20.923	23.158	19.864
%H_2O	Moisture Content, Percent by Volume	20.0	21.0	20.0
Mfd	Dry Mole Fraction	0.800	0.790	0.800
%CO_2	Carbon Dioxide, Percent By Volume, Dry	11.2	11.3	12.0
%O_2	Oxygen, Percent By Volume, Dry	7.9	7.8	7.0
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.11	30.12	30.20
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.69	27.57	27.76
Pg	Flue Gas Static Pressure, Inches H_2O	-6.20	-6.60	-6.40
Ps	Absolute Flue Gas Pressure, Inches Hg	29.64	29.61	29.63
ts	Flue Gas Temperature, Degrees F	261	260	260
Delta-p	Average Velocity Head, Inches H_2O	0.5265	0.5579	0.5630
vs	Flue Gas Velocity, Feet/Second	48.84	50.37	50.41
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	92,500	94,241	95,574
Qaw	Volumetric Air Flow Rate, Wet ACFM	159,381	164,374	164,505
%I	Isokinetic Sampling Rate, Percent	111.8	104.5	102.7
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	366	375	404

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-PO-M104-1	1-PO-M104-2	1-PO-M104-3
	Beryllium			
fwt	Formula Weight, lb/lb-Mole	9.01	9.01	9.01
ug	Catch Weight, Micrograms	< .5	< .5	< .5
ppmvd	Concentration, ppmvd	< 5.64E-004	< 5.40E-004	< 5.94E-004
gr/DSCF	Concentration, grains/DSCF *	< 9.23E-008	< 8.84E-008	< 9.72E-008
lb/hr	Emission Rate, lb/hr	< 7.32E-005	< 7.14E-005	< 7.96E-005
lb/10^6Btu	Emission Rate, lb/10^6Btu	< 2.00E-007	< 1.90E-007	< 1.97E-007

< Indicates the value is below the detection limit.

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.1.b.2

A. TEST RESULTS

  1. Unit No. 1

    b. ESP Outlet

      2. Carbon Dioxide, Carbon Monoxide, Nitrogen Oxides, Oxygen, and Sulfur Dioxide

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-PO-CEM-1 (OUTLET)
SOURCE: N. Co. Resource Recov   DATE: 10/26/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	1.4	4.8	3.1
49.6 ppm SO2	50.8	53.3	52.1
0.0 ppm NOx	0.0	0.0	0.0
240.0 ppm NOx	232.0	235.1	233.6
0.0 ppm CO	0.2	-0.1	0.1
24.8 ppm CO	23.1	22.9	23.0
0.00 % Oxygen	0.01	0.02	0.02
12.50 % Oxygen	12.48	12.34	12.41
0.00 % CO2	0.04	0.18	0.11
11.06 % CO2	11.23	11.42	11.33

Uncorrected Data:		
	46 ppm SO2	6.4 % Oxygen
	223 ppm NOx	13.3 % CO2
	28 ppm CO	89,768 DSCFM

==

CORRECTED RESULTS

43.4 ppm SO2	13.0 % CO2
229.1 ppm NOx	6.4 % Oxygen
26.3 ppm CO	38.8 lb SO2/hr
0.098 lb SO2/MBtu	147.3 lb NO2/hr
0.372 lb NOx/MBtu	10.3 lb CO/hr
0.026 lb CO/MBtu	

==

Corrected Conc. = $\bar{C}_{ma}(C - C_o)/(C_m - C_o)$

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-PO-CEM-3 (OUTLET)
SOURCE: N. Co. Resource Recov   DATE: 10/27/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	1.6	5.0	3.3
49.6 ppm SO2	49.4	54.3	51.9
0.0 ppm NOx	0.0	-0.3	-0.2
240.0 ppm NOx	232.7	237.9	235.3
0.0 ppm CO	0.0	-0.3	-0.2
24.8 ppm CO	23.7	23.5	23.6
0.00 % Oxygen	0.01	0.02	0.02
12.50 % Oxygen	12.41	12.37	12.39
0.00 % CO2	0.02	0.12	0.07
11.06 % CO2	11.16	11.23	11.20

Uncorrected Data:		
	36 ppm SO2	5.8 % Oxygen
	204 ppm NOx	13.7 % CO2
	36 ppm CO	85,616 DSCFM

CORRECTED RESULTS

33.4 ppm SO2	13.5 % CO2
208.1 ppm NOx	5.8 % Oxygen
32.6 ppm CO	28.5 lb SO2/hr
0.072 lb SO2/MBtu	127.6 lb NO2/hr
0.325 lb NOx/MBtu	12.2 lb CO/hr
0.031 lb CO/MBtu	

Corrected Conc. = $\bar{C}ma(C - Co)/(Cm - Co)$

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-PO-CEM-5 (OUTLET)
SOURCE: N. Co. Resource Recov DATE: 10/27/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	1.9	2.7	2.3
49.6 ppm SO2	49.0	49.1	49.1
0.0 ppm NOx	-0.5	0.0	-0.3
240.0 ppm NOx	234.6	236.5	235.6
0.0 ppm CO	0.4	-0.1	0.2
24.8 ppm CO	23.7	23.7	23.7
0.00 % Oxygen	0.03	0.02	0.03
12.50 % Oxygen	12.34	12.43	12.39
0.00 % CO2	0.12	0.17	0.15
11.06 % CO2	11.12	11.19	11.16

Uncorrected Data:		
	23 ppm SO2	6.4 % Oxygen
	218 ppm NOx	13.2 % CO2
	26 ppm CO	88,176 DSCFM

CORRECTED RESULTS

21.9 ppm SO2	13.1 % CO2
222.1 ppm NOx	6.4 % Oxygen
23.7 ppm CO	19.2 lb SO2/hr
0.049 lb SO2/MBtu	140.3 lb NO2/hr
0.361 lb NOx/MBtu	9.1 lb CO/hr
0.023 lb CO/MBtu	

Corrected Conc. = $\bar{C}ma(C - Co)/(Cm - Co)$

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

APPENDIX A.1.b.3

A. TEST RESULTS

1. Unit No. 1

b. ESP Outlet

3. Hydrogen Chloride and Hydrogen Fluoride

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-PO-M13B-1	10/26/89	Unit No. 1 ESP Outlet	Leslie C. Murray
1-PO-M13B-3	10/27/89	Unit No. 1 ESP Outlet	Leslie C. Murray
1-PO-M13B-5	10/27/89	Unit No. 1 ESP Outlet	Leslie C. Murray

		1-PO-M13B-1	1-PO-M13B-3	1-PO-M13B-5
	Run Start Time	935	1150	1845
	Run Finish Time	1038	1259	1955
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	62.50	62.50	62.50
Dia	Nozzle Diameter, Inches	0.251	0.251	0.254
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9848	0.9848	0.9848
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.17	1.02	1.16
Vm	Volume Of Metered Gas Sample, Dry ACF	38.416	36.172	38.500
tm	Dry Gas Meter Temperature, Degrees F	90	96	90
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	36.506	33.990	36.585
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	218.5	179.0	218.0
Vwstd	Volume of Water Vapor, SCF*	10.285	8.426	10.261
%H_2O	Moisture Content, Percent by Volume	22.0	19.9	21.9
Mfd	Dry Mole Fraction	0.780	0.801	0.781
%CO_2	Carbon Dioxide, Percent By Volume, Dry	12.3	12.7	12.7
%O_2	Oxygen, Percent By Volume, Dry	6.8	6.2	6.5
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.24	30.28	30.29
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.55	27.84	27.60
Pg	Flue Gas Static Pressure, Inches H_2O	-5.80	-5.20	-5.90
Ps	Absolute Flue Gas Pressure, Inches Hg	29.57	29.62	29.57
ts	Flue Gas Temperature, Degrees F	260	265	259
Delta-p	Average Velocity Head, Inches H_2O	0.5195	0.4553	0.5001
vs	Flue Gas Velocity, Feet/Second	48.66	45.43	47.67
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	89,768	85,616	88,176
Qaw	Volumetric Air Flow Rate, Wet ACFM	158,794	148,253	155,563
%I	Isokinetic Sampling Rate, Percent	103.0	100.5	102.6
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	385	383	386

* 68° F -- 29.92 Inches of Mercury (Hg)

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PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-PO-M13B-1	1-PO-M13B-3	1-PO-M13B-5
	Hydrogen Fluoride			
fwt	Formula Weight, lb/lb-Mole	20.01	20.01	20.01
ug	Catch Weight, Micrograms	322	128	118
ppmvd	Concentration, ppmvd	0.374	0.160	0.137
lb/hr	Emission Rate, lb/hr	0.105	0.0426	0.0376
lb/10^6Btu	Emission Rate, lb/10^6Btu	2.72E-004	1.11E-004	9.74E-005
	Hydrogen Chloride			
fwt	Formula Weight, lb/lb-Mole	36.46	36.46	36.46
mg	Catch Weight, Micrograms	27.3	21.2	14.2
ppmvd	Concentration, ppmvd	17.4	14.5	9.04
lb/hr	Emission Rate, lb/hr	8.88	7.06	4.53
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.0231	0.0185	0.0117

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.1.b.4

A. TEST RESULTS

  1. Unit No. 1

    b. ESP Outlet

      4. Lead and Particulate

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-PO-M5&12-1	10/23/89	Unit No. 1 ESP Outlet	Barry F. Rudd
1-PO-M5&12-2	10/23/89	Unit No. 1 ESP Outlet	Barry F. Rudd
1-PO-M5&12-3	10/23/89	Unit No. 1 ESP Outlet	Barry F. Rudd

		1-PO-M5&12-1	1-PO-M5&12-2	1-PO-M5&12-3
	Run Start Time	930	1335	1630
	Run Finish Time	1251	1557	1851
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.254	0.251	0.254
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9973	0.9973	0.9973
Pbar	Barometric Pressure, Inches Hg	30.10	30.10	30.10
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.23	1.35	1.26
Vm	Volume Of Metered Gas Sample, Dry ACF	77.816	81.150	78.232
tm	Dry Gas Meter Temperature, Degrees F	90	88	91
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	75.145	78.674	75.415
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	398.0	435.5	400.0
Vwstd	Volume of Water Vapor, SCF*	18.734	20.499	18.828
$\%H_2O$	Moisture Content, Percent by Volume	20.0	20.7	20.0
Mfd	Dry Mole Fraction	0.800	0.793	0.800
$\%CO_2$	Carbon Dioxide, Percent By Volume, Dry	11.2	11.3	12.0
$\%O_2$	Oxygen, Percent By Volume, Dry	7.9	7.8	7.0
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.11	30.12	30.20
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.69	27.61	27.76
Pg	Flue Gas Static Pressure, Inches H_2O	-5.80	-6.70	-6.40
Ps	Absolute Flue Gas Pressure, Inches Hg	29.67	29.61	29.63
ts	Flue Gas Temperature, Degrees F	260	265	261
Delta-p	Average Velocity Head, Inches H_2O	0.4936	0.5682	0.5244
vs	Flue Gas Velocity, Feet/Second	47.23	50.98	48.69
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	89,666	95,084	92,185
Qaw	Volumetric Air Flow Rate, Wet ACFM	154,127	166,365	158,892
%I	Isokinetic Sampling Rate, Percent	103.6	104.8	101.2
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	355	379	390

* 68° F -- 29.92 Inches of Mercury (Hg)

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FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-PO-M5&12-1	1-PO-M5&12-2	1-PO-M5&12-3
	Filterable Particulate			
mg	Catch Weight, Milligrams	3.2	13.4	1.7
gr/DSCF	Concentration, grains/DSCF *	6.57E-004	2.63E-003	3.48E-004
gr@12%	Concentration, gr/DSCF @ 12% CO2	7.04E-004	2.79E-003	3.48E-004
gr@7%	Concentration, gr/DSCF @ 7% O2	7.02E-004	2.79E-003	3.48E-004
lb/hr	Emission Rate, lb/hr	0.505	2.14	0.275
lb/10^6Btu	Emission Rate, lb/10^6Btu	1.42E-003	5.65E-003	7.05E-004
	Lead			
fwt	Formula Weight, lb/lb-Mole	207.19	207.19	207.19
ug	Catch Weight, Micrograms	160	100	50
ppmvd	Concentration, ppmvd	0.00873	0.00521	0.00272
gr/DSCF	Concentration, grains/DSCF *	3.29E-005	1.96E-005	1.02E-005
lb/hr	Emission Rate, lb/hr	0.0253	0.0160	0.00808
lb/10^6Btu	Emission Rate, lb/10^6Btu	7.12E-005	4.22E-005	2.07E-005

* 68° F -- 29.92 Inches of Mercury (Hg)

A. TEST RESULTS

1. Unit No. 1

b. ESP Outlet

5. Mercury

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-PO-M101A-1	10/23/89	Unit No. 1 ESP Outlet	Leslie C. Murray
1-PO-M101A-2	10/23/89	Unit No. 1 ESP Outlet	Leslie C. Murray
1-PO-M101A-3	10/23/89	Unit No. 1 ESP Outlet	Leslie C. Murray

		1-PO-M101A-1	1-PO-M101A-2	1-PO-M101A-3
	Run Start Time	930	1335	1630
	Run Finish Time	1251	1557	1851
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.263	0.241	0.263
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9848	0.9848	0.9848
Pbar	Barometric Pressure, Inches Hg	30.10	30.10	30.10
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.50	1.29	1.60
Vm	Volume Of Metered Gas Sample, Dry ACF	85.632	81.033	89.394
tm	Dry Gas Meter Temperature, Degrees F	98	106	100
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	80.538	75.097	83.797
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	438.5	425.5	451.0
Vwstd	Volume of Water Vapor, SCF*	20.640	20.028	21.229
%H_2O	Moisture Content, Percent by Volume	20.4	21.1	20.2
Mfd	Dry Mole Fraction	0.796	0.789	0.798
%CO_2	Carbon Dioxide, Percent By Volume, Dry	11.2	11.3	12.0
%O_2	Oxygen, Percent By Volume, Dry	7.9	7.8	7.0
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.11	30.12	30.20
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.64	27.56	27.74
Pg	Flue Gas Static Pressure, Inches H_2O	-6.20	-7.00	-6.60
Ps	Absolute Flue Gas Pressure, Inches Hg	29.64	29.59	29.61
ts	Flue Gas Temperature, Degrees F	259	259	261
Delta-p	Average Velocity Head, Inches H_2O	0.4946	0.5810	0.5274
vs	Flue Gas Velocity, Feet/Second	47.31	51.40	48.86
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	89,402	96,115	92,213
Qaw	Volumetric Air Flow Rate, Wet ACFM	154,388	167,735	159,446
%I	Isokinetic Sampling Rate, Percent	103.9	107.3	104.8
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	353	383	390

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION

(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-PO-M101A-1	1-PO-M101A-2	1-PO-M101A-3
	Mercury			
fwt	Formula Weight, lb/lb-Mole	200.59	200.59	200.59
ug	Catch Weight, Micrograms	70.5	119	176
ppmvd	Concentration, ppmvd	0.00371	0.00671	0.00889
gr/DSCF	Concentration, grains/DSCF *	1.35E-005	2.45E-005	3.24E-005
lb/hr	Emission Rate, lb/hr	0.0104	0.0201	0.0256
lb/10^6Btu	Emission Rate, lb/10^6Btu	2.93E-005	5.26E-005	6.57E-005

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.1.b.6

A. TEST RESULTS

1. Unit No. 1

b. ESP Outlet

6. Sulfuric Acid Mist

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
1-PO-M8-1	10/26/89	Unit No. 1 ESP Outlet	Barry F. Rudd
1-PO-M8-4	10/27/89	Unit No. 1 ESP Outlet	Barry F. Rudd
1-PO-M8-5	10/27/89	Unit No. 1 ESP Outlet	Barry F. Rudd

		1-PO-M8-1	1-PO-M8-4	1-PO-M8-5
	Run Start Time	905	1515	1815
	Run Finish Time	1115	1726	2026
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.266	0.254	0.266
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9850	0.9850	0.9850
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.62	1.15	1.40
Vm	Volume Of Metered Gas Sample, Dry ACF	89.952	75.827	83.348
tm	Dry Gas Meter Temperature, Degrees F	98	99	98
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	84.363	70.907	78.128
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	453.5	384.5	463.5
Vwstd	Volume of Water Vapor, SCF*	21.346	18.098	21.817
%H_2O	Moisture Content, Percent by Volume	20.2	20.3	21.8
Mfd	Dry Mole Fraction	0.798	0.797	0.782
%CO_2	Carbon Dioxide, Percent By Volume, Dry	12.3	12.5	12.7
%O_2	Oxygen, Percent By Volume, Dry	6.8	6.6	6.5
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.24	30.26	30.29
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.77	27.77	27.61
Pg	Flue Gas Static Pressure, Inches H_2O	-6.00	-5.70	-6.20
Ps	Absolute Flue Gas Pressure, Inches Hg	29.56	29.58	29.54
ts	Flue Gas Temperature, Degrees F	261	261	269
Delta-p	Average Velocity Head, Inches H_2O	0.5674	0.4781	0.4922
vs	Flue Gas Velocity, Feet/Second	50.70	46.52	47.63
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	95,524	87,598	86,917
Qaw	Volumetric Air Flow Rate, Wet ACFM	165,451	151,810	155,433
%I	Isokinetic Sampling Rate, Percent	99.6	100.1	101.3
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	410	381	381

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		1-PO-M8-1	1-PO-M8-4	1-PO-M8-5
	Sulfuric Acid Mist (incl. SO3)			
fwt	Formula Weight, lb/lb-Mole	98.08	98.08	98.08
mg	Catch Weight, Milligrams	13.3	9.2	8.7
ppmvd	Concentration, ppmvd	1.37	1.12	0.964
lb/hr	Emission Rate, lb/hr	1.99	1.50	1.28
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.00486	0.00395	0.00336

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.1.b.7

A. TEST RESULTS

- 1. Unit No. 1
  - b. ESP Outlet
    - 7. Total Hydrocarbons as Methane

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, Florida

SAMPLING LOCATION: Unit No. 1 ESP Outlet

		1-PO-M25A-1	1-PO-M25A-3	1-PO-M25A-4
	Test Date	10/26/89	10/27/89	10/27/89
	Run Start Time	935	1206	1546
	Run Finish Time	1035	1305	1645
Theta	Net Run Time, Minutes	60	60	60
%H2O	Moisture Content, Percent by Volume	22.0	19.9	20.3
%O2	Oxygen, Percent By Volume, Dry	6.8	6.2	6.6
F	F-Factor, DSCF/Million Btu	9,439	9,439	9,439
Qsd	Volumetric Air Flow Rate, Dry SCFM*	89,768	85,616	87,598
	<u>Total Hydrocarbons, as Methane Results</u>			
fwt	Formula Weight, lb/lb-mole	16.04	16.04	16.04
ppmvw	Concentration, ppmvw	1.43	0.585	1.42
ppmvd	Concentration, ppmvd	1.833	0.730	1.782
lb/hr	Emission Rate, lb/hr	0.321	0.125	0.311
Lb/MMBtu	Emission Rate, lb/MMBtu	0.00107	0.000408	0.00102

* From Runs 1-PO-M13B-1, 1-PO-M13-3, and 1-PO-M8-4, Respectively.

APPENDIX A.2.a.1

A. TEST RESULTS

  2. Unit No. 2

    a. Dry Scrubber Inlet

      1. Carbon Dioxide, Oxygen, and Sulfur Dioxide

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 2-SI-CEM-1 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/25/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	3.2	6.7	5.0
218.0 ppm SO2	215.3	219.2	217.3
0.00 % Oxygen	0.01	0.04	0.03
11.93 % Oxygen	11.77	11.69	11.73
0.00 % CO2	0.04	0.26	0.15
11.06 % CO2	11.02	11.14	11.08

Uncorrected Data: 149 ppm SO2
6.0 % Oxygen
13.6 % CO2

CORRECTED RESULTS

147.9 ppm SO2
13.6 % CO2
6.1 % Oxygen
0.327 lb SO2/MBtu

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 2-SI-CEM-2 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/25/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	6.7	5.3	6.0
218.0 ppm SO2	219.2	216.4	217.8
0.00 % Oxygen	0.04	0.02	0.03
11.93 % Oxygen	11.69	11.76	11.73
0.00 % CO2	0.26	0.38	0.32
11.06 % CO2	11.14	11.22	11.18

Uncorrected Data:	
	108 ppm SO2
	6.8 % Oxygen
	12.8 % CO2

CORRECTED RESULTS

105 ppm SO2
12.7 % CO2
6.9 % Oxygen
0.246 lb SO2/MBtu

Corrected Conc. = $\overline{C}$ma(C - Co)/(Cm - Co)

Where: $\overline{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 2-SI-CEM-3 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/25/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	5.3	3.0	4.2
218.0 ppm SO2	216.4	213.5	215.0
0.00 % Oxygen	0.02	0.05	0.04
11.93 % Oxygen	11.76	11.68	11.72
0.00 % CO2	0.38	0.48	0.43
11.06 % CO2	11.22	11.30	11.26

Uncorrected Data:
126 ppm SO2
5.9 % Oxygen
13.9 % CO2

CORRECTED RESULTS

126 ppm SO2
13.6 % CO2
6.0 % Oxygen
0.277 lb SO2/MBtu

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

APPENDIX A.2.a.2

A. TEST RESULTS

  2. Unit No. 2

    a. Dry Scrubber Inlet

      2. Hydrogen Chloride and Hydrogen Fluoride

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-SI-M13B-1	10/25/89	Unit No. 2 Dry Scrubber Inlet	Neill M. Harden
2-SI-M13B-2	10/25/89	Unit No. 2 Dry Scrubber Inlet	Neill M. Harden
2-SI-M13B-3	10/25/89	Unit No. 2 Dry Scrubber Inlet	Neill M. Harden

		2-SI-M13B-1	2-SI-M13B-2	2-SI-M13B-3
	Run Start Time	1300	1600	1920
	Run Finish Time	1420	1758	2026
	Net Traversing Points	15	15	15
Theta	Net Run Time, Minutes	60.00	51.00	53.50
Dia	Nozzle Diameter, Inches	0.263	0.254	0.263
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	1.0052	1.0052	1.0052
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.52	1.45	1.27
Vm	Volume Of Metered Gas Sample, Dry ACF	38.571	31.405	30.382
tm	Dry Gas Meter Temperature, Degrees F	103	110	105
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	36.580	29.413	28.694
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	164.5	141.5	134.5
Vwstd	Volume of Water Vapor, SCF*	7.743	6.660	6.331
$\%H_2O$	Moisture Content, Percent by Volume	17.5	18.5	18.1
Mfd	Dry Mole Fraction	0.825	0.815	0.819
$\%CO_2$	Carbon Dioxide, Percent By Volume, Dry	12.1	12.2	12.1
$\%O_2$	Oxygen, Percent By Volume, Dry	7.1	7.1	7.1
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.22	30.24	30.22
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.08	27.98	28.01
Pg	Flue Gas Static Pressure, Inches H_2O	-2.70	-2.80	-2.60
Ps	Absolute Flue Gas Pressure, Inches Hg	29.80	29.79	29.81
ts	Flue Gas Temperature, Degrees F	349	354	348
Delta-p	Average Velocity Head, Inches H_2O	0.4871	0.5416	0.4429
vs	Flue Gas Velocity, Feet/Second	49.28	52.23	47.01
A	Stack/Duct Area, Square Inches	7,766	7,766	7,766
Qsd	Volumetric Air Flow Rate, Dry SCFM*	85,517	88,957	81,112
Qaw	Volumetric Air Flow Rate, Wet ACFM	159,462	169,008	152,117
%I	Isokinetic Sampling Rate, Percent	101.9	99.4	94.5
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	359	373	340

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-SI-M13B-1	2-SI-M13B-2	2-SI-M13B-3
	<u>Hydrogen Fluoride</u>			
fwt	Formula Weight, lb/lb-Mole	20.01	20.01	20.01
ug	Catch Weight, Micrograms	12426	4423	7635
ppmvd	Concentration, ppmvd	14.4	6.38	11.3
lb/hr	Emission Rate, lb/hr	3.84	1.77	2.85
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.0107	0.00474	0.00839
	<u>Hydrogen Chloride</u>			
fwt	Formula Weight, lb/lb-Mole	36.46	36.46	36.46
mg	Catch Weight, Micrograms	893.5	809.4	733.2
ppmvd	Concentration, ppmvd	569	641	595
lb/hr	Emission Rate, lb/hr	276	324	274
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.770	0.867	0.805

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.a.3

A. TEST RESULTS
    2. Unit No. 2
        a. Dry Scrubber Inlet
            3. Particulate

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-SI-M5-1	10/24/89	Unit No. 2 Dry Scrubber Inlet	Neill M. Harden
2-SI-M5-2	10/24/89	Unit No. 2 Dry Scrubber Inlet	Neill M. Harden
2-SI-M5-3	10/24/89	Unit No. 2 Dry Scrubber Inlet	Neill M. Harden

		2-SI-M5-1	2-SI-M5-2	2-SI-M5-3
	Run Start Time	1225	1522	1824
	Run Finish Time	1348	1642	1945
	Net Traversing Points	15	15	15
Theta	Net Run Time, Minutes	75.00	75.00	75.00
Dia	Nozzle Diameter, Inches	0.260	0.266	0.260
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	1.0052	1.0052	1.0052
Pbar	Barometric Pressure, Inches Hg	30.20	30.20	30.20
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.85	1.72	1.43
Vm	Volume Of Metered Gas Sample, Dry ACF	53.291	51.071	46.941
tm	Dry Gas Meter Temperature, Degrees F	106	106	100
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	50.646	48.521	45.043
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	216.5	304.0	213.0
Vwstd	Volume of Water Vapor, SCF*	10.191	14.309	10.026
%H_2O	Moisture Content, Percent by Volume	16.8	22.8	18.2
Mfd	Dry Mole Fraction	0.832	0.772	0.818
%CO_2	Carbon Dioxide, Percent By Volume, Dry	10.7	13.4	12.7
%O_2	Oxygen, Percent By Volume, Dry	8.5	5.5	6.3
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.05	30.36	30.28
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.03	27.54	28.05
Pg	Flue Gas Static Pressure, Inches H_2O	-3.50	-2.75	-2.75
Ps	Absolute Flue Gas Pressure, Inches Hg	29.94	30.00	30.00
ts	Flue Gas Temperature, Degrees F	361	345	350
Delta-p	Average Velocity Head, Inches H_2O	0.6350	0.5418	0.4916
vs	Flue Gas Velocity, Feet/Second	56.60	52.18	49.40
A	Stack/Duct Area, Square Inches	7,766	7,766	7,766
Qsd	Volumetric Air Flow Rate, Dry SCFM*	98,063	85,725	85,462
Qaw	Volumetric Air Flow Rate, Wet ACFM	183,148	168,846	159,850
%I	Isokinetic Sampling Rate, Percent	100.7	105.5	102.8
F	F-Factor, DSCF/10^6Btu	9,439	9,420	9,420
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	370	402	380

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION

(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-SI-M5-1	2-SI-M5-2	2-SI-M5-3
	Filterable Particulate			
mg	Catch Weight, Milligrams	9,877.1	12,637.3	7215
gr/DSCF	Concentration, grains/DSCF *	3.01	4.02	2.47
gr@12%	Concentration, gr/DSCF @ 12% CO2	3.38	3.60	2.33
gr@7%	Concentration, gr/DSCF @ 7% O2	3.37	3.63	2.35
lb/hr	Emission Rate, lb/hr	2,530	2,953	1,811
lb/10^6Btu	Emission Rate, lb/10^6Btu	6.83	7.34	4.76

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.a.4

A. TEST RESULTS
  2. Unit No. 2
    a. Dry Scrubber Inlet
      4. Sulfuric Acid Mist

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-SI-M8-1	10/25/89	Unit No. 2 Dry Scrubber Inlet	Dennis D. Holzschuh
2-SI-M8-2	10/25/89	Unit No. 2 Dry Scrubber Inlet	Dennis D. Holzschuh
2-SI-M8-3	10/25/89	Unit No. 2 Dry Scrubber Inlet	Dennis D. Holzschuh

		2-SI-M8-1	2-SI-M8-2	2-SI-M8-3
	Run Start Time	1250	1600	1920
	Run Finish Time	1420	1803	2030
	Net Traversing Points	15	15	15
Theta	Net Run Time, Minutes	75.00	60.00	60.00
Dia	Nozzle Diameter, Inches	0.241	0.241	0.241
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9938	0.9938	0.9938
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.03	1.19	1.17
Vm	Volume Of Metered Gas Sample, Dry ACF	40.359	34.187	33.472
tm	Dry Gas Meter Temperature, Degrees F	96	99	95
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	38.272	32.258	31.809
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	159.5	140.5	133.5
Vwstd	Volume of Water Vapor, SCF*	7.508	6.613	6.284
%H_2O	Moisture Content, Percent by Volume	16.4	17.0	16.5
Mfd	Dry Mole Fraction	0.836	0.830	0.835
%CO_2	Carbon Dioxide, Percent By Volume, Dry	12.1	12.2	12.1
%O_2	Oxygen, Percent By Volume, Dry	7.1	7.1	7.1
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.22	30.24	30.22
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.22	28.16	28.20
Pg	Flue Gas Static Pressure, Inches H_2O	-2.60	-2.60	-2.60
Ps	Absolute Flue Gas Pressure, Inches Hg	29.81	29.81	29.81
ts	Flue Gas Temperature, Degrees F	355	357	357
Delta-p	Average Velocity Head, Inches H_2O	0.4916	0.5192	0.5199
vs	Flue Gas Velocity, Feet/Second	49.56	51.05	51.05
A	Stack/Duct Area, Square Inches	7,766	7,766	7,766
Qsd	Volumetric Air Flow Rate, Dry SCFM*	86,537	88,282	88,814
Qaw	Volumetric Air Flow Rate, Wet ACFM	160,368	165,189	165,189
%I	Isokinetic Sampling Rate, Percent	100.4	103.7	101.6
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	363	371	373

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION

(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-SI-M8-1	2-SI-M8-2	2-SI-M8-3
	Sulfuric Acid Mist (incl. SO3)			
fwt	Formula Weight, lb/lb-Mole	98.08	98.08	98.08
mg	Catch Weight, Milligrams	1.4	3.3	10.3
ppmvd	Concentration, ppmvd	0.317	0.886	2.80
lb/hr	Emission Rate, lb/hr	0.419	1.19	3.80
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.00115	0.00322	0.0102

* 68° F -- 29.92 Inches of Mercury (Hg)

A. TEST RESULTS

  2. Unit No. 2

    b. ESP Outlet

      1. Beryllium

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-PO-M104-1	10/24/89	Unit No. 2 ESP Outlet	Dennis D. Holzchuh
2-PO-M104-2	10/24/89	Unit No. 2 ESP Outlet	Dennis D. Holzchuh
2-PO-M104-3	10/24/89	Unit No. 2 ESP Outlet	Dennis D. Holzchuh

		2-PO-M104-1	2-PO-M104-2	2-PO-M104-3
	Run Start Time	1145	1440	1750
	Run Finish Time	1400	1655	2011
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.266	0.254	0.266
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9850	0.9850	0.9850
Pbar	Barometric Pressure, Inches Hg	29.90	29.90	29.90
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.75	1.32	1.37
Vm	Volume Of Metered Gas Sample, Dry ACF	92.607	80.141	82.376
tm	Dry Gas Meter Temperature, Degrees F	96	97	98
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	86.904	74.992	76.954
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	447.5	463.5	420.0
Vwstd	Volume of Water Vapor, SCF*	21.064	21.817	19.769
$\%H_2O$	Moisture Content, Percent by Volume	19.5	22.5	20.4
Mfd	Dry Mole Fraction	0.805	0.775	0.796
$\%CO_2$	Carbon Dioxide, Percent By Volume, Dry	10.0	12.0	12.2
$\%O_2$	Oxygen, Percent By Volume, Dry	9.4	7.1	7.0
Md	Gas Molecular Weight, lb/lb-Mole, Dry	29.98	30.20	30.23
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.64	27.45	27.74
Pg	Flue Gas Static Pressure, Inches H_2O	-7.20	-6.40	-5.00
Ps	Absolute Flue Gas Pressure, Inches Hg	29.37	29.43	29.53
ts	Flue Gas Temperature, Degrees F	259	260	260
Delta-p	Average Velocity Head, Inches H_2O	0.6173	0.5281	0.4821
vs	Flue Gas Velocity, Feet/Second	53.10	49.27	46.75
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	100,554	89,883	87,894
Qaw	Volumetric Air Flow Rate, Wet ACFM	173,283	160,784	152,561
%I	Isokinetic Sampling Rate, Percent	97.4	103.2	98.7
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	352	377	372

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION

(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-PO-M104-1	2-PO-M104-2	2-PO-M104-3
	Beryllium			
fwt	Formula Weight, lb/lb-Mole	9.01	9.01	9.01
ug	Catch Weight, Micrograms	< .5	< .5	< .5
ppmvd	Concentration, ppmvd	< 5.42E-004	< 6.29E-004	< 6.13E-004
gr/DSCF	Concentration, grains/DSCF *	< 8.88E-008	< 1.03E-007	< 1.00E-007
lb/hr	Emission Rate, lb/hr	< 7.65E-005	< 7.93E-005	< 7.55E-005
lb/10^6Btu	Emission Rate, lb/10^6Btu	< 2.18E-007	< 2.10E-007	< 2.03E-007

< Indicates the value is below the detection limit.

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.b.2

A. TEST RESULTS

  2. Unit No. 2

    b. ESP Outlet

      2. Carbon Dioxide, Carbon Monoxide, Nitrogen Oxides, Oxygen, and Sulfur Dioxide

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 2-PO-CEM-1 (OUTLET)
SOURCE: N. Co. Resource Recov   DATE: 10/25/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	1.0	2.9	2.0
49.6 ppm SO2	49.0	51.3	50.2
0.0 ppm NOx	0.7	1.5	1.1
240.0 ppm NOx	233.1	238.5	235.8
0.0 ppm CO	0.7	0.1	0.4
24.8 ppm CO	23.5	23.5	23.5
0.00 % Oxygen	0.02	0.01	0.02
11.93 % Oxygen	11.84	11.76	11.80
0.00 % CO2	0.02	0.10	0.06
11.06 % CO2	11.26	11.36	11.31

Uncorrected Data:		
	45 ppm SO2	6.2 % Oxygen
	214 ppm NOx	13.3 % CO2
	17 ppm CO	94,721 DSCFM

CORRECTED RESULTS

44.2 ppm SO2	13.0 % CO2
217.7 ppm NOx	6.3 % Oxygen
15.5 ppm CO	41.7 lb SO2/hr
0.099 lb SO2/MBtu	147.7 lb NO2/hr
0.351 lb NOx/MBtu	6.4 lb CO/hr
0.015 lb CO/MBtu	

Corrected Conc. = $\bar{\text{C}}$ma(C - Co)/(Cm - Co)

Where: $\bar{\text{C}}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 2-PO-CEM-2 (OUTLET)
SOURCE: N. Co. Resource Recov DATE: 10/25/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	2.9	2.7	2.8
49.6 ppm SO2	51.3	49.8	50.6
0.0 ppm NOx	1.5	1.6	1.6
240.0 ppm NOx	238.5	238.3	238.4
0.0 ppm CO	0.1	0.1	0.1
24.8 ppm CO	23.5	23.5	23.5
0.00 % Oxygen	0.01	0.00	0.01
11.93 % Oxygen	11.76	11.60	11.68
0.00 % CO2	0.10	0.10	0.10
11.06 % CO2	11.36	11.36	11.36

Uncorrected Data:		
	38 ppm SO2	7.0 % Oxygen
	216 ppm NOx	12.6 % CO2
	27 ppm CO	92,893 DSCFM

CORRECTED RESULTS

36.5 ppm SO2	12.3 % CO2
217.3 ppm NOx	7.1 % Oxygen
25.0 ppm CO	33.8 lb SO2/hr
0.087 lb SO2/MBtu	144.6 lb NO2/hr
0.371 lb NOx/MBtu	10.1 lb CO/hr
0.026 lb CO/MBtu	

Corrected Conc. = $\bar{C}ma(C - Co)/(Cm - Co)$

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 2-PO-CEM-3 (OUTLET)
SOURCE: N. Co. Resource Recov   DATE: 10/25/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	2.7	2.6	2.7
49.6 ppm SO2	49.8	53.9	51.9
0.0 ppm NOx	1.6	1.5	1.6
240.0 ppm NOx	238.3	240.3	239.3
0.0 ppm CO	0.1	0.5	0.3
24.8 ppm CO	23.5	21.2	22.4
0.00 % Oxygen	0.00	0.00	0.00
11.93 % Oxygen	11.60	11.73	11.67
0.00 % CO2	0.10	0.18	0.14
11.06 % CO2	11.36	11.44	11.40

Uncorrected Data:		
	34 ppm SO2	6.1 % Oxygen
	211 ppm NOx	13.5 % CO2
	19 ppm CO	88,794 DSCFM

CORRECTED RESULTS

31.6 ppm SO2	13.1 % CO2
211.4 ppm NOx	6.2 % Oxygen
18.2 ppm CO	28.0 lb SO2/hr
0.070 lb SO2/MBtu	134.5 lb NO2/hr
0.339 lb NOx/MBtu	7.0 lb CO/hr
0.018 lb CO/MBtu	

Corrected Conc. = $\overline{C}$ma(C - Co)/(Cm - Co)

Where: $\overline{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

APPENDIX A.2.b.3

A. TEST RESULTS

2. Unit No. 2

b. ESP Outlet

3. Hydrogen Chloride and Hydrogen Fluoride

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-PO-M13B-1	10/25/89	Unit No. 2 ESP Outlet	Leslie C. Murray
2-PO-M13B-2	10/25/89	Unit No. 2 ESP Outlet	Leslie C. Murray
2-PO-M13B-3	10/25/89	Unit No. 2 ESP Outlet	Leslie C. Murray

		2-PO-M13B-1	2-PO-M13B-2	2-PO-M13B-3
	Run Start Time	1300	1600	1920
	Run Finish Time	1412	1710	2030
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	62.50	62.50	62.50
Dia	Nozzle Diameter, Inches	0.254	0.251	0.251
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9848	0.9848	0.9848
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.23	1.23	1.12
Vm	Volume Of Metered Gas Sample, Dry ACF	39.926	39.720	37.801
tm	Dry Gas Meter Temperature, Degrees F	94	96	89
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	37.672	37.343	35.982
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	169.5	213.5	199.0
Vwstd	Volume of Water Vapor, SCF*	7.978	10.049	9.367
$\%H_2O$	Moisture Content, Percent by Volume	17.5	21.2	20.7
Mfd	Dry Mole Fraction	0.825	0.788	0.793
$\%CO_2$	Carbon Dioxide, Percent By Volume, Dry	12.5	12.4	12.2
$\%O_2$	Oxygen, Percent By Volume, Dry	6.6	7.3	7.1
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.26	30.28	30.24
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	28.11	27.68	27.71
Pg	Flue Gas Static Pressure, Inches H_2O	-5.45	-6.05	-4.80
Ps	Absolute Flue Gas Pressure, Inches Hg	29.60	29.56	29.65
ts	Flue Gas Temperature, Degrees F	262	260	259
Delta-p	Average Velocity Head, Inches H_2O	0.5284	0.5479	0.4927
vs	Flue Gas Velocity, Feet/Second	48.63	49.86	47.15
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	94,721	92,893	88,794
Qaw	Volumetric Air Flow Rate, Wet ACFM	158,696	162,710	153,866
%I	Isokinetic Sampling Rate, Percent	98.4	101.8	102.6
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	412	384	373

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-PO-M13B-1	2-PO-M13B-2	2-PO-M13B-3
	Hydrogen Fluoride			
fwt	Formula Weight, lb/lb-Mole	20.01	20.01	20.01
ug	Catch Weight, Micrograms	101	81.1	77.5
ppmvd	Concentration, ppmvd	0.114	0.0922	0.0914
lb/hr	Emission Rate, lb/hr	0.0336	0.0267	0.0253
lb/10^6Btu	Emission Rate, lb/10^6Btu	8.15E-005	6.95E-005	6.79E-005
	Hydrogen Chloride			
fwt	Formula Weight, lb/lb-Mole	36.46	36.46	36.46
mg	Catch Weight, Micrograms	29.5	27.2	28.9
ppmvd	Concentration, ppmvd	18.2	17.0	18.7
lb/hr	Emission Rate, lb/hr	9.81	8.95	9.43
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.0238	0.0233	0.0253

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.b.4

A. TEST RESULTS
  2. Unit No. 2
    b. ESP Outlet
      4. Lead and Particulate

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-PO-M5&12-1	10/24/89	Unit No. 2 ESP Outlet	Barry F. Rudd
2-PO-M5&12-2	10/24/89	Unit No. 2 ESP Outlet	Barry F. Rudd
2-PO-M5&12-3	10/24/89	Unit No. 2 ESP Outlet	Barry F. Rudd

		2-PO-M5&12-1	2-PO-M5&12-2	2-PO-M5&12-3
	Run Start Time	1145	1440	1755
	Run Finish Time	1400	1655	2011
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.251	0.254	0.251
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9973	0.9973	0.9973
Pbar	Barometric Pressure, Inches Hg	29.90	29.90	29.90
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.29	1.14	1.03
Vm	Volume Of Metered Gas Sample, Dry ACF	79.933	75.670	71.681
tm	Dry Gas Meter Temperature, Degrees F	87	89	88
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	77.110	72.705	68.979
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	392.5	444.5	382.5
Vwstd	Volume of Water Vapor, SCF*	18.475	20.923	18.004
%H_2O	Moisture Content, Percent by Volume	19.3	22.3	20.7
Mfd	Dry Mole Fraction	0.807	0.777	0.793
%CO_2	Carbon Dioxide, Percent By Volume, Dry	10.0	12.0	12.2
%O_2	Oxygen, Percent By Volume, Dry	9.4	7.1	7.0
Md	Gas Molecular Weight, lb/lb-Mole, Dry	29.98	30.20	30.23
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.67	27.48	27.70
Pg	Flue Gas Static Pressure, Inches H_2O	-6.90	-5.40	-5.00
Ps	Absolute Flue Gas Pressure, Inches Hg	29.39	29.50	29.53
ts	Flue Gas Temperature, Degrees F	265	258	267
Delta-p	Average Velocity Head, Inches H_2O	0.5930	0.5015	0.4733
vs	Flue Gas Velocity, Feet/Second	52.21	47.86	46.58
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	98,361	87,988	86,404
Qaw	Volumetric Air Flow Rate, Wet ACFM	170,379	156,183	152,006
%I	Isokinetic Sampling Rate, Percent	99.3	102.2	101.1
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	344	369	365

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-PO-M5&12-1	2-PO-M5&12-2	2-PO-M5&12-3
	Filterable Particulate			
mg	Catch Weight, Milligrams	7.2	51	3.5
gr/DSCF	Concentration, grains/DSCF *	1.44E-003	1.08E-002	7.83E-004
gr@12%	Concentration, gr/DSCF @ 12% CO2	1.73E-003	1.08E-002	7.70E-004
gr@7%	Concentration, gr/DSCF @ 7% O2	1.74E-003	1.09E-002	7.83E-004
lb/hr	Emission Rate, lb/hr	1.21	8.16	0.580
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.00353	0.0221	0.00159
	Lead			
fwt	Formula Weight, lb/lb-Mole	207.19	207.19	207.19
ug	Catch Weight, Micrograms	50	60	30
gr/DSCF	Concentration, grains/DSCF *	1.00E-005	1.27E-005	6.71E-006
gr@12%	Concentration, gr/DSCF @ 12% CO2	1.20E-005	1.27E-005	6.60E-006
gr@7%	Concentration, gr/DSCF @ 7% O2	1.21E-005	1.28E-005	6.71E-006
lb/hr	Emission Rate, lb/hr	0.00844	0.00960	0.00497
lb/10^6Btu	Emission Rate, lb/10^6Btu	2.45E-005	2.60E-005	1.36E-005

< Indicates the value is below the detection limit.

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.b.5

A. TEST RESULTS

  2. Unit No. 2

    b. ESP Outlet

      5. Mercury

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-PO-M101A-1	10/24/89	Unit No. 2 ESP Outlet	Leslie C. Murray
2-PO-M101A-2	10/24/89	Unit No. 2 ESP Outlet	Leslie C. Murray
2-PO-M101A-3	10/24/89	Unit No. 2 ESP Outlet	Leslie C. Murray

		2-PO-M101A-1	2-PO-M101A-2	2-PO-M101A-3
	Run Start Time	1145	1440	1755
	Run Finish Time	1400	1655	2011
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.241	0.263	0.241
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9848	0.9848	0.9848
Pbar	Barometric Pressure, Inches Hg	29.90	29.90	29.90
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.18	1.32	0.895
Vm	Volume Of Metered Gas Sample, Dry ACF	78.264	82.383	68.635
tm	Dry Gas Meter Temperature, Degrees F	97	92	91
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	73.195	77.772	64.844
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	386.0	484.0	322.5
Vwstd	Volume of Water Vapor, SCF*	18.169	22.782	15.180
%H_2O	Moisture Content, Percent by Volume	19.9	22.7	19.0
Mfd	Dry Mole Fraction	0.801	0.773	0.810
%CO_2	Carbon Dioxide, Percent By Volume, Dry	10.0	12.0	12.2
%O_2	Oxygen, Percent By Volume, Dry	9.4	7.1	7.0
Md	Gas Molecular Weight, lb/lb-Mole, Dry	29.98	30.20	30.23
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.60	27.43	27.91
Pg	Flue Gas Static Pressure, Inches H_2O	-7.40	-5.20	-5.00
Ps	Absolute Flue Gas Pressure, Inches Hg	29.36	29.52	29.53
ts	Flue Gas Temperature, Degrees F	262	265	263
Delta-p	Average Velocity Head, Inches H_2O	0.5884	0.4946	0.4487
vs	Flue Gas Velocity, Feet/Second	52.00	47.79	45.05
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	97,541	86,622	85,830
Qaw	Volumetric Air Flow Rate, Wet ACFM	169,693	155,955	147,013
%I	Isokinetic Sampling Rate, Percent	103.1	103.6	103.8
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	341	364	363

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-PO-M101A-1	2-PO-M101A-2	2-PO-M101A-3
	Mercury			
fwt	Formula Weight, lb/lb-Mole	200.59	200.59	200.59
ug	Catch Weight, Micrograms	50.3	35.1	45.6
ppmvd	Concentration, ppmvd	0.00291	0.00191	0.00298
gr/DSCF	Concentration, grains/DSCF *	1.06E-005	6.96E-006	1.09E-005
lb/hr	Emission Rate, lb/hr	0.00887	0.00517	0.00798
lb/10^6Btu	Emission Rate, lb/10^6Btu	2.60E-005	1.42E-005	2.20E-005

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.b.6

A. TEST RESULTS
    2. Unit No. 2
        b. ESP Outlet
            6. Sulfuric Acid Mist

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

RUN #	DATE	SAMPLING LOCATION	OPERATOR
2-PO-M8-1	10/25/89	Unit No. 2 ESP Outlet	Barry F. Rudd
2-PO-M8-2	10/25/89	Unit No. 2 ESP Outlet	Barry F. Rudd
2-PO-M8-3	10/25/89	Unit No. 2 ESP Outlet	Barry F. Rudd

		2-PO-M8-1	2-PO-M8-2	2-PO-M8-3
	Run Start Time	1230	1530	1850
	Run Finish Time	1442	1743	2102
	Net Traversing Points	25	25	25
Theta	Net Run Time, Minutes	125.00	125.00	125.00
Dia	Nozzle Diameter, Inches	0.254	0.266	0.254
Cp	Pitot Tube Coefficient	0.840	0.840	0.840
Y	Dry Gas Meter Calibration Factor	0.9973	0.9973	0.9973
Pbar	Barometric Pressure, Inches Hg	30.00	30.00	30.00
Delta-H	Avg. Pressure Differential of Orifice Meter, Inches H_2O	1.15	1.55	1.21
Vm	Volume Of Metered Gas Sample, Dry ACF	75.365	86.210	77.465
tm	Dry Gas Meter Temperature, Degrees F	89	98	91
Vmstd	Volume Of Metered Gas Sample, Dry SCF*	72.655	81.849	74.419
Vlc	Total Volume of Liquid Collected in Impingers & Silica Gel, ml	357.0	435.0	397.0
Vwstd	Volume of Water Vapor, SCF*	16.804	20.475	18.687
$\%H_2O$	Moisture Content, Percent by Volume	18.8	20.0	20.1
Mfd	Dry Mole Fraction	0.812	0.800	0.799
$\%CO_2$	Carbon Dioxide, Percent By Volume, Dry	12.5	12.4	12.2
$\%O_2$	Oxygen, Percent By Volume, Dry	6.6	7.3	7.1
Md	Gas Molecular Weight, lb/lb-Mole, Dry	30.26	30.28	30.24
Ms	Gas Molecular Weight, lb/lb-Mole, Wet	27.96	27.82	27.78
Pg	Flue Gas Static Pressure, Inches H_2O	-6.00	-6.10	-5.00
Ps	Absolute Flue Gas Pressure, Inches Hg	29.56	29.55	29.63
ts	Flue Gas Temperature, Degrees F	258	260	264
Delta-p	Average Velocity Head, Inches H_2O	0.5099	0.5630	0.5352
vs	Flue Gas Velocity, Feet/Second	47.79	50.43	49.27
A	Stack/Duct Area, Square Inches	7,832	7,832	7,832
Qsd	Volumetric Air Flow Rate, Dry SCFM*	92,004	95,354	92,780
Qaw	Volumetric Air Flow Rate, Wet ACFM	155,955	164,570	160,784
%I	Isokinetic Sampling Rate, Percent	97.6	96.8	99.2
F	F-Factor, DSCF/10^6Btu	9,439	9,439	9,439
10^6Btu/hr	Approximate Heat Input, 10^6Btu/hr	400	394	389

* 68° F -- 29.92 Inches of Mercury (Hg)

(Continued next page)

FIELD DATA AND RESULTS TABULATION
(Continued)

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, FL

		2-PO-M8-1	2-PO-M8-2	2-PO-M8-3
	<u>Sulfuric Acid Mist (incl. SO3)</u>			
fwt	Formula Weight, lb/lb-Mole	98.08	98.08	98.08
mg	Catch Weight, Milligrams	4.8	7.9	13.9
ppmvd	Concentration, ppmvd	0.572	0.836	1.62
lb/hr	Emission Rate, lb/hr	0.804	1.22	2.29
lb/10^6Btu	Emission Rate, lb/10^6Btu	0.00201	0.00309	0.00589

* 68° F -- 29.92 Inches of Mercury (Hg)

APPENDIX A.2.b.7

A. TEST RESULTS

  2. Unit No. 2

    b. ESP Outlet

      7. Total Hydrocarbons as Methane

FIELD DATA AND RESULTS TABULATION

PLANT: North County Regional Resource Recovery Facility, West Palm Beach, Florida

SAMPLING LOCATION: Unit No. 2 ESP Outlet

		2-PO-M25A-1	2-PO-M25A-2	2-PO-M25A-3
	Test Date	10/25/89	10/25/89	10/25/89
	Run Start Time	1301	1601	1921
	Run Finish Time	1400	1700	2020
Theta	Net Run Time, Minutes	60	60	60
%H20	Moisture Content, Percent by Volume*	17.5	21.2	20.7
%O2	Oxygen, Percent By Volume, Dry*	6.6	7.3	7.1
F	F-Factor, DSCF/Million Btu	9,439	9,439	9,439
Qsd	Volumetric Air Flow Rate, Dry SCFM*	94,721	92,893	88,794
	Total Hydrocarbons, as Methane Results			
fwt	Formula Weight, lb/lb-mole	16.04	16.04	16.04
ppmvw	Concentration, ppmvw	0.594	0.882	0.745
ppmvd	Concentration, ppmvd	0.720	1.119	0.939
lb/hr	Emission Rate, lb/hr	0.170	0.260	0.208
Lb/MMBtu	Emission Rate, lb/MMBtu	0.000413	0.000676	0.000559

* From Runs 2-PO-M13B-1, 2-PO-M13B-2, and 2-PO-M13B-3, Respectively.

APPENDIX A.3

A. TEST RESULTS

3. Example Calculations

EXAMPLE TEST CALCULATIONS RUN 1-SI-M13B-1

Unit No. 1 Dry Scrubber Inlet

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$\text{Vmstd} = 17.64 * Y * \text{Vm} * \frac{\text{Pbar} + (\text{Delta H}/13.6)}{(460 + \text{tm})}$$

$$\text{Vmstd} = 17.64 * 1.0052 * 27.905 * \frac{30.00 + (1.060/13.6)}{(460 + 99)} = 26.624 \text{ DSCF}$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$\text{Vwstd} = 0.04707 * \text{Vlc}$

$\text{Vwstd} = 0.04707 * 119.5 = 5.625$ SCF

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN FLUE GAS

$\%H_2O = 100 * \text{Vwstd} / (\text{Vwstd} + \text{Vmstd})$

$$\%H_2O = \frac{5.625}{5.625 + 26.624} * 100 = 17.4 \%$$

ABSOLUTE FLUE GAS PRESSURE

$\text{Ps} = \text{Pbar} + (\text{Pg} / 13.6)$

$\text{Ps} = 30.00 + (-2.75/13.6) = 29.80$ inches Hg

DRY MOLE FRACTION OF FLUE GAS

$\text{Mfd} = 1 - \%H_2O / 100$

$\text{Mfd} = 1 - 17.4/100 = 0.826$

DRY MOLECULAR WEIGHT OF FLUE GAS

$\text{Md} = (\%CO_2/100 * 44) + (\%O_2/100 * 32) + ((100 - \%CO_2 - \%O_2)/100 * 28)$

$\text{Md} = (12.5/100 * 44) + (6.5/100 * 32) + ((100 - 12.5 - 6.5)/100 * 28)$

Md = 30.26 lb/lb-Mole

WET MOLECULAR WEIGHT OF FLUE GAS

$\text{Ms} = (\text{Md} * \text{Mfd}) + (0.18 * \%H_2O)$

$\text{Ms} = (30.26 * 0.826) + (0.18 * 17.4) = 28.13$ lb/lb-Mole

AVERAGE FLUE GAS VELOCITY [Note: (Delta p)avg is square of average square root]

$$vs = 85.49 * Cp * \text{SQUARE ROOT}\left[\frac{(\text{Delta P})avg * (460 + ts)}{Ps * Ms}\right]$$

$$vs = 85.49 * 0.840 * \text{SQUARE ROOT}\left[\frac{0.4968 * (460 + 351)}{29.80 * 28.13}\right] = 49.79 \text{ ft/sec}$$

DRY VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{Tstd}{460 + ts} * \frac{Ps}{Pstd}$$

$$Qsd = \frac{60}{144} * 0.826 * 49.79 * 7{,}766.0 * \frac{528}{460 + 351} * \frac{29.80}{29.92}$$

$$Qsd = 86{,}293 \text{ SCFM}$$

WET VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Qaw = 60 / 144 * vs * A$$

$$Qaw = 60 / 144 * 49.79 * 7{,}766.0 = 161{,}112 \text{ ACFM}$$

PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{Pstd}{Tstd} * \frac{100}{60} * \frac{(ts + 460) * Vmstd}{Ps * vs * Mfd * Theta * (\pi * (NozzleDia/2)^2/144)}$$

$$\%I = \frac{29.92}{528} * \frac{100}{60} * \frac{(351 + 460) * 26.624}{29.80 * 49.79 * 0.826 * 52.00 * (\pi * (0.241/2)^2/144)}$$

$$\%I = 101.0 \ \%$$

APPROXIMATE HEAT INPUT RATE

$$10^6 \text{ Btu/hr} = 60 * \frac{Qsd}{F} * \frac{20.9 - \%O_2}{20.9}$$

$$10^6 \text{ Btu/hr} = 60 * \frac{86{,}293}{9{,}439} * \frac{20.9 - 6.5}{20.9} = 378.0 \ 10^6 \text{ Btu/hr}$$

CONCENTRATION, PARTS PER MILLION BY VOLUME DRY, HYDROGEN FLUORIDE

$$ppmvd = \frac{385.3 * 10^6 * (ug/10^6)}{453.592 * \text{Mol. Wt.} * Vmstd}$$

$$ppmvd = \frac{385.3 * 10^6 * (5265.0/10^6)}{453.592 * 20.01 * 26.624} = 8.39 \text{ ppmvd}$$

EMISSION RATE, POUNDS PER HOUR, HYDROGEN FLUORIDE

$$\text{lb/hr} = \frac{60}{453.592} * \frac{(\text{ug} / 10^6)}{\text{Vmstd}} * \text{Qsd}$$

$$\text{lb/hr} = \frac{60}{453.592} * \frac{(5265.0/10^6)}{26.624} * 86{,}293 = 2.26 \quad \text{lb/hr}$$

EMISSION RATE, POUNDS PER MILLION BTU, HYDROGEN FLUORIDE

$$\text{lb}/10^6\,\text{Btu} = \frac{(\text{ug} / 10^6)}{453.592 * \text{Vmstd}} * F * \frac{20.9}{20.9 - \%O_2}$$

$$\text{lb}/10^6\,\text{Btu} = \frac{(5265.0/10^6)}{453.592 * 26.624} * 9{,}439 * \frac{20.9}{20.9 - 6.5} = 0.00597 \quad \text{lb}/10^6\,\text{Btu}$$

EXAMPLE TEST CALCULATIONS RUN 1-PO-101A-1

Unit No. 1 ESP Outlet

VOLUME OF DRY GAS SAMPLED AT STANDARD CONDITIONS

$$Vmstd = 17.64 * Y * Vm * \frac{Pbar + (Delta\ H/13.6)}{(460 + tm)}$$

$$Vmstd = 17.64 * 0.9848 * 85.632 * \frac{30.10 + (1.500/13.6)}{(460 + 98)} = 80.538\ DSCF$$

VOLUME OF WATER VAPOR AT STANDARD CONDITIONS

$Vwstd = 0.04707 * Vlc$

$Vwstd = 0.04707 * 438.5 = 20.640$ SCF

PERCENT MOISTURE, BY VOLUME, AS MEASURED IN FLUE GAS

$\%H_2O = 100 * Vwstd / (Vwstd + Vmstd)$

$$\%H_2O = \frac{20.640}{20.640 + 80.538} * 100 = 20.4\ \%$$

ABSOLUTE FLUE GAS PRESSURE

$Ps = Pbar + (Pg / 13.6)$

$Ps = 30.10 + (-6.20/13.6) = 29.64$ inches Hg

DRY MOLE FRACTION OF FLUE GAS

$Mfd = 1 - \%H_2O / 100$

$Mfd = 1 - 20.4/100 = 0.796$

DRY MOLECULAR WEIGHT OF FLUE GAS

$Md = (\%CO_2/100 * 44) + (\%O_2/100 * 32) + ((100 - \%CO_2 - \%O_2)/100 * 28)$

$Md = (11.2/100 * 44) + (7.9/100 * 32) + ((100 - 11.2 - 7.9)/100 * 28)$

$Md = 30.11$ lb/lb-Mole

WET MOLECULAR WEIGHT OF FLUE GAS

$Ms = (Md * Mfd) + (0.18 * \%H_2O)$

$Ms = (30.11 * 0.796) + (0.18 * 20.4) = 27.64$ lb/lb-Mole

AVERAGE FLUE GAS VELOCITY [Note: (Delta p)avg is square of average square root]

$$vs = 85.49 * Cp * \text{SQUARE ROOT}\left[\frac{(\text{Delta P})avg * (460 + ts)}{Ps * Ms}\right]$$

$$vs = 85.49 * 0.840 * \text{SQUARE ROOT}\left[\frac{0.4946 * (460 + 259)}{29.64 * 27.64}\right] = 47.31 \text{ ft/sec}$$

DRY VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Qsd = \frac{60}{144} * Mfd * vs * A * \frac{Tstd}{460 + ts} * \frac{Ps}{Pstd}$$

$$Qsd = \frac{60}{144} * 0.796 * 47.31 * 7{,}832.0 * \frac{528}{460 + 259} * \frac{29.64}{29.92}$$

$$Qsd = 89{,}402 \text{ SCFM}$$

WET VOLUMETRIC FLUE GAS FLOW RATE AT STANDARD CONDITIONS

$$Qaw = 60 / 144 * vs * A$$

$$Qaw = 60 / 144 * 47.31 * 7{,}832.0 = 154{,}388 \text{ ACFM}$$

PERCENT ISOKINETIC OF SAMPLING RATE

$$\%I = \frac{Pstd}{Tstd} * \frac{100}{60} * \frac{(ts + 460) * Vmstd}{Ps * vs * Mfd * Theta * (\pi * (NozzleDia/2)^2/144)}$$

$$\%I = \frac{29.92}{528} * \frac{100}{60} * \frac{(259 + 460) * 80.538}{29.64 * 47.31 * 0.796 * 125.00 * (\pi * (0.263/2)^2/144)}$$

$$\%I = 103.9 \%$$

APPROXIMATE HEAT INPUT RATE

$$10^6 \text{ Btu/hr} = 60 * \frac{Qsd}{F} * \frac{20.9 - \%O_2}{20.9}$$

$$10^6 \text{ Btu/hr} = 60 * \frac{89{,}402}{9{,}439} * \frac{20.9 - 7.9}{20.9} = 353.0 \quad 10^6 \text{ Btu/hr}$$

CONCENTRATION, PARTS PER MILLION BY VOLUME DRY, MERCURY

$$ppmvd = \frac{385.3 * 10^6 * (ug/10^6)}{453.592 * Mol.\ Wt. * Vmstd}$$

$$ppmvd = \frac{385.3 * 10^6 * (70.5/10^6)}{453.592 * 200.59 * 80.538} = 0.00371 \text{ ppmvd}$$

CONCENTRATION, GRAINS PER DRY STANDARD CUBIC FOOT, MERCURY

$$gr/DSCF = \frac{7{,}000}{453.592} * \frac{(ug\ /\ 10^6)}{Vmstd}$$

$$gr/DSCF = \frac{7{,}000}{453.592} * \frac{(70.5/10^6)}{80.538} = \quad 1.35E-005 \quad gr/DSCF$$

EMISSION RATE, POUNDS PER HOUR, MERCURY

$$lb/hr = \frac{60}{453.592} * \frac{(ug\ /\ 10^6)}{Vmstd} * Qsd$$

$$lb/hr = \frac{60}{453.592} * \frac{(70.5/10^6)}{80.538} * 89{,}402 = \quad 0.0104 \quad lb/hr$$

EMISSION RATE, POUNDS PER MILLION BTU, MERCURY

$$lb/10^6\,Btu = \frac{(ug\ /\ 10^6)}{453.592 * Vmstd} * F * \frac{20.9}{20.9 - \%O_2}$$

$$lb/10^6\,Btu = \frac{(70.5/10^6)}{453.592 * 80.538} * 9{,}439 * \frac{20.9}{20.9 - 7.9} = \quad 2.93E-005 \quad lb/10^6\,Btu$$

SPECIAL SOOT BLOW AVERAGING FOR RUN 1-PO-M5&12-2

$$E = \left[Esbr * \frac{(A + B) * S}{A * R}\right] + \left[Enosb * \left(\frac{R - S}{R} - \frac{B * S}{A * R}\right)\right]$$

$$E = \left[0.00565 * \frac{(0.666 + 1.42) * 1.33}{0.666 * 24}\right] + \left[0.00106 * \left(\frac{24 - 1.33}{24} - \frac{1.42 * 1.33}{0.666 * 24}\right)\right]$$

E = 0.00186 Pounds Per Million Btu

where:

E(any) = pounds of particulate emissions per hour

E = average E for daily operating time

Esbr = E of sample containing soot blowing (or average E if more than one run)

Enosb = average E of sample(s) with no soot blowing

A = hours soot blowing during sample(s)

B = hours not soot blowing during sample(s) containing soot blowing

R = average hours of operation per 24 hours

S = average hours of soot blowing per 24 hours

Sulfur Dioxide Removal Efficiency, Percent

$$RE = \frac{\text{Inlet } SO_2 \text{ Emissions} - \text{Outlet } SO_2 \text{ Emissions}}{\text{Inlet } SO_2 \text{ Emissions}} * 100$$

Sulfuric Acid, Hydrogen Fluoride, Hydrogen Chloride, and total acid gases removal efficiencies were calculated in a similar fashion.

Fuel Factor, SCF/MMBtu, dry

$$F_d = \frac{10^6[3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O)]}{GCV}$$

where GCV is the gross calorific value of the fuel in Btu/lb.

APPENDIX B.1.a.1

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

a. Dry Scrubber Inlet

1. Carbon Dioxide, Oxygen, and Sulfur Dioxide

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Calibration Error Check

DATE : 10-26-1989 TIME: 07:27 - 08:25

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.8
1	OUTLET	ppmSO2	49.6	51.0
1	OUTLET	ppmSO2	90.7	89.0
3	OUTLET	ppmNOX	0.0	0.5
3	OUTLET	ppmNOX	240.0	240.6
3	OUTLET	ppmNOX	455.0	454.5
4	OUTLET	ppmCO	0.0	0.6
4	OUTLET	ppmCO	24.8	23.1
4	OUTLET	ppmCO	64.3	61.3
4	OUTLET	ppmCO	149.6	149.5
2	OUTLET	% O2	0.00	0.04
2	OUTLET	% O2	12.50	12.51
2	OUTLET	% O2	19.93	19.94
5	OUTLET	% CO2	0.00	0.01
5	OUTLET	% CO2	11.06	11.29
5	OUTLET	% CO2	17.50	17.48
6	INLET	ppmSO2	0.0	0.2
6	INLET	ppmSO2	218.0	218.1
6	INLET	ppmSO2	454.1	455.8
7	INLET	% O2	0.00	0.05
7	INLET	% O2	12.50	12.52
7	INLET	% O2	19.93	19.92
8	INLET	% CO2	0.00	0.01
8	INLET	% CO2	11.06	11.04
8	INLET	% CO2	17.50	17.50

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 1 Calibration Bias Check Unit 1

DATE : 10-26-1989 TIME: 08:26 - 08:52

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.4
1	OUTLET	ppmSO2	49.6	50.8
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	232.0
4	OUTLET	ppmCO	0.0	0.2
4	OUTLET	ppmCO	24.8	23.1
2	OUTLET	% O2	0.00	0.01
2	OUTLET	% O2	12.50	12.48
5	OUTLET	% CO2	0.00	0.04
5	OUTLET	% CO2	11.06	11.23
6	INLET	ppmSO2	0.0	2.2
6	INLET	ppmSO2	218.0	215.3
7	INLET	% O2	0.00	0.02
7	INLET	% O2	12.50	12.44
8	INLET	% CO2	0.00	0.04
8	INLET	% CO2	11.06	11.00

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Palm Beach Co. Solid Waste Authority  Compliance     10-26-1989
         CHAN 1   CHAN 3   CHAN 4   CHAN 2   CHAN 5   CHAN 6   CHAN 7   CHAN 8   OUTLET   OUTLET   OUTLET   INLET
         OUTLET   OUTLET   OUTLET   OUTLET   OUTLET   INLET    INLET    INLET    lb SO2   lb NOX   lb CO    lb SO2
TIME     ppmSO2   ppmNOX   ppmCO    % O2     % CO2    ppmSO2   % O2     % CO2    MBTU     MBTU     MBTU     MBTU
09:06     58.8    223.1     37.0     7.38    12.36    127.6     6.98    12.60    0.144    0.394    0.040    0.304
09:07     56.9    221.7     37.7     7.41    12.33    128.8     6.86    12.73    0.140    0.393    0.041    0.305
09:08     53.0    225.4     37.7     7.39    12.38    128.4     6.95    12.63    0.130    0.398    0.041    0.306
09:09     52.9    224.5     36.0     7.24    12.47    126.1     6.89    12.68    0.129    0.393    0.038    0.299
09:10     50.8    224.9     35.5     7.34    12.40    124.3     7.15    12.42    0.124    0.396    0.038    0.300
09:11     49.7    222.4     34.9     7.40    12.33    127.8     6.78    12.81    0.122    0.393    0.038    0.301
09:12     44.3    221.2     34.7     7.38    12.40    129.7     6.74    12.87    0.109    0.391    0.037    0.304
09:13     41.6    220.7     34.2     7.29    12.46    123.0     7.32    12.25    0.102    0.387    0.037    0.301
09:14     39.1    217.2     35.3     7.43    12.31    120.5     7.49    12.09    0.096    0.385    0.038    0.299
09:15     33.7    211.8     36.4     7.70    12.09    114.1     7.98    11.64    0.085    0.383    0.040    0.293
09:16     27.4    206.4     36.9     8.09    11.80    121.2     7.26    12.30    0.071    0.385    0.042    0.295
09:17     22.5    208.5     36.2     7.83    12.04    124.2     7.10    12.49    0.057    0.381    0.040    0.299
09:18     18.7    212.9     34.2     7.65    12.19    135.9     6.02    13.55    0.047    0.384    0.038    0.303
09:19     14.3    215.7     33.3     7.12    12.68    125.4     7.27    12.30    0.035    0.374    0.035    0.305
09:20     11.3    210.5     33.1     7.24    12.44    124.2     7.13    12.42    0.027    0.368    0.035    0.299

09:21      9.0    209.0     33.6     7.67    12.16    123.1     7.21    12.33    0.023    0.377    0.037    0.298
09:22      7.5    207.2     32.1     7.66    12.16    121.8     7.11    12.40    0.019    0.374    0.035    0.293
09:23      6.9    206.4     31.1     7.73    12.10    123.8     6.90    12.61    0.017    0.374    0.034    0.294
09:24      7.0    208.9     31.0     7.56    12.22    119.9     7.29    12.27    0.017    0.374    0.034    0.292
09:25      6.7    208.5     31.6     7.70    12.11    121.0     7.08    12.46    0.017    0.377    0.035    0.291
09:26      6.8    209.6     31.4     7.82    12.07    128.7     6.62    12.89    0.017    0.383    0.035    0.299
09:27      7.2    217.6     30.0     7.33    12.45    141.1     5.83    13.68    0.018    0.383    0.032    0.311
09:28      9.5    218.1     28.9     6.82    12.92    138.3     6.40    13.12    0.022    0.370    0.030    0.317
09:29     11.3    221.2     29.0     6.72    12.93    144.5     5.83    13.68    0.026    0.373    0.030    0.318
09:30     13.1    223.2     29.2     6.67    13.02    143.4     6.19    13.31    0.030    0.375    0.030    0.324
09:31     12.2    220.0     29.0     6.60    13.04    142.5     5.96    13.54    0.028    0.368    0.029    0.317
09:32     14.3    223.2     29.2     6.63    13.03    143.0     6.17    13.32    0.033    0.374    0.030    0.322
09:33     17.6    226.2     28.7     6.66    12.99    154.1     5.40    14.09    0.041    0.379    0.029    0.330
09:34     22.3    225.1     28.1     6.28    13.38    148.9     5.91    13.58    0.051    0.368    0.028    0.330
09:35     26.2    223.9     27.9     6.38    13.26    156.9     5.29    14.19    0.060    0.368    0.028    0.334

AVERAGE VALUES FOR THE LAST 15 MINUTES
09:35     11.8    216.5     30.1     7.08    12.66    136.7     6.35    13.16    0.028    0.374    0.032    0.311

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AVERAGE VALUES FOR THE LAST HOUR: 30 MINUTES OF VALID DATA
09:35     25.1    217.2     32.8     7.27    12.48    131.1     6.70    12.84    0.061    0.381    0.035    0.306
----------------------------------------------------------------------------------------------------------------
09:36     30.1    225.7     27.8     6.09    13.57    170.1     4.66    14.78    0.067    0.364    0.027    0.348
09:37     36.3    228.7     26.8     5.54    14.05    178.1     4.89    14.57    0.078    0.356    0.025    0.369
09:38     45.0    226.1     26.4     5.36    14.18    169.5     4.97    14.47    0.096    0.347    0.025    0.353
09:39     43.9    226.1     26.8     5.62    13.91    160.7     5.77    13.69    0.095    0.354    0.026    0.353
09:40     39.8    225.8     27.1     5.99    13.55    167.6     5.02    14.41    0.089    0.362    0.026    0.351
09:41     37.2    222.0     28.2     6.09    13.56    190.4     4.51    14.94    0.083    0.358    0.028    0.365
09:42     42.6    223.1     28.9     5.42    14.16    171.1     4.76    14.69    0.091    0.344    0.027    0.352
09:43     44.9    224.5     29.8     5.33    14.24    174.6     4.64    14.80    0.096    0.344    0.028    0.357
09:44     48.0    216.9     42.2     5.05    14.47    165.1     5.26    14.20    0.101    0.327    0.039    0.351
09:45     48.1    217.8     42.9     5.20    14.27    152.7     6.01    13.49    0.102    0.331    0.040    0.341
09:46     44.9    214.3     34.4     5.79    13.78    165.9     4.94    14.54    0.099    0.339    0.033    0.345
09:47     47.3    214.9     58.9     5.47    14.14    154.2     5.76    13.75    0.102    0.333    0.055    0.338
09:48     46.8    221.0     45.4     5.61    13.94    145.1     6.60    12.89    0.102    0.345    0.043    0.337
09:49     45.6    219.2     37.8     6.09    13.45    135.6     7.21    12.27    0.102    0.354    0.037    0.329
09:50     42.7    221.4     33.6     7.01    12.65    135.4     7.20    12.31    0.102    0.381    0.035    0.328
```

[illegible]

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
09:50	42.9	221.8	34.5	5.71	13.86	161.8	5.48	13.99	0.094	0.349	0.033	0.348
09:51	42.6	222.2	36.2	7.40	12.43	168.0	4.69	14.81	0.105	0.393	0.039	0.344
09:52	54.3	227.9	33.9	6.14	13.68	176.7	4.33	15.12	0.122	0.369	0.033	0.354
09:53	65.4	228.0	30.5	5.09	14.50	174.0	4.44	15.01	0.137	0.344	0.028	0.351
09:54	70.6	224.4	28.8	4.95	14.58	160.9	5.19	14.28	0.147	0.336	0.026	0.340
09:55	66.3	227.7	26.4	5.35	14.18	163.0	5.10	14.40	0.142	0.350	0.025	0.343
09:56	67.1	228.2	22.6	5.54	14.05	168.6	4.68	14.79	0.145	0.355	0.021	0.345
09:57	76.1	227.9	21.5	5.41	14.20	165.4	5.12	14.37	0.163	0.351	0.020	0.348
09:58	81.3	228.4	22.0	5.57	14.01	162.1	5.39	14.12	0.176	0.356	0.021	0.347
09:59	79.9	226.4	22.0	5.84	13.77	155.8	5.69	13.80	0.176	0.359	0.021	0.340
10:00	75.8	226.7	21.7	6.12	13.51	163.1	5.10	14.39	0.170	0.366	0.021	0.343
10:01	77.4	225.7	20.9	5.92	13.74	159.3	5.36	14.17	0.171	0.360	0.020	0.340
10:02	78.2	226.3	21.2	5.89	13.76	165.6	4.96	14.54	0.173	0.360	0.021	0.345
10:03	77.2	226.6	21.0	5.76	13.90	165.2	5.13	14.37	0.169	0.357	0.020	0.348
10:04	70.5	223.0	21.7	5.65	13.97	163.4	5.18	14.33	0.154	0.349	0.021	0.345
10:05	62.4	222.7	22.7	5.71	13.91	169.4	4.77	14.73	0.136	0.350	0.022	0.349
AVERAGE VALUES FOR THE LAST 15 MINUTES												
10:05	69.7	226.1	24.9	5.76	13.88	165.4	5.01	14.48	0.152	0.357	0.024	0.345
10:06	56.8	223.7	22.3	5.63	14.03	169.8	4.72	14.76	0.124	0.350	0.021	0.348
10:07	51.7	224.0	23.1	5.39	14.22	161.9	5.23	14.27	0.111	0.345	0.022	0.343
10:08	45.2	225.8	22.7	5.49	14.07	154.5	5.73	13.78	0.097	0.350	0.021	0.338
10:09	40.0	224.3	21.3	5.90	13.71	156.7	5.45	14.08	0.088	0.357	0.021	0.337
10:10	37.3	221.6	22.1	6.07	13.58	155.8	5.33	14.18	0.084	0.357	0.022	0.332
10:11	36.7	223.3	21.7	6.10	13.59	160.2	5.37	14.16	0.082	0.360	0.021	0.342
10:12	38.0	222.6	21.4	5.89	13.74	149.5	5.92	13.62	0.084	0.354	0.021	0.331
10:13	38.1	220.1	22.4	6.15	13.49	144.7	5.95	13.59	0.086	0.356	0.022	0.321
10:14	34.8	221.7	22.4	6.41	13.28	143.3	5.93	13.61	0.080	0.365	0.022	0.318
10:15	32.9	221.3	22.4	6.43	13.26	143.3	5.97	13.58	0.076	0.365	0.022	0.319
10:16	32.1	223.1	22.2	6.44	13.26	138.4	6.33	13.22	0.074	0.368	0.022	0.315
10:17	32.9	221.5	24.2	6.55	13.11	134.5	6.64	12.92	0.076	0.369	0.024	0.313
10:18	31.2	221.2	27.1	7.02	12.70	135.0	6.63	12.91	0.075	0.381	0.028	0.314
10:19	31.3	220.4	29.9	7.08	12.69	133.9	6.66	12.86	0.075	0.381	0.031	0.312
10:20	28.5	218.3	31.9	7.11	12.60	129.7	7.33	12.17	0.069	0.378	0.034	0.317
AVERAGE VALUES FOR THE LAST 15 MINUTES												
10:20	37.8	222.2	23.8	6.25	13.42	147.4	5.95	13.58	0.085	0.362	0.024	0.327
10:21	24.3	216.7	29.6	7.60	12.22	125.2	7.14	12.40	0.061	0.389	0.032	0.302
10:22	28.2	217.2	29.3	7.70	12.15	119.5	7.53	11.99	0.071	0.393	0.032	0.297
10:23	29.5	214.1	27.7	7.83	12.02	116.0	7.83	11.73	0.075	0.391	0.031	0.295
10:24	30.4	212.2	28.2	8.12	11.78	117.8	7.51	12.06	0.079	0.396	0.032	0.292
10:25	29.9	212.7	29.5	8.25	11.71	120.9	7.59	11.98	0.078	0.401	0.034	0.301
10:26	32.0	215.2	28.2	7.97	11.91	112.0	8.00	11.60	0.082	0.398	0.032	0.289
10:27	31.8	217.3	28.8	8.17	11.76	115.2	7.55	12.00	0.083	0.408	0.033	0.287
10:28	32.0	218.0	30.3	8.09	11.84	117.4	7.50	12.04	0.083	0.406	0.034	0.291
10:29	33.9	217.7	31.3	7.99	11.88	122.2	7.08	12.49	0.087	0.403	0.035	0.294
10:30	34.9	223.7	33.0	7.84	12.06	121.5	7.19	12.35	0.089	0.409	0.037	0.294
10:31	36.4	223.5	31.5	7.63	12.19	124.4	7.06	12.51	0.091	0.402	0.035	0.299
10:32	36.1	224.9	31.1	7.52	12.30	129.0	6.64	12.96	0.090	0.401	0.034	0.300
10:33	38.5	228.3	30.7	7.22	12.56	127.7	6.84	12.73	0.094	0.399	0.033	0.302

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
10:34	40.3	229.3	30.4	7.13	12.59	125.8	6.75	12.83	0.097	0.398	0.032	0.295
10:35	39.8	229.5	31.9	7.21	12.54	132.9	6.54	12.95	0.097	0.400	0.034	0.307
AVERAGE VALUES FOR THE LAST 15 MINUTES												
10:35	33.2	220.0	30.1	7.75	12.10	121.8	7.25	12.31	0.084	0.400	0.033	0.296
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
10:35	45.9	222.5	28.3	6.37	13.32	149.1	5.92	13.59	0.104	0.367	0.028	0.329
10:36	40.5	231.2	33.3	6.99	12.73	132.1	6.49	13.08	0.097	0.397	0.035	0.304
10:37	42.4	232.9	33.3	6.80	12.90	133.1	6.55	13.04	0.100	0.395	0.034	0.308
10:38	44.4	230.8	33.6	6.76	12.91	128.5	6.81	12.77	0.104	0.390	0.035	0.303
10:39	43.7	227.0	39.0	6.89	12.77	130.1	6.56	13.04	0.104	0.387	0.040	0.301
10:40	42.3	228.6	44.9	6.96	12.75	136.1	6.12	13.48	0.101	0.392	0.047	0.306
10:41	41.4	230.9	44.0	6.77	12.98	144.1	5.65	13.96	0.097	0.390	0.045	0.314
10:42	44.4	230.6	43.2	6.22	13.45	139.1	5.98	13.61	0.100	0.375	0.043	0.310
10:43	45.4	230.4	44.0	6.29	13.36	127.1	7.13	12.46	0.103	0.377	0.044	0.306
10:44	44.9	224.9	46.7	6.76	12.84	118.7	7.61	11.98	0.105	0.380	0.048	0.297
10:45	40.2	220.1	51.1	7.55	12.19	112.8	8.00	11.62	0.100	0.394	0.056	0.290
10:46	35.2	213.7	51.5	8.06	11.77	110.3	8.04	11.57	0.091	0.398	0.058	0.285
10:47	31.3	211.0	49.5	8.38	11.51	115.7	7.59	11.99	0.083	0.403	0.057	0.289
10:48	34.0	211.6	46.6	8.32	11.62	119.4	7.44	12.16	0.090	0.402	0.054	0.294
10:49	38.8	212.6	43.7	7.99	11.85	113.4	7.83	11.76	0.100	0.393	0.049	0.288
10:50	38.3	214.1	45.7	8.23	11.66	114.7	7.61	11.96	0.100	0.404	0.052	0.287
AVERAGE VALUES FOR THE LAST 15 MINUTES												
10:50	40.5	223.4	43.3	7.27	12.49	125.0	7.03	12.56	0.098	0.392	0.046	0.299
10:51	38.7	215.6	45.6	8.17	11.73	127.1	6.67	12.91	0.101	0.404	0.052	0.296
10:52	39.0	221.5	42.6	7.64	12.22	139.4	6.13	13.47	0.098	0.399	0.047	0.313
10:53	43.0	223.5	40.0	6.84	12.86	134.2	6.48	13.14	0.102	0.380	0.041	0.309
10:54	44.3	222.4	39.4	6.91	12.74	114.1	8.01	11.63	0.105	0.380	0.041	0.294
10:55	42.0	209.9	45.3	7.86	11.84	109.9	8.00	11.61	0.107	0.385	0.051	0.283
10:56	34.9	200.8	61.6	8.76	11.19	120.8	6.91	12.62	0.096	0.395	0.074	0.287
10:57	34.2	201.5	59.8	8.47	11.57	188.5	3.32	16.12	0.091	0.387	0.070	0.355
10:58	49.4	204.2	110.3	5.92	13.95	184.2	3.94	15.58	0.109	0.326	0.105	0.360
10:59	65.2	215.2	107.5	4.62	14.90	188.1	4.21	15.33	0.133	0.316	0.096	0.374
11:00	72.5	221.1	74.8	4.74	14.74	165.2	5.16	14.43	0.149	0.327	0.067	0.349
11:01	70.9	227.6	51.9	5.16	14.40	172.0	4.89	14.70	0.150	0.345	0.048	0.357
11:02	68.9	221.7	43.2	5.29	14.28	162.1	5.64	13.98	0.147	0.339	0.040	0.353
11:03	64.0	227.8	37.9	5.59	14.00	166.1	5.05	14.54	0.139	0.355	0.036	0.348
11:04	61.1	231.7	33.2	5.56	14.08	167.5	5.17	14.44	0.132	0.361	0.031	0.353
11:05	61.6	231.4	30.4	5.48	14.12	164.8	5.09	14.53	0.133	0.358	0.029	0.346
AVERAGE VALUES FOR THE LAST 15 MINUTES												
11:05	52.6	218.4	54.9	6.47	13.24	153.6	5.64	13.94	0.119	0.364	0.055	0.332
11:06	58.3	231.3	28.5	5.81	13.84	163.2	5.21	14.41	0.128	0.366	0.027	0.345
11:07	56.8	230.2	25.7	5.65	14.00	157.0	5.45	14.17	0.124	0.360	0.024	0.338
11:08	56.1	233.1	24.2	5.83	13.79	158.2	5.19	14.42	0.123	0.369	0.023	0.334
11:09	53.7	228.0	24.7	5.76	13.92	159.5	5.30	14.34	0.118	0.360	0.024	0.340
11:10	54.4	228.3	24.2	5.75	13.85	147.1	6.08	13.57	0.119	0.360	0.023	0.330
11:11	51.3	229.6	25.0	6.24	13.41	144.6	6.01	13.63	0.116	0.374	0.025	0.322
11:12	47.9	228.0	24.8	6.38	13.32	141.9	6.11	13.51	0.109	0.375	0.025	0.319

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
11:13	46.2	231.1	25.3	6.51	13.19	149.8	5.61	14.00	0.107	0.384	0.026	0.325
11:14	46.0	229.4	25.2	6.31	13.40	143.9	5.95	13.65	0.105	0.375	0.025	0.320
11:15	46.1	227.6	26.7	6.35	13.30	149.2	5.54	14.07	0.105	0.374	0.027	0.322
11:16	43.8	226.8	27.2	6.27	13.41	144.0	5.43	14.14	0.099	0.370	0.027	0.309

COMMENTS: End of Test 1-1

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1/ Pre-test 2 Calibration Bias Check Unit 1

DATE : 10-26-1989 TIME: 11:16 - 11:39

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	4.8
1	OUTLET	ppmSO2	49.6	53.3
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	235.1
4	OUTLET	ppmCO	0.0	-0.1
4	OUTLET	ppmCO	24.8	22.9
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.34
5	OUTLET	% CO2	0.00	0.18
5	OUTLET	% CO2	11.06	11.42
6	INLET	ppmSO2	0.0	4.2
6	INLET	ppmSO2	218.0	212.5
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.27
8	INLET	% CO2	0.00	0.24
8	INLET	% CO2	11.06	11.11

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Comoliance

REASON: Preliminary Outlet SO2 Calibration Error Check

DATE : 10-26-1989 TIME: 11:40 - 11:47

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.3
1	OUTLET	ppmSO2	49.6	50.7
1	OUTLET	ppmSO2	89.3	89.8

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 2 Outlet SO2 Calibration Bias Check

DATE : 10-26-1989 TIME: 11:48 - 11:53

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.3
1	OUTLET	ppmSO2	49.6	49.9

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:01	43.1	229.4	30.4	7.26	12.49	119.4	7.02	12.57	0.105	0.402	0.032	0.286
12:02	37.8	227.9	31.0	7.34	12.48	119.1	6.96	12.65	0.092	0.401	0.033	0.284
12:03	34.0	226.0	29.6	7.36	12.45	120.3	6.80	12.84	0.083	0.399	0.032	0.283
12:04	32.4	226.4	30.7	7.27	12.54	115.9	7.19	12.41	0.079	0.397	0.033	0.281
12:05	32.0	226.4	31.6	7.40	12.40	119.3	7.06	12.52	0.079	0.401	0.034	0.286
12:06	32.7	227.2	29.9	7.44	12.41	134.3	6.51	13.11	0.081	0.403	0.032	0.310
12:07	38.0	228.9	28.6	7.09	12.67	139.1	6.23	13.38	0.091	0.396	0.030	0.315
12:08	42.7	230.5	28.6	6.90	12.86	128.5	6.76	12.81	0.101	0.393	0.030	0.302
12:09	44.1	229.5	28.5	7.02	12.72	130.0	6.37	13.21	0.105	0.395	0.030	0.297
12:10	42.6	229.9	27.3	6.98	12.78	134.3	5.92	13.69	0.102	0.394	0.029	0.298
12:11	40.5	228.1	25.7	6.61	13.12	123.5	6.88	12.74	0.094	0.381	0.026	0.293
12:12	40.5	227.2	26.0	6.92	12.77	118.7	6.93	12.65	0.096	0.388	0.027	0.282
12:13	39.7	230.2	28.2	7.29	12.53	130.0	6.18	13.47	0.097	0.404	0.030	0.293
12:14	41.6	230.3	27.3	6.81	12.95	122.9	6.46	13.17	0.098	0.390	0.028	0.283
12:15	42.9	232.4	28.2	6.89	12.90	131.9	6.02	13.65	0.102	0.396	0.029	0.294
12:16	44.5	231.4	27.1	6.58	13.18	119.1	7.15	12.54	0.103	0.386	0.028	0.288
12:17	46.2	227.9	27.9	6.98	12.76	117.6	6.78	12.88	0.110	0.391	0.029	0.276
12:18	46.5	225.9	28.6	7.20	12.65	125.6	6.40	13.30	0.113	0.394	0.030	0.288
12:19	50.4	226.3	28.3	7.03	12.76	120.6	7.07	12.60	0.121	0.390	0.030	0.289
12:20	53.5	223.6	26.6	7.26	12.54	122.9	6.48	13.15	0.130	0.392	0.028	0.283
12:21	54.4	228.0	25.4	7.24	12.62	116.9	7.04	12.60	0.132	0.399	0.027	0.280
12:22	54.9	227.0	25.7	7.03	12.72	117.1	6.82	12.83	0.131	0.391	0.027	0.276
12:23	47.8	228.6	27.3	7.25	12.54	111.4	7.56	12.05	0.116	0.400	0.029	0.277
12:24	54.8	225.8	29.0	7.52	12.32	117.9	6.86	12.76	0.136	0.403	0.031	0.279
12:25	71.4	228.9	28.5	7.43	12.41	122.3	6.68	12.93	0.176	0.406	0.031	0.286
12:26	89.8	231.2	27.1	7.24	12.61	128.6	6.55	13.14	0.218	0.404	0.029	0.298
12:27	100.0	232.5	26.2	7.03	12.73	127.5	6.70	12.91	0.239	0.400	0.027	0.298
12:28	100.0	232.3	26.9	7.16	12.67	140.4	5.86	13.79	0.242	0.404	0.028	0.310
12:29	100.0	237.0	26.9	6.61	13.18	131.6	6.28	13.34	0.232	0.396	0.027	0.299
12:30	100.0	237.5	27.2	6.51	13.23	140.3	5.55	14.08	0.231	0.394	0.027	0.304

AVERAGE VALUES FOR THE LAST HOUR: 30 MINUTES OF VALID DATA

12:30	53.3	229.1	28.0	7.09	12.70	124.9	6.64	12.99	0.128	0.396	0.029	0.291

12:31	100.0	240.0	26.8	6.09	13.64	139.7	5.81	13.83	0.224	0.387	0.026	0.307
12:32	100.0	239.2	27.7	6.14	13.57	149.4	5.03	14.57	0.225	0.387	0.027	0.312
12:33	75.7	239.1	26.9	5.69	14.05	158.4	4.80	14.84	0.166	0.375	0.026	0.327
12:34	43.5	238.0	25.9	5.27	14.34	144.4	5.83	13.81	0.092	0.364	0.024	0.318
12:35	27.0	237.8	25.9	5.81	13.80	138.3	6.25	13.40	0.059	0.376	0.025	0.314
12:36	17.1	235.0	26.4	6.35	13.35	144.2	5.64	14.00	0.039	0.386	0.026	0.314
12:37	11.7	236.5	26.1	6.26	13.48	144.5	5.87	13.79	0.026	0.386	0.026	0.319
12:38	9.2	234.7	25.1	6.03	13.64	140.0	6.00	13.63	0.020	0.377	0.024	0.312
12:39	11.8	236.1	26.0	6.46	13.23	134.7	6.43	13.19	0.027	0.390	0.026	0.309
12:40	16.7	233.5	26.4	6.71	13.03	143.3	5.74	13.89	0.039	0.393	0.027	0.314
12:41	22.1	234.8	25.2	6.51	13.22	138.9	6.07	13.56	0.051	0.390	0.025	0.311
12:42	30.5	232.4	24.5	6.39	13.33	135.7	6.19	13.43	0.070	0.382	0.025	0.306
12:43	32.2	233.5	24.1	6.47	13.20	129.9	6.53	13.08	0.074	0.387	0.024	0.300
12:44	29.8	232.9	23.5	6.68	13.04	139.3	5.75	13.86	0.070	0.391	0.024	0.305
12:45	28.4	232.4	22.9	6.41	13.29	131.1	6.44	13.18	0.065	0.383	0.023	0.301

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:51	19.8	231.2	28.4	7.05	12.73	126.7	6.63	13.01	0.047	0.399	0.030	0.295
12:52	23.1	230.1	27.4	6.83	12.86	123.7	6.70	12.91	0.054	0.391	0.028	0.289
12:53	29.2	227.2	27.0	7.01	12.69	107.8	7.77	11.81	0.070	0.391	0.028	0.273
12:54	33.0	220.7	30.2	7.44	12.33	118.0	6.76	12.83	0.081	0.392	0.033	0.277
12:55	35.5	222.9	31.2	7.45	12.36	118.0	6.98	12.61	0.088	0.396	0.034	0.281
12:56	37.8	227.0	31.2	7.29	12.49	118.7	6.79	12.84	0.092	0.398	0.033	0.279
12:57	38.9	229.0	30.3	7.20	12.54	121.8	6.32	13.25	0.094	0.399	0.032	0.277
12:58	40.0	231.5	29.4	7.07	12.71	128.1	6.28	13.36	0.096	0.400	0.031	0.291
12:59	44.2	234.9	27.8	6.77	12.93	124.3	6.70	12.93	0.104	0.397	0.029	0.291
13:00	46.4	233.4	27.5	6.99	12.69	123.1	6.95	12.64	0.111	0.401	0.029	0.293
13:01	49.2	228.9	31.1	7.23	12.50	123.3	6.86	12.74	0.119	0.400	0.033	0.292
13:02	52.4	229.9	28.1	7.30	12.47	126.2	6.70	12.87	0.128	0.404	0.030	0.295
13:03	52.9	229.6	27.4	7.31	12.46	142.9	5.69	13.93	0.129	0.403	0.029	0.312
13:04	54.4	229.3	24.6	6.66	13.10	134.3	6.64	13.02	0.127	0.385	0.025	0.313
13:05	58.2	230.0	25.6	6.75	12.92	133.9	6.67	12.95	0.137	0.388	0.026	0.312

AVERAGE VALUES FOR THE LAST 15 MINUTES

13:05	41.0	229.1	28.5	7.09	12.65	124.7	6.70	12.91	0.099	0.396	0.030	0.291

13:06	56.3	231.7	26.6	7.03	12.71	146.4	6.29	13.34	0.135	0.399	0.028	0.333
13:07	55.2	234.9	24.9	6.86	12.87	148.9	6.16	13.44	0.131	0.399	0.026	0.336
13:08	54.2	235.1	24.2	6.76	12.97	153.7	5.94	13.70	0.127	0.397	0.025	0.341
13:09	57.1	238.8	23.5	6.44	13.25	145.8	6.10	13.53	0.131	0.394	0.024	0.327
13:10	60.7	237.5	24.5	6.60	13.11	146.1	6.22	13.44	0.141	0.397	0.025	0.331
13:11	62.5	238.1	25.1	6.49	13.20	137.7	6.29	13.28	0.144	0.395	0.025	0.313
13:12	59.7	237.4	26.9	6.70	13.05	146.3	5.74	13.93	0.140	0.399	0.028	0.321
13:13	59.2	241.0	27.0	6.22	13.47	136.1	6.16	13.49	0.134	0.392	0.027	0.307
13:14	57.6	242.0	28.3	6.38	13.31	136.9	5.98	13.66	0.132	0.398	0.028	0.305
13:15	56.2	242.9	28.8	6.42	13.27	137.5	6.13	13.50	0.129	0.401	0.029	0.309
13:16	68.0	239.0	29.7	6.51	13.17	137.5	6.05	13.56	0.157	0.397	0.030	0.307
13:17	78.6	237.8	30.9	6.63	13.10	139.2	6.23	13.39	0.183	0.398	0.031	0.315
13:18	79.6	239.1	29.8	6.67	13.05	141.3	6.01	13.62	0.186	0.401	0.030	0.315
13:19	77.6	235.9	28.9	6.53	13.21	138.1	6.34	13.31	0.179	0.392	0.029	0.315
13:20	83.1	234.6	28.8	6.57	13.10	137.3	6.10	13.52	0.193	0.391	0.029	0.308

AVERAGE VALUES FOR THE LAST 15 MINUTES

13:20	64.4	237.7	27.2	6.59	13.12	141.9	6.12	13.51	0.149	0.397	0.028	0.319

13:21	69.1	233.7	28.9	6.59	13.15	141.4	6.01	13.63	0.160	0.390	0.029	0.315
13:22	73.1	235.2	28.2	6.32	13.38	139.5	6.03	13.56	0.167	0.385	0.028	0.311
13:23	86.5	234.0	28.8	6.26	13.43	145.4	5.82	13.82	0.196	0.382	0.029	0.320
13:24	76.6	235.1	29.0	6.29	13.38	141.9	6.09	13.51	0.174	0.384	0.029	0.318
13:25	72.8	234.9	29.9	6.51	13.23	154.5	5.25	14.35	0.168	0.390	0.030	0.328
13:26	76.3	238.0	29.8	6.06	13.65	150.9	5.42	14.18	0.171	0.383	0.029	0.324
13:27	99.6	236.1	28.5	5.92	13.73	144.7	6.33	13.32	0.221	0.376	0.028	0.330
13:28	83.7	234.2	28.5	6.13	13.46	135.3	6.77	12.83	0.188	0.379	0.028	0.318
13:29	40.4	236.0	30.6	6.94	12.77	136.3	6.77	12.85	0.096	0.404	0.032	0.320
13:30	37.9	232.6	31.7	7.12	12.63	138.0	6.55	13.10	0.091	0.403	0.033	0.319
13:31	55.5	233.3	30.0	6.90	12.85	129.8	7.31	12.27	0.132	0.398	0.031	0.317
13:32	59.7	229.5	28.8	7.40	12.37	127.2	7.33	12.33	0.147	0.406	0.031	0.311
13:33	59.7	226.6	30.1	7.45	12.33	115.6	7.82	11.79	0.147	0.402	0.033	0.294
13:34	50.3	221.3	31.8	7.90	11.97	115.8	7.78	11.84	0.128	0.406	0.035	0.293
13:35	46.6	219.3	32.1	8.05	11.90	114.8	7.68	11.93	0.120	0.407	0.036	0.289

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Palm Beach Co. Solid Waste Authority  Compliance     10-26-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2      MBTU      MBTU      MBTU      MBTU
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AVERAGE VALUES FOR THE LAST 15 MINUTES
13:35     65.9     232.0      29.8      6.79     12.95     135.4      6.60     13.02     0.154     0.393     0.031     0.314

13:36     53.6     219.8      30.5      7.75     12.12     122.3      6.91     12.70     0.135     0.399     0.034     0.290
13:37     64.5     223.8      29.9      7.47     12.36     117.3      7.13     12.42     0.160     0.398     0.032     0.283
13:38     72.1     225.6      29.6      7.63     12.22     129.5      6.31     13.30     0.180     0.406     0.032     0.295
13:39     96.0     229.4      26.4      7.01     12.75     125.0      6.71     12.92     0.229     0.394     0.028     0.292
13:40    100.0     227.6      25.8      7.09     12.64     125.8      6.39     13.20     0.240     0.394     0.027     0.288
13:41    100.0     227.1      25.7      7.00     12.77     127.8      6.39     13.24     0.239     0.390     0.027     0.292
13:42    100.0     226.5      24.7      6.78     12.90     117.0      7.18     12.44     0.235     0.383     0.025     0.283
13:43    100.0     224.3      27.7      7.33     12.43     120.0      6.84     12.75     0.245     0.395     0.030     0.283
13:44    100.0     222.9      28.3      7.38     12.43     132.0      6.10     13.50     0.246     0.394     0.030     0.296
13:45     98.2     227.6      27.2      7.07     12.69     130.8      6.40     13.21     0.236     0.393     0.029     0.299
13:46     75.6     227.5      25.9      6.94     12.79     133.1      5.97     13.65     0.180     0.389     0.027     0.296
13:47     76.0     230.6      25.0      6.69     13.04     149.6      5.98     13.63     0.178     0.387     0.026     0.333
13:48     87.1     229.7      24.3      6.53     13.20     160.7      6.39     13.23     0.201     0.382     0.025     0.368
13:49    100.0     229.3      23.0      6.70     13.03     161.7      6.14     13.49     0.234     0.385     0.023     0.364
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CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Calibration Error Check

DATE : 10-27-1989 TIME: 07:28 - 08:17

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.2
1	OUTLET	ppmSO2	49.6	49.9
1	OUTLET	ppmSO2	89.3	90.5
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	241.7
3	OUTLET	ppmNOX	455.0	458.0
4	OUTLET	ppmCO	0.0	0.7
4	OUTLET	ppmCO	24.8	22.8
4	OUTLET	ppmCO	64.3	61.6
4	OUTLET	ppmCO	149.6	150.7
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.52
2	OUTLET	% O2	19.93	19.95
5	OUTLET	% CO2	0.00	0.00
5	OUTLET	% CO2	11.06	11.24
5	OUTLET	% CO2	17.50	17.41
6	INLET	ppmSO2	0.0	0.6
6	INLET	ppmSO2	218.0	216.0
6	INLET	ppmSO2	454.1	456.8
7	INLET	% O2	0.00	0.01
7	INLET	% O2	12.50	12.52
7	INLET	% O2	19.93	19.92
8	INLET	% CO2	0.00	0.00
8	INLET	% CO2	11.06	11.01
8	INLET	% CO2	17.50	17.48

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 2 Calibration Bias Check

DATE : 10-27-1989 TIME: 08:18 - 08:39

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.6
1	OUTLET	ppmSO2	49.6	49.4
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	232.7
4	OUTLET	ppmCO	0.0	0.0
4	OUTLET	ppmCO	24.8	23.7
2	OUTLET	% O2	0.00	0.01
2	OUTLET	% O2	12.50	12.41
5	OUTLET	% CO2	0.00	0.02
5	OUTLET	% CO2	11.06	11.16
6	INLET	ppmSO2	0.0	2.9
6	INLET	ppmSO2	218.0	214.1
7	INLET	% O2	0.00	0.05
7	INLET	% O2	12.50	12.51
8	INLET	% CO2	0.00	0.02
8	INLET	% CO2	11.06	10.94

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
         CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
         OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME     ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
09:14     17.8     203.4      22.6      6.94     12.64     106.4      6.46     13.08     0.042     0.348     0.024     0.245
09:15     17.3     204.5      23.6      6.89     12.75     103.7      6.80     12.78     0.041     0.349     0.024     0.244
09:16     16.8     206.5      23.9      6.93     12.68     112.2      6.17     13.36     0.040     0.353     0.025     0.253
09:17     17.8     210.0      24.1      6.63     12.99     114.2      6.42     13.14     0.041     0.351     0.025     0.262
09:18     19.1     211.4      23.3      6.47     13.08     108.6      6.49     13.06     0.044     0.350     0.023     0.250
09:19     18.1     210.4      23.1      6.73     12.85     106.7      6.75     12.80     0.042     0.355     0.024     0.250
09:20     17.5     209.1      23.3      6.86     12.72     108.4      6.40     13.15     0.041     0.355     0.024     0.248

09:21     18.1     206.1      23.5      6.80     12.83     111.2      6.39     13.16     0.043     0.349     0.024     0.254
09:22     22.1     206.4      22.3      6.58     12.98     109.0      6.53     13.02     0.051     0.344     0.023     0.252
09:23     24.7     205.7      23.4      6.69     12.88     108.9      6.52     13.03     0.058     0.346     0.024     0.251
09:24     25.8     205.6      22.9      6.77     12.83     114.2      6.19     13.38     0.061     0.347     0.024     0.258
09:25     27.5     206.5      22.3      6.51     13.10     109.5      6.49     13.04     0.064     0.343     0.023     0.252
09:26     27.9     206.0      24.7      6.43     13.12     114.7      5.93     13.59     0.064     0.340     0.025     0.254
09:27     27.8     208.5      23.7      6.35     13.21     114.4      6.04     13.48     0.063     0.342     0.024     0.256
09:28     28.0     208.7      22.5      6.24     13.28     111.6      6.24     13.25     0.063     0.340     0.022     0.253
09:29     29.4     206.8      22.0      6.27     13.22     118.4      5.74     13.75     0.067     0.338     0.022     0.259
09:30     29.8     208.5      21.8      6.12     13.42     121.6      5.63     13.88     0.067     0.337     0.021     0.264
09:31     31.3     208.8      22.0      5.84     13.62     111.8      6.45     13.07     0.069     0.331     0.021     0.257
09:32     31.0     208.9      21.4      6.31     13.15     114.1      6.05     13.49     0.071     0.342     0.021     0.255
09:33     31.3     210.2      23.2      6.45     13.13     116.5      6.45     13.08     0.072     0.347     0.023     0.267
09:34     39.9     206.5      29.4      6.16     13.29     108.9      6.68     12.87     0.090     0.335     0.029     0.254
09:35     43.6     209.2      25.4      6.70     12.86     113.4      6.46     13.09     0.102     0.352     0.026     0.261

AVERAGE VALUES FOR THE LAST 15 MINUTES
09:35     29.2     207.5      23.4      6.42     13.13     113.2      6.25     13.28     0.067     0.342     0.023     0.257

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AVERAGE VALUES FOR THE LAST HOUR: 22 MINUTES OF VALID DATA
09:35     25.6     207.6      23.4      6.53     13.03     111.7      6.33     13.21     0.059     0.345     0.024     0.255
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09:36     46.8     206.6      23.0      6.54     13.00     113.0      6.59     13.00     0.108     0.344     0.023     0.262
09:37     48.3     211.2      23.4      6.69     12.89     115.0      6.52     13.07     0.113     0.355     0.024     0.266
09:38     49.8     211.8      22.2      6.58     13.01     114.4      6.52     13.06     0.115     0.353     0.023     0.264
09:39     50.5     208.9      22.4      6.55     13.04     114.3      6.69     12.92     0.117     0.348     0.023     0.267
09:40     50.3     208.6      23.3      6.55     13.01     114.3      6.45     13.16     0.116     0.347     0.024     0.263
09:41     50.5     212.0      22.2      6.63     13.00     115.2      6.58     13.04     0.117     0.355     0.023     0.267
09:42     52.7     215.1      21.2      6.67     12.91     117.0      6.45     13.18     0.123     0.361     0.022     0.269
09:43     51.0     218.9      21.3      6.72     12.92     115.2      6.55     13.08     0.119     0.369     0.022     0.267
09:44     44.2     218.7      21.0      6.68     12.95     124.3      5.82     13.83     0.103     0.367     0.021     0.274
09:45     52.0     218.2      20.5      6.26     13.42     121.4      6.04     13.61     0.118     0.356     0.020     0.271
09:46     54.1     220.6      19.8      6.16     13.44     123.6      6.01     13.66     0.122     0.357     0.020     0.276
09:47     56.4     220.2      20.6      6.16     13.47     122.7      6.27     13.39     0.127     0.357     0.020     0.278
09:48     59.6     221.7      21.4      6.25     13.34     116.7      6.75     12.91     0.135     0.362     0.021     0.274
09:49     60.0     220.4      21.3      6.62     12.98     115.6      6.54     13.13     0.140     0.369     0.022     0.267
09:50     58.4     220.0      21.5      6.80     12.88     120.8      6.26     13.43     0.138     0.373     0.022     0.274

AVERAGE VALUES FOR THE LAST 15 MINUTES
09:50     52.3     215.5      21.7      6.52     13.08     117.6      6.40     13.23     0.121     0.358     0.022     0.269

COMMENTS: Atomizer plugging again
            (CONTINUED ON THE NEXT PAGE)
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Begin Test 3

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
11:52    44.7     200.9      35.6      6.93     12.70     148.9      7.04     12.57     0.106     0.343     0.037     0.357
11:53    40.2     200.9      30.8      6.95     12.66     147.2      6.98     12.65     0.096     0.344     0.032     0.351
11:54    36.1     196.1      28.6      6.89     12.71     147.3      7.32     12.29     0.086     0.334     0.030     0.360
11:55    35.8     187.1      37.5      6.98     12.66     164.2      6.19     13.44     0.085     0.321     0.039     0.371
11:56    34.9     193.0      46.0      6.64     13.04     164.7      5.93     13.72     0.081     0.323     0.047     0.365
11:57    36.0     202.9      38.6      6.22     13.39     159.3      5.84     13.79     0.081     0.330     0.038     0.351
11:58    31.4     204.2      36.3      6.01     13.55     159.3      5.78     13.86     0.070     0.327     0.035     0.350
11:59    27.6     207.9      32.8      6.04     13.56     167.7      5.33     14.29     0.062     0.334     0.032     0.358
12:00    26.4     206.4      34.6      5.70     13.85     161.6      5.70     13.94     0.058     0.324     0.033     0.353
12:01    27.0     206.5      31.4      5.78     13.77     161.5      5.62     13.99     0.059     0.326     0.030     0.351
12:02    26.0     211.5      29.3      5.86     13.70     162.1      5.31     14.30     0.057     0.336     0.028     0.345
12:03    25.6     211.5      31.4      5.61     13.92     160.6      5.78     13.84     0.056     0.330     0.030     0.353
12:04    25.8     214.0      27.7      5.68     13.83     162.6      5.66     13.96     0.056     0.336     0.026     0.354
12:05    26.3     216.3      22.0      5.79     13.74     165.8      5.63     14.00     0.058     0.342     0.021     0.360
12:06    27.0     215.1      20.4      5.81     13.73     166.9      5.50     14.12     0.059     0.340     0.020     0.360

AVERAGE VALUES FOR THE LAST 15 MINUTES
12:06    31.4     205.0      32.2      6.19     13.39     160.0      5.97     13.65     0.071     0.333     0.032     0.356

12:07    25.5     211.9      22.8      5.73     13.83     178.3      4.69     14.91     0.056     0.334     0.022     0.365
12:08    27.5     209.2      24.7      5.29     14.28     173.6      5.40     14.24     0.058     0.320     0.023     0.372
12:09    31.5     213.1      27.3      5.39     14.07     170.2      5.38     14.25     0.067     0.328     0.026     0.364
12:10    33.2     215.1      23.7      5.60     13.94     174.5      5.11     14.54     0.072     0.336     0.023     0.367
12:11    37.8     212.5      24.8      5.36     14.20     179.2      4.93     14.71     0.081     0.327     0.023     0.373
12:12    43.6     213.7      25.2      5.20     14.30     169.4      5.27     14.37     0.092     0.325     0.023     0.360
12:13    48.9     217.6      24.0      5.48     14.07     186.1      4.33     15.25     0.105     0.337     0.023     0.373
12:14    57.5     210.5      25.1      5.06     14.48     167.7      5.29     14.37     0.121     0.318     0.023     0.357
12:15    58.5     206.2      37.8      5.03     14.41     146.3      6.42     13.25     0.122     0.310     0.035     0.336
12:16    52.8     204.8      48.7      5.75     13.74     142.8      6.06     13.64     0.116     0.323     0.047     0.320
12:17    45.2     207.7      41.1      5.94     13.67     136.2      6.55     13.18     0.100     0.332     0.040     0.315
12:18    39.6     212.9      39.4      6.06     13.48     128.4      6.79     12.91     0.089     0.343     0.039     0.302
12:19    32.6     209.9      40.1      6.33     13.29     124.5      6.93     12.75     0.074     0.344     0.040     0.296
12:20    26.5     205.9      43.9      6.40     13.17     121.9      6.80     12.86     0.061     0.339     0.044     0.287
-----------------------------------------------------------------------------------------------------------------------------
AVERAGE VALUES FOR THE LAST HOUR: 29 MINUTES OF VALID DATA
12:20    35.6     207.8      32.1      5.91     13.65     158.6      5.85     13.79     0.079     0.331     0.031     0.349
-----------------------------------------------------------------------------------------------------------------------------
12:21    22.6     202.9      38.5      6.49     13.11     120.0      6.68     12.95     0.052     0.336     0.039     0.280

AVERAGE VALUES FOR THE LAST 15 MINUTES
12:21    38.9     210.3      32.5      5.67     13.87     154.6      5.77     13.88     0.084     0.330     0.031     0.338

12:22    21.8     207.2      34.0      6.45     13.11     119.1      6.70     12.87     0.050     0.342     0.034     0.278
12:23    22.4     200.7      34.0      6.34     13.17     117.2      7.13     12.44     0.051     0.329     0.034     0.282
12:24    23.6     195.2      46.4      6.50     12.94     113.0      7.20     12.35     0.054     0.324     0.047     0.274
12:25    24.3     191.1      48.5      6.70     12.79     117.7      6.70     12.82     0.057     0.321     0.050     0.275
12:26    25.4     193.3      50.5      6.55     12.93     135.5      4.58     14.82     0.059     0.322     0.051     0.275
12:27    26.0     191.5      71.4      5.74     13.82     152.6      4.01     15.38     0.057     0.302     0.068     0.300
12:28    31.0     192.5     117.7      4.65     14.63     134.1      5.75     13.79     0.063     0.283     0.105     0.294
12:29    32.1     199.6      58.2      5.07     14.12     127.1      5.53     13.94     0.067     0.301     0.062     0.274
12:30    29.3     204.5      36.3      5.69     13.72     129.2      5.74     13.74     0.064     0.321     0.035     0.283
12:31    30.5     202.5      34.2      5.55     13.75     121.8      6.03     13.40     0.066     0.315     0.032     0.272
12:32    29.6     202.5      27.0      5.87     13.47     131.5      4.92     14.47     0.065     0.322     0.026     0.273
12:33    27.9     201.5      23.6      5.69     13.71     141.3      4.59     14.79     0.061     0.317     0.022     0.288
12:34    31.9     197.2      35.1      5.07     14.20     134.0      5.33     14.12     0.067     0.298     0.032     0.286
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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
       CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
       OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME   ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
12:35    37.0     198.9     31.1      5.28     13.96     131.6      5.47     13.98     0.079     0.304     0.029     0.283
12:36    37.1     205.0     25.6      5.51     13.81     132.1      5.24     14.20     0.080     0.318     0.024     0.280

AVERAGE VALUES FOR THE LAST 15 MINUTES
12:36    28.7     198.9     45.6      5.78     13.61     129.2      5.66     13.81     0.063     0.315     0.043     0.281

12:37    35.3     206.6     24.2      5.40     13.94     137.4      4.89     14.54     0.076     0.318     0.023     0.285
12:38    36.4     206.5     27.2      5.14     14.17     135.8      5.08     14.37     0.077     0.313     0.025     0.285
12:39    38.5     205.7     29.1      5.11     14.16     135.2      5.06     14.39     0.081     0.311     0.027     0.283
12:40    41.2     203.8     39.3      5.18     14.14     135.3      5.11     14.27     0.087     0.310     0.036     0.285
12:41    44.9     202.4     63.7      5.06     14.21     138.0      4.89     14.51     0.094     0.305     0.058     0.286
12:42    47.3     203.6     51.1      4.93     14.29     132.7      5.16     14.27     0.098     0.304     0.046     0.280
12:43    50.5     201.1     42.4      5.28     13.94     135.6      4.71     14.67     0.107     0.307     0.039     0.278
12:44    54.2     200.4     37.2      5.44     13.91     136.6      4.76     14.64     0.116     0.310     0.035     0.281
12:45    59.0     199.3     34.6      5.07     14.18     129.3      5.56     13.88     0.124     0.301     0.032     0.280
12:46    53.0     199.2     28.3      5.42     13.82     124.7      5.95     13.52     0.113     0.307     0.027     0.277
12:47    39.4     201.0     26.4      5.80     13.51     128.2      5.49     13.98     0.087     0.318     0.025     0.276
12:48    36.2     203.6     23.3      5.77     13.63     127.7      5.81     13.67     0.079     0.321     0.022     0.281
12:49    35.1     203.6     22.7      5.70     13.61     124.9      5.76     13.72     0.077     0.320     0.022     0.274
12:50    36.1     204.1     22.4      5.79     13.57     122.9      6.02     13.49     0.079     0.322     0.021     0.274
12:51    37.0     202.2     23.6      5.91     13.44     123.6      6.10     13.40     0.082     0.322     0.023     0.277

AVERAGE VALUES FOR THE LAST 15 MINUTES
12:51    42.9     202.9     33.0      5.40     13.90     131.2      5.36     14.09     0.092     0.313     0.031     0.280

12:52    37.0     201.4     22.1      6.05     13.35     127.5      5.85     13.66     0.083     0.324     0.022     0.281
12:53    34.5     200.1     22.4      5.92     13.47     123.2      6.07     13.45     0.077     0.319     0.022     0.276
12:54    30.9     201.1     20.3      6.04     13.35     126.8      5.56     13.94     0.069     0.323     0.020     0.274
12:55    29.8     200.0     21.1      5.86     13.58     127.8      5.69     13.83     0.066     0.318     0.020     0.279
12:56    32.9     202.4     27.9      5.63     13.72     122.6      5.93     13.61     0.072     0.317     0.027     0.272
12:57    34.9     205.3     22.8      5.91     13.47     131.2      5.38     14.13     0.077     0.327     0.022     0.281
12:58    34.3     206.2     21.4      5.91     13.55     132.5      5.59     13.94     0.076     0.328     0.021     0.287
12:59    38.4     201.9     22.5      5.58     13.81     131.3      5.75     13.79     0.083     0.315     0.021     0.288
13:00    42.4     196.9     22.8      5.69     13.66     131.8      6.02     13.53     0.093     0.309     0.022     0.294
13:01    45.1     194.2     23.8      6.03     13.32     118.2      6.82     12.74     0.101     0.312     0.023     0.279
13:02    40.0     199.6     22.2      6.63     12.80     111.4      7.37     12.22     0.093     0.334     0.023     0.274
13:03    36.3     193.5     21.4      6.86     12.61     105.3      7.55     12.04     0.086     0.329     0.022     0.262
13:04    34.7     188.1     30.2      7.14     12.42     114.0      6.50     13.08     0.084     0.326     0.032     0.263
13:05    40.0     193.8     26.6      6.82     12.73     111.6      7.01     12.59     0.094     0.329     0.027     0.267
13:06    43.0     198.2     22.9      6.79     12.69     104.3      7.65     11.92     0.101     0.335     0.024     0.261

AVERAGE VALUES FOR THE LAST 15 MINUTES
13:06    36.9     198.9     23.4      6.19     13.24     121.3      6.32     13.23     0.084     0.323     0.023     0.276

13:07    38.4     194.1     24.4      7.12     12.42     113.3      6.09     13.48     0.092     0.336     0.026     0.254
13:08    33.4     196.6     24.4      6.74     12.87     115.6      6.71     12.89     0.078     0.332     0.025     0.270
13:09    34.3     197.1     22.6      6.46     12.90     100.1      7.72     11.84     0.079     0.326     0.023     0.252
13:10    32.1     197.9     22.8      7.37     12.18     103.5      7.18     12.38     0.079     0.350     0.025     0.251
13:11    28.7     199.1     22.5      7.35     12.25     108.4      6.51     13.03     0.070     0.351     0.024     0.250
13:12    24.8     200.2     20.1      7.08     12.50     110.4      6.98     12.54     0.060     0.346     0.021     0.263
13:13    24.3     194.5     19.7      6.81     12.64     102.9      7.52     12.02     0.057     0.330     0.020     0.255
13:14    23.2     196.0     19.8      7.18     12.32     105.5      7.06     12.45     0.056     0.341     0.021     0.253
13:15    21.7     200.3     18.6      7.29     12.29     111.3      6.73     12.83     0.053     0.352     0.020     0.261
13:16    21.7     203.6     18.1      7.02     12.50     108.0      7.10     12.44     0.052     0.350     0.019     0.260
13:17    20.6     202.9     18.2      7.14     12.39     110.0      6.57     12.95     0.050     0.352     0.019     0.255
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END of TEST 1-3

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Palm Beach Co. Solid Waste Authority  Compliance    10-27-1989
       CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
       OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME   ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
13:18    21.4     202.4      18.7     7.02     12.52     110.8      6.74     12.80     0.051     0.348     0.020     0.260
13:19    26.0     200.6      18.5     6.87     12.62     111.6      6.40     13.12     0.061     0.341     0.019     0.255
13:20    32.9     201.3      19.1     6.67     12.80     112.0      6.61     12.92     0.077     0.338     0.020     0.260
--------------------------------------------------------------------------------------------------------------------------
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
13:20    33.9     200.0      30.9     6.09     13.32     122.8      6.04     13.46     0.076     0.323     0.030     0.274
--------------------------------------------------------------------------------------------------------------------------
13:21    38.7     201.6      20.7     6.62     12.81     104.2      7.11     12.38     0.090     0.337     0.021     0.251

AVERAGE VALUES FOR THE LAST 15 MINUTES
13:21    28.1     199.2      20.6     6.98     12.53     108.5      6.87     12.67     0.067     0.342     0.021     0.257

13:22    38.7     197.3      20.3     6.92     12.53     107.8      6.79     12.70     0.092     0.337     0.021     0.254
13:23    38.8     195.8      20.1     6.94     12.57     113.6      6.32     13.13     0.092     0.335     0.021     0.259
13:24    42.2     194.6      21.2     6.56     12.84     104.9      6.81     12.62     0.098     0.324     0.021     0.247
13:25    43.2     196.1      20.2     6.83     12.59     108.4      6.54     12.88     0.102     0.333     0.021     0.251
13:26    44.2     195.5      20.9     6.75     12.65     106.7      6.67     12.70     0.104     0.330     0.021     0.249
13:27    42.1     195.9      22.9     6.70     12.65     108.7      6.18     13.16     0.098     0.330     0.023     0.245
13:28    38.9     194.6      22.9     6.60     12.76     109.6      6.31     12.99     0.090     0.325     0.023     0.249
13:29    39.0     192.9      22.4     6.37     12.90     108.3      6.48     12.85     0.089     0.317     0.022     0.249
13:30    38.3     189.5      23.8     6.42     12.82     102.9      7.01     12.34     0.088     0.313     0.024     0.246
13:31    37.0     189.0      23.9     6.76     12.54     105.5      6.33     12.99     0.087     0.319     0.025     0.240

COMMENTS: End of Test 1-3
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CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1-3/ Pre-test 1-4 Calibration Bias Check

DATE : 10-27-1989 TIME: 13:31 - 13:56

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	5.0
1	OUTLET	ppmSO2	49.6	54.3
3	OUTLET	ppmNOX	0.0	-0.3
3	OUTLET	ppmNOX	240.0	237.9
4	OUTLET	ppmCO	0.0	-0.3
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.37
5	OUTLET	% CO2	0.00	0.12
5	OUTLET	% CO2	11.06	11.23
6	INLET	ppmSO2	0.0	4.0
6	INLET	ppmSO2	218.0	207.1
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.38
8	INLET	% CO2	0.00	0.22
8	INLET	% CO2	11.06	11.06

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Outlet SO2 Calibration Error Check

DATE : 10-27-1989 TIME: 13:57 - 14:06

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	-0.5
1	OUTLET	ppmSO2	49.6	49.7
1	OUTLET	ppmSO2	89.3	89.8

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 1-4 Outlet SO2 Calibration Bias Check

DATE : 10-27-1989 TIME: 14:06 - 14:10

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.6
1	OUTLET	ppmSO2	49.6	48.7

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
        CHAN 1   CHAN 3   CHAN 4   CHAN 2   CHAN 5   CHAN 6   CHAN 7   CHAN 8   OUTLET   OUTLET   OUTLET   INLET
        OUTLET   OUTLET   OUTLET   OUTLET   OUTLET   INLET    INLET    INLET    lb SO2   lb NOX   lb CO    lb SO2
TIME    ppmSO2   ppmNOX   ppmCO    % O2     % CO2    ppmSO2   % O2     % CO2    MBTU     MBTU     MBTU     MBTU
15:19    12.4    213.3     23.0    6.72    12.82    128.8     6.35    13.27    0.029    0.359    0.024    0.294
15:20    14.6    216.6     23.0    6.59    12.94    126.3     6.80    12.84    0.034    0.361    0.023    0.298
15:21    16.0    215.6     23.7    6.70    12.80    123.2     6.78    12.84    0.037    0.363    0.024    0.290
15:22    16.5    211.5     24.6    6.87    12.69    128.2     6.43    13.21    0.039    0.360    0.025    0.294
15:23    21.7    214.1     24.8    6.73    12.83    130.1     6.53    13.12    0.051    0.361    0.025    0.301
15:24    28.4    213.1     24.6    6.58    12.93    127.1     6.58    13.08    0.066    0.355    0.025    0.295
15:25    28.7    212.3     25.0    6.70    12.86    127.5     6.53    13.10    0.067    0.357    0.026    0.295
15:26    26.7    214.6     25.0    6.68    12.88    130.2     6.41    13.21    0.062    0.360    0.026    0.298
15:27    24.8    214.5     24.7    6.52    13.02    123.6     6.59    13.02    0.057    0.356    0.025    0.287
15:28    24.0    209.9     25.4    6.53    12.96    130.3     6.06    13.57    0.055    0.349    0.026    0.292
15:29    21.3    211.5     25.5    6.42    13.10    123.0     6.78    12.87    0.049    0.349    0.026    0.289
15:30    21.8    211.6     24.5    6.61    12.86    122.5     6.66    12.93    0.051    0.354    0.025    0.286

15:31    23.9    209.0     25.1    6.81    12.74    129.5     6.14    13.49    0.056    0.354    0.026    0.291
15:32    24.7    209.6     26.9    6.50    13.03    134.6     5.75    13.82    0.057    0.348    0.027    0.295
15:33    26.3    210.5     26.7    6.23    13.29    134.3     5.91    13.72    0.060    0.343    0.026    0.298
15:34    34.4    208.2     28.0    6.00    13.47    134.7     5.92    13.73    0.077    0.334    0.027    0.299
15:35    41.0    207.4     31.3    5.94    13.50    127.6     6.36    13.24    0.091    0.331    0.030    0.291
15:36    38.0    207.2     33.0    6.25    13.23    134.4     5.87    13.75    0.086    0.338    0.033    0.297
15:37    37.3    211.3     36.8    6.06    13.45    127.7     6.34    13.30    0.084    0.340    0.036    0.291
15:38    37.6    214.7     36.3    6.15    13.28    125.0     6.43    13.24    0.085    0.348    0.036    0.287
15:39    37.7    215.3     29.9    6.43    13.02    117.3     6.93    12.70    0.086    0.355    0.030    0.279
15:40    35.6    213.6     29.1    6.88    12.64    121.3     6.65    13.05    0.084    0.364    0.030    0.283
15:41    34.1    211.8     27.9    6.80    12.72    112.1     7.17    12.44    0.080    0.359    0.029    0.271
15:42    31.4    208.7     28.3    7.08    12.46    111.7     7.29    12.40    0.076    0.361    0.030    0.273
15:43    32.8    208.5     29.7    7.20    12.35    107.5     7.36    12.27    0.079    0.363    0.032    0.264
15:44    30.8    206.9     31.1    7.48    12.16    108.0     7.41    12.23    0.076    0.368    0.034    0.266
15:45    31.3    209.0     34.5    7.54    12.11    109.0     7.43    12.25    0.078    0.374    0.037    0.269

AVERAGE VALUES FOR THE LAST 15 MINUTES
15:45    33.1    210.1     30.3    6.62    12.90    122.3     6.60    13.04    0.077    0.352    0.031    0.284

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AVERAGE VALUES FOR THE LAST HOUR: 27 MINUTES OF VALID DATA
15:45    27.9    211.5     27.7    6.63    12.89    124.3     6.57    13.06    0.065    0.354    0.028    0.288
---------------------------------------------------------------------------------------------------------------
15:46    33.8    209.7     34.9    7.56    12.09    107.3     7.74    11.91    0.084    0.375    0.038    0.271
15:47    34.8    206.4     35.2    7.66    12.02    106.9     7.70    11.97    0.087    0.372    0.039    0.269
15:48    33.5    207.0     35.6    7.63    12.06    109.8     6.88    12.71    0.084    0.372    0.039    0.260
15:49    29.9    210.3     34.7    7.34    12.35    115.0     6.96    12.78    0.073    0.370    0.037    0.274
15:50    28.9    211.0     32.9    6.97    12.56    108.7     7.64    12.04    0.069    0.362    0.034    0.272
15:51    30.7    209.2     33.1    7.37    12.23    108.3     7.22    12.41    0.075    0.369    0.036    0.263
15:52    31.0    210.4     34.7    7.51    12.21    118.4     6.64    13.04    0.077    0.375    0.038    0.276
15:53    35.2    211.0     35.3    6.93    12.65    114.5     6.96    12.72    0.084    0.361    0.037    0.273
15:54    38.8    207.6     35.0    6.86    12.64    110.2     7.65    12.03    0.092    0.353    0.036    0.276
15:55    39.9    198.1     35.7    7.40    12.18    119.9     6.80    12.81    0.098    0.350    0.038    0.282
15:56    42.3    202.5     37.8    7.47    12.20    120.0     6.72    12.95    0.105    0.360    0.041    0.281
15:57    45.5    209.5     36.1    7.27    12.38    124.1     6.32    13.35    0.111    0.367    0.039    0.283
15:58    48.3    213.4     31.1    6.78    12.77    124.0     6.53    13.11    0.114    0.361    0.032    0.286
15:59    45.5    213.4     28.5    6.72    12.80    129.8     5.99    13.67    0.107    0.359    0.029    0.289
16:00    44.5    209.4     29.1    6.40    13.12    125.5     6.45    13.23    0.102    0.345    0.029    0.288

AVERAGE VALUES FOR THE LAST 15 MINUTES
16:00    37.5    208.6     34.0    7.19    12.42    116.2     6.95    12.72    0.091    0.364    0.036    0.276
```

Begin
1-4

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
16:01	44.9	208.7	27.9	6.40	13.04	123.0	6.45	13.17	0.103	0.344	0.028	0.283
16:02	44.4	207.9	27.9	6.62	12.86	128.4	6.04	13.58	0.103	0.348	0.028	0.287
16:03	44.7	208.3	31.0	6.46	13.06	131.6	5.96	13.64	0.103	0.345	0.031	0.292
16:04	44.6	207.5	32.0	6.19	13.25	129.4	6.34	13.29	0.101	0.337	0.032	0.295
16:05	48.2	205.3	30.3	6.21	13.22	128.7	6.17	13.45	0.109	0.334	0.030	0.290
16:06	44.1	205.9	33.1	6.22	13.22	128.5	6.13	13.50	0.100	0.335	0.033	0.289
16:07	39.0	205.7	30.0	6.08	13.35	127.7	5.82	13.77	0.087	0.332	0.029	0.281
16:08	33.9	207.3	29.3	6.03	13.41	128.1	5.79	13.79	0.076	0.333	0.029	0.282
16:09	28.8	209.3	30.6	5.94	13.46	128.8	5.72	13.88	0.064	0.334	0.030	0.282
16:10	23.1	211.7	28.0	5.96	13.44	128.5	5.52	14.01	0.051	0.338	0.027	0.277
16:11	18.5	209.7	25.4	5.91	13.50	130.6	5.36	14.16	0.041	0.334	0.025	0.279
16:12	18.9	207.7	25.3	5.64	13.72	130.0	5.50	14.04	0.041	0.325	0.024	0.280
16:13	21.4	207.8	24.5	5.68	13.63	133.1	5.18	14.32	0.047	0.326	0.023	0.281
16:14	20.5	208.8	25.3	5.76	13.63	139.7	4.92	14.55	0.045	0.330	0.024	0.290
16:15	17.9	202.1	30.8	5.40	13.93	139.7	4.99	14.54	0.038	0.311	0.029	0.292
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:15	32.9	207.6	28.8	6.03	13.38	130.4	5.73	13.85	0.074	0.334	0.028	0.285
16:16	17.3	203.1	41.2	5.21	14.05	131.5	5.49	14.06	0.037	0.309	0.038	0.283
16:17	17.2	206.7	31.0	5.48	13.77	131.5	5.50	14.05	0.037	0.320	0.029	0.284
16:18	15.7	211.1	24.9	5.78	13.54	126.7	5.98	13.61	0.034	0.333	0.024	0.282
16:19	14.4	208.9	22.4	6.01	13.34	130.6	5.31	14.23	0.032	0.335	0.022	0.278
16:20	12.2	204.6	25.4	5.89	13.53	137.4	4.82	14.70	0.027	0.325	0.025	0.284
16:21	11.7	205.1	26.4	5.46	13.94	143.0	4.61	14.91	0.025	0.317	0.025	0.291
16:22	16.9	202.0	38.5	4.96	14.36	136.5	5.34	14.24	0.035	0.303	0.035	0.291
16:23	20.2	206.9	44.8	5.22	14.05	128.4	5.82	13.74	0.043	0.315	0.041	0.283
16:24	17.7	212.2	30.5	5.75	13.56	131.8	5.27	14.26	0.039	0.334	0.029	0.280
16:25	16.8	211.3	23.6	5.86	13.54	136.9	4.99	14.53	0.037	0.336	0.023	0.286
16:26	19.9	204.7	28.3	5.47	13.90	138.8	4.99	14.54	0.043	0.317	0.027	0.290
16:27	29.7	202.2	33.5	5.26	14.05	127.0	6.13	13.45	0.063	0.309	0.031	0.286
16:28	39.5	206.9	29.4	5.76	13.50	119.2	6.41	13.15	0.087	0.326	0.028	0.273
16:29	46.0	207.9	23.5	6.35	13.00	112.6	7.12	12.47	0.105	0.341	0.023	0.271
16:30	46.9	202.9	23.5	6.79	12.61	110.5	7.01	12.58	0.110	0.343	0.024	0.264
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:30	22.8	206.4	29.8	5.68	13.65	129.5	5.65	13.90	0.050	0.324	0.028	0.282
16:31	46.3	197.0	25.4	6.99	12.51	111.6	7.23	12.39	0.111	0.338	0.027	0.271
16:32	50.4	192.4	30.1	6.92	12.55	114.7	6.73	12.89	0.120	0.329	0.031	0.269
16:33	50.7	196.1	29.6	6.87	12.64	122.7	5.89	13.73	0.120	0.334	0.031	0.271
16:34	43.0	197.2	35.0	6.43	13.12	124.2	6.34	13.29	0.099	0.326	0.035	0.283
16:35	38.2	200.5	60.2	6.13	13.27	123.9	6.11	13.54	0.086	0.324	0.059	0.278
16:36	34.7	207.0	40.1	6.32	13.14	128.1	5.75	13.82	0.079	0.339	0.040	0.281
16:37	36.6	197.1	44.7	6.15	13.38	143.0	4.68	14.90	0.082	0.319	0.044	0.293
16:38	41.1	200.9	76.5	5.35	14.04	140.2	4.72	14.83	0.088	0.309	0.071	0.288
16:39	42.0	208.5	43.2	5.42	13.96	136.1	5.28	14.32	0.090	0.322	0.045	0.289
16:40	39.1	206.3	35.5	5.42	13.97	149.7	4.40	15.15	0.084	0.318	0.033	0.301
16:41	39.0	201.0	77.6	4.94	14.41	139.8	5.00	14.53	0.081	0.301	0.071	0.292
16:42	35.3	200.4	62.8	5.05	14.25	142.0	4.77	14.75	0.074	0.302	0.058	0.292
16:43	34.7	199.6	42.5	5.06	14.25	137.8	5.00	14.51	0.073	0.301	0.039	0.288
16:44	34.7	201.5	31.5	5.19	14.10	145.6	4.36	15.10	0.073	0.306	0.029	0.292
16:45	33.9	200.3	33.8	5.01	14.30	147.3	4.72	14.76	0.071	0.301	0.031	0.302

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
        CHAN 1   CHAN 3   CHAN 4   CHAN 2   CHAN 5   CHAN 6   CHAN 7   CHAN 8   OUTLET   OUTLET   OUTLET   INLET
        OUTLET   OUTLET   OUTLET   OUTLET   OUTLET   INLET    INLET    INLET    lb SO2   lb NOX   lb CO    lb SO2
TIME    ppmSO2   ppmNOX   ppmCO    % O2     % CO2    ppmSO2   % O2     % CO2    MBTU     MBTU     MBTU     MBTU

AVERAGE VALUES FOR THE LAST 15 MINUTES
16:45    40.0    200.4     44.9     5.82    13.59    133.8     5.40    14.17    0.089    0.318    0.043    0.286

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
16:45    33.3    205.8     34.3     6.18    13.26    127.5     5.93    13.66    0.076    0.335    0.034    0.282
--------------------------------------------------------------------------------------------------------------
16:46    36.4    196.2     64.3     4.78    14.41    140.0     4.99    14.47    0.075    0.291    0.058    0.292
16:47    41.6    193.5     55.9     5.14    14.07    137.1     5.30    14.22    0.088    0.293    0.052    0.292
16:48    44.8    192.6     65.8     5.40    13.83    133.9     5.25    14.24    0.096    0.297    0.062    0.284
16:49    42.5    195.0     56.1     5.53    13.73    127.9     5.40    14.00    0.092    0.303    0.053    0.274
16:50    40.3    197.0     35.5     5.73    13.53    130.7     5.36    14.11    0.088    0.310    0.034    0.279
16:51    33.8    197.8     25.2     5.75    13.50    132.2     5.22    14.24    0.074    0.312    0.024    0.280
16:52    39.1    196.8     23.0     5.69    13.60    130.9     5.25    14.19    0.085    0.309    0.022    0.278
16:53    43.5    198.0     21.6     5.65    13.61    130.2     5.24    14.21    0.095    0.310    0.021    0.276
16:54    43.7    201.8     21.2     5.63    13.63    128.0     5.61    13.90    0.095    0.316    0.020    0.278
16:55    40.4    205.5     20.1     5.75    13.49    126.7     5.89    13.67    0.089    0.324    0.019    0.280
16:56    38.1    210.3     20.4     6.10    13.24    122.7     6.31    13.28    0.086    0.339    0.020    0.279
16:57    39.7    210.5     20.8     6.30    13.04    121.8     5.99    13.59    0.090    0.344    0.021    0.271
16:58    37.4    210.2     20.6     6.47    12.94    119.9     6.19    13.42    0.086    0.348    0.021    0.271
16:59    33.2    209.2     20.1     6.40    13.00    118.5     6.13    13.48    0.076    0.345    0.020    0.266
17:00    29.7    208.4     20.5     6.42    13.01    114.7     6.72    12.92    0.068    0.344    0.021    0.269

AVERAGE VALUES FOR THE LAST 15 MINUTES
17:00    39.0    201.5     32.7     5.78    13.51    127.7     5.66    13.86    0.086    0.319    0.031    0.278

17:01    27.7    204.2     22.1     6.56    12.84    120.2     6.03    13.63    0.064    0.340    0.022    0.268
17:02    23.0    201.0     22.8     6.54    12.96    120.4     6.21    13.43    0.053    0.334    0.023    0.272
17:03    19.1    198.9     25.5     6.34    13.09    114.6     6.87    12.77    0.044    0.326    0.025    0.271
17:04    17.0    196.3     25.5     6.58    12.80    115.4     6.73    12.93    0.039    0.327    0.026    0.270
17:05    16.0    198.7     23.2     6.82    12.63    111.3     7.06    12.60    0.038    0.337    0.024    0.267
17:06    14.4    201.0     22.9     7.02    12.47    115.7     6.41    13.26    0.034    0.346    0.024    0.265
17:07    14.2    205.9     22.7     6.89    12.64    112.6     6.46    13.18    0.034    0.351    0.024    0.259
17:08    13.3    209.6     22.3     6.74    12.72    114.4     6.37    13.28    0.031    0.354    0.023    0.262
17:09    11.7    210.4     21.6     6.70    12.76    110.1     6.55    13.13    0.027    0.354    0.022    0.255
17:10    10.2    210.7     22.9     6.81    12.68    117.8     5.87    13.77    0.024    0.357    0.024    0.260
17:11    10.6    209.0     23.6     6.49    13.03    118.9     5.95    13.71    0.024    0.346    0.024    0.264
17:12    13.6    207.3     26.8     6.17    13.27    117.9     5.92    13.77    0.031    0.336    0.026    0.261
17:13    17.1    209.0     25.8     6.12    13.32    112.9     6.32    13.37    0.038    0.338    0.025    0.257
17:14    21.1    209.5     25.5     6.38    13.08    113.2     6.21    13.50    0.048    0.344    0.026    0.256
17:15    24.0    210.6     26.8     6.42    13.06    112.9     6.30    13.39    0.055    0.347    0.027    0.257

AVERAGE VALUES FOR THE LAST 15 MINUTES
17:15    16.9    205.5     24.0     6.57    12.89    115.2     6.35    13.32    0.039    0.343    0.024    0.263

17:16    27.8    212.4     26.4     6.51    12.99    121.1     5.83    13.87    0.064    0.353    0.027    0.267
17:17    32.0    212.5     24.4     6.31    13.18    117.6     6.20    13.51    0.073    0.348    0.024    0.266
17:18    34.4    212.3     22.9     6.40    13.07    116.6     6.21    13.53    0.079    0.349    0.023    0.263
17:19    32.9    213.5     22.1     6.43    13.06    115.2     6.55    13.19    0.076    0.352    0.022    0.267
17:20    28.1    210.7     22.0     6.66    12.83    113.7     6.56    13.17    0.066    0.353    0.022    0.263
17:21    24.2    207.0     23.1     6.76    12.77    119.1     6.05    13.67    0.057    0.350    0.024    0.266
17:22    23.5    209.2     24.0     6.56    13.00    126.8     5.36    14.31    0.054    0.348    0.024    0.271
17:23    22.5    211.2     22.7     6.09    13.43    124.4     5.62    14.07    0.050    0.341    0.022    0.270
17:24    21.1    213.4     21.6     5.97    13.47    116.1     6.46    13.27    0.047    0.341    0.021    0.267
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END
1-4

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
17:25	18.3	215.9	21.1	6.35	13.10	118.7	5.89	13.78	0.042	0.354	0.021	0.263
17:26	17.8	220.9	21.1	6.38	13.14	121.2	5.90	13.83	0.041	0.363	0.021	0.268
17:27	21.1	221.4	21.0	6.23	13.26	118.4	6.22	13.50	0.048	0.360	0.021	0.268
17:28	20.2	216.6	22.5	6.43	13.05	121.7	5.83	13.84	0.046	0.358	0.023	0.268
17:29	16.8	214.1	22.1	6.34	13.22	126.9	5.72	14.02	0.038	0.351	0.022	0.278
17:30	17.1	211.7	22.7	5.98	13.49	121.4	6.02	13.73	0.038	0.339	0.022	0.271
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:30	23.9	213.5	22.7	6.36	13.14	119.9	6.03	13.69	0.055	0.351	0.023	0.268
17:31	17.2	210.4	23.6	6.05	13.45	122.5	6.00	13.77	0.039	0.338	0.023	0.273
17:32	16.7	214.2	26.7	6.08	13.42	124.6	5.90	13.86	0.037	0.345	0.026	0.276

COMMENTS: End of Test 1-4

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1-4/ Pre-test 1-5 Calibration Bias Check

DATE : 10-27-1989 TIME: 17:32 - 17:56

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.9
1	OUTLET	ppmSO2	49.6	49.0
3	OUTLET	ppmNOX	0.0	-0.5
3	OUTLET	ppmNOX	240.0	234.6
4	OUTLET	ppmCO	0.0	0.4
4	OUTLET	ppmCO	24.8	23.7
2	OUTLET	% O2	0.00	0.03
2	OUTLET	% O2	12.50	12.34
2	OUTLET	% O2	19.93	19.73
5	OUTLET	% CO2	0.00	0.12
5	OUTLET	% CO2	11.06	11.12
6	INLET	ppmSO2	0.0	4.5
6	INLET	ppmSO2	218.0	209.6
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.46
7	INLET	% O2	19.93	19.89
8	INLET	% CO2	0.00	0.33
8	INLET	% CO2	11.06	11.13

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
18:16	29.4	211.5	30.0	7.51	12.19	108.6	7.34	12.47	0.073	0.377	0.033	0.266
18:17	29.0	211.4	28.0	7.50	12.24	104.9	7.26	12.51	0.072	0.377	0.030	0.255
18:18	21.9	211.8	28.1	7.48	12.25	115.3	6.46	13.30	0.054	0.377	0.030	0.265
18:19	16.7	212.5	27.0	7.28	12.49	120.3	6.13	13.66	0.041	0.373	0.029	0.270
18:20	16.1	213.2	25.4	6.80	12.85	116.8	6.30	13.47	0.038	0.361	0.026	0.266
18:21	18.2	211.9	22.7	6.70	12.90	116.2	6.47	13.25	0.043	0.356	0.023	0.267
18:22	21.0	210.2	21.7	6.84	12.78	121.5	6.12	13.63	0.050	0.357	0.022	0.273
18:23	26.3	209.5	23.7	6.76	12.88	122.8	6.09	13.64	0.062	0.354	0.024	0.275
18:24	31.0	211.5	22.6	6.51	13.10	132.1	5.35	14.34	0.072	0.351	0.023	0.282
18:25	36.5	211.7	20.2	6.18	13.42	132.1	5.88	13.85	0.082	0.344	0.020	0.292
18:26	35.7	211.2	21.4	6.00	13.52	123.6	6.01	13.71	0.080	0.339	0.021	0.276
18:27	29.4	211.9	22.7	6.17	13.39	129.5	5.69	14.05	0.066	0.343	0.022	0.283
18:28	23.7	212.3	24.1	6.07	13.49	128.4	5.78	13.96	0.053	0.342	0.024	0.282
18:29	20.6	213.5	24.9	6.13	13.44	131.3	5.59	14.11	0.046	0.345	0.025	0.285
18:30	19.4	214.0	26.6	6.01	13.56	134.8	5.29	14.44	0.043	0.343	0.026	0.287
AVERAGE VALUES FOR THE LAST 15 MINUTES												
18:30	25.0	211.9	24.6	6.66	12.97	122.6	6.12	13.63	0.058	0.356	0.025	0.275
18:31	20.5	218.1	23.8	5.80	13.78	140.9	4.95	14.77	0.045	0.345	0.023	0.293
18:32	22.9	216.0	22.6	5.67	13.87	143.3	4.96	14.74	0.050	0.339	0.022	0.298
18:33	24.8	213.0	21.4	5.62	13.96	147.1	4.77	14.94	0.054	0.333	0.020	0.303
18:34	29.0	212.1	22.7	5.30	14.21	136.7	5.70	14.06	0.062	0.325	0.021	0.298
18:35	29.2	214.4	22.0	5.59	13.86	135.2	5.69	14.06	0.063	0.335	0.021	0.295
18:36	29.1	217.2	22.0	5.95	13.61	136.4	5.61	14.14	0.065	0.347	0.021	0.296
18:37	31.8	215.9	21.8	5.94	13.66	138.6	5.69	14.08	0.071	0.345	0.021	0.303
18:38	34.8	215.2	24.1	5.84	13.71	137.5	5.80	14.00	0.077	0.341	0.023	0.302
18:39	35.8	213.9	23.6	6.01	13.56	139.5	5.43	14.33	0.080	0.343	0.023	0.299
18:40	37.9	215.4	25.8	5.99	13.63	143.6	5.48	14.28	0.084	0.345	0.025	0.309
18:41	40.8	215.5	21.9	5.97	13.63	142.8	5.58	14.16	0.091	0.345	0.021	0.309
18:42	39.1	213.1	22.1	5.87	13.73	150.2	5.02	14.71	0.086	0.339	0.021	0.314
18:43	37.3	212.3	23.5	5.69	13.90	149.5	5.17	14.57	0.081	0.333	0.022	0.315
18:44	37.8	212.6	28.5	5.46	14.11	158.1	4.81	14.88	0.081	0.329	0.027	0.326
18:45	37.6	215.1	41.9	5.32	14.19	160.9	4.64	15.07	0.080	0.330	0.039	0.329
AVERAGE VALUES FOR THE LAST 15 MINUTES												
18:45	32.5	214.7	24.5	5.73	13.83	144.0	5.29	14.45	0.071	0.338	0.023	0.306
AVERAGE VALUES FOR THE LAST HOUR: 30 MINUTES OF VALID DATA												
18:45	28.8	213.3	24.6	6.20	13.40	133.3	5.70	14.04	0.065	0.347	0.024	0.291
18:46	37.5	218.2	27.1	5.14	14.34	139.4	5.71	13.98	0.079	0.331	0.025	0.305
18:47	35.6	215.6	26.6	5.47	14.00	148.3	4.95	14.74	0.077	0.334	0.025	0.309
18:48	33.2	219.4	23.5	5.57	13.96	143.7	5.20	14.48	0.072	0.342	0.022	0.304
18:49	31.7	215.5	27.5	5.57	13.94	143.8	4.93	14.74	0.069	0.336	0.026	0.299
18:50	29.5	216.0	37.1	5.55	13.97	146.5	4.59	15.05	0.064	0.336	0.035	0.298
18:51	31.0	216.8	30.7	5.32	14.17	131.9	5.72	14.01	0.066	0.332	0.029	0.288
18:52	29.5	220.0	25.2	5.68	13.76	130.3	5.56	14.12	0.064	0.345	0.024	0.282
18:53	23.8	219.8	22.3	6.10	13.44	135.1	4.91	14.72	0.053	0.355	0.022	0.281
18:54	25.6	219.0	23.4	5.83	13.75	132.4	5.34	14.34	0.056	0.347	0.023	0.282
18:55	28.5	220.2	23.8	5.66	13.84	130.3	5.10	14.49	0.062	0.345	0.023	0.274
18:56	25.7	217.0	30.7	5.62	13.90	132.1	5.04	14.60	0.056	0.339	0.029	0.277
18:57	22.5	217.2	24.5	5.56	13.89	129.4	5.71	13.98	0.049	0.338	0.023	0.283
18:58	19.0	218.2	21.4	5.94	13.56	130.7	5.72	13.99	0.042	0.348	0.021	0.286

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
18:59	16.0	219.1	20.2	5.99	13.55	136.5	5.38	14.32	0.036	0.351	0.020	0.292
19:00	14.8	220.7	19.4	5.91	13.64	134.0	5.71	14.03	0.033	0.352	0.019	0.293
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:00	26.9	218.2	25.6	5.66	13.85	136.3	5.30	14.37	0.058	0.342	0.024	0.290
19:01	13.8	220.0	19.5	5.96	13.58	130.9	5.68	14.05	0.031	0.352	0.019	0.285
19:02	14.2	218.5	20.9	5.97	13.59	133.4	5.68	14.07	0.032	0.350	0.020	0.291
19:03	15.8	219.2	21.2	6.02	13.54	133.0	5.76	13.96	0.035	0.352	0.021	0.292
19:04	16.4	221.2	20.5	6.02	13.54	137.6	5.58	14.18	0.037	0.355	0.020	0.298
19:05	15.9	217.9	20.5	5.93	13.61	127.8	6.02	13.67	0.035	0.348	0.020	0.285
19:06	15.3	219.1	20.8	6.21	13.39	146.2	4.84	14.84	0.035	0.356	0.021	0.302
19:07	16.5	221.4	20.3	5.67	13.88	137.9	5.52	14.17	0.036	0.347	0.019	0.298
19:08	18.1	223.5	21.3	5.70	13.79	145.0	4.84	14.79	0.039	0.351	0.020	0.300
19:09	19.8	222.6	25.4	5.61	13.91	148.5	4.62	15.03	0.043	0.348	0.024	0.303
19:10	22.7	221.8	28.7	5.34	14.14	148.1	4.53	15.11	0.049	0.340	0.027	0.300
19:11	24.9	221.4	33.3	5.26	14.21	139.8	5.19	14.49	0.053	0.338	0.031	0.295
19:12	27.1	222.1	26.5	5.47	13.95	134.4	5.78	13.95	0.058	0.344	0.025	0.295
19:13	30.1	222.6	23.1	5.97	13.49	122.2	5.92	13.76	0.067	0.356	0.022	0.271
19:14	33.2	226.3	23.2	6.34	13.25	124.0	5.76	13.99	0.076	0.371	0.023	0.272
19:15	32.2	225.8	23.3	6.15	13.42	118.3	5.72	13.96	0.072	0.366	0.023	0.259
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:15	21.1	221.6	23.2	5.84	13.69	135.1	5.43	14.27	0.046	0.352	0.022	0.290
19:16	26.1	225.9	23.3	6.11	13.49	129.1	4.95	14.74	0.059	0.365	0.023	0.269
19:17	20.2	224.1	22.4	5.80	13.77	134.7	4.74	14.91	0.044	0.354	0.022	0.277
19:18	17.5	220.9	23.0	5.58	13.98	132.9	5.29	14.44	0.038	0.344	0.022	0.283
19:19	16.8	219.6	24.1	5.63	13.85	119.1	6.17	13.58	0.036	0.344	0.023	0.268
19:20	14.2	221.8	24.4	6.14	13.39	124.9	5.52	14.22	0.032	0.359	0.024	0.270
19:21	11.1	222.5	24.4	6.25	13.36	129.1	5.47	14.26	0.025	0.363	0.024	0.278
19:22	10.6	221.6	23.6	6.14	13.44	128.9	5.40	14.32	0.024	0.358	0.023	0.276
19:23	12.7	222.7	23.2	6.08	13.49	119.6	6.13	13.64	0.028	0.359	0.023	0.269
19:24	13.8	223.9	23.2	6.27	13.27	122.4	5.64	14.10	0.031	0.366	0.023	0.266
19:25	15.1	221.6	22.0	6.36	13.25	127.3	6.20	13.62	0.034	0.364	0.022	0.287
19:26	18.5	221.5	22.0	6.42	13.14	120.9	6.53	13.26	0.043	0.366	0.022	0.279
19:27	20.2	219.6	23.3	6.77	12.83	117.5	6.95	12.87	0.047	0.371	0.024	0.280
19:28	20.4	216.4	25.0	7.03	12.60	112.9	7.12	12.70	0.049	0.373	0.026	0.272
19:29	20.7	214.5	26.3	7.17	12.50	110.6	6.79	13.00	0.050	0.373	0.028	0.260
19:30	22.3	212.3	25.7	7.32	12.41	113.6	6.82	12.99	0.055	0.373	0.027	0.268
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:30	17.3	220.6	23.7	6.34	13.25	122.9	5.98	13.78	0.040	0.362	0.024	0.273
19:31	25.8	210.4	25.0	7.25	12.44	106.5	7.31	12.47	0.063	0.368	0.027	0.260
19:32	27.9	208.2	25.2	7.49	12.23	108.4	7.21	12.59	0.069	0.371	0.027	0.263
19:33	30.9	208.3	25.6	7.54	12.24	116.8	6.86	12.96	0.077	0.372	0.028	0.276
19:34	35.1	211.9	26.8	7.36	12.39	120.3	7.01	12.82	0.086	0.374	0.029	0.288
19:35	37.7	211.0	29.0	7.37	12.35	118.6	6.38	12.93	0.092	0.372	0.031	0.281
19:36	34.8	215.3	30.0	7.36	12.39	113.0	7.45	12.35	0.085	0.380	0.032	0.279
19:37	30.5	212.2	28.8	7.40	12.32	116.4	7.04	12.75	0.075	0.375	0.031	0.279
19:38	26.9	213.9	29.3	7.49	12.27	115.9	7.20	12.61	0.067	0.381	0.032	0.281
19:39	25.3	212.8	28.3	7.55	12.16	117.9	6.93	12.88	0.063	0.381	0.031	0.280
19:40	24.2	215.4	28.5	7.58	12.19	116.1	7.11	12.71	0.060	0.386	0.031	0.279
19:41	23.6	215.6	31.2	7.63	12.13	105.2	7.70	12.10	0.059	0.388	0.034	0.265

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
19:42     23.0     215.8      32.3      7.85     11.94     103.2      7.80     12.02     0.059     0.395     0.036     0.262
19:43     18.6     213.0      34.2      8.04     11.76      98.1      7.93     11.88     0.048     0.396     0.039     0.251
19:44     13.3     214.2      34.5      8.28     11.62     108.7      6.48     13.33     0.035     0.405     0.040     0.250
19:45     10.4     221.4      32.4      7.65     12.18     104.0      6.88     12.90     0.026     0.399     0.036     0.246

AVERAGE VALUES FOR THE LAST 15 MINUTES
19:45     25.9     213.3      29.4      7.59     12.17     111.3      7.19     12.62     0.064     0.383     0.032     0.269

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
19:45     22.8     218.4      25.5      6.36     13.24     126.4      5.97     13.76     0.052     0.360     0.026     0.281
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19:46      8.1     218.8      29.9      7.49     12.21     106.9      7.09     12.70     0.020     0.390     0.032     0.257
19:47      6.9     215.6      29.1      7.83     11.97     113.9      7.27     12.56     0.017     0.394     0.032     0.277
19:48      6.3     216.3      28.0      7.74     12.03     109.9      7.23     12.58     0.016     0.393     0.031     0.267
19:49      6.4     217.6      28.3      7.69     12.06     107.0      7.39     12.39     0.016     0.393     0.031     0.263
19:50      5.9     218.1      29.0      7.74     12.01     109.8      6.96     12.83     0.015     0.396     0.032     0.262
19:51      6.3     221.0      28.2      7.52     12.21     105.5      7.34     12.44     0.016     0.394     0.031     0.258
19:52      8.2     219.6      27.3      7.58     12.12     105.0      7.11     12.66     0.020     0.394     0.030     0.253
19:53     10.1     216.7      27.3      7.60     12.12     103.9      7.31     12.47     0.025     0.389     0.030     0.254
19:54     11.3     217.1      26.0      7.74     12.01     101.9      7.32     12.45     0.029     0.394     0.029     0.249
19:55     18.8     214.7      25.0      7.66     12.09     101.2      7.05     12.74     0.047     0.387     0.027     0.243
19:56     25.6     215.6      24.7      7.63     12.12      99.3      7.42     12.35     0.064     0.388     0.027     0.245
19:57     28.7     215.2      23.7      7.62     12.14     105.8      6.88     12.80     0.072     0.387     0.026     0.251
19:58     33.2     216.1      24.2      7.46     12.30     117.3      6.29     13.50     0.082     0.384     0.026     0.267
19:59     38.7     221.2      23.5      7.08     12.61     122.0      6.07     13.70     0.093     0.382     0.025     0.273
20:00     41.8     222.6      23.2      6.83     12.82     131.8      5.66     14.12     0.099     0.378     0.024     0.287

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:00     17.1     217.8      26.5      7.55     12.19     109.4      6.96     12.82     0.042     0.390     0.029     0.260

20:01     49.5     224.2      21.6      6.56     13.08     133.0      5.67     14.10     0.114     0.373     0.022     0.290
20:02     50.9     224.6      21.5      6.35     13.26     130.4      5.63     14.15     0.116     0.369     0.022     0.284
20:03     39.2     226.8      20.4      6.24     13.35     127.3      5.79     13.96     0.089     0.369     0.020     0.280
20:04     28.2     222.8      23.2      6.24     13.33     135.1      5.36     14.40     0.064     0.363     0.023     0.289
20:05     21.8     222.9      21.8      6.21     13.37     121.5      6.57     13.20     0.049     0.362     0.022     0.281
20:06     18.2     220.3      21.9      6.52     12.99     127.6      5.89     13.92     0.042     0.366     0.022     0.282
20:07     13.8     221.2      21.8      6.62     12.98     123.1      5.80     13.94     0.032     0.370     0.022     0.271
20:08     11.6     223.0      22.0      6.61     13.03     132.5      5.31     14.45     0.027     0.373     0.022     0.282
20:09     10.0     225.1      20.9      6.28     13.36     132.5      5.53     14.26     0.023     0.368     0.021     0.286
20:10      9.8     222.6      20.1      6.02     13.56     133.8      5.64     14.14     0.022     0.357     0.020     0.291
20:11     10.2     223.2      19.9      6.08     13.47     126.0      6.01     13.76     0.023     0.360     0.020     0.281
20:12     10.3     221.3      20.3      6.23     13.32     133.9      5.65     14.14     0.023     0.360     0.020     0.292
20:13     10.3     219.3      20.9      6.36     13.23     129.6      5.47     14.25     0.024     0.360     0.021     0.279
20:14      5.2     220.2      23.2      6.25     13.36     140.2      4.90     14.85     0.021     0.359     0.023     0.291
20:15      8.8     219.2      23.1      5.87     13.75     141.2      4.66     15.05     0.020     0.348     0.022     0.289

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:15     20.1     222.4      21.5      6.30     13.30     131.2      5.59     14.17     0.046     0.364     0.021     0.284

20:16      9.6     217.5      25.5      5.48     14.07     144.1      4.70     15.05     0.021     0.337     0.024     0.295
20:17     10.0     218.2      24.2      5.33     14.18     138.3      4.92     14.79     0.021     0.335     0.023     0.287
20:18      9.4     221.7      25.5      5.39     14.11     150.2      4.60     15.15     0.020     0.341     0.024     0.306
20:19      9.1     219.2      22.0      5.22     14.28     141.5      5.23     14.57     0.019     0.334     0.020     0.300
20:20      9.2     221.6      19.8      5.48     14.02     137.5      5.21     14.58     0.020     0.343     0.019     0.291
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Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
20:21	11.4	223.3	20.6	5.58	13.96	137.7	5.10	14.66	0.025	0.348	0.020	0.289
20:22	11.5	222.8	21.6	5.63	13.93	142.8	4.75	14.98	0.025	0.348	0.021	0.294
20:23	11.0	216.7	27.6	5.42	14.16	158.4	4.01	15.68	0.024	0.334	0.026	0.311
20:24	11.8	211.9	32.0	5.02	14.48	146.8	4.84	14.86	0.025	0.319	0.029	0.304
20:25	11.2	218.8	29.6	5.20	14.28	158.0	4.50	15.24	0.024	0.333	0.027	0.320
20:26	15.6	220.3	24.9	5.10	14.41	158.3	4.53	15.24	0.033	0.333	0.023	0.321
20:27	26.3	219.6	22.9	5.12	14.38	141.8	5.17	14.61	0.055	0.332	0.021	0.299
20:28	31.2	221.6	22.7	5.33	14.13	129.4	5.57	14.23	0.067	0.340	0.021	0.280

COMMENTS: End of Test 1-5

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1-5 Calibration Bias Check

DATE : 10-27-1989 TIME: 20:29 - 20:50

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.7
1	OUTLET	ppmSO2	49.6	49.1
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	236.5
4	OUTLET	ppmCO	0.0	-0.1
4	OUTLET	ppmCO	24.8	23.7
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.43
5	OUTLET	% CO2	0.00	0.17
5	OUTLET	% CO2	11.06	11.19
6	INLET	ppmSO2	0.0	5.2
6	INLET	ppmSO2	218.0	216.3
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.41
8	INLET	% CO2	0.00	0.46
8	INLET	% CO2	11.06	11.19

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/26/89

RUN NUMBER: 1-SI-CEM-1 (INLET)

SPAN VALUES:
500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.2	2.2	0.40	4.2	0.80	0.40
SO2 UP-SCALE	218.1	215.3	-0.56	212.5	-1.12	-0.56
O2 ZERO GAS	0.05	0.02	-0.12	0.04	-0.04	0.08
O2 UP-SCALE	12.52	12.44	-0.32	12.27	-1.00	-0.68
CO2 ZERO GAS	0.01	0.04	0.15	0.24	1.15	1.00
CO2 UP-SCALE	11.04	11.00	-0.20	11.11	0.35	0.55

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/27/89

RUN NUMBER: 1-SI-CEM-3 (INLET)

SPAN VALUES:
500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.6	2.9	0.46	4.0	0.68	0.22
SO2 UP-SCALE	216.0	214.1	-0.38	207.1	-1.78	-1.40
O2 ZERO GAS	0.01	0.05	0.16	0.04	0.12	-0.04
O2 UP-SCALE	12.52	12.51	-0.04	12.38	-0.56	-0.52
CO2 ZERO GAS	0.00	0.02	0.10	0.22	1.10	1.00
CO2 UP-SCALE	11.01	10.94	-0.35	11.06	0.25	0.60

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/27/89

RUN NUMBER: 1-SI-CEM-5 (INLET)

SPAN VALUES: 500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.6	4.5	0.78	5.2	0.92	0.14
SO2 UP-SCALE	216.0	209.6	-1.28	216.3	0.06	1.34
O2 ZERO GAS	0.01	0.04	0.12	0.04	0.12	0.00
O2 UP-SCALE	12.52	12.46	-0.24	12.41	-0.44	-0.20
CO2 ZERO GAS	0.00	0.33	1.65	0.46	2.30	0.65
CO2 UP-SCALE	11.01	11.13	0.60	11.19	0.90	0.30

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

APPENDIX B.1.a.2

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

a. Dry Scrubber Inlet

2. Hydrogen Chloride and Hydrogen Fluoride

Preliminary Field Data

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

LOCATION WEST PALM BEACH, FL

SAMPLING LOCATION UNITS 1 + 2 DRY SCRUBBER INLET

NO. OF PORTS 3

PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 100 1/8"

NIPPLE LENGTH 12"

DEPTH OF DUCT 88 1/8"

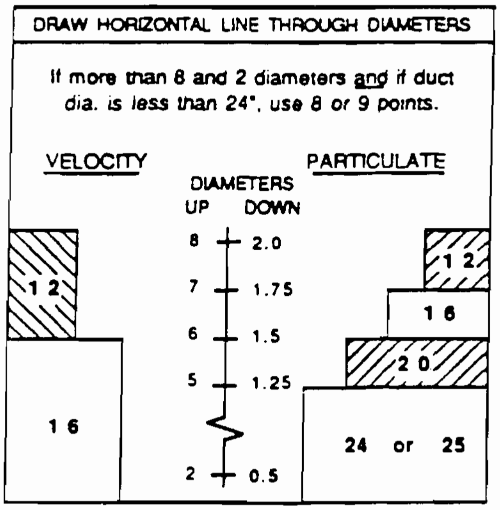
WIDTH (RECTANGULAR DUCT) 88 1/8"

EQUIVALENT DIAMETER:

$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} = 88\ 1/8"$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	5'	5'
DIAMETERS	<1	<1

STACK AREA = 88 1/8" × 88 1/8" = 7766 IN²


DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.

POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8"	20 7/8"
2	20.0	26 3/8"	38 5/8"
3	30.0	44"	56"
4	40.0	61 5/8"	73 5/8"
5	50.0	79"	91"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.8	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.6	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY ENVIRONMENTALISTS, INC.

ORSAT FIELD DATA

Plant Name NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
Sampling Location UNIT 1 DRY SCRUBBER INLET Fuel Type RDF

Run and/or Sample No. 1-DSI-M3-1 Leak Test? ✓ Date 10/26/89 Operator MJ

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
0935	1110	12.5	19.0	—	6.5	—	
TO		12.5	19.0		6.5		
1045		12.5	19.0		6.5		
	Avg.	12.5		Avg.	6.5		81.0

Run and/or Sample No. 1-DSI-M3-2 Leak Test? Date 10/26/89 Operator

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
	Avg.			Avg.			

Run and/or Sample No. 1-DSI-M3-3 Leak Test? Date 10/26/89 Operator

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
	Avg.			Avg.			

ORSAT FIELD DATA

Plant Name NCRRAF

Sampling Location UNIT 1 DSI Fuel Type RDF

Run and/or Sample No. 1-DSI-M3-3 Leak Test? ✓ Date 10-27 Operator MJf

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1150	1350	12.2	18.9	—	6.7	—	
/	/	12.2	18.9		6.7		
1305	1410	12.1	18.8		6.7		
	Avg.	12.2		Avg.	6.7		81.1

Run and/or Sample No. 1-DSI-M3-4 Leak Test? ✓ Date 10-27 Operator MJf

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
~~1545~~	~~1800~~	~~13.2~~	~~18.9~~	~~—~~	~~5.7~~	~~—~~	
~~/~~	~~/~~	~~13.1~~	~~18.9~~		~~5.8~~		
~~1700~~	~~1830~~	~~13.2~~	~~18.8~~		~~5.6~~		
	Avg.	~~13.2~~		Avg.	~~5.7~~		~~81.1~~

Run and/or Sample No. 1-DSI-M3-5 Leak Test? ✓ Date 10-27 Operator BtR

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1845	2105	12.6	19.1	—	6.5	—	
/	2115	12.6	19.1		6.5		
2000	2120	12.6	19.0		6.6		
	Avg.	12.6		Avg.	6.5	—	80.9

F-1009
8/86

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER 1-DSI-M13B-1
ADDRESS W. PALM BCH., FL. TIME START 0935
SAMPLING LOCATION UNIT 1 DRY SCRUBBER INLET TIME FINISH 1037
DATE 10-26-89 TEAM LEADER MF TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -2.75
TRAIN LEAK CHECK VACUUM IN. HG 15 15(F)
TRAIN LEAK RATE, CU.FT/MIN 0.003 0.004

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
— M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 77 PRE
✓ THERMOCOUPLE @ 82 POST

IDENTIFICATION NUMBERS

REAGENT BOX 224 NOZZLE 506 DIAMETER 0.241
METER BOX N5 T/C READOUT F21
UMBILICAL U9 T/C PROBE 9-6
SAMPLE BOX 33 ORSAT PUMP —
PROBE 9-3 PITOT — TEDLAR BAG —

LEAK CHECK READINGS

B
1
E
B
2
E
B
3
E
B
4
E
B
5
E
B
6
E

FILTER #	TARE
WH. 541	—

DELTA H@ 1.90
METER TEMP 110
EST. %H_2O 16
C FACTOR 0.90
STACK TEMP 360
REF DELTA P 0.85
K-FACTOR 2.16

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	B1	0	109.668	0.40	0.87	0.87	89	2	245	65	351	
2	2	4	111.69	0.38	0.82	0.82	90	2	255	65	355	
3	3	8	113.56	0.51	1.10	1.10	92	2	255	65	355	
4	4	12	115.76	0.43	0.93	0.93	94	2	255	65	356	
5	5	16	117.85	0.65	1.41	1.41	95	3	255	65	356	
6	C1	20/0	120.385	0.43	0.93	0.93	97	3	250	60	352	
7	2	4	122.44	0.53	1.15	1.15	99	3	250	60	348	
8	3	8	124.69	0.44	0.95	0.95	102	3	250	60	350	
9	4	12	126.78	0.40	0.87	0.87	104	3	250	60	347	
10	5	16	128.75	0.48	1.04	1.04	105	3	250	60	347	
11	A1	40/0	130.858	0.43	0.93	0.93	106	5	250	60	348	
12	2	4	132.92	0.54	1.17	1.17	107	7	250	60	350	
13	3	8	135.06	0.95	2.06	1.65	108	14	250	60	350	
14	4	12	137.573									
15	5	16										
16		60/OFF										
17												
18												
19												
20												
21												
22												
23												
24												
25												

52	27.905	0.4968	1.06	99	351
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER 1-DSI-M13B-3
ADDRESS W. PALM BCH., FL
TIME START 1150
SAMPLING LOCATION UNIT 1 DSI
TIME FINISH 1307
DATE 10-27-89 TEAM LEADER VMH TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -2.65

TRAIN LEAK CHECK VACUUM IN. HG	15	15 ①	15 ②	15 ③	15 F		
TRAIN LEAK RATE, CU.FT/MIN	0.003	0.003	0.003	0.003	0.004		

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
— M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 75 PRE
✓ THERMOCOUPLE @ 85 POST

IDENTIFICATION NUMBERS

REAGENT BOX ~~224~~ 241 NOZZLE 506 DIAMETER 0.241
METER BOX N5 T/C READOUT F21
UMBILICAL U9 T/C PROBE 9-6
SAMPLE BOX 32 ORSAT PUMP
PROBE 9-3 PITOT — TEDLAR BAG —

LEAK CHECK READINGS

B 1 E	6.269 186.200 .069
B 2 E	2.653 192.600 .053
B 3 E	5.027 204.952 .075
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
WH.541	—

					FYRITE
DELTA H@	1.90				
METER TEMP	105				
EST. %H_2O	16				
C FACTOR	0.90				
STACK TEMP	360				
REF DELTA P	0.84				
K-FACTOR	2.19				C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #	STAT. PRES.
1	B 1	0	180.160	0.26	0.57	0.57	100	2	240	66	345		
2	2	4	181.88	0.29	0.64	0.64	101	2	240	66	347		
3	3	8	183.50	0.45	0.99	0.99	102	6	240	66	346		
4	4	12	185.42	0.43	0.94	0.94	103	15	240	66	347	X	
5	5	16	187.27	0.53	1.16	1.16	104	3	250	63	347		
6	C 1	20/0	189.489	0.32	0.70	0.70	105	8	255	63	348		
7	2	4	191.34	0.46	1.01	1.01	107	13	255	63	352	X	
8	3	8	193.19	0.35	0.77	0.77	108	3	255	63	348		
9	4	12	195.12	0.30	0.66	0.66	111	4	255	63	348		2.75
10	5	16	196.69	0.40	0.88	0.88	111	7	255	63	346		2.40
11	A 1	40/0	198.800	0.29	0.64	0.64	113	6	255	65	345		2.00
12	2	4	200.58	0.75	1.64	1.64	115	12	255	65	348		2.70
13	3	8	203.21	0.70	1.53	1.53	116	14	250	65	346	X	2.30
14	4	12	206.05	0.77	1.69	1.69	116	3	250	65	347		2.45
15	5	16	208.63	0.61	1.34	1.34	117	3	250	65	344		2.50
16		60/OFF	211.042										
17													
18													
19													
20													
21													
22													
23													
24													
25													

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
60	30.685	0.4461	1.01	109	347

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY RRRF
RUN NUMBER 1-~~D~~SI-M~~5~~-~~5~~ 138
ADDRESS W. PALM BCH, FL
TIME START 1845
SAMPLING LOCATION UNIT 1 DRY SCRUBBER INLET
TIME FINISH 2002
DATE 10-27-89
TEAM LEADER MJ
TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG ~~30.0~~ 29.8
STATIC PRESSURE IN. H_2O -2.6

TRAIN LEAK CHECK VACUUM IN. HG	15	13 ①	15 ②	8 Ⓕ			
TRAIN LEAK RATE, CU.FT/MIN	0.003	0.002	0.003	0.002			

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
— M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 84 PRE
✓ THERMOCOUPLE @ 81 POST

IDENTIFICATION NUMBERS

REAGENT BOX ~~601~~ 241
NOZZLE 506
DIAMETER 0.241
METER BOX N5
T/C READOUT F21
UMBILICAL 21
T/C PROBE 10-33
SAMPLE BOX 42
ORSAT PUMP ~~16~~
PROBE 9-8
PITOT —
TEDLAR BAG —

LEAK CHECK READINGS

1	B	4.802
		254.712
	E	.090
2	B	7.023
		266.918
	E	.105
3	B	
	E	
4	B	
	E	
5	B	
	E	
6	B	
	E	

FILTER #	TARE
WH. 541	—

DELTA H@	1.90			
METER TEMP	105			
EST. %H_2O	16			
C FACTOR	0.90			
STACK TEMP	360			
REF DELTA P	0.85			
K-FACTOR	2.16			

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	B 1	0	245.068	0.27	0.58	0.58	92	2	240	65	355	
2	2	4	246.75	0.32	0.69	0.69	93	3	240	65	357	
3	3	8	248.49	0.48	1.04	1.04	93	3	240	65	358	
4	4	12	250.65	0.38	0.82	0.82	94	3	240	65	357	
5	5	16	252.60	0.46	1.00	1.00	95	4	240	65	357	
6	C 1	20/0	254.712	0.32	0.69	0.69	97	3	240	65	357	X
7	2	4	256.44	0.39	0.84	0.84	98	15	240	65	360	X
8	3	8	258.33	0.40	0.87	0.87	100	3	240	65	358	
9	4	12	260.31	0.32	0.69	0.69	101	3	240	65	357	
10	5	16	262.15	0.45	0.97	0.97	104	3	240	65	356	
11	A 1	40/0	264.208	0.39	0.84	0.84	104	3	250	63	360	
12	2	4	266.33	0.84	1.82	1.82	104	6	250	63	364	
13	3	8	269.11	0.80	1.73	1.73	106	6	250	63	362	
14	4	12	271.94	0.69	1.49	1.49	107	6	250	63	358	
15	5	16	274.49	0.65	1.41	1.41	107	6	250	63	356	
16		60/OFF	277.032									
17												
18												
19												
20												
21												
22												
23												
24												
25												
			31.769									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
60	~~31.964~~	0.4628	1.03	100	358

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Facility EEI Ref# 6284

Sampling Location: Unit No. 1 Dry Scrubber Inlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0224,0213

Run Number	1-SI-M13B-1	1-SI-M13B-3	1-SI-M13B-5
Run Date	10/26	10/27	10/27

ANALYSIS OF MOISTURE CATCH

Reagent 1 (0.1N NaOH)			
Final Weight, g.	510.0	540.0	540.0
Tared Weight, g.	400.0	400.0	400.0
	==========	==========	==========
Water Catch, g.	110.0	140.0	140.0
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	110.0	140.0	140.0
Silica Gel:			
Final Weight, g.	209.5	211.5	211.5
Tared Weight, g.	200.0	200.0	200.0
	==========	==========	==========
ADSORBED WATER, g.	9.5	11.5	11.5
TOTAL WATER COLLECTED, g.	119.5	151.5	151.5

HCl Analytical Data Sheet

Job Name: North County Regional Resource Facility
Analyst: F. Jones Job Num. 6284
Sampling Location: Unit No.1 Dry Scrubber Inlet Date: 11/17/89

Chloride Standard Calibration Curve by Linear Regression

Conc. (ug/ml)	Peak Area Run 1	Peak Area Run 2	% Diff.	Predicted Concentration (ug/ml)	Percent Deviation from Actual
5.00	9139	9012	0.70%	5.01	0.24%
10.00	18676	18047	1.71%	9.99	-0.15%
30.00	56382	55098	1.15%	30.00	0.01%
50.00	93979	93503	0.25%	50.35	0.71%

Standard Curve Slope 1867 Intercept -283

Method 13B Field Samples

Sample ID	Run 1 Area	Run 2 Area	Average	Percent Deviation	Dilution Factor	Sample Volume (ml)	HCl Catch (mg)
Blank	<454	<454	<454	0.00%	1	200	<0.08
1-SI-M13B-1	47742	48699	48221	0.99%	20	1000	534.3
1-SI-M13B-3	70027	69748	69888	0.20%	20	1250	966.3
1-SI-M13B-5	81176	81137	81157	0.02%	20	1200	1077

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-3-89
DATE REPORTED 11-29-89
89W8724

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-7

ATTENTION: BRUCE HAWKS

<u>SAMPLE DESCRIPTION:</u> DRY SCRUBBER INLET UNIT 1

1. 1-SI-M13B-1 FV 1000
2. 1-SI-M13B-3 FV 1250
3. 1-SI-M13B-5 FV 1200
4. METHOD CODE

RESULTS

	1	2	3	4
Fluoride, as F, ug	5000	11500	9600 10600	13B

ROGER C. OXFORD , CHEMIST

Entropy

DATE 11-6-89

8724

11-9-89

ANALYST LD

	1	2	3	EPA Known
F	FV=1000ml 25ml $\frac{100ug \times .925}{25}$ = 3.7ug/ml $\frac{ugF \times \text{Meter Reading}}{ml \text{ sample}}$ = ug/ml F	FV=1250ml 25ml $\frac{100ug \times 1.65}{25}$ = 6.6ug/ml	FV=1200ml 25ml $\frac{100ug \times 1.4}{25}$ = 5.6ug/ml	Actual Value = .21ug/ $\frac{10ug \times .56}{25}$ = .22ug/
Distilled F	200ml ↓ 25 $\frac{100ug \times 1.25}{25}$ = 5.0ug/ml	200ml ↓ 25 $\frac{100ug \times 2.3}{25}$ = 9.2ug/ml	200ml ↓ 25 $\frac{100ug \times 2}{25}$ = 8.0ug/ml $\frac{100ug \times 2.2}{25}$ = 8.8ug/ml	EPA Known (instrument check not distilled) 25ml $\frac{10ug \times .53}{25}$ = .21ug/m

Blk	1ug/ml
200ml ↓ 25ml #1 $\frac{10ug \times .575}{25}$ = .23ug/ml	200ml ↓ 25 $\frac{30 \times .85}{25}$ = 1.02ug/ml
#2 $\frac{10ug \times .7}{25}$ = .28ug/ml 200ml ↓ 25	* Blanks were distilled behind samples, and 1ug/ml standard followed blank

CUSTODY SHEET FOR REAGENT BOX # 0241

Date of Makeup 10/26/89 Initials SDM Locked? ✓

Individual Tare of Reagent: 200 mls. of NAOH

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION Unit #1 Dry Scrubber Inlet

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-DSI-M13B-3	10-27-89	JRW	✓	10-27-89	60	JRW	✓
1-DSI-M13B-4	10-27-89	JRW	✓	10-27-89	60	JRW	✓
1-DSI-M13B-5	10-27-89	JRW	✓	10-27-89	40	JRW	✓

Received in Lab Date 10/30 Initials FJ Locked? ✓

Sampling Method: ______

Remarks:

Zero & Span Balance Initials FJ

Filter #	Tare Weight (grams)	Used on Test
Whatman 541		

ENTROPY ENVIRONMENTALISTS, INC.

BEST AVAILABLE COPY

CUSTODY SHEET FOR REAGENT BOX # 0224

Date of Makeup 19 Oct 1989 Initials JJG Locked? ✓

Individual Tare of Reagent: 200 mls. of 0.1N NaOH .

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #2 DRY SCRUBBER INLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
2-0SI-M13B-FB	10-25-89	SRD	✓	10-25-89	N/A	SRD	✓
1-0SI-M13B-FB	10-26-89	SRD	✓	10-26-89	N/A	SRD	✓
1-0SI-M13B-1	10-26-89	PFD	✓	10-26-89	40%	PFD	✓

Received in Lab Date 10/30 Initials FJ Locked? ✓

Sampling Method: M13B

Remarks:

Zero & Span Balance Initials FJ

Filter #	Tare Weight (grams)	Used on Test
WHATMAN	541	
WHATMAN	541	1-DSI-M13-B-

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 O-7 JOB NAME: NORTH COUNTY RRR.F.

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-1-89 EXPECTED DATE OF RESULTS: 11-15-89

SAMPLE MATRIX: M13 B. Dry Scrubber Inlet. Unit 1.

TYPE OF ANALYSIS REQUESTED: Fluoride. See Rules and Regulations.

Sample#	Sample ID		
1	1-SI-M13B-1		
2	1-SI-M13B-3		
3	1-SI-M13B-5		

SUBMITTED BY: Richard Lebeau

L-0005a
8/86

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 6284 0-7 were sh~~ipped via~~ Hand delivered on 11-1-89 by RAT
to OLI

Samples received at OLI on 11-2-89
by M Corcleton

Note any broken seals, leakage, spillage, and/or damage to the samples.

L-0009
1/87

APPENDIX B.1.a.3

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

a. Dry Scrubber Inlet

3. Particulate

Preliminary Field Data

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
LOCATION WEST PALM BEACH, FL
SAMPLING LOCATION UNITS 1 + 2 DRY SCRUBBER INLET

NO. OF PORTS 3
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 100 1/8"
NIPPLE LENGTH 12"
DEPTH OF DUCT 88 1/8"
WIDTH (RECTANGULAR DUCT) 88 1/8"

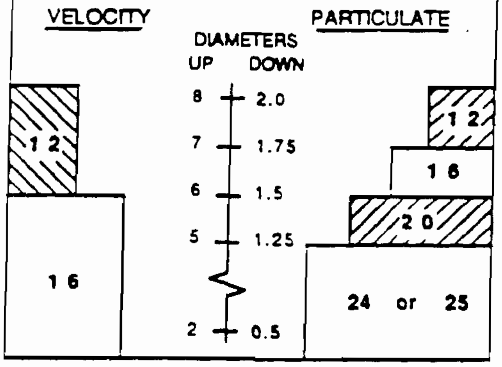
EQUIVALENT DIAMETER:
$D_E = \frac{2 \times DEPTH \times WIDTH}{DEPTH + WIDTH} = \frac{2(\quad)(\quad)}{(\quad + \quad)} =$ 88 1/8"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	5'	5'
DIAMETERS	<1	<1

STACK AREA = 88 1/8 x 88 1/8" = 7766 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8"	20 7/8"
2	20.0	26 3/8"	38 3/8"
3	30.0	44"	56"
4	40.0	61 5/8"	73 5/8"
5	50.0	79"	91"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ORSAT FIELD DATA

Plant Name NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
Sampling Location UNIT 1 DRY SCRUBBER INLET Fuel Type RDF

Run and/or Sample No. 1-DSI-M3-1 Leak Test? ✓ Date 10-23 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
0930	1230	13.2	18.8	—	5.6	—	
TO	TO	13.3	18.8		5.5		
1154	1254	13.3	18.8		5.5		
	Avg.	13.3		Avg.	5.5		81.2

Run and/or Sample No. 1-DSI-M3-2 Leak Test? ✓ Date 10-23 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1400	1600	11.6	19.0	—	7.4	—	
TO	TO	11.6	19.0		7.4		
1523	1620	11.6	19.0		7.4		
	Avg.	11.6		Avg.	7.4		81.0

Run and/or Sample No. 1-DSI-M3-3 Leak Test? ✓ Date 10-23 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1700	1915	12.2	19.0	—	6.8	—	
TO	TO	12.3	19.0		6.7		
1822	1935	12.2	19.0		6.8		
	Avg.	12.2		Avg.	6.8		81.0

F-1009
8/86

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY **RUN NUMBER** 1-051-M5-1
ADDRESS WEST PALM BEACH, FL **TIME START** 0930
SAMPLING LOCATION UNIT 1 DRY SCRUBBER INLET **TIME FINISH** 1154
DATE 10-23-89 **TEAM LEADER** MJH **TECHNICIANS** DPP
BAROMETRIC PRESSURE. IN. HG 30.0 **STATIC PRESSURE IN. H_2O** -1.69
TRAIN LEAK CHECK VACUUM IN. HG 15 15(F)
TRAIN LEAK RATE, CU.FT/MIN 0.002 0.002

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 90 PRE
- ✓ THERMOCOUPLE @ 95 POST

IDENTIFICATION NUMBERS

REAGENT BOX 601 NOZZLE 6187 DIAMETER 0.266
METER BOX N5 T/C READOUT F21
UMBILICAL 21 T/C PROBE 9-69
SAMPLE BOX 22 ORSAT PUMP 16
PROBE 9-4 PITOT PT-10 TEDLAR BAG 48

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	0.4446

DELTA H@ 1.90
METER TEMP 120
EST. %H_2O 16
C FACTOR 0.91
STACK TEMP 360
REF DELTA P 0.60
K-FACTOR

FYRITE 15.0
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	574.708	0.27	0.80	0.80	98	2	275	65	338	
2		4	576.75	0.85	2.52	2.52	99	3	275	65	340	
3	2	8	580.35	0.78	2.36	2.36	101	4	275	65	343	
4		12	583.69	0.75	2.26	2.26	102	5	270	65	340	
5	3	16	586.68	0.72	2.13	2.13	104	5	270	63	343	
6		20	590.00	0.75	2.26	2.26	106	6	270	63	361	
7	4	24	592.80	0.87	2.60	2.60	108	7	265	63	350	
8		28	596.22	0.88	2.62	2.62	109	8	265	63	355	
9	5	32	599.24	0.95	2.80	2.80	110	10	265	63	357	
10		36	603.40	0.84	2.50	2.50	113	12	265	63	354	
11	B 1	40/0	605.772	0.35	1.02	1.02	114	7	260	63	350	
12		4	608.06	0.45	1.31	1.31	114	8	255	63	350	
13	2	8	610.38	0.32	0.93	0.93	116	8	255	63	353	
14		12	612.52	0.33	0.96	0.96	118	8	250	63	355	
15	3	16	614.69	0.49	1.43	1.43	118	11	250	63	352	
16		20	617.11	0.51	1.55	1.55	120	13	250	63	353	
17	4	24	619.72	0.37	1.13	1.13	120	13	250	63	353	
18		28	622.25	0.35	1.07	1.07	120	13	250	63	349	
19	5	32	624.52	0.55	1.66	1.66	123	14	250	63	347	
20		36	627.25	0.50	1.52	1.40	124	15	250	63	349	
21	C 1	40/0	629.685									
22		4										
23	2	8										
24		12										
25	3	16										

0934
1032

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
80	54.977	.5725	1.77	112	350

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY RRRF
RUN NUMBER 1-8S1-M5-2
ADDRESS W. PALM BCH., FL
TIME START 1400
SAMPLING LOCATION UNIT 1 DRY SCRUBBER INLET
TIME FINISH 1523
DATE 10-23-89 TEAM LEADER MYK TECHNICIANS DPA
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -2.5
TRAIN LEAK CHECK VACUUM IN. HG 15 12Ⓕ
TRAIN LEAK RATE, CU.FT/MIN 0.002 0.001

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
✓ M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 44 PRE
✓ THERMOCOUPLE @ 95 POST

IDENTIFICATION NUMBERS

REAGENT BOX 601
NOZZLE GL161
DIAMETER 0.260
METER BOX N5
T/C READOUT E21
UMBILICAL 21
T/C PROBE 9-8
SAMPLE BOX 13
ORSAT PUMP 16
PROBE 9-2
PITOT PT-21
TEDLAR BAG 18

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	0.4660

DELTA H@ 1.90
METER TEMP 120
EST. %H_2O 16
C FACTOR 0.91
STACK TEMP 350
REF DELTA P 0.635
K-FACTOR 2.9

FYRITE 10.0

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	630.142	0.38	1.10	1.10	105	2	225	66	363	
2	2	5	633.19	1.00	2.90	2.90	107	4	230	66	364	
3	3	10	637.52	0.90	2.61	2.61	109	5	235	66	361	
4	4	15	641.64	0.79	2.29	2.29	112	5	235	66	359	
5	5	20	645.60	0.77	2.23	2.23	114	6	235	66	357	
6	B 1	25/0	649.333	0.41	1.19	1.19	115	4	240	63	357	
7	2	5	652.82	0.37	1.07	1.07	118	4	240	63	358	
8	3	10	655.55	0.46	1.33	1.33	120	5	245	63	358	
9	4	15	658.66	1.08	3.13	3.13	121	9	245	63	360	
10	5	20	663.23	0.47	1.36	1.36	122	7	245	63	354	
11	C 1	50/0	666.366	0.49	1.42	1.42	122	7	245	63	354	
12	2	5	669.69	0.65	1.88	1.88	124	9	240	63	357	
13	3	10	673.28	0.60	1.74	1.74	126	10	240	63	356	
14	4	15	677.00	0.50	1.45	1.45	126	9	240	63	358	
15	5	20	680.11	0.55	1.59	1.59	127	10	240	63	358	
16		75/OFF	683.563									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
75	53.421	.6097	1.82	118	358

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY RRRF
RUN NUMBER 1-ØSI-MS-3
ADDRESS W. PALM BCH. FL.
TIME START 1700
SAMPLING LOCATION UNIT 1 DRY SCRUBBER INLET
TIME FINISH 1822
DATE 10-23-89 TEAM LEADER MH
TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -2.7
TRAIN LEAK CHECK VACUUM IN. HG 15 10Ⓕ
TRAIN LEAK RATE, CU.FT/MIN 0.005 0.002

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 94 PRE
- ✓ THERMOCOUPLE @ 93 POST

IDENTIFICATION NUMBERS

REAGENT BOX 601 NOZZLE GL87 DIAMETER 0.266
METER BOX N5
T/C READOUT F21
UMBILICAL 21
T/C PROBE 9-69
SAMPLE BOX 22
ORSAT PUMP 16
PROBE 9-4 PITOT PT-10 TEDLAR BAG 16

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	0.4596

DELTA H@	1.90			
METER TEMP	115			
EST. %H_2O	16			
C FACTOR	0.91			
STACK TEMP	360			
REF DELTA P	0.60			
K-FACTOR	3.07			

FYRITE 11.5

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	683.892	0.30	0.92	0.92	102	2	225	66	345	
2	2	5	686.56	0.79	2.42	2.42	103	3	235	66	347	
3	3	10	690.52	0.75	2.30	2.30	104	4	240	65	349	
4	4	15	694.48	0.65	1.99	1.99	107	5	240	65	340	
5	5	20	698.35	0.69	2.12	2.12	110	5	245	65	342	
6	B 1	25/0	702.095	0.29	0.89	0.89	111	4	250	65	336	
7	2	5	704.75	0.32	0.98	0.98	114	4	250	65	338	
8	3	10	707.52	0.47	1.44	1.44	116	6	250	65	342	
9	4	15	710.75	0.38	1.17	1.17	118	6	250	65	343	
10	5	20	713.69	0.57	1.75	1.75	120	7	250	65	346	
11	C 1	50/0	717.180	0.46	1.41	1.41	120	7	255	65	348	
12	2	5	720.38	0.60	1.84	1.84	121	9	255	65	349	
13	3	10	723.98	0.48	1.47	1.47	121	9	255	65	347	
14	4	15	727.50	0.38	1.17	1.17	122	10	250	65	347	
15	5	20	730.39	0.49	1.50	1.50	122	10	250	65	346	
16		75/OFF	733.618									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
75	49.726	.4959	1.56	114	344

F1010
9/89
p1

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 Dry Scrubber Inlet

Date Received: 10/31 Date Analyzed: 10/31 Reagent Box(es): 0601

Run Number	1-SI-M5-1	1-SI-M5-2	1-SI-M5-3
Run Date	10/23	10/23	10/23

ANALYSIS OF MOISTURE CATCH

Reagent 1 (5% HNO3/ 10% H2O2)			
Final Weight, g.	804.5	811.5	815.5
Tared Weight, g.	585.0	569.5	596.5
	==========	==========	==========
Water Catch,g.	219.5	242.0	219.0
Reagent 2 (4% KMnO4 / 10% H2SO4)			
Final Weight, g.	339.0	344.5	345.0
Tared Weight, g.	334.0	334.5	339.0
	==========	==========	==========
Water Catch,g.	5.0	10.0	6.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	224.5	252.0	225.0
Silica Gel:			
Final Weight, g.	216.5	217.5	214.0
Tared Weight, g.	200.0	200.0	200.0
	==========	==========	==========
ADSORBED WATER, g.	16.5	17.5	14.0
TOTAL WATER COLLECTED, g.	241.0	269.5	239.0

PARTICULATE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 Dry Scrubber Inlet

Date Received: 10/31 Date Analyzed: 11/8 Reagent Box(es): 0601

Run Number	1-SI-M5-1	1-SI-M5-2	1-SI-M5-3
Run Date	10/23	10/23	10/23
Sample ID/Container #	F / 1104	F / 1105	F / 1106
		✓90.3226	
	83.4675	90.3230	83.0937
	✓83.4672	90.3250	✓83.0933
	83.4683	90.3273	83.0960
	83.4696	90.3291	83.0975
Tare Weight., g.	76.4869	78.8001	77.1267
SAMPLE WT., g.	6.9803	11.5225	5.9666
Sample ID/Container #	R / 2529	R / 2558	R / 2559
	100.3372		✓98.1685
	✓100.3368	✓98.9779	98.1685
	100.3395	98.9784	98.1710
	100.3577	98.9845	98.3153
Tare Wt., g.	99.7779	97.0445	97.9836
SAMPLE WT., g.	0.5589	1.9334	0.1849
Sum of Particulate, mg.	7539.2	13455.9	6151.5
Total Filter Tare, mg.	444.6	466.0	459.6
Blank Residue, mg.	(250 ml) 0.5	(250 ml) 0.5	(225 ml) 0.5
TOTAL PARTICULATE CATCH, mg.	7094.1	12989.4	5691.4

Blank Beaker #	2003
Final wt., mg.	99546.3
Tare wt., mg.	99545.9
Residue, mg.	0.4
Volume, ml.	200

---Legend---

✓ = Final Weight
L = Loose Particulate
F = Filter D = Dish
R = Rinse P = Pan

Notes and Comments

Concentration, mg/ml 0.002

CUSTODY SHEET FOR REAGENT BOX # 0601

Date of Makeup 10/19 Initials FJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 5% HNO_3 / 10% H_2O_2

Individual Tare of Reagent: ________ mls. of ________

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 DRY SCRUBBER INLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-DSI-M5-1	10-23-89	PFD	✓	10-23-89	70%	PFD	✓
1-DSI-M5-2	10-23-89	PFD	✓	10-23-89	40%	PFD	✓
1-DSI-M5-3	10-23-89	PFD	✓	10-23-89	60%	PFD	✓

	Date	Initials	Locked?
Received in Lab	10/31/89	PR	✓

Sampling Method: M5

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	0.4446	1-I-M5-1
QUARTZ	0.4660	1-DSI-M5-2
QUARTZ	0.4596	1-DSI-M5-3

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0215

Date of Makeup 10/19 Initials FJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 5% HNO_3 / 10% H_2O_2

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 & 2 DRY SCRUBBER INLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-DSI-M5FB	10-23-89	PFD	✓	10-23-89	—	PFD	✓
2-DSI-M5FB	10-24-89	PFD	✓	10-24-89	—	PFD	✓

	Date	Initials	Locked?
Received in Lab	10/31/89	PR	✓

Zero & Span Balance Initials PR

Sampling Method: M5

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	0.4675	1-DSI-M5-FB
QUARTZ	0.4664	2-DSI-M5-FB

Remarks:

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX B.1.a.4

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

a. Dry Scrubber Inlet

4. Sulfuric Acid Mist

Preliminary Field Data

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

LOCATION WEST PALM BEACH, FL

SAMPLING LOCATION UNITS 1 + 2 DRY SCRUBBER INLET

NO. OF PORTS 3

PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 100 1/8"

NIPPLE LENGTH 12"

DEPTH OF DUCT 88 1/8"

WIDTH (RECTANGULAR DUCT) 88 1/8"

EQUIVALENT DIAMETER:

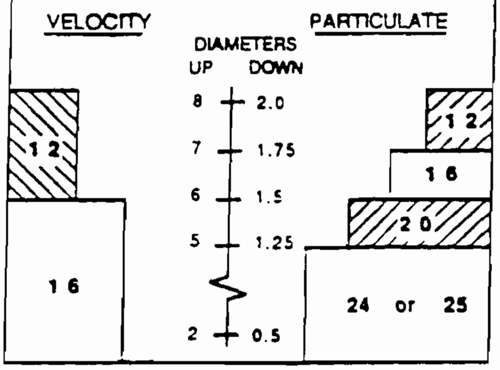
$$D_E = \frac{2 \times DEPTH \times WIDTH}{DEPTH + WIDTH} = \frac{2(\quad)(\quad)}{(\quad + \quad)} = 88\ 1/8''$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	5'	5'
DIAMETERS	< 1	< 1

STACK AREA = 88 1/8 × 88 1/8" = 7766 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8"	20 7/8"
2	20.0	26 3/8"	38 5/8"
3	30.0	44"	56"
4	40.0	61 5/8"	73 5/8"
5	50.0	79"	91"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	18.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

F0003
4/24/89

ENTROPY
ENVIRONMENTALISTS, INC

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRF RUN NUMBER 1-DSE-m8-1
ADDRESS West Palm Beach Fla. TIME START 09:35
SAMPLING LOCATION Unit No. 1 Dryer Scrubber Inlet TIME FINISH 10:45
DATE 10-26-89 TEAM LEADER DDH TECHNICIANS DP
BAROMETRIC PRESSURE. IN. HG 30.00 STATIC PRESSURE IN. H_2O -2.8
TRAIN LEAK CHECK VACUUM IN. HG 15 15" 15"
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000 0.001

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
✓ M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 360 PRE
✓ THERMOCOUPLE @ 360 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0564 NOZZLE 606 DIAMETER .263
METER BOX N-20 T/C READOUT F-5
UMBILICAL U-19 T/C PROBE 10-11
SAMPLE BOX 22 ORSAT PUMP 16
PROBE 9-1 PITOT — TEDLAR BAG 41

LEAK CHECK READINGS

B1	192.919
E1	192.969
B2	
E2	
B3	
E3	
B4	
E4	
B5	
E5	
B6	
E6	

FILTER #	TARE
N/A	n/A

DELTA H@ 1.813
METER TEMP 100
EST. %H_2O 16
C FACTOR .87
STACK TEMP 360
REF DELTA P .62
K-FACTOR 2.9627 7/19

FYRITE
61
11
11
11
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	167.500	.32	.95	.95	91	2	235	48	350	
2	2	4	169.650	.85	2.52	2.52	94	6	240	45	352	
3	3	8	172.640	.80	2.37	2.37	96	6	250	45	357	
4	4	12	175.700	.85	2.52	2.52	99	9	250	45	359	
5	5	16	179.110	.83	2.46	2.46	99	10	250	45	357	
6	B 1	20	182.359	.35	1.03	1.03	100	7	250	46	358	
7	2	24	184.520	.30	.89	.89	100	10	250	46	359	
8	3	28	186.480	.47	1.39	1.39	102	13	260	47	355	
9	4	32	188.900	.30	.89	.89	102	13	260	47	352	
10	5	36	190.900	.35	1.03	.90	102	13	260	48	349	
11	C 1	40	192.969	.37	1.10	1.10	101	4	260	49	355	
12	2	44	195.120	.46	1.37	1.37	102	4	260	49	360	
13	3	48	197.510	.47	1.39	1.39	102	4	260	49	359	
14	4	52	200.300	.39	1.16	1.16	102	4	260	49	359	
15	5	56	202.515	.44	1.60	1.60	102	4	260	49	359	
16	off	60	205.390									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
60	37.890	.4843	1.50	100	356

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRF RUN NUMBER I-DSI-M8-4
ADDRESS West Palm Beach Fla TIME START 15:45
SAMPLING LOCATION Unit No1 Dry Scrubber Inlet TIME FINISH 17:00
DATE 10-26-89 TEAM LEADER DDH TECHNICIANS DP
BAROMETRIC PRESSURE. IN. HG 29.80 STATIC PRESSURE IN. H_2O -2.4
TRAIN LEAK CHECK VACUUM IN. HG 15" 12"
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 360 PRE
- ✓ THERMOCOUPLE @ 360 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0219 NOZZLE 505 DIAMETER .251
METER BOX 720 T/C READOUT F-5
UMBILICAL U19 T/C PROBE 9-20
SAMPLE BOX 25 ORSAT PUMP 16
PROBE 9-10 PITOT ______ TEDLAR BAG 21

LEAK CHECK READINGS

B	348.304
1	348.254
E	.050
B	
2	
E	
B	
3	
E	
B	
4	
E	
B	
5	
E	
B	
6	
E	

FILTER #	TARE
n/A	n/A

DELTA H@ 1.813
METER TEMP 90
EST. %H_2O 16
C FACTOR .90
STACK TEMP 360
REF DELTA P .71
K-FACTOR 2.5915493

FYRITE
11
12
12
12
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	325.000	.30	.78	.78	80	2	225	44	359	
2	2	4	327.205	.90	2.33	2.33	80	5	235	44	359	
3	3	8	329.900	.84	2.18	2.18	83	6	240	44	356	
4	4	12	332.998	.70	1.81	1.81	83	6	240	44	359	
5	5	16	335.800	.74	1.92	1.92	83	9	240	44	360	
6	B 1	20	338.902	.27	.70	.70	83	5	250	44	351	
7	2	24	340.775	.26	.67	.67	92	5	250	44	358	
8	3	28	342.555	.43	1.11	1.11	92	9	250	44	360	
9	4	32	344.700	.33	.86	.86	96	9	250	43	360	
10	5	36	346.590	.40	1.04	1.04	97	12	250	44	360	
11	C 1	40	348.254	.33	.86	.86	98	3	250	44	360	
12	2	44	350.510	.41	1.06	1.06	99	3	250	44	360	
13	3	48	352.710	.37	.96	.96	99	5	250	44	360	
14	4	52	354.590	.30	.78	.78	100	5	250	44	360	
15	5	56	356.490	.37	.96	.96	100	5	250	43	360	
16	Off	60	358.460									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
60	~~33.46~~ 33.410	.4428	1.20	91	359

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER 1-DSI-M8-5
ADDRESS West Palm Beach Fla. TIME START 18:45
SAMPLING LOCATION Unit No. 1 DSD SCRUBBER Inlet TIME FINISH 20:00
DATE 10-24-89 TEAM LEADER DDH TECHNICIANS DP
BAROMETRIC PRESSURE. IN. HG 29.80 STATIC PRESSURE IN. H_2O -2.6
TRAIN LEAK CHECK VACUUM IN. HG 15 12
TRAIN LEAK RATE, CU.FT/MIN 0.009 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 360 PRE
- ✓ THERMOCOUPLE @ 360 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0219 NOZZLE 606 DIAMETER .265
METER BOX N20 T/C READOUT F5
UMBILICAL U19 T/C PROBE 9-6
SAMPLE BOX 22 ORSAT PUMP 16
PROBE 9-3 PITOT TEDLAR BAG 15

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
N/A	N/A

DELTA H@ 1.813
METER TEMP 100
EST. %H_2O 16
C FACTOR .87
STACK TEMP 360
REF DELTA P .62
K-FACTOR 2.967419

FYRITE
12
12
12
12

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	366.172	.33	.98	.98	93	2	250	41	358	
2	2	4	368.310	.87	2.58	2.58	94	6	250	42	359	
3	3	8	371.250	.85	2.52	2.52	95	9	250	42	360	
4	4	12	374.400	.76	2.26	2.26	95	9	250	41	360	
5	5	16	377.767	.74	2.20	2.20	95	9	250	41	360	
6	B 1	20/0	380.942	.30	.89	.89	98	9	250	41	360	
7	2	24	383.000	.32	.95	.95	95	9	250	41	360	
8	3	28	385.020	.55	1.63	1.63	98	12	250	41	360	
9	4	32	387.730	.40	1.19	1.19	98	11	250	44	359	
10	5	36	390.300	.61	1.81	1.80	98	11	250	44	359	
11	C 1	40/0	392.571	.37	1.10	1.10	96	3	250	44	362	
12	2	44	394.876	.40	1.19	1.19	96	3	250	44	362	
13	3	48	397.125	.43	1.28	1.28	97	3	250	43	360	
14	4	52	399.500	.44	1.30	1.30	100	10	250	42	361	
15	5	56	402.091	.45	1.34	1.34	100	10	250	42	360	
16		60/off	404.571									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
60	38.399	.5051	1.53	97	360

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 Dry Scrubber Inlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0564, 0219

Run Number	1-SI-M8-1	1-SI-M8-4	1-SI-M8-5
Run Date	10/26	10/27	10/27

ANALYSIS OF MOISTURE CATCH

Reagent 1 (5% H2O2)			
Final Weight, g.	658.5	635.5	652.0
Tared Weight, g.	581.5	569.0	578.0
	==========	==========	==========
Water Catch,g.	77.0	66.5	74.0
Reagent 2 (80% IPA)			
Final Weight, g.	372.5	372.0	382.0
Tared Weight, g.	314.5	307.5	314.5
	==========	==========	==========
Water Catch,g.	58.0	64.5	67.5
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	135.0	131.0	141.5
Silica Gel:			
Final Weight, g.	441.5	436.0	429.5
Tared Weight, g.	400.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	41.5	36.0	29.5
TOTAL WATER COLLECTED, g.	176.5	167.0	171.0

SULFURIC ACID (H2SO4) ANALYTICAL RESULTS

EPA REFERENCE METHOD

Company Name: NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY EEI #: 6284

Sampling Location: UNIT NO. 1 DRY SCRUBBER INLET

Date Analyzed: 11/28

Analyst: PR

Burette Size Used: 10 ml

Analytical Media: 80% IPA

RUN NUMBER	SAMPLE VOLUME mls (V)	ALIQUOT VOLUME mls (A)	ALIQUOT FACTOR (F)	TITRANT VOLUME mls (T1)	TITRANT VOLUME mls (T2)	TITRANT VOLUME mls (Tavg)	MASS H2SO4 mg (MH2SO4)
Reagent Blank	XXXXXX	20	XXXXXX	0.06	0.06	0.060	Tbavg
1-SI-M8-1	350	20	17.5	0.5	0.48	0.490	3.6
1-SI-M8-4	600	20	30.0	0.49	0.5	0.495	6.3
1-SI-M8-5	500	20	25.0	1.14	1.16	1.150	13.1

Where:

Tavg = (T + T) / 2

F = V / A

N = Volume H2SO4 * 0.02N / Volume BaCl2

MSO2 = 49.04 * (Tavg + Tbavg) * N * F

Titration Standardization
against 0.02N H2SO4

H2SO4 Volume	BaCl2 Volume	BaCl2 Normality
5	10.25	0.0098
5	10.25	0.0098
5	10.20	0.0098
	Average	0.0098

For Run: 1-SI-M8-1

MH2SO4=49.04 *(0.490 - 0.06) * 0.0098 * 17.5

MH2SO4 = 3.6 mg

NOTE: Results reported to the nearest 0.1 mg. or four significant figures

CUSTODY SHEET FOR REAGENT BOX # 0564

Date of Makeup 10/13 Initials MEG Locked? ✓

Individual Tare of Reagent: 200 gms. of 5% H_2O_2

Individual Tare of Reagent: 84 gms. of 80% IPA

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Fac

SAMPLING LOCATION Unit #1 Dry Scrubber Inlet

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locke
1-DSI-M8-1	10-26-89	JRW	✓	10-26-89	60	JRW	✓
1-DSI-M8-2	10-26-89	JRW	✓	10-26-89	40	JRW	✓
1-DSI-M8-3	10-27-89	JRW	✓	10-27-89	40	JRW	✓

Received in Lab Date 10/31/89 Initials PR Locked? ✓

Zero & Span Balance Initials PR

Sampling Method: M8

Filter #	Tare Weight (grams)	Used on Test

Remarks:

1-DSI-M8-2 Aborted

CUSTODY SHEET FOR REAGENT BOX # 0219

Date of Makeup 10/26 Initials FJ Locked? ✓

Individual Tare of Reagent: 200 gms. of 5% H2O2

Individual Tare of Reagent: 84 gms. of 80% IPA

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION Dry Scrubber Inlet Unit #1

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locke
1-0SI-M8-4	10-27-89	JRW	✓	10-27-89	70	PFD	J
1-0SI-M8-5	10-27-89	JRW	✓	10-27-89	70	PFD	✓

	Date	Initials	Locked?
Received in Lab	10/31/89	PR	✓

Zero & Span Balance Initials PR

Sampling Method: M8

Filter #	Tare Weight (grams)	Used on Test
Unnumbered, Untared		

Remarks:

APPENDIX B.1.b.1

B. FIELD AND ANALYTICAL DATA

   1. Unit No. 1

      b. ESP Outlet

         1. Beryllium

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility

LOCATION West Palm Beach, FL

SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5

PORT INSIDE DIAMETER 4"

DUCT DEPTH FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"

NIPPLE LENGTH 9"

DEPTH OF DUCT 88 1/2"

WIDTH (RECTANGULAR DUCT) 88 1/2"

EQUIVALENT DIAMETER:

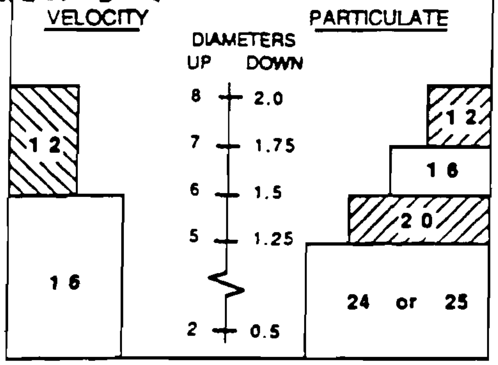
$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} = 88\tfrac{1}{2}"$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	28.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	84.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY ENVIRONMENTALISTS, INC.

ORSAT FIELD DATA

Plant Name NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
Sampling Location UNIT 1 ESP OUTLET Fuel Type RDF

Run and/or Sample No. 1-ESPO-M3-1 Leak Test? ✓ Date 10-23 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
0930	1255	11.1	19.1	—	8.0	—	
TO	TO	11.2	19.1		7.9		
1251	1315	11.2	19.1		7.9		
	Avg.	11.2		Avg.	7.9		80.9

Run and/or Sample No. 1-ESPO-M3-2 Leak Test? ✓ Date 10-23 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1335	1625	11.2	19.0	—	7.8	—	
TO	TO	11.3	19.1		7.8		
1557	1645	11.3	19.1		7.8		
	Avg.	11.3		Avg.	7.8		80.9

Run and/or Sample No. 1-ESPO-M3-3 Leak Test? ✓ Date 10-23 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1630	1930	12.0	19.0	—	7.0	—	
TO	TO	12.0	19.0		7.0		
1851	1950	12.0	19.0		7.0		
	Avg.	12.0		Avg.	7.0		81.0

F-1009
8/86

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME North County Regional Resource Recovery RUN NUMBER 1-EPTO M104-1
ADDRESS West Palm Beach Fla. TIME START 09:30
SAMPLING LOCATION Unit No. 1 ESP Outlet Duct TIME FINISH 12:51
DATE 10-23-89 TEAM LEADER DDH TECHNICIANS DDH
BAROMETRIC PRESSURE. IN. HG 30.10 STATIC PRESSURE IN. H_2O -6.2
TRAIN LEAK CHECK VACUUM IN. HG 5" 5" 10"
TRAIN LEAK RATE, CU.FT/MIN 0.000 .000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 250 PRE
- ✓ THERMOCOUPLE @ 250 POST

IDENTIFICATION NUMBERS 605 .254
REAGENT BOX 0552 NOZZLE 609 DIAMETER .311
METER BOX N7 T/C READOUT F6
UMBILICAL U5 T/C PROBE 95
SAMPLE BOX 37 ORSAT PUMP 2
PROBE 9-4 PITOT 43 TEDLAR BAG 25

LEAK CHECK READINGS

B	86.975
1	87.035
E	
B	
2	
E	
B	
3	
E	
B	
4	
E	
B	
5	
E	
B	
6	
E	

FILTER #	TARE
QUARTZ	N/A

DELTA H@	1.780			
METER TEMP	80			
EST. %H_2O	18%			
C FACTOR	.77			
STACK TEMP	260			
REF DELTA P	~~.34~~	.71		
K-FACTOR	~~31~~	~~5.9354~~	2.5915493	

FYRITE
13
12
12
12

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E 1	0	34.130	.53	3.14	3.14	79	3	228	39	260	
2	2	5	38.850	.51	3.02	3.02	80	4	240	43	260	
3	3	10	43.630	.52	3.09	3.09	82	4	240	42	258	
* 4	4	15	48.470	.55	1.42	1.42	82	4	240	43	259	*
5	5	20	52.520	.45	1.16	1.16	82	4	249	42	259	
6	D 1	25	55.639	.51	1.32	1.32	83	2	250	42	250	
7	2	30	58.840	.54	1.40	1.40	85	2	255	48	258	
8	3	35	62.115	.42	1.09	1.09	90	2	250	48	257	
9	4	40	65.080	.47	1.22	1.22	90	2	250	49	260	
10	5	45	68.160	.60	1.55	1.55	90	2	250	49	275	
11	E 1	50	71.495	.40	1.03	1.03	88	2	250	49	255	
12	2	55	74.335	.46	1.19	1.19	89	2	255	50	261	
13	3	60	77.730	.48	1.24	1.24	90	2	255	51	260	
14	4	65	80.460	.55	1.43	1.43	91	2	256	50	261	
15	5	70	83.265	.50	1.30	1.30	92	2	255	51	260	
16	A 1	75	87.035	.50	1.30	1.30	93	2	256	51	261	
17	2	80	90.265	.61	1.58	1.58	93	3	261	52	263	
18	3	85	93.800	.63	1.63	1.63	94	3	255	52	263	
19	4	90	97.400	.63	1.63	1.63	94	3	250	50	263	
20	5	95	101.000	.61	1.58	1.58	94	3	250	50	264	
21	B 1	100	104.522	.54	1.40	1.40	94	3	250	51	257	
22	2	105	107.960	.60	1.55	1.55	93	3	250	51	262	
23	3	110	111.380	.58	1.50	1.50	92	3	250	52	263	
24	4	115	114.850	.48	1.24	1.24	92	3	250	52	262	
25	5	120	118.310	.54	1.40	1.40	92	3	250	51	260	
	Off	125	121.638									

changed K

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	87.448	0.5265	1.58	89	261

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY RUN NUMBER 1-ESPO-M104-2
ADDRESS West Palm Beach Fla. TIME START 13:35
SAMPLING LOCATION Unit No. 1 ESP Outlet Duct TIME FINISH 15:57
DATE 10-23-89 TEAM LEADER DDH TECHNICIANS DDH
BAROMETRIC PRESSURE. IN. HG 30.10 STATIC PRESSURE IN. H_2O -.66
TRAIN LEAK CHECK VACUUM IN. HG 15 5"
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.004

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 150 PRE
- ✓ THERMOCOUPLE @ 250 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0552 NOZZLE 504 DIAMETER .266
METER BOX N-7 T/C READOUT F-6
UMBILICAL U5 T/C PROBE 9-4
SAMPLE BOX 17 ORSAT PUMP 2
PROBE 9-9 PITOT — TEDLAR BAG 15

LEAK CHECK READINGS

B 1	175.200
E	175576
B 2	
E	
B 3	
E	
B 4	
E	
B 5	
E	
B 6	
E	

FILTER #	TARE
N/A	n/A

DELTA H@ 1.780
METER TEMP 100
EST. $\%H_2O$ 1820
C FACTOR .80
STACK TEMP 260
REF DELTA P .59
K-FACTOR 3.118644

FYRITE
11
12
12
12
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	C 1	0	122.142	.55	1.72	1.72	92	3	275	48	264	
2	2	5	125.880	.70	2.18	2.18	95	3	270	49	263	
3	3	10	129.830	.62	1.93	1.93	97	3	260	48	260	
4	4	15	133.822	.50	1.56	1.56	98	3	258	49	260	
5	5	20	137.450	.37	1.15	1.15	96	3	250	50	260	
6	D 1	25/0	140.469	.55	1.72	1.72	97	3	250	50	255	
7	2	30	144.120	.51	1.59	1.59	98	3	250	51	259	
8	3	35	147.710	.44	1.37	1.37	98	3	250	51	260	
9	4	40	151.030	.48	1.50	1.50	98	3	240	52	258	
10	5	45	154.488	.52	1.62	1.62	99	3	250	52	259	
11	E 1	50/0	158.017	.55	1.72	1.72	98	3	250	53	254	
12	2	55	161.690	.46	1.43	1.43	99	3	250	52	259	
13	3	60	165.050	.49	1.53	1.53	97	3	250	52	259	
14	4	65	168.500	.50	1.56	1.56	97	3	250	52	259	
15	5	70	172.015	.52	1.62	1.62	97	3	255	53	260	
16	A 1	75/0	175.576	.54	1.68	1.68	96	3	230	54	257	
17	2	80	179.330	.74	2.30	2.30	96	3	245	54	258	
18	3	85	183.425	.56	1.75	1.75	98	5	250	54	261	
19	4	90	187.275	.68	2.12	2.12	98	5	250	54	263	
20	5	95	191.400	.32	1.00	1.00	99	4	250	53	264	
21	B 1	100/0	194.382	.71	2.21	2.21	97	5	250	51	255	
22	2	105	198.590	.80	2.50	2.50	98	5	250	52	265	
23	3	110	203020	.73	2.28	2.28	99	5	250	52	263	
24	4	115	207.400	.57	1.78	1.78	100	5	250	52	262	
25	5	120	211.100	.69	2.15	2.15	100	5	250	53	261	
		125	215.129									

125 minutes
92.611 Vm
0.5579 $(\sqrt{\Delta p})^2$
1.76 ΔH
97 tm
260 ts

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF **RUN NUMBER** 1-ESPO-M104-3
ADDRESS West Palm Beach Fla. **TIME START** 16:30
SAMPLING LOCATION Unit no. 1 ESP Outlet Duct **TIME FINISH** 18:51
DATE 10-23-89 **TEAM LEADER** DDH **TECHNICIANS** DDH
BAROMETRIC PRESSURE. IN. HG 30.10 **STATIC PRESSURE IN. H_2O** -6.4
TRAIN LEAK CHECK VACUUM IN. HG 15" 5" 10
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 250 PRE
- ✓ THERMOCOUPLE @ 250 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0552 NOZZLE 605 DIAMETER .254
METER BOX N 7 T/C READOUT F-6
UMBILICAL U5 T/C PROBE 9-5
SAMPLE BOX 37 ORSAT PUMP 2
PROBE 9-14 PITOT 43 TEDLAR BAG 4

LEAK CHECK READINGS

B1	266.705
E	266.934
B2	
E	
B3	
E	
B4	
E	
B5	
E	
B6	
E	

FILTER #	TARE
N/A	N/A

DELTA H@	1.780	
METER TEMP	100	
EST. %H_2O	18	
C FACTOR	.80	
STACK TEMP	260	
REF DELTA P	~~.57~~	.69
K-FACTOR	3.1126441	2.666667

FYRITE
12
12
12
12
12
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	C 1	0	215.616	.69	1.84	1.84	92	3	249	53	250	
2	2	5	219.495	.75	2.00	2.00	96	3	250	53	260	
3	3	10	223.510	.68	1.81	1.81	98	3	250	53	259	
4	4	15	227.350	.69	1.84	1.84	99	3	250	53	260	
5	5	20	231.140	.85	2.26	2.26	99	3	250	52	261	
6	D 1	25/0	235.299	.45	1.20	1.20	94	3	250	53	255	
7	2	30	238.370	.45	1.20	1.20	96	3	250	52	261	
8	3	35	241.420	.50	1.33	1.33	96	3	250	50	257	
9	4	40	244.710	.40	1.07	1.07	97	3	255	51	257	
10	5	45	247.640	.46	1.23	1.23	97	3	255	52	259	
11	E 1	50/0	250.251	.37	.99	.99	98	2	250	52	260	
12	2	55	253.555	.39	1.04	1.04	96	2	250	52	260	
13	3	60	256.450	.47	1.25	1.25	97	2	250	52	258	
14	4	65	259.600	.61	1.63	1.63	96	2	250	52	259	
15	5	70	263.05	.64	1.71	1.71	97	2	245	54	260	
16	A 1	75/0	266.934	.41	1.09	1.09	99	2	250	53	255	
17	2	80	269.850	.60	1.60	1.60	100	2	250	53	264	
18	3	85	272.785	.55	1.47	1.47	100	2	250	52	265	
19	4	90	276.200	.62	1.65	1.65	100	2	250	52	265	
20	5	95	279.600	.50	1.33	1.33	100	2	250	53	264	
21	B 1	100/0	282.808	.50	1.33	1.33	100	2	250	54	264	
22	2	105	286.000	.75	2.00	2.00	96	2	250	53	263	
23	3	110	289.320	.75	2.0	2.0	96	2	250	53	265	
24	4	115	293.170	.55	1.47	1.47	100	2	250	53	260	
25	5	120	296.630	.63	1.68	1.68	100	2	250	52	263	
		125	300.231									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	84.406	0.5630	1.52	98	260

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0602

Run Number	1-PO-M104-1	1-PO-M104-2	1-PO-M104-3
Run Date	10/23	10/23	10/23

ANALYSIS OF MOISTURE CATCH

Reagent 1 (H2O)			
Final Weight, g.	994.5	1035.5	976.5
Tared Weight, g.	571.0	571.5	583.0
	==========	==========	==========
Water Catch, g.	423.5	464.0	393.5
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	423.5	464.0	393.5
Silica Gel:			
Final Weight, g.	221.0	428.0	428.5
Tared Weight, g.	200.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	21.0	28.0	28.5
TOTAL WATER COLLECTED, g.	444.5	492.0	422.0

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-2-89
DATE REPORTED 11-28-89
89W8693

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC P.O. # 62840-3
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

ATTENTION: BRUCE HAWKS

<u>SAMPLE DESCRIPTION:</u> M104

1. 1-ESPO-M104-1
2. 1-ESPO-M104-2
3. 1-ESPO-M104-3
4. 1-ESPO-M104-FB
5. 1-ESPO-M104-2 DUPLICATE
6. METHOD CODE

RESULTS

	1	2	3	4	5	6
Beryllium, as Be, total ug	<.500	<.500	<.500	<.500	<.500	

Roger Oxford
ROGER C. OXFORD , CHEMIST

PO #62840-3
method 104
SW846-7000's

Entropy

89W 8693
11-9-89

	① F.V. = 10mls.	② F.V. = 10mls.	③
Be	<.05 × 10 = <.500	<.05 × 10 = <.500	<.05 × 10 = <.500
	④	⑤ Dup. #2	Q.A.C. Blank Pad with 25ug Stds
Be	<.05X10 = <.500	<.05 × 10 = <.500	2.40X10 24.0 96% Recovery

CUSTODY SHEET FOR REAGENT BOX # 0652

Date of Makeup 10/09/89 Initials PR Locked? ✓

Individual Tare of Reagent: 200 mls. of dH_2O

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION ESP OUTLET UNIT #1

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-~~ES~~PO-M104-1	10-23-89	SRD	—	10-23-89	80%	SRD	✓
1-~~ES~~PO-M104-2	10-23-89	SRD	—	10-23-89	50%	SRD	—
1-~~ES~~PO-M104-3	10-23-89	SRD	—	10-23-89	40%	SRD	✓

	Date	Initials	Locked?
Received in Lab	10/30/89	PR	✓

Sampling Method: M104

Remarks: DOUBLE CHARGE SILICA GEL ON 2nd + 3rd RUNS

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
UNTARED	QUARTZ	
"	"	
"	"	

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0602

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 200 mls. of dH_2O

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked
1-~~[illegible]~~10-M104-FB	10-23-89	SRD	✓	10-23-89	N/A	SRD	✓
2-~~[illegible]~~10-M104-FB	10-24-89	SRD	✓	10-24-89	N/A	SRD	✓

	Date	Initials	Locked?
Received in Lab	10/30/89	PR	✓

Sampling Method: M104

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	UNTARED	

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-3

JOB NAME: NORTH COUNTY REGIONAL BRF.

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-1-89

EXPECTED DATE OF RESULTS: 11-15-89

SAMPLE MATRIX: M104 Sample train Unit 1.

TYPE OF ANALYSIS REQUESTED: Be (particulate and gaseous) Refer to Method 104, Rules and Regulations, APRIL 6, 1973.

Sample#	Sample ID	Components
1	1-ESPO-M104-1	Reagent, acetone rinse, Filter.
2	1-ESPO-M104-2	" " " "
3	1-ESPO-M104-3	" " " "
4	1-ESPO-M104-FB	" " " "
5	1-ESPO-M104-2 (dup)	

SUBMITTED BY: Richard Tebeau

L-0005a
8/86

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 62840-3 were
sh~~ipped via~~ Hand delivered on 11-1-89 by RAT
to OLI

Samples received at OLI on 11-2-89
by M. Congleton

Note any broken seals, leakage, spillage, and/or damage to the samples.

APPENDIX B.1.b.2

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

b. ESP Outlet

2. Carbon Dioxide, Carbon Monoxide, Nitrogen Oxides, Oxygen, and Sulfur Dioxide

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Calibration Error Check

DATE : 10-26-1989 TIME: 07:27 - 08:25

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.8
1	OUTLET	ppmSO2	49.6	51.0
1	OUTLET	ppmSO2	90.7	89.0
3	OUTLET	ppmNOX	0.0	0.5
3	OUTLET	ppmNOX	240.0	240.6
3	OUTLET	ppmNOX	455.0	454.5
4	OUTLET	ppmCO	0.0	0.6
4	OUTLET	ppmCO	24.8	23.1
4	OUTLET	ppmCO	64.3	61.3
4	OUTLET	ppmCO	149.6	149.5
2	OUTLET	% O2	0.00	0.04
2	OUTLET	% O2	12.50	12.51
2	OUTLET	% O2	19.93	19.94
5	OUTLET	% CO2	0.00	0.01
5	OUTLET	% CO2	11.06	11.29
5	OUTLET	% CO2	17.50	17.48
6	INLET	ppmSO2	0.0	0.2
6	INLET	ppmSO2	218.0	218.1
6	INLET	ppmSO2	454.1	455.8
7	INLET	% O2	0.00	0.05
7	INLET	% O2	12.50	12.52
7	INLET	% O2	19.93	19.92
8	INLET	% CO2	0.00	0.01
8	INLET	% CO2	11.06	11.04
8	INLET	% CO2	17.50	17.50

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 1 Calibration Bias Check Unit 1

DATE : 10-26-1989 TIME: 08:26 - 08:52

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.4
1	OUTLET	ppmSO2	49.6	50.8
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	232.0
4	OUTLET	ppmCO	0.0	0.2
4	OUTLET	ppmCO	24.8	23.1
2	OUTLET	% O2	0.00	0.01
2	OUTLET	% O2	12.50	12.48
5	OUTLET	% CO2	0.00	0.04
5	OUTLET	% CO2	11.06	11.23
6	INLET	ppmSO2	0.0	2.2
6	INLET	ppmSO2	218.0	215.3
7	INLET	% O2	0.00	0.02
7	INLET	% O2	12.50	12.44
8	INLET	% CO2	0.00	0.04
8	INLET	% CO2	11.06	11.00

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Palm Beach Co. Solid Waste Authority  Compliance     10-26-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
09:06    58.8     223.1     37.0      7.38     12.36     127.6      6.98     12.60     0.144     0.394     0.040     0.304
09:07    56.9     221.7     37.7      7.41     12.33     128.8      6.86     12.73     0.140     0.393     0.041     0.305
09:08    53.0     225.4     37.7      7.39     12.38     128.4      6.95     12.63     0.130     0.398     0.041     0.306
09:09    52.9     224.5     36.0      7.24     12.47     126.1      6.89     12.68     0.129     0.393     0.038     0.299
09:10    50.8     224.9     35.5      7.34     12.40     124.3      7.15     12.42     0.124     0.396     0.038     0.300
09:11    49.7     222.4     34.9      7.40     12.33     127.8      6.78     12.81     0.122     0.393     0.038     0.301
09:12    44.3     221.2     34.7      7.38     12.40     129.7      6.74     12.87     0.109     0.391     0.037     0.304
09:13    41.6     220.7     34.2      7.29     12.46     123.0      7.32     12.25     0.102     0.387     0.037     0.301
09:14    39.1     217.2     35.3      7.43     12.31     120.5      7.49     12.09     0.096     0.385     0.038     0.299
09:15    33.7     211.8     36.4      7.70     12.09     114.1      7.98     11.64     0.085     0.383     0.040     0.293
09:16    27.4     206.4     36.9      8.09     11.80     121.2      7.26     12.30     0.071     0.385     0.042     0.295
09:17    22.5     208.5     36.2      7.83     12.04     124.2      7.10     12.49     0.057     0.381     0.040     0.299
09:18    18.7     212.9     34.2      7.65     12.19     135.9      6.02     13.55     0.047     0.384     0.038     0.303
09:19    14.3     215.7     33.3      7.12     12.68     125.4      7.27     12.30     0.035     0.374     0.035     0.305
09:20    11.3     210.5     33.1      7.24     12.44     124.2      7.13     12.42     0.027     0.368     0.035     0.299

09:21     9.0     209.0     33.6      7.67     12.16     123.1      7.21     12.33     0.023     0.377     0.037     0.298
09:22     7.5     207.2     32.1      7.66     12.16     121.8      7.11     12.40     0.019     0.374     0.035     0.293
09:23     6.9     206.4     31.1      7.73     12.10     123.8      6.90     12.61     0.017     0.374     0.034     0.294
09:24     7.0     208.9     31.0      7.56     12.22     119.9      7.29     12.27     0.017     0.374     0.034     0.292
09:25     6.7     208.5     31.6      7.70     12.11     121.0      7.08     12.46     0.017     0.377     0.035     0.291
09:26     6.8     209.6     31.4      7.82     12.07     128.7      6.62     12.89     0.017     0.383     0.035     0.299
09:27     7.2     217.6     30.0      7.33     12.45     141.1      5.83     13.68     0.018     0.383     0.032     0.311
09:28     9.5     218.1     28.9      6.82     12.92     138.3      6.40     13.12     0.022     0.370     0.030     0.317
09:29    11.3     221.2     29.0      6.72     12.93     144.5      5.83     13.68     0.026     0.373     0.030     0.318
09:30    13.1     223.2     29.2      6.67     13.02     143.4      6.19     13.31     0.030     0.375     0.030     0.324
09:31    12.2     220.0     29.0      6.60     13.04     142.5      5.96     13.54     0.028     0.368     0.029     0.317
09:32    14.3     223.2     29.2      6.63     13.03     143.0      6.17     13.32     0.033     0.374     0.030     0.322
09:33    17.6     226.2     28.7      6.66     12.99     154.1      5.40     14.09     0.041     0.379     0.029     0.330
09:34    22.3     225.1     28.1      6.28     13.38     148.9      5.91     13.58     0.051     0.368     0.028     0.330
09:35    26.2     223.9     27.9      6.38     13.26     156.9      5.29     14.19     0.060     0.368     0.028     0.334

AVERAGE VALUES FOR THE LAST 15 MINUTES
09:35    11.8     216.5     30.1      7.08     12.66     136.7      6.35     13.16     0.028     0.374     0.032     0.311

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AVERAGE VALUES FOR THE LAST HOUR: 30 MINUTES OF VALID DATA
09:35    25.1     217.2     32.8      7.27     12.48     131.1      6.70     12.84     0.061     0.381     0.035     0.306
---------------------------------------------------------------------------------------------------------------------------
09:36    30.1'    225.7     27.8      6.09     13.57     170.1      4.66     14.78     0.067     0.364     0.027     0.348
09:37    36.3     228.7     26.8      5.54     14.05     178.1      4.89     14.57     0.078     0.356     0.025     0.369
09:38    45.0     226.1     26.4      5.36     14.18     169.5      4.97     14.47     0.096     0.347     0.025     0.353
09:39    43.9     226.1     26.8      5.62     13.91     160.7      5.77     13.69     0.095     0.354     0.026     0.353
09:40    39.8     225.8     27.1      5.99     13.55     167.6      5.02     14.41     0.089     0.362     0.026     0.351
09:41    37.2     222.0     28.2      6.09     13.56     180.4      4.51     14.94     0.083     0.358     0.028     0.365
09:42    42.6     223.1     28.9      5.42     14.16     171.1      4.76     14.69     0.091     0.344     0.027     0.352
09:43    44.9     224.5     29.8      5.33     14.24     174.6      4.64     14.80     0.096     0.344     0.028     0.357
09:44    48.0     216.9     42.2      5.05     14.47     165.1      5.26     14.20     0.101     0.327     0.039     0.351
09:45    48.1     217.8     42.9      5.20     14.27     152.7      6.01     13.49     0.102     0.331     0.040     0.341
09:46    44.9     214.3     34.4      5.79     13.78     165.9      4.94     14.54     0.099     0.339     0.033     0.345
09:47    47.3     214.9     58.9      5.47     14.14     154.2      5.76     13.75     0.102     0.333     0.055     0.338
09:48    46.8     221.0     45.4      5.61     13.94     145.1      6.60     12.89     0.102     0.345     0.043     0.337
09:49    45.6     219.2     37.8      6.09     13.45     135.6      7.21     12.27     0.102     0.354     0.037     0.329
09:50    42.7     221.4     33.6      7.01     12.65     135.4      7.20     12.31     0.102     0.381     0.035     0.328
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Run
-1

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
09:50	42.9	221.8	34.5	5.71	13.86	161.8	5.48	13.99	0.094	0.349	0.033	0.348
09:51	42.6	222.2	36.2	7.40	12.43	168.0	4.69	14.81	0.105	0.393	0.039	0.344
09:52	54.3	227.9	33.9	6.14	13.68	176.7	4.33	15.12	0.122	0.369	0.033	0.354
09:53	65.4	228.0	30.5	5.09	14.50	174.0	4.44	15.01	0.137	0.344	0.028	0.351
09:54	70.6	224.4	28.8	4.95	14.58	160.9	5.19	14.28	0.147	0.336	0.026	0.340
09:55	66.3	227.7	26.4	5.35	14.18	163.0	5.10	14.40	0.142	0.350	0.025	0.343
09:56	67.1	228.2	22.6	5.54	14.05	168.6	4.68	14.79	0.145	0.355	0.021	0.345
09:57	76.1	227.9	21.5	5.41	14.20	165.4	5.12	14.37	0.163	0.351	0.020	0.348
09:58	81.3	228.4	22.0	5.57	14.01	162.1	5.39	14.12	0.176	0.356	0.021	0.347
09:59	79.9	226.4	22.0	5.84	13.77	155.8	5.69	13.80	0.176	0.359	0.021	0.340
10:00	75.8	226.7	21.7	6.12	13.51	163.1	5.10	14.39	0.170	0.366	0.021	0.343
10:01	77.4	225.7	20.9	5.92	13.74	159.3	5.36	14.17	0.171	0.360	0.020	0.340
10:02	78.2	226.3	21.2	5.89	13.76	165.6	4.96	14.54	0.173	0.360	0.021	0.345
10:03	77.2	226.6	21.0	5.76	13.90	165.2	5.13	14.37	0.169	0.357	0.020	0.348
10:04	70.5	223.0	21.7	5.65	13.97	163.4	5.18	14.33	0.154	0.349	0.021	0.345
10:05	62.4	222.7	22.7	5.71	13.91	169.4	4.77	14.73	0.136	0.350	0.022	0.349
AVERAGE VALUES FOR THE LAST 15 MINUTES												
10:05	69.7	226.1	24.9	5.76	13.88	165.4	5.01	14.48	0.152	0.357	0.024	0.345
10:06	56.8	223.7	22.3	5.63	14.03	169.8	4.72	14.76	0.124	0.350	0.021	0.348
10:07	51.7	224.0	23.1	5.39	14.22	161.9	5.23	14.27	0.111	0.345	0.022	0.343
10:08	45.2	225.8	22.7	5.49	14.07	154.5	5.73	13.78	0.097	0.350	0.021	0.338
10:09	40.0	224.3	21.3	5.90	13.71	156.7	5.45	14.08	0.088	0.357	0.021	0.337
10:10	37.3	221.6	22.1	6.07	13.58	155.8	5.33	14.18	0.084	0.357	0.022	0.332
10:11	36.7	223.3	21.7	6.10	13.59	160.2	5.37	14.16	0.082	0.360	0.021	0.342
10:12	38.0	222.6	21.4	5.89	13.74	149.5	5.92	13.62	0.084	0.354	0.021	0.331
10:13	33.1	220.1	22.4	6.15	13.49	144.7	5.95	13.59	0.086	0.356	0.022	0.321
10:14	34.8	221.7	22.4	6.41	13.28	143.3	5.93	13.61	0.080	0.365	0.022	0.318
10:15	32.9	221.3	22.4	6.43	13.26	143.3	5.97	13.58	0.076	0.365	0.022	0.319
10:16	32.1	223.1	22.2	6.44	13.26	138.4	6.33	13.22	0.074	0.368	0.022	0.315
10:17	32.9	221.5	24.2	6.55	13.11	134.5	6.64	12.92	0.076	0.369	0.024	0.313
10:18	31.2	221.2	27.1	7.02	12.70	135.0	6.63	12.91	0.075	0.381	0.028	0.314
10:19	31.3	220.4	29.9	7.08	12.69	133.9	6.66	12.86	0.075	0.381	0.031	0.312
10:20	28.5	218.3	31.9	7.11	12.60	129.7	7.33	12.17	0.069	0.378	0.034	0.317
AVERAGE VALUES FOR THE LAST 15 MINUTES												
10:20	37.8	222.2	23.8	6.25	13.42	147.4	5.95	13.58	0.085	0.362	0.024	0.327
10:21	24.3	216.7	29.6	7.60	12.22	125.2	7.14	12.40	0.061	0.389	0.032	0.302
10:22	28.2	217.2	29.3	7.70	12.15	119.5	7.53	11.99	0.071	0.393	0.032	0.297
10:23	29.5	214.1	27.7	7.83	12.02	116.0	7.83	11.73	0.075	0.391	0.031	0.295
10:24	30.4	212.2	28.2	8.12	11.78	117.8	7.51	12.06	0.079	0.396	0.032	0.292
10:25	29.9	212.7	29.5	8.25	11.71	120.9	7.59	11.98	0.078	0.401	0.034	0.301
10:26	32.0	215.2	28.2	7.97	11.91	112.0	8.00	11.60	0.082	0.398	0.032	0.289
10:27	31.8	217.3	28.8	8.17	11.76	115.2	7.55	12.00	0.083	0.408	0.033	0.287
10:28	32.0	218.0	30.3	8.09	11.84	117.4	7.50	12.04	0.083	0.406	0.034	0.291
10:29	33.9	217.7	31.3	7.99	11.88	122.2	7.08	12.49	0.087	0.403	0.035	0.294
10:30	34.9	223.7	33.0	7.84	12.06	121.5	7.19	12.35	0.089	0.409	0.037	0.294
10:31	36.4	223.5	31.5	7.63	12.19	124.4	7.06	12.51	0.091	0.402	0.035	0.299
10:32	36.1	224.9	31.1	7.52	12.30	129.0	6.64	12.96	0.090	0.401	0.034	0.300
10:33	38.5	228.3	30.7	7.22	12.56	127.7	6.84	12.73	0.094	0.399	0.033	0.302

BEST AVAILABLE COPY

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Palm Beach Co. Solid Waste Authority  Compliance     10-26-1989
        CHAN 1   CHAN 3   CHAN 4   CHAN 2   CHAN 5   CHAN 6   CHAN 7   CHAN 8   OUTLET   OUTLET   OUTLET   INLET
        OUTLET   OUTLET   OUTLET   OUTLET   OUTLET   INLET    INLET    INLET    lb SO2   lb NOX   lb CO    lb SO2
TIME    ppmSO2   ppmNOX   ppmCO    % O2     % CO2    ppmSO2   % O2     % CO2    MBTU     MBTU     MBTU     MBTU
10:34    40.3    229.3     30.4     7.13    12.59    125.8     6.75    12.83    0.097    0.398    0.032    0.295
10:35    39.8    229.5     31.9     7.21    12.54    132.9     6.54    12.95    0.097    0.400    0.034    0.307

AVERAGE VALUES FOR THE LAST 15 MINUTES
10:35    33.2    220.0     30.1     7.75    12.10    121.8     7.25    12.31    0.084    0.400    0.033    0.296

-------------------------------------------------------------------------------------------------------------------
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
10:35    45.9    222.5     28.3     6.37    13.32    149.1     5.92    13.59    0.104    0.367    0.028    0.329
-------------------------------------------------------------------------------------------------------------------
10:36    40.5    231.2     33.3     6.99    12.73    132.1     6.49    13.08    0.097    0.397    0.035    0.304
10:37    42.4    232.9     33.3     6.80    12.90    133.1     6.55    13.04    0.100    0.395    0.034    0.308
10:38    44.4    230.8     33.6     6.76    12.91    128.5     6.81    12.77    0.104    0.390    0.035    0.303
10:39    43.7    227.0     39.0     6.89    12.77    130.1     6.56    13.04    0.104    0.387    0.040    0.301
10:40    42.3    228.6     44.9     6.96    12.75    136.1     6.12    13.48    0.101    0.392    0.047    0.306
10:41    41.4    230.9     44.0     6.77    12.98    144.1     5.65    13.96    0.097    0.390    0.045    0.314
10:42    44.4    230.6     43.2     6.22    13.45    139.1     5.98    13.61    0.100    0.375    0.043    0.310
10:43    45.4    230.4     44.0     6.29    13.36    127.1     7.13    12.46    0.103    0.377    0.044    0.306
10:44    44.9    224.9     46.7     6.76    12.84    118.7     7.61    11.98    0.105    0.380    0.048    0.297
10:45    40.2    220.1     51.1     7.55    12.19    112.8     8.00    11.62    0.100    0.394    0.056    0.290
10:46    35.2    213.7     51.5     8.06    11.77    110.3     8.04    11.57    0.091    0.398    0.058    0.285
10:47    31.3    211.0     49.5     8.38    11.51    115.7     7.59    11.99    0.083    0.403    0.057    0.289
10:48    34.0    211.6     46.6     8.32    11.62    119.4     7.44    12.16    0.090    0.402    0.054    0.294
10:49    38.8    212.6     43.7     7.99    11.85    113.4     7.83    11.76    0.100    0.393    0.049    0.288
10:50    38.3    214.1     45.7     8.23    11.66    114.7     7.61    11.96    0.100    0.404    0.052    0.287

AVERAGE VALUES FOR THE LAST 15 MINUTES
10:50    40.5    223.4     43.3     7.27    12.49    125.0     7.03    12.56    0.098    0.392    0.046    0.299

10:51    38.7    215.6     45.6     8.17    11.73    127.1     6.67    12.91    0.101    0.404    0.052    0.296
10:52    39.0    221.5     42.6     7.64    12.22    139.4     6.13    13.47    0.098    0.399    0.047    0.313
10:53    43.0    223.5     40.0     6.84    12.86    134.2     6.48    13.14    0.102    0.380    0.041    0.309
10:54    44.3    222.4     39.4     6.91    12.74    114.1     8.01    11.63    0.105    0.380    0.041    0.294
10:55    42.0    209.9     45.3     7.86    11.84    109.9     8.00    11.61    0.107    0.385    0.051    0.283
10:56    34.9    200.8     61.6     8.76    11.19    120.8     6.91    12.62    0.096    0.395    0.074    0.287
10:57    34.2    201.5     59.8     8.47    11.57    188.5     3.32    16.12    0.091    0.387    0.070    0.355
10:58    49.4    204.2    110.3     5.92    13.95    184.2     3.94    15.58    0.109    0.326    0.105    0.360
10:59    65.2    215.2    107.5     4.62    14.90    188.1     4.21    15.33    0.133    0.316    0.096    0.374
11:00    72.5    221.1     74.8     4.74    14.74    165.2     5.16    14.43    0.149    0.327    0.067    0.349
11:01    70.9    227.6     51.9     5.16    14.40    172.0     4.89    14.70    0.150    0.345    0.048    0.357
11:02    68.9    221.7     43.2     5.29    14.28    162.1     5.64    13.98    0.147    0.339    0.040    0.353
11:03    64.0    227.8     37.9     5.59    14.00    166.1     5.05    14.54    0.139    0.355    0.036    0.348
11:04    61.1    231.7     33.2     5.56    14.08    167.5     5.17    14.44    0.132    0.361    0.031    0.353
11:05    61.6    231.4     30.4     5.48    14.12    164.8     5.09    14.53    0.133    0.358    0.029    0.346

AVERAGE VALUES FOR THE LAST 15 MINUTES
11:05    52.6    218.4     54.9     6.47    13.24    153.6     5.64    13.94    0.119    0.364    0.055    0.332

11:06    58.3    231.3     28.5     5.81    13.84    163.2     5.21    14.41    0.128    0.366    0.027    0.345
11:07    56.8    230.2     25.7     5.65    14.00    157.0     5.45    14.17    0.124    0.360    0.024    0.338
11:08    56.1    233.1     24.2     5.83    13.79    158.2     5.19    14.42    0.123    0.369    0.023    0.334
11:09    53.7    228.0     24.7     5.76    13.92    159.5     5.30    14.34    0.118    0.360    0.024    0.340
11:10    54.4    228.3     24.2     5.75    13.85    147.1     6.08    13.57    0.119    0.360    0.023    0.330
11:11    51.3    229.6     25.0     6.24    13.41    144.6     6.01    13.63    0.116    0.374    0.025    0.322
11:12    47.9    228.0     24.8     6.38    13.32    141.9     6.11    13.51    0.109    0.375    0.025    0.319
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Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
11:13	46.2	231.1	25.3	6.51	13.19	149.8	5.61	14.00	0.107	0.384	0.026	0.325
11:14	46.0	229.4	25.2	6.31	13.40	143.9	5.95	13.65	0.105	0.375	0.025	0.320
11:15	46.1	227.6	26.7	6.35	13.30	149.2	5.54	14.07	0.105	0.374	0.027	0.322
11:16	43.8	226.8	27.2	6.27	13.41	144.0	5.43	14.14	0.099	0.370	0.027	0.309

COMMENTS: End of Test 1-1

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1/ Pre-test 2 Calibration Bias Check Unit 1

DATE : 10-26-1989 TIME: 11:16 - 11:39

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	4.8
1	OUTLET	ppmSO2	49.6	53.3
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	235.1
4	OUTLET	ppmCO	0.0	-0.1
4	OUTLET	ppmCO	24.8	22.9
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.34
5	OUTLET	% CO2	0.00	0.13
5	OUTLET	% CO2	11.06	11.42
6	INLET	ppmSO2	0.0	4.2
6	INLET	ppmSO2	218.0	212.5
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.27
8	INLET	% CO2	0.00	0.24
8	INLET	% CO2	11.06	11.11

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Outlet SO2 Calibration Error Check

DATE : 10-26-1989 TIME: 11:40 - 11:47

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.3
1	OUTLET	ppmSO2	49.6	50.7
1	OUTLET	ppmSO2	89.3	89.8

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 2 Outlet SO2 Calibration Bias Check

DATE : 10-26-1989 TIME: 11:48 - 11:53

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.3
1	OUTLET	ppmSO2	49.6	49.9

Palm Beach Co. Solid Waste Authority Comoliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:01	43.1	229.4	30.4	7.26	12.49	119.4	7.02	12.57	0.105	0.402	0.032	0.286
12:02	37.8	227.9	31.0	7.34	12.48	119.1	6.96	12.65	0.092	0.401	0.033	0.284
12:03	34.0	226.0	29.6	7.36	12.45	120.3	6.80	12.84	0.083	0.399	0.032	0.283
12:04	32.4	226.4	30.7	7.27	12.54	115.9	7.19	12.41	0.079	0.397	0.033	0.281
12:05	32.0	226.4	31.6	7.40	12.40	119.3	7.06	12.52	0.079	0.401	0.034	0.286
12:06	32.7	227.2	29.9	7.44	12.41	134.3	6.51	13.11	0.081	0.403	0.032	0.310
12:07	38.0	228.9	28.6	7.09	12.67	139.1	6.23	13.38	0.091	0.396	0.030	0.315
12:08	42.7	230.5	28.6	6.90	12.86	128.5	6.76	12.81	0.101	0.393	0.030	0.302
12:09	44.1	229.5	28.5	7.02	12.72	130.0	6.37	13.21	0.105	0.395	0.030	0.297
12:10	42.6	229.9	27.3	6.98	12.78	134.3	5.92	13.69	0.102	0.394	0.029	0.298
12:11	40.5	228.1	25.7	6.61	13.12	123.5	6.88	12.74	0.094	0.381	0.026	0.293
12:12	40.5	227.2	26.0	6.92	12.77	118.7	6.93	12.65	0.096	0.388	0.027	0.282
12:13	39.7	230.2	28.2	7.29	12.53	130.0	6.18	13.47	0.097	0.404	0.030	0.293
12:14	41.6	230.3	27.3	6.81	12.95	122.9	6.46	13.17	0.098	0.390	0.028	0.283
12:15	42.9	232.4	28.2	6.89	12.90	131.9	6.02	13.65	0.102	0.396	0.029	0.294
12:16	44.5	231.4	27.1	6.58	13.18	119.1	7.15	12.54	0.103	0.386	0.028	0.288
12:17	46.2	227.9	27.9	6.98	12.76	117.6	6.78	12.88	0.110	0.391	0.029	0.276
12:18	46.5	225.9	28.6	7.20	12.65	125.6	6.40	13.30	0.113	0.394	0.030	0.288
12:19	50.4	226.3	28.3	7.03	12.76	120.6	7.07	12.60	0.121	0.390	0.030	0.289
12:20	53.5	223.6	26.6	7.26	12.54	122.9	6.48	13.15	0.130	0.392	0.028	0.283
12:21	54.4	228.0	25.4	7.24	12.62	116.9	7.04	12.60	0.132	0.399	0.027	0.280
12:22	54.9	227.0	25.7	7.03	12.72	117.1	6.82	12.83	0.131	0.391	0.027	0.276
12:23	47.8	228.6	27.3	7.25	12.54	111.4	7.56	12.05	0.116	0.400	0.029	0.277
12:24	54.8	225.8	29.0	7.52	12.32	117.9	6.86	12.76	0.136	0.403	0.031	0.279
12:25	71.4	228.9	28.5	7.43	12.41	122.3	6.68	12.93	0.176	0.406	0.031	0.286
12:26	89.8	231.2	27.1	7.24	12.61	128.6	6.55	13.14	0.218	0.404	0.029	0.298
12:27	100.0	232.5	26.2	7.03	12.73	127.5	6.70	12.91	0.239	0.400	0.027	0.298
12:28	100.0	232.3	26.9	7.16	12.67	140.4	5.86	13.79	0.242	0.404	0.028	0.310
12:29	100.0	237.0	26.9	6.61	13.18	131.6	6.28	13.34	0.232	0.396	0.027	0.299
12:30	100.0	237.5	27.2	6.51	13.23	140.3	5.55	14.08	0.231	0.394	0.027	0.304

AVERAGE VALUES FOR THE LAST HOUR: 30 MINUTES OF VALID DATA

12:30	53.3	229.1	28.0	7.09	12.70	124.9	6.64	12.99	0.128	0.396	0.029	0.291

12:31	100.0	240.0	26.8	6.09	13.64	139.7	5.81	13.83	0.224	0.387	0.026	0.307
12:32	100.0	239.2	27.7	6.14	13.57	149.4	5.03	14.57	0.225	0.387	0.027	0.312
12:33	75.7	239.1	26.9	5.69	14.05	158.4	4.80	14.84	0.166	0.375	0.026	0.327
12:34	43.5	238.0	25.9	5.27	14.34	144.4	5.83	13.81	0.092	0.364	0.024	0.318
12:35	27.0	237.8	25.9	5.81	13.80	138.3	6.25	13.40	0.059	0.376	0.025	0.314
12:36	17.1	235.0	26.4	6.35	13.35	144.2	5.64	14.00	0.039	0.386	0.026	0.314
12:37	11.7	236.5	26.1	6.26	13.48	144.5	5.87	13.79	0.026	0.386	0.026	0.319
12:38	9.2	234.7	25.1	6.03	13.64	140.0	6.00	13.63	0.020	0.377	0.024	0.312
12:39	11.8	236.1	26.0	6.46	13.23	134.7	6.43	13.19	0.027	0.390	0.026	0.309
12:40	16.7	233.5	26.4	6.71	13.03	143.3	5.74	13.89	0.039	0.393	0.027	0.314
12:41	22.1	234.8	25.2	6.51	13.22	138.9	6.07	13.56	0.051	0.390	0.025	0.311
12:42	30.5	232.4	24.5	6.39	13.33	135.7	6.19	13.43	0.070	0.382	0.025	0.306
12:43	32.2	233.5	24.1	6.47	13.20	129.9	6.53	13.08	0.074	0.387	0.024	0.300
12:44	29.8	232.9	23.5	6.68	13.04	139.3	5.75	13.86	0.070	0.391	0.024	0.305
12:45	28.4	232.4	22.9	6.41	13.29	131.1	6.44	13.18	0.065	0.383	0.023	0.301

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:51	19.8	231.2	28.4	7.05	12.73	126.7	6.63	13.01	0.047	0.399	0.030	0.295
12:52	23.1	230.1	27.4	6.83	12.86	123.7	6.70	12.91	0.054	0.391	0.028	0.289
12:53	29.2	227.2	27.0	7.01	12.69	107.8	7.77	11.81	0.070	0.391	0.028	0.273
12:54	33.0	220.7	30.2	7.44	12.33	118.0	6.76	12.83	0.081	0.392	0.033	0.277
12:55	35.5	222.9	31.2	7.45	12.36	118.0	6.98	12.61	0.088	0.396	0.034	0.281
12:56	37.8	227.0	31.2	7.29	12.49	118.7	6.79	12.84	0.092	0.398	0.033	0.279
12:57	38.9	229.0	30.3	7.20	12.54	121.8	6.32	13.25	0.094	0.399	0.032	0.277
12:58	40.0	231.5	29.4	7.07	12.71	128.1	6.28	13.36	0.096	0.400	0.031	0.291
12:59	44.2	234.9	27.8	6.77	12.93	124.3	6.70	12.93	0.104	0.397	0.029	0.291
13:00	46.4	233.4	27.5	6.99	12.69	123.1	6.95	12.64	0.111	0.401	0.029	0.293
13:01	49.2	228.9	31.1	7.23	12.50	123.3	6.86	12.74	0.119	0.400	0.033	0.292
13:02	52.4	229.9	28.1	7.30	12.47	126.2	6.70	12.87	0.128	0.404	0.030	0.295
13:03	52.9	229.6	27.4	7.31	12.46	142.9	5.69	13.93	0.129	0.403	0.029	0.312
13:04	54.4	229.3	24.6	6.66	13.10	134.3	6.64	13.02	0.127	0.385	0.025	0.313
13:05	58.2	230.0	25.6	6.75	12.92	133.9	6.67	12.95	0.137	0.388	0.026	0.312
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:05	41.0	229.1	28.5	7.09	12.65	124.7	6.70	12.91	0.099	0.396	0.030	0.291
13:06	56.3	231.7	26.6	7.03	12.71	146.4	6.29	13.34	0.135	0.399	0.028	0.333
13:07	55.2	234.9	24.9	6.86	12.87	148.9	6.16	13.44	0.131	0.399	0.026	0.336
13:08	54.2	235.1	24.2	6.76	12.97	153.7	5.94	13.70	0.127	0.397	0.025	0.341
13:09	57.1	238.8	23.5	6.44	13.25	145.8	6.10	13.53	0.131	0.394	0.024	0.327
13:10	60.7	237.5	24.5	6.60	13.11	146.1	6.22	13.44	0.141	0.397	0.025	0.331
13:11	62.5	238.1	25.1	6.49	13.20	137.7	6.29	13.28	0.144	0.395	0.025	0.313
13:12	59.7	237.4	26.9	6.70	13.05	146.3	5.74	13.93	0.140	0.399	0.028	0.321
13:13	59.2	241.0	27.0	6.22	13.47	136.1	6.16	13.49	0.134	0.392	0.027	0.307
13:14	57.6	242.0	28.3	6.38	13.31	136.9	5.98	13.66	0.132	0.398	0.028	0.305
13:15	56.2	242.9	28.8	6.42	13.27	137.5	6.13	13.50	0.129	0.401	0.029	0.309
13:16	68.0	239.0	29.7	6.51	13.17	137.5	6.05	13.56	0.157	0.397	0.030	0.307
13:17	78.6	237.8	30.9	6.63	13.10	139.2	6.23	13.39	0.183	0.398	0.031	0.315
13:18	79.6	239.1	29.8	6.67	13.05	141.3	6.01	13.62	0.186	0.401	0.030	0.315
13:19	77.6	235.9	28.9	6.53	13.21	138.1	6.34	13.31	0.179	0.392	0.029	0.315
13:20	83.1	234.6	28.8	6.57	13.10	137.3	6.10	13.52	0.193	0.391	0.029	0.308
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:20	64.4	237.7	27.2	6.59	13.12	141.9	6.12	13.51	0.149	0.397	0.028	0.319
13:21	69.1	233.7	28.9	6.59	13.15	141.4	6.01	13.63	0.160	0.390	0.029	0.315
13:22	73.1	235.2	28.2	6.32	13.38	139.5	6.03	13.56	0.167	0.385	0.028	0.311
13:23	86.5	234.0	28.8	6.26	13.43	145.4	5.82	13.82	0.196	0.382	0.029	0.320
13:24	76.6	235.1	29.0	6.29	13.38	141.9	6.09	13.51	0.174	0.384	0.029	0.318
13:25	72.8	234.9	29.9	6.51	13.23	154.5	5.25	14.35	0.168	0.390	0.030	0.328
13:26	76.3	238.0	29.8	6.06	13.65	150.9	5.42	14.18	0.171	0.383	0.029	0.324
13:27	99.6	236.1	28.5	5.92	13.73	144.7	6.33	13.32	0.221	0.376	0.028	0.330
13:28	83.7	234.2	28.5	6.13	13.46	135.3	6.77	12.83	0.188	0.379	0.028	0.318
13:29	40.4	236.0	30.6	5.94	12.77	136.3	6.77	12.85	0.096	0.404	0.032	0.320
13:30	37.9	232.6	31.7	7.12	12.63	138.0	6.55	13.10	0.091	0.403	0.033	0.319
13:31	55.5	233.3	30.0	5.90	12.85	129.8	7.31	12.27	0.132	0.398	0.031	0.317
13:32	59.7	229.5	28.8	7.40	12.37	127.2	7.33	12.33	0.147	0.406	0.031	0.311
13:33	59.7	226.6	30.1	7.45	12.33	115.6	7.82	11.79	0.147	0.402	0.033	0.294
13:34	50.3	221.3	31.8	7.90	11.97	115.8	7.78	11.84	0.128	0.406	0.035	0.293
13:35	46.6	219.3	32.1	8.05	11.90	114.8	7.68	11.93	0.120	0.407	0.036	0.289

Palm Beach Co. Solid Waste Authority Compliance 10-26-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:35	65.9	232.0	29.8	6.79	12.95	135.4	6.60	13.02	0.154	0.393	0.031	0.314
13:36	53.6	219.8	30.5	7.75	12.12	122.3	6.91	12.70	0.135	0.399	0.034	0.290
13:37	64.5	223.8	29.9	7.47	12.36	117.3	7.13	12.42	0.160	0.398	0.032	0.283
13:38	72.1	225.6	29.6	7.63	12.22	129.5	6.31	13.30	0.180	0.406	0.032	0.295
13:39	96.0	229.4	26.4	7.01	12.75	125.0	6.71	12.92	0.229	0.394	0.028	0.292
13:40	100.0	227.6	25.8	7.09	12.64	125.8	6.39	13.20	0.240	0.394	0.027	0.288
13:41	100.0	227.1	25.7	7.00	12.77	127.8	6.39	13.24	0.239	0.390	0.027	0.292
13:42	100.0	226.5	24.7	6.78	12.90	117.0	7.18	12.44	0.235	0.383	0.025	0.283
13:43	100.0	224.3	27.7	7.33	12.43	120.0	6.84	12.75	0.245	0.395	0.030	0.283
13:44	100.0	222.9	28.3	7.38	12.43	132.0	6.10	13.50	0.246	0.394	0.030	0.296
13:45	98.2	227.6	27.2	7.07	12.69	130.8	6.40	13.21	0.236	0.393	0.029	0.299
13:46	75.6	227.5	25.9	6.94	12.79	133.1	5.97	13.65	0.180	0.389	0.027	0.296
13:47	76.0	230.6	25.0	6.69	13.04	149.6	5.98	13.63	0.178	0.387	0.026	0.333
13:48	87.1	229.7	24.3	6.53	13.20	160.7	6.39	13.23	0.201	0.382	0.025	0.368
13:49	100.0	229.3	23.0	6.70	13.03	161.7	6.14	13.49	0.234	0.385	0.023	0.364

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Calibration Error Check

DATE : 10-27-1989 TIME: 07:28 - 08:17

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.2
1	OUTLET	ppmSO2	49.6	49.9
1	OUTLET	ppmSO2	89.3	90.5
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	241.7
3	OUTLET	ppmNOX	455.0	458.0
4	OUTLET	ppmCO	0.0	0.7
4	OUTLET	ppmCO	24.8	22.8
4	OUTLET	ppmCO	64.3	61.6
4	OUTLET	ppmCO	149.6	150.7
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.52
2	OUTLET	% O2	19.93	19.95
5	OUTLET	% CO2	0.00	0.00
5	OUTLET	% CO2	11.06	11.24
5	OUTLET	% CO2	17.50	17.41
6	INLET	ppmSO2	0.0	0.6
6	INLET	ppmSO2	218.0	216.0
6	INLET	ppmSO2	454.1	456.8
7	INLET	% O2	0.00	0.01
7	INLET	% O2	12.50	12.52
7	INLET	% O2	19.93	19.92
8	INLET	% CO2	0.00	0.00
8	INLET	% CO2	11.06	11.01
8	INLET	% CO2	17.50	17.48

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 2 Calibration Bias Check

DATE : 10-27-1989 TIME: 08:18 - 08:39

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.6
1	OUTLET	ppmSO2	49.6	49.4
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	232.7
4	OUTLET	ppmCO	0.0	0.0
4	OUTLET	ppmCO	24.8	23.7
2	OUTLET	% O2	0.00	0.01
2	OUTLET	% O2	12.50	12.41
5	OUTLET	% CO2	0.00	0.02
5	OUTLET	% CO2	11.06	11.16
6	INLET	ppmSO2	0.0	2.9
6	INLET	ppmSO2	218.0	214.1
7	INLET	% O2	0.00	0.05
7	INLET	% O2	12.50	12.51
8	INLET	% CO2	0.00	0.02
8	INLET	% CO2	11.06	10.94

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
         CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
         OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME     ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
09:14      17.8     203.4      22.6      6.94     12.64     106.4      6.46     13.08     0.042     0.348     0.024     0.245
09:15      17.3     204.5      23.6      6.89     12.75     103.7      6.80     12.78     0.041     0.349     0.024     0.244
09:16      16.8     206.5      23.9      6.93     12.68     112.2      6.17     13.36     0.040     0.353     0.025     0.253
09:17      17.8     210.0      24.1      6.63     12.99     114.2      6.42     13.14     0.041     0.351     0.025     0.262
09:18      19.1     211.4      23.3      6.47     13.08     108.6      6.49     13.06     0.044     0.350     0.023     0.250
09:19      18.1     210.4      23.1      6.73     12.85     106.7      6.75     12.80     0.042     0.355     0.024     0.250
09:20      17.5     209.1      23.3      6.86     12.72     108.4      6.40     13.15     0.041     0.355     0.024     0.248

09:21      18.1     206.1      23.5      6.80     12.83     111.2      6.39     13.16     0.043     0.349     0.024     0.254
09:22      22.1     206.4      22.3      6.58     12.98     109.0      6.53     13.02     0.051     0.344     0.023     0.252
09:23      24.7     205.7      23.4      6.69     12.88     108.9      6.52     13.03     0.058     0.346     0.024     0.251
09:24      25.8     205.6      22.9      6.77     12.83     114.2      6.19     13.38     0.061     0.347     0.024     0.258
09:25      27.5     206.5      22.3      6.51     13.10     109.5      6.49     13.04     0.064     0.343     0.023     0.252
09:26      27.9     206.0      24.7      6.43     13.12     114.7      5.93     13.59     0.064     0.340     0.025     0.254
09:27      27.8     208.5      23.7      6.35     13.21     114.4      6.04     13.48     0.063     0.342     0.024     0.256
09:28      28.0     208.7      22.5      6.24     13.28     111.6      6.24     13.25     0.063     0.340     0.022     0.253
09:29      29.4     206.8      22.0      6.27     13.22     118.4      5.74     13.75     0.067     0.338     0.022     0.259
09:30      29.8     208.5      21.8      6.12     13.42     121.6      5.63     13.88     0.067     0.337     0.021     0.264
09:31      31.3     208.8      22.0      5.84     13.62     111.8      6.45     13.07     0.069     0.331     0.021     0.257
09:32      31.0     208.9      21.4      6.31     13.15     114.1      6.05     13.49     0.071     0.342     0.021     0.255
09:33      31.3     210.2      23.2      6.45     13.13     116.5      6.45     13.08     0.072     0.347     0.023     0.267
09:34      39.9     206.5      29.4      6.16     13.29     108.9      6.68     12.87     0.090     0.335     0.029     0.254
09:35      43.6     209.2      25.4      6.70     12.86     113.4      6.46     13.09     0.102     0.352     0.026     0.261

AVERAGE VALUES FOR THE LAST 15 MINUTES
09:35      29.2     207.5      23.4      6.42     13.13     113.2      6.25     13.28     0.067     0.342     0.023     0.257

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AVERAGE VALUES FOR THE LAST HOUR: 22 MINUTES OF VALID DATA
09:35      25.6     207.6      23.4      6.53     13.03     111.7      6.33     13.21     0.059     0.345     0.024     0.255
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09:36      46.8     206.6      23.0      6.54     13.00     113.0      6.59     13.00     0.108     0.344     0.023     0.262
09:37      48.3     211.2      23.4      6.69     12.89     115.0      6.52     13.07     0.113     0.355     0.024     0.266
09:38      49.8     211.8      22.2      6.58     13.01     114.4      6.52     13.06     0.115     0.353     0.023     0.264
09:39      50.5     208.9      22.4      6.55     13.04     114.3      6.69     12.92     0.117     0.348     0.023     0.267
09:40      50.3     208.6      23.3      6.55     13.01     114.3      6.45     13.16     0.116     0.347     0.024     0.263
09:41      50.5     212.0      22.2      6.63     13.00     115.2      6.58     13.04     0.117     0.355     0.023     0.267
09:42      52.7     215.1      21.2      6.67     12.91     117.0      6.45     13.18     0.123     0.361     0.022     0.269
09:43      51.0     218.9      21.3      6.72     12.92     115.2      6.55     13.08     0.119     0.369     0.022     0.267
09:44      44.2     218.7      21.0      6.68     12.95     124.3      5.82     13.83     0.103     0.367     0.021     0.274
09:45      52.0     218.2      20.5      6.26     13.42     121.4      6.04     13.61     0.118     0.356     0.020     0.271
09:46      54.1     220.6      19.8      6.16     13.44     123.6      6.01     13.66     0.122     0.357     0.020     0.276
09:47      56.4     220.2      20.6      6.16     13.47     122.7      6.27     13.39     0.127     0.357     0.020     0.278
09:48      59.6     221.7      21.4      6.25     13.34     116.7      6.75     12.91     0.135     0.362     0.021     0.274
09:49      60.0     220.4      21.3      6.62     12.98     115.6      6.54     13.13     0.140     0.369     0.022     0.267
09:50      58.4     220.0      21.5      6.80     12.88     120.8      6.26     13.43     0.138     0.373     0.022     0.274

AVERAGE VALUES FOR THE LAST 15 MINUTES
09:50      52.3     215.5      21.7      6.52     13.08     117.6      6.40     13.23     0.121     0.358     0.022     0.269

COMMENTS: Atomizer plugging again
          (CONTINUED ON THE NEXT PAGE)
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Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

Begin Test 3

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
11:52	44.7	200.9	35.6	6.93	12.70	148.9	7.04	12.57	0.106	0.343	0.037	0.357
11:53	40.2	200.9	30.8	6.95	12.66	147.2	6.98	12.65	0.096	0.344	0.032	0.351
11:54	36.1	196.1	28.6	6.89	12.71	147.3	7.32	12.29	0.086	0.334	0.030	0.360
11:55	35.8	187.1	37.5	6.98	12.66	164.2	6.19	13.44	0.085	0.321	0.039	0.371
11:56	34.9	193.0	46.0	6.64	13.04	164.7	5.93	13.72	0.081	0.323	0.047	0.365
11:57	36.0	202.9	38.6	6.22	13.39	159.3	5.84	13.79	0.081	0.330	0.038	0.351
11:58	31.4	204.2	36.3	6.01	13.55	159.3	5.78	13.86	0.070	0.327	0.035	0.350
11:59	27.6	207.9	32.8	6.04	13.56	167.7	5.33	14.29	0.062	0.334	0.032	0.358
12:00	26.4	206.4	34.6	5.70	13.85	161.6	5.70	13.94	0.058	0.324	0.033	0.353
12:01	27.0	206.5	31.4	5.78	13.77	161.5	5.62	13.99	0.059	0.326	0.030	0.351
12:02	26.0	211.5	29.3	5.86	13.70	162.1	5.31	14.30	0.057	0.336	0.028	0.345
12:03	25.6	211.5	31.4	5.61	13.92	160.6	5.78	13.84	0.056	0.330	0.030	0.353
12:04	25.8	214.0	27.7	5.68	13.83	162.6	5.66	13.96	0.056	0.336	0.026	0.354
12:05	26.3	216.3	22.0	5.79	13.74	165.8	5.63	14.00	0.058	0.342	0.021	0.360
12:06	27.0	215.1	20.4	5.81	13.73	166.9	5.50	14.12	0.059	0.340	0.020	0.360
AVERAGE VALUES FOR THE LAST 15 MINUTES												
12:06	31.4	205.0	32.2	6.19	13.39	160.0	5.97	13.65	0.071	0.333	0.032	0.356
12:07	25.5	211.9	22.8	5.73	13.83	178.3	4.69	14.91	0.056	0.334	0.022	0.365
12:08	27.5	209.2	24.7	5.29	14.28	173.6	5.40	14.24	0.058	0.320	0.023	0.372
12:09	31.5	213.1	27.3	5.39	14.07	170.2	5.38	14.25	0.067	0.328	0.026	0.364
12:10	33.2	215.1	23.7	5.60	13.94	174.5	5.11	14.54	0.072	0.336	0.023	0.367
12:11	37.8	212.5	24.8	5.36	14.20	179.2	4.93	14.71	0.081	0.327	0.023	0.373
12:12	43.6	213.7	25.2	5.20	14.30	169.4	5.27	14.37	0.092	0.325	0.023	0.360
12:13	48.9	217.6	24.0	5.48	14.07	186.1	4.33	15.25	0.105	0.337	0.023	0.373
12:14	57.5	210.5	25.1	5.06	14.48	167.7	5.29	14.37	0.121	0.318	0.023	0.357
12:15	58.5	206.2	37.8	5.03	14.41	146.3	6.42	13.25	0.122	0.310	0.035	0.336
12:16	52.8	204.8	48.7	5.75	13.74	142.8	6.06	13.64	0.116	0.323	0.047	0.320
12:17	45.2	207.7	41.1	5.94	13.67	136.2	6.55	13.18	0.100	0.332	0.040	0.315
12:18	39.6	212.9	39.4	6.06	13.48	128.4	6.79	12.91	0.089	0.343	0.039	0.302
12:19	32.6	209.9	40.1	6.33	13.29	124.5	6.93	12.75	0.074	0.344	0.040	0.296
12:20	26.5	205.9	43.9	6.40	13.17	121.9	6.80	12.86	0.061	0.339	0.044	0.287
AVERAGE VALUES FOR THE LAST HOUR: 29 MINUTES OF VALID DATA												
12:20	35.6	207.8	32.1	5.91	13.65	158.6	5.85	13.79	0.079	0.331	0.031	0.349
12:21	22.6	202.9	38.5	6.49	13.11	120.0	6.68	12.95	0.052	0.336	0.039	0.280
AVERAGE VALUES FOR THE LAST 15 MINUTES												
12:21	38.9	210.3	32.5	5.67	13.87	154.6	5.77	13.88	0.084	0.330	0.031	0.338
12:22	21.8	207.2	34.0	6.45	13.11	119.1	6.70	12.87	0.050	0.342	0.034	0.278
12:23	22.4	200.7	34.0	6.34	13.17	117.2	7.13	12.44	0.051	0.329	0.034	0.282
12:24	23.6	195.2	46.4	6.50	12.94	113.0	7.20	12.35	0.054	0.324	0.047	0.274
12:25	24.3	191.1	48.5	6.70	12.79	117.7	6.70	12.82	0.057	0.321	0.050	0.275
12:26	25.4	193.3	50.5	6.55	12.93	135.5	4.58	14.82	0.059	0.322	0.051	0.275
12:27	26.0	191.5	71.4	5.74	13.82	152.6	4.01	15.38	0.057	0.302	0.068	0.300
12:28	31.0	192.5	117.7	4.65	14.63	134.1	5.75	13.79	0.063	0.283	0.105	0.294
12:29	32.1	199.6	58.2	5.07	14.12	127.1	5.53	13.94	0.067	0.301	0.062	0.274
12:30	29.3	204.5	36.3	5.69	13.72	129.2	5.74	13.74	0.064	0.321	0.035	0.283
12:31	30.5	202.5	34.2	5.55	13.75	121.8	6.03	13.40	0.066	0.315	0.032	0.272
12:32	29.6	202.5	27.0	5.87	13.47	131.5	4.92	14.47	0.065	0.322	0.026	0.273
12:33	27.9	201.5	23.6	5.69	13.71	141.3	4.59	14.79	0.061	0.317	0.022	0.288
12:34	31.9	197.2	35.1	5.07	14.20	134.0	5.33	14.12	0.067	0.298	0.032	0.286

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:35	37.0	198.9	31.1	5.28	13.96	131.6	5.47	13.98	0.079	0.304	0.029	0.283
12:36	37.1	205.0	25.6	5.51	13.81	132.1	5.24	14.20	0.080	0.318	0.024	0.280
AVERAGE VALUES FOR THE LAST 15 MINUTES												
12:36	38.7	198.9	45.6	5.78	13.61	129.2	5.66	13.81	0.063	0.315	0.043	0.281
12:37	35.3	206.6	24.2	5.40	13.94	137.4	4.89	14.54	0.076	0.318	0.023	0.285
12:38	36.4	206.5	27.2	5.14	14.17	135.8	5.08	14.37	0.077	0.313	0.025	0.285
12:39	38.5	205.7	29.1	5.11	14.16	135.2	5.06	14.39	0.081	0.311	0.027	0.283
12:40	41.2	203.8	39.3	5.18	14.14	135.3	5.11	14.27	0.087	0.310	0.036	0.285
12:41	44.9	202.4	63.7	5.06	14.21	138.0	4.89	14.51	0.094	0.305	0.058	0.286
12:42	47.3	203.6	51.1	4.93	14.29	132.7	5.16	14.27	0.098	0.304	0.046	0.280
12:43	50.5	201.1	42.4	5.28	13.94	135.6	4.71	14.67	0.107	0.307	0.039	0.278
12:44	54.2	200.4	37.2	5.44	13.91	136.6	4.76	14.64	0.116	0.310	0.035	0.281
12:45	59.0	199.3	34.6	5.07	14.18	129.3	5.56	13.88	0.124	0.301	0.032	0.280
12:46	53.0	199.2	28.3	5.42	13.82	124.7	5.95	13.52	0.113	0.307	0.027	0.277
12:47	39.4	201.0	26.4	5.80	13.51	128.2	5.49	13.98	0.087	0.318	0.025	0.276
12:48	36.2	203.6	23.3	5.77	13.63	127.7	5.81	13.67	0.079	0.321	0.022	0.281
12:49	35.1	203.6	22.7	5.70	13.61	124.9	5.76	13.72	0.077	0.320	0.022	0.274
12:50	36.1	204.1	22.4	5.79	13.57	122.9	6.02	13.49	0.079	0.322	0.021	0.274
12:51	37.0	202.2	23.6	5.91	13.44	123.6	6.10	13.40	0.082	0.322	0.023	0.277
AVERAGE VALUES FOR THE LAST 15 MINUTES												
12:51	42.9	202.9	33.0	5.40	13.90	131.2	5.36	14.09	0.092	0.313	0.031	0.280
12:52	37.0	201.4	22.1	6.05	13.35	127.5	5.85	13.66	0.083	0.324	0.022	0.281
12:53	34.5	200.1	22.4	5.92	13.47	123.2	6.07	13.45	0.077	0.319	0.022	0.276
12:54	30.9	201.1	20.3	6.04	13.35	126.8	5.56	13.94	0.069	0.323	0.020	0.274
12:55	29.8	200.0	21.1	5.86	13.58	127.8	5.69	13.83	0.066	0.318	0.020	0.279
12:56	32.9	202.4	27.9	5.63	13.72	122.6	5.93	13.61	0.072	0.317	0.027	0.272
12:57	34.9	205.3	22.8	5.91	13.47	131.2	5.38	14.13	0.077	0.327	0.022	0.281
12:58	34.3	206.2	21.4	5.91	13.55	132.5	5.59	13.94	0.076	0.328	0.021	0.287
12:59	36.4	201.9	22.5	5.58	13.81	131.3	5.75	13.79	0.083	0.315	0.021	0.288
13:00	42.4	196.9	22.8	5.69	13.66	131.8	6.02	13.53	0.093	0.309	0.022	0.294
13:01	45.1	194.2	23.8	6.03	13.32	118.2	6.82	12.74	0.101	0.312	0.023	0.279
13:02	40.0	199.6	22.2	6.63	12.80	111.4	7.37	12.22	0.093	0.334	0.023	0.274
13:03	36.3	193.5	21.4	6.86	12.61	105.3	7.55	12.04	0.086	0.329	0.022	0.262
13:04	34.7	188.1	30.2	7.14	12.42	114.0	6.50	13.08	0.084	0.326	0.032	0.263
13:05	40.0	193.8	26.6	6.82	12.73	111.6	7.01	12.59	0.094	0.329	0.027	0.267
13:06	43.0	198.2	22.9	6.79	12.69	104.3	7.65	11.92	0.101	0.335	0.024	0.261
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:06	36.9	198.9	23.4	6.19	13.24	121.3	6.32	13.23	0.084	0.323	0.023	0.276
13:07	38.4	194.1	24.4	7.12	12.42	113.3	6.09	13.48	0.092	0.336	0.026	0.254
13:08	33.4	196.6	24.4	6.74	12.87	115.6	6.71	12.89	0.078	0.332	0.025	0.270
13:09	34.3	197.1	22.6	6.46	12.90	100.1	7.72	11.84	0.079	0.326	0.023	0.252
13:10	32.1	197.9	22.8	7.37	12.18	103.5	7.18	12.38	0.079	0.350	0.025	0.251
13:11	29.7	199.1	22.5	7.35	12.25	108.4	6.51	13.03	0.070	0.351	0.024	0.250
13:12	24.8	200.2	20.1	7.08	12.50	110.4	6.98	12.54	0.060	0.346	0.021	0.263
13:13	24.3	194.5	19.7	6.81	12.64	102.9	7.52	12.02	0.057	0.330	0.020	0.255
13:14	23.2	196.0	19.8	7.18	12.32	105.5	7.06	12.45	0.056	0.341	0.021	0.253
13:15	21.7	200.3	18.6	7.29	12.29	111.3	6.73	12.83	0.053	0.352	0.020	0.261
13:16	21.7	203.6	18.1	7.02	12.50	108.0	7.10	12.44	0.052	0.350	0.019	0.260
13:17	20.6	202.9	18.2	7.14	12.39	110.0	6.57	12.95	0.050	0.352	0.019	0.255

End of Test 1-3

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
13:18     21.4     202.4     18.7      7.02     12.52     110.8      6.74     12.80     0.051     0.348     0.020     0.260
13:19     26.0     200.6     18.5      6.87     12.62     111.6      6.40     13.12     0.061     0.341     0.019     0.255
13:20     32.9     201.3     19.1      6.67     12.80     112.0      6.61     12.92     0.077     0.338     0.020     0.260
--------------------------------------------------------------------------------------------------------------------------
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
13:20     33.9     200.0     30.9      6.09     13.32     122.8      6.04     13.46     0.076     0.323     0.030     0.274
--------------------------------------------------------------------------------------------------------------------------
13:21     38.7     201.6     20.7      6.62     12.81     104.2      7.11     12.38   . 0.090     0.337     0.021     0.251

AVERAGE VALUES FOR THE LAST 15 MINUTES
13:21     28.1     199.2     20.6      6.98     12.53     108.5      6.87     12.67     0.067     0.342     0.021     0.257

13:22     38.7     197.3     20.3      6.92     12.53     107.8      6.79     12.70     0.092     0.337     0.021     0.254
13:23     38.8     195.8     20.1      6.94     12.57     113.6      6.32     13.13     0.092     0.335     0.021     0.259
13:24     42.2     194.6     21.2      6.56     12.84     104.9      6.81     12.62     0.098     0.324     0.021     0.247
13:25     43.2     196.1     20.2      6.83     12.59     108.4      6.54     12.88     0.102     0.333     0.021     0.251
13:26     44.2     195.5     20.9      6.75     12.65     106.7      6.67     12.70     0.104     0.330     0.021     0.249
13:27     42.1     195.9     22.9      6.70     12.65     108.7      6.18     13.16     0.098     0.330     0.023     0.245
13:28     38.9     194.6     22.9      6.60     12.76     109.6      6.31     12.99     0.090     0.325     0.023     0.249
13:29     39.0     192.9     22.4      6.37     12.90     108.3      6.48     12.85     0.089     0.317     0.022     0.249
13:30     38.3     189.5     23.8      6.42     12.82     102.9      7.01     12.34     0.088     0.313     0.024     0.246
13:31     37.0     189.0     23.9      6.76     12.54     105.5      6.33     12.99     0.087     0.319     0.025     0.240

COMMENTS: End of Test 1-3
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CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1-3/ Pre-test 1-4 Calibration Bias Check

DATE : 10-27-1989 TIME: 13:31 - 13:56

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	5.0
1	OUTLET	ppmSO2	49.6	54.3
3	OUTLET	ppmNOX	0.0	-0.3
3	OUTLET	ppmNOX	240.0	237.9
4	OUTLET	ppmCO	0.0	-0.3
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.37
5	OUTLET	% CO2	0.00	0.12
5	OUTLET	% CO2	11.06	11.23
6	INLET	ppmSO2	0.0	4.0
6	INLET	ppmSO2	218.0	207.1
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.38
8	INLET	% CO2	0.00	0.22
8	INLET	% CO2	11.06	11.06

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Outlet SO2 Calibration Error Check

DATE : 10-27-1989 TIME: 13:57 - 14:06

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	-0.5
1	OUTLET	ppmSO2	49.6	49.7
1	OUTLET	ppmSO2	89.3	89.8

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 1-4 Outlet SO2 Calibration Bias Check

DATE : 10-27-1989 TIME: 14:06 - 14:10

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.6
1	OUTLET	ppmSO2	49.6	48.7

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Palm Beach Co. Solid Waste Authority  Comoliance     10-27-1989
        CHAN 1     CHAN 3     CHAN 4     CHAN 2     CHAN 5     CHAN 6     CHAN 7     CHAN 8     OUTLET     OUTLET     OUTLET     INLET
        OUTLET     OUTLET     OUTLET     OUTLET     OUTLET     INLET      INLET      INLET      lb SO2     lb NOX     lb CO      lb SO2
TIME    ppmSO2     ppmNOX     ppmCO      % O2       % CO2      ppmSO2     % O2       % CO2      MBTU       MBTU       MBTU       MBTU
15:19     12.4      213.3      23.0      6.72      12.82      128.8      6.35      13.27      0.029      0.359      0.024      0.294
15:20     14.6      216.6      23.0      6.59      12.94      126.3      6.80      12.84      0.034      0.361      0.023      0.298
15:21     16.0      215.6      23.7      6.70      12.80      123.2      6.78      12.84      0.037      0.363      0.024      0.290
15:22     16.5      211.5      24.6      6.87      12.69      128.2      6.43      13.21      0.039      0.360      0.025      0.294
15:23     21.7      214.1      24.8      6.73      12.83      130.1      6.53      13.12      0.051      0.361      0.025      0.301
15:24     28.4      213.1      24.6      6.58      12.93      127.1      6.58      13.08      0.066      0.355      0.025      0.295
15:25     28.7      212.3      25.0      6.70      12.86      127.5      6.53      13.10      0.067      0.357      0.026      0.295
15:26     26.7      214.6      25.0      6.68      12.88      130.2      6.41      13.21      0.062      0.360      0.026      0.298
15:27     24.8      214.5      24.7      6.52      13.02      123.6      6.59      13.02      0.057      0.356      0.025      0.287
15:28     24.0      209.9      25.4      6.53      12.96      130.3      6.06      13.57      0.055      0.349      0.026      0.292
15:29     21.3      211.5      25.5      6.42      13.10      123.0      6.78      12.87      0.049      0.349      0.026      0.289
15:30     21.8      211.6      24.5      6.61      12.86      122.5      6.66      12.93      0.051      0.354      0.025      0.286

15:31     23.9      209.0      25.1      6.81      12.74      129.5      6.14      13.49      0.056      0.354      0.026      0.291
15:32     24.7      209.6      26.9      6.50      13.03      134.6      5.75      13.82      0.057      0.348      0.027      0.295
15:33     26.3      210.5      26.7      6.23      13.29      134.3      5.91      13.72      0.060      0.343      0.026      0.298
15:34     34.4      208.2      28.0      6.00      13.47      134.7      5.92      13.73      0.077      0.334      0.027      0.299
15:35     41.0      207.4      31.3      5.94      13.50      127.6      6.36      13.24      0.091      0.331      0.030      0.291
15:36     38.0      207.2      33.0      6.25      13.23      134.4      5.87      13.75      0.086      0.338      0.033      0.297
15:37     37.3      211.3      36.8      6.06      13.45      127.7      6.34      13.30      0.084      0.340      0.036      0.291
15:38     37.6      214.7      36.3      6.15      13.28      125.0      6.43      13.24      0.085      0.348      0.036      0.287
15:39     37.7      215.3      29.9      6.43      13.02      117.3      6.93      12.70      0.086      0.355      0.030      0.279
15:40     35.6      213.6      29.1      6.88      12.64      121.3      6.65      13.05      0.084      0.364      0.030      0.283
15:41     34.1      211.8      27.9      6.80      12.72      112.1      7.17      12.44      0.080      0.359      0.029      0.271
15:42     31.4      208.7      28.3      7.08      12.46      111.7      7.29      12.40      0.076      0.361      0.030      0.273
15:43     32.8      208.5      29.7      7.20      12.35      107.5      7.36      12.27      0.079      0.363      0.032      0.264
15:44     30.8      206.9      31.1      7.48      12.16      108.0      7.41      12.23      0.076      0.368      0.034      0.266
15:45     31.3      209.0      34.5      7.54      12.11      109.0      7.43      12.25      0.078      0.374      0.037      0.269

AVERAGE VALUES FOR THE LAST 15 MINUTES
15:45     33.1      210.1      30.3      6.62      12.90      122.3      6.60      13.04      0.077      0.352      0.031      0.284

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AVERAGE VALUES FOR THE LAST HOUR: 27 MINUTES OF VALID DATA
15:45     27.9      211.5      27.7      6.63      12.89      124.3      6.57      13.06      0.065      0.354      0.028      0.288
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15:46     33.8      209.7      34.9      7.56      12.09      107.3      7.74      11.91      0.084      0.375      0.038      0.271
15:47     34.8      206.4      35.2      7.66      12.02      106.9      7.70      11.97      0.087      0.372      0.039      0.269
15:48     33.5      207.0      35.6      7.63      12.06      109.8      6.88      12.71      0.084      0.372      0.039      0.260
15:49     29.9      210.3      34.7      7.34      12.35      115.0      6.96      12.78      0.073      0.370      0.037      0.274
15:50     28.9      211.0      32.9      6.97      12.56      108.7      7.64      12.04      0.069      0.362      0.034      0.272
15:51     30.7      209.2      33.1      7.37      12.23      108.3      7.22      12.41      0.075      0.369      0.036      0.263
15:52     31.0      210.4      34.7      7.51      12.21      118.4      6.64      13.04      0.077      0.375      0.038      0.276
15:53     35.2      211.0      35.3      6.93      12.65      114.5      6.96      12.72      0.084      0.361      0.037      0.273
15:54     38.8      207.6      35.0      6.86      12.64      110.2      7.65      12.03      0.092      0.353      0.036      0.276
15:55     39.9      198.1      35.7      7.40      12.18      119.9      6.60      12.81      0.098      0.350      0.038      0.282
15:56     42.3      202.5      37.8      7.47      12.20      120.0      6.72      12.95      0.105      0.360      0.041      0.281
15:57     45.5      209.5      36.1      7.27      12.38      124.1      6.32      13.35      0.111      0.367      0.039      0.283
15:58     48.3      213.4      31.1      6.78      12.77      124.0      6.53      13.11      0.114      0.361      0.032      0.286
15:59     45.5      213.4      28.5      6.72      12.80      129.8      5.99      13.67      0.107      0.359      0.029      0.289
16:00     44.5      209.4      29.1      6.40      13.12      125.5      6.45      13.23      0.102      0.345      0.029      0.288

AVERAGE VALUES FOR THE LAST 15 MINUTES
16:00     37.5      208.6      34.0      7.19      12.42      116.2      6.95      12.72      0.091      0.364      0.036      0.276
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Begin -4

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
16:01	44.9	208.7	27.9	6.40	13.04	123.0	6.45	13.17	0.103	0.344	0.028	0.283
16:02	44.4	207.9	27.9	6.62	12.86	128.4	6.04	13.58	0.103	0.348	0.028	0.287
16:03	44.7	208.3	31.0	6.46	13.06	131.6	5.96	13.64	0.103	0.345	0.031	0.292
16:04	44.6	207.5	32.0	6.19	13.25	129.4	6.34	13.29	0.101	0.337	0.032	0.295
16:05	48.2	205.3	30.3	6.21	13.22	128.7	6.17	13.45	0.109	0.334	0.030	0.290
16:06	44.1	205.9	33.1	6.22	13.22	128.5	6.13	13.50	0.100	0.335	0.033	0.289
16:07	39.0	205.7	30.0	6.08	13.35	127.7	5.82	13.77	0.087	0.332	0.029	0.281
16:08	33.9	207.3	29.3	6.03	13.41	128.1	5.79	13.79	0.076	0.333	0.029	0.282
16:09	28.8	209.3	30.6	5.94	13.46	128.8	5.72	13.88	0.064	0.334	0.030	0.282
16:10	23.1	211.7	28.0	5.96	13.44	128.5	5.52	14.01	0.051	0.338	0.027	0.277
16:11	18.5	209.7	25.4	5.91	13.50	130.6	5.36	14.16	0.041	0.334	0.025	0.279
16:12	18.9	207.7	25.3	5.64	13.72	130.0	5.50	14.04	0.041	0.325	0.024	0.280
16:13	21.4	207.8	24.5	5.68	13.63	133.1	5.18	14.32	0.047	0.326	0.023	0.281
16:14	20.5	208.8	25.3	5.76	13.63	139.7	4.92	14.55	0.045	0.330	0.024	0.290
16:15	17.9	202.1	30.8	5.40	13.93	139.7	4.99	14.54	0.038	0.311	0.029	0.292
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:15	32.9	207.6	28.8	6.03	13.38	130.4	5.73	13.85	0.074	0.334	0.028	0.285
16:16	17.3	203.1	41.2	5.21	14.05	131.5	5.49	14.06	0.037	0.309	0.038	0.283
16:17	17.2	206.7	31.0	5.48	13.77	131.5	5.50	14.05	0.037	0.320	0.029	0.284
16:18	15.7	211.1	24.9	5.78	13.54	126.7	5.98	13.61	0.034	0.333	0.024	0.282
16:19	14.4	208.9	22.4	6.01	13.34	130.6	5.31	14.23	0.032	0.335	0.022	0.278
16:20	12.2	204.6	25.4	5.89	13.53	137.4	4.82	14.70	0.027	0.325	0.025	0.284
16:21	11.7	205.1	26.4	5.46	13.94	143.0	4.61	14.91	0.025	0.317	0.025	0.291
16:22	16.9	202.0	38.5	4.96	14.36	136.5	5.34	14.24	0.035	0.303	0.035	0.291
16:23	20.2	206.9	44.8	5.22	14.05	128.4	5.82	13.74	0.043	0.315	0.041	0.283
16:24	17.7	212.2	30.5	5.75	13.56	131.8	5.27	14.26	0.039	0.334	0.029	0.280
16:25	16.8	211.3	23.6	5.86	13.54	136.9	4.99	14.53	0.037	0.336	0.023	0.286
16:26	19.9	204.7	28.3	5.47	13.90	138.8	4.99	14.54	0.043	0.317	0.027	0.290
16:27	29.7	202.2	33.5	5.26	14.05	127.0	6.13	13.45	0.063	0.309	0.031	0.286
16:28	39.5	206.9	29.4	5.76	13.50	119.2	6.41	13.15	0.087	0.326	0.028	0.273
16:29	46.0	207.9	23.5	6.35	13.00	112.6	7.12	12.47	0.105	0.341	0.023	0.271
16:30	46.9	202.9	23.5	6.79	12.61	110.5	7.01	12.58	0.110	0.343	0.024	0.264
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:30	22.8	206.4	29.8	5.68	13.65	129.5	5.65	13.90	0.050	0.324	0.028	0.282
16:31	46.3	197.0	25.4	6.99	12.51	111.6	7.23	12.39	0.111	0.338	0.027	0.271
16:32	50.4	192.4	30.1	6.92	12.55	114.7	6.73	12.89	0.120	0.329	0.031	0.269
16:33	50.7	196.1	29.6	6.87	12.64	122.7	5.89	13.73	0.120	0.334	0.031	0.271
16:34	43.0	197.2	35.0	6.43	13.12	124.2	6.34	13.29	0.099	0.326	0.035	0.283
16:35	38.2	200.5	60.2	6.13	13.27	123.9	6.11	13.54	0.086	0.324	0.059	0.278
16:36	34.7	207.0	40.1	6.32	13.14	128.1	5.75	13.82	0.079	0.339	0.040	0.281
16:37	36.6	197.1	44.7	6.15	13.38	143.0	4.68	14.90	0.082	0.319	0.044	0.293
16:38	41.1	200.9	76.5	5.35	14.04	140.2	4.72	14.83	0.088	0.309	0.071	0.288
16:39	42.0	208.5	48.2	5.42	13.96	136.1	5.28	14.32	0.090	0.322	0.045	0.289
16:40	39.1	206.3	35.5	5.42	13.97	149.7	4.40	15.15	0.084	0.318	0.033	0.301
16:41	39.0	201.0	77.6	4.94	14.41	139.8	5.00	14.53	0.081	0.301	0.071	0.292
16:42	35.3	200.4	62.8	5.05	14.25	142.0	4.77	14.75	0.074	0.302	0.058	0.292
16:43	34.7	199.6	42.5	5.06	14.25	137.8	5.00	14.51	0.073	0.301	0.039	0.288
16:44	34.7	201.5	31.5	5.19	14.10	145.6	4.36	15.10	0.073	0.306	0.029	0.292
16:45	33.9	200.3	33.8	5.01	14.30	147.3	4.72	14.76	0.071	0.301	0.031	0.302

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:45	40.0	200.4	44.9	5.82	13.59	133.8	5.40	14.17	0.089	0.318	0.043	0.286
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
16:45	33.3	205.8	34.3	6.18	13.26	127.5	5.93	13.66	0.076	0.335	0.034	0.282
16:46	36.4	196.2	64.3	4.78	14.41	140.0	4.99	14.47	0.075	0.291	0.058	0.292
16:47	41.6	193.5	55.9	5.14	14.07	137.1	5.30	14.22	0.088	0.293	0.052	0.292
16:48	44.8	192.6	65.8	5.40	13.83	133.9	5.25	14.24	0.096	0.297	0.062	0.284
16:49	42.5	195.0	56.1	5.53	13.73	127.9	5.40	14.00	0.092	0.303	0.053	0.274
16:50	40.3	197.0	35.5	5.73	13.53	130.7	5.36	14.11	0.088	0.310	0.034	0.279
16:51	33.8	197.8	25.2	5.75	13.50	132.2	5.22	14.24	0.074	0.312	0.024	0.280
16:52	39.1	196.8	23.0	5.69	13.60	130.9	5.25	14.19	0.085	0.309	0.022	0.278
16:53	43.5	198.0	21.6	5.65	13.61	130.2	5.24	14.21	0.095	0.310	0.021	0.276
16:54	43.7	201.8	21.2	5.63	13.63	128.0	5.61	13.90	0.095	0.316	0.020	0.278
16:55	40.4	205.5	20.1	5.75	13.49	126.7	5.89	13.67	0.089	0.324	0.019	0.280
16:56	38.1	210.3	20.4	6.10	13.24	122.7	6.31	13.28	0.086	0.339	0.020	0.279
16:57	39.7	210.5	20.8	6.30	13.04	121.8	5.99	13.59	0.090	0.344	0.021	0.271
16:58	37.4	210.2	20.6	6.47	12.94	119.9	6.19	13.42	0.086	0.348	0.021	0.271
16:59	33.2	209.2	20.1	6.40	13.00	118.5	6.13	13.48	0.076	0.345	0.020	0.266
17:00	29.7	208.4	20.5	6.42	13.01	114.7	6.72	12.92	0.068	0.344	0.021	0.269
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:00	39.0	201.5	32.7	5.78	13.51	127.7	5.66	13.86	0.086	0.319	0.031	0.278
17:01	27.7	204.2	22.1	6.56	12.84	120.2	6.03	13.63	0.064	0.340	0.022	0.268
17:02	23.0	201.0	22.8	6.54	12.96	120.4	6.21	13.43	0.053	0.334	0.023	0.272
17:03	19.1	198.9	25.5	6.34	13.09	114.6	6.87	12.77	0.044	0.326	0.025	0.271
17:04	17.0	196.3	25.5	6.58	12.80	115.4	6.73	12.93	0.039	0.327	0.026	0.270
17:05	16.0	198.7	23.2	6.82	12.63	111.3	7.06	12.60	0.038	0.337	0.024	0.267
17:06	14.4	201.0	22.9	7.02	12.47	115.7	6.41	13.26	0.034	0.346	0.024	0.265
17:07	14.2	205.9	22.7	6.89	12.64	112.6	6.46	13.18	0.034	0.351	0.024	0.259
17:08	13.3	209.6	22.3	6.74	12.72	114.4	6.37	13.28	0.031	0.354	0.023	0.262
17:09	11.7	210.4	21.6	6.70	12.76	110.1	6.55	13.13	0.027	0.354	0.022	0.255
17:10	10.2	210.7	22.9	6.81	12.68	117.8	5.87	13.77	0.024	0.357	0.024	0.260
17:11	10.6	209.0	23.6	6.49	13.03	118.9	5.95	13.71	0.024	0.346	0.024	0.264
17:12	13.6	207.3	26.8	6.17	13.27	117.9	5.92	13.77	0.031	0.336	0.026	0.261
17:13	17.1	209.0	25.8	6.12	13.32	112.9	6.32	13.37	0.038	0.338	0.025	0.257
17:14	21.1	209.5	25.5	6.38	13.08	113.2	6.21	13.50	0.048	0.344	0.026	0.256
17:15	24.0	210.6	26.8	6.42	13.06	112.9	6.30	13.39	0.055	0.347	0.027	0.257
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:15	16.9	205.5	24.0	6.57	12.89	115.2	6.35	13.32	0.039	0.343	0.024	0.263
17:16	27.8	212.4	26.4	6.51	12.99	121.1	5.83	13.87	0.064	0.353	0.027	0.267
17:17	32.0	212.5	24.4	6.31	13.18	117.6	6.20	13.51	0.073	0.348	0.024	0.266
17:18	34.4	212.3	22.9	6.40	13.07	116.6	6.21	13.53	0.079	0.349	0.023	0.263
17:19	32.9	213.5	22.1	6.43	13.06	115.2	6.55	13.19	0.076	0.352	0.022	0.267
17:20	33.1	210.7	22.0	6.66	12.83	113.7	6.56	13.17	0.066	0.353	0.022	0.263
17:21	34.2	207.0	23.1	6.76	12.77	119.1	6.05	13.67	0.057	0.350	0.024	0.266
17:22	33.5	209.2	24.0	6.56	13.00	126.8	5.36	14.31	0.054	0.348	0.024	0.271
17:23	32.5	211.2	22.7	6.09	13.43	124.4	5.62	14.07	0.050	0.341	0.022	0.270
17:24	31.1	213.4	21.6	5.97	13.47	116.1	6.46	13.27	0.047	0.341	0.021	0.267

END

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
17:25	18.3	215.9	21.1	6.35	13.10	118.7	5.89	13.78	0.042	0.354	0.021	0.263
17:26	17.8	220.9	21.1	6.38	13.14	121.2	5.90	13.83	0.041	0.363	0.021	0.268
17:27	21.1	221.4	21.0	6.23	13.26	118.4	6.22	13.50	0.048	0.360	0.021	0.268
17:28	20.2	216.6	22.5	6.43	13.05	121.7	5.83	13.84	0.046	0.358	0.023	0.268
17:29	16.8	214.1	22.1	6.34	13.22	126.9	5.72	14.02	0.038	0.351	0.022	0.278
17:30	17.1	211.7	22.7	5.98	13.49	121.4	6.02	13.73	0.038	0.339	0.022	0.271
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:30	23.9	213.5	22.7	6.36	13.14	119.9	6.03	13.69	0.055	0.351	0.023	0.268
17:31	17.2	210.4	23.6	6.05	13.45	122.5	6.00	13.77	0.039	0.338	0.023	0.273
17:32	16.7	214.2	26.7	6.08	13.42	124.6	5.90	13.86	0.037	0.345	0.026	0.276

COMMENTS: End of Test 1-4

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1-4/ Pre-test 1-5 Calibration Bias Check

DATE : 10-27-1989 TIME: 17:32 - 17:56

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.9
1	OUTLET	ppmSO2	49.6	49.0
3	OUTLET	ppmNOX	0.0	-0.5
3	OUTLET	ppmNOX	240.0	234.6
4	OUTLET	ppmCO	0.0	0.4
4	OUTLET	ppmCO	24.8	23.7
2	OUTLET	% O2	0.00	0.03
2	OUTLET	% O2	12.50	12.34
2	OUTLET	% O2	19.93	19.73
5	OUTLET	% CO2	0.00	0.12
5	OUTLET	% CO2	11.06	11.12
6	INLET	ppmSO2	0.0	4.5
6	INLET	ppmSO2	218.0	209.6
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.46
7	INLET	% O2	19.93	19.89
8	INLET	% CO2	0.00	0.33
8	INLET	% CO2	11.06	11.13

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
18:16    29.4     211.5     30.0      7.51     12.19     108.6      7.34     12.47     0.073     0.377     0.033     0.266
18:17    29.0     211.4     28.0      7.50     12.24     104.9      7.26     12.51     0.072     0.377     0.030     0.255
18:18    21.9     211.8     28.1      7.48     12.25     115.3      6.46     13.30     0.054     0.377     0.030     0.265
18:19    16.7     212.5     27.0      7.28     12.49     120.3      6.13     13.66     0.041     0.373     0.029     0.270
18:20    16.1     213.2     25.4      6.80     12.85     116.8      6.30     13.47     0.038     0.361     0.026     0.266
18:21    18.2     211.9     22.7      6.70     12.90     116.2      6.47     13.25     0.043     0.356     0.023     0.267
18:22    21.0     210.2     21.7      6.84     12.78     121.5      6.12     13.63     0.050     0.357     0.022     0.273
18:23    26.3     209.5     23.7      6.76     12.88     122.8      6.09     13.64     0.062     0.354     0.024     0.275
18:24    31.0     211.5     22.6      6.51     13.10     132.1      5.35     14.34     0.072     0.351     0.023     0.282
18:25    36.5     211.7     20.2      6.18     13.42     132.1      5.88     13.85     0.082     0.344     0.020     0.292
18:26    35.7     211.2     21.4      6.00     13.52     123.6      6.01     13.71     0.080     0.339     0.021     0.276
18:27    29.4     211.9     22.7      6.17     13.39     129.5      5.69     14.05     0.066     0.343     0.022     0.283
18:28    23.7     212.3     24.1      6.07     13.49     128.4      5.78     13.96     0.053     0.342     0.024     0.282
18:29    20.6     213.5     24.9      6.13     13.44     131.3      5.59     14.11     0.046     0.345     0.025     0.285
18:30    19.4     214.0     26.6      6.01     13.56     134.8      5.29     14.44     0.043     0.343     0.026     0.287

AVERAGE VALUES FOR THE LAST 15 MINUTES
18:30    25.0     211.9     24.6      6.66     12.97     122.6      6.12     13.63     0.058     0.356     0.025     0.275

18:31    30.5     218.1     23.8      5.80     13.78     140.9      4.95     14.77     0.045     0.345     0.023     0.293
18:32    22.9     216.0     22.6      5.67     13.87     143.3      4.96     14.74     0.050     0.339     0.022     0.298
18:33    24.8     213.0     21.4      5.62     13.96     147.1      4.77     14.94     0.054     0.333     0.020     0.303
18:34    29.0     212.1     22.7      5.30     14.21     136.7      5.70     14.06     0.062     0.325     0.021     0.298
18:35    29.2     214.4     22.0      5.59     13.86     135.2      5.69     14.06     0.063     0.335     0.021     0.295
18:36    29.1     217.2     22.0      5.95     13.61     136.4      5.61     14.14     0.065     0.347     0.021     0.296
18:37    31.8     215.9     21.8      5.94     13.66     138.6      5.69     14.08     0.071     0.345     0.021     0.303
18:38    34.8     215.2     24.1      5.84     13.71     137.5      5.80     14.00     0.077     0.341     0.023     0.302
18:39    35.8     213.9     23.6      6.01     13.56     139.5      5.43     14.33     0.080     0.343     0.023     0.299
18:40    37.9     215.4     25.8      5.99     13.63     143.6      5.48     14.28     0.084     0.345     0.025     0.309
18:41    40.8     215.5     21.9      5.97     13.63     142.8      5.58     14.16     0.091     0.345     0.021     0.309
18:42    39.1     213.1     22.1      5.87     13.73     150.2      5.02     14.71     0.086     0.339     0.021     0.314
18:43    37.3     212.3     23.5      5.69     13.90     149.5      5.17     14.57     0.081     0.333     0.022     0.315
18:44    37.8     212.6     28.5      5.46     14.11     158.1      4.81     14.88     0.081     0.329     0.027     0.326
18:45    37.6     215.1     41.9      5.32     14.19     160.9      4.64     15.07     0.080     0.330     0.039     0.329

AVERAGE VALUES FOR THE LAST 15 MINUTES
18:45    32.5     214.7     24.5      5.73     13.83     144.0      5.29     14.45     0.071     0.338     0.023     0.306

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AVERAGE VALUES FOR THE LAST HOUR: 30 MINUTES OF VALID DATA
18:45    28.8     213.3     24.6      6.20     13.40     133.3      5.70     14.04     0.065     0.347     0.024     0.291
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18:46    37.5     218.2     27.1      5.14     14.34     139.4      5.71     13.98     0.079     0.331     0.025     0.305
18:47    35.6     215.6     26.6      5.47     14.00     148.3      4.95     14.74     0.077     0.334     0.025     0.309
18:48    33.2     219.4     23.5      5.57     13.96     143.7      5.20     14.48     0.072     0.342     0.022     0.304
18:49    31.7     215.5     27.5      5.57     13.94     143.8      4.93     14.74     0.069     0.336     0.026     0.299
18:50    29.5     216.0     37.1      5.55     13.97     146.5      4.59     15.05     0.064     0.336     0.035     0.298
18:51    31.0     216.8     30.7      5.32     14.17     131.9      5.72     14.01     0.066     0.332     0.029     0.288
18:52    29.5     220.0     25.2      5.68     13.76     130.3      5.56     14.12     0.064     0.345     0.024     0.282
18:53    23.8     219.8     22.3      6.10     13.44     135.1      4.91     14.72     0.053     0.355     0.022     0.281
18:54    25.6     219.0     23.4      5.83     13.75     132.4      5.34     14.34     0.056     0.347     0.023     0.282
18:55    28.5     220.2     23.8      5.66     13.84     130.3      5.10     14.49     0.062     0.345     0.023     0.274
18:56    25.7     217.0     30.7      5.62     13.90     132.1      5.04     14.60     0.056     0.339     0.029     0.277
18:57    22.5     217.2     24.5      5.56     13.89     129.4      5.71     13.98     0.049     0.338     0.023     0.283
18:58    19.0     218.2     21.4      5.94     13.56     130.7      5.72     13.99     0.042     0.348     0.021     0.286
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Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
18:59	16.0	219.1	20.2	5.99	13.55	136.5	5.38	14.32	0.036	0.351	0.020	0.292
19:00	14.8	220.7	19.4	5.91	13.64	134.0	5.71	14.03	0.033	0.352	0.019	0.293
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:00	26.9	218.2	25.6	5.66	13.85	136.3	5.30	14.37	0.058	0.342	0.024	0.290
19:01	13.8	220.0	19.5	5.96	13.58	130.9	5.68	14.05	0.031	0.352	0.019	0.285
19:02	14.2	218.5	20.9	5.97	13.59	133.4	5.68	14.07	0.032	0.350	0.020	0.291
19:03	15.8	219.2	21.2	6.02	13.54	133.0	5.76	13.96	0.035	0.352	0.021	0.292
19:04	16.4	221.2	20.5	6.02	13.54	137.6	5.58	14.18	0.037	0.355	0.020	0.298
19:05	15.9	217.9	20.5	5.93	13.61	127.8	6.02	13.67	0.035	0.348	0.020	0.285
19:06	15.3	219.1	20.8	6.21	13.39	146.2	4.84	14.84	0.035	0.356	0.021	0.302
19:07	16.5	221.4	20.3	5.67	13.88	137.9	5.52	14.17	0.036	0.347	0.019	0.298
19:08	18.1	223.5	21.3	5.70	13.79	145.0	4.84	14.79	0.039	0.351	0.020	0.300
19:09	19.8	222.6	25.4	5.61	13.91	148.5	4.62	15.03	0.043	0.348	0.024	0.303
19:10	22.7	221.8	28.7	5.34	14.14	148.1	4.53	15.11	0.049	0.340	0.027	0.300
19:11	24.9	221.4	33.3	5.26	14.21	139.8	5.19	14.49	0.053	0.338	0.031	0.295
19:12	27.1	222.1	26.5	5.47	13.95	134.4	5.78	13.95	0.058	0.344	0.025	0.295
19:13	30.1	222.6	23.1	5.97	13.49	122.2	5.92	13.76	0.067	0.356	0.022	0.271
19:14	33.2	226.3	23.2	6.34	13.25	124.0	5.76	13.99	0.076	0.371	0.023	0.272
19:15	32.2	225.8	23.3	6.15	13.42	118.3	5.72	13.96	0.072	0.366	0.023	0.259
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:15	21.1	221.6	23.2	5.84	13.69	135.1	5.43	14.27	0.046	0.352	0.022	0.290
19:16	26.1	225.9	23.3	6.11	13.49	129.1	4.95	14.74	0.059	0.365	0.023	0.269
19:17	20.2	224.1	22.4	5.80	13.77	134.7	4.74	14.91	0.044	0.354	0.022	0.277
19:18	17.5	220.9	23.0	5.58	13.98	132.9	5.29	14.44	0.038	0.344	0.022	0.283
19:19	16.8	219.6	24.1	5.63	13.85	119.1	6.17	13.58	0.036	0.344	0.023	0.268
19:20	14.2	221.8	24.4	6.14	13.39	124.9	5.52	14.22	0.032	0.359	0.024	0.270
19:21	11.1	222.5	24.4	6.25	13.36	129.1	5.47	14.26	0.025	0.363	0.024	0.278
19:22	10.6	221.6	23.6	6.14	13.44	128.9	5.40	14.32	0.024	0.358	0.023	0.276
19:23	12.7	222.7	23.2	6.08	13.49	119.6	6.13	13.64	0.028	0.359	0.023	0.269
19:24	13.8	223.9	23.2	6.27	13.27	122.4	5.64	14.10	0.031	0.366	0.023	0.266
19:25	15.1	221.6	22.0	6.36	13.25	127.3	6.20	13.62	0.034	0.364	0.022	0.287
19:26	18.5	221.5	22.0	6.42	13.14	120.9	6.53	13.26	0.043	0.366	0.022	0.279
19:27	20.2	219.6	23.3	6.77	12.83	117.5	6.95	12.87	0.047	0.371	0.024	0.280
19:28	20.4	216.4	25.0	7.03	12.60	112.9	7.12	12.70	0.049	0.373	0.026	0.272
19:29	20.7	214.5	26.3	7.17	12.50	110.6	6.79	13.00	0.050	0.373	0.028	0.260
19:30	22.3	212.3	25.7	7.32	12.41	113.6	6.82	12.99	0.055	0.373	0.027	0.268
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:30	17.3	220.6	23.7	6.34	13.25	122.9	5.98	13.78	0.040	0.362	0.024	0.273
19:31	25.8	210.4	25.0	7.25	12.44	106.5	7.31	12.47	0.063	0.368	0.027	0.260
19:32	27.9	208.2	25.2	7.49	12.23	108.4	7.21	12.59	0.069	0.371	0.027	0.263
19:33	30.9	208.3	25.6	7.54	12.24	116.8	6.86	12.96	0.077	0.372	0.028	0.276
19:34	35.1	211.9	26.8	7.36	12.39	120.3	7.01	12.82	0.086	0.374	0.029	0.288
19:35	37.7	211.0	29.0	7.37	12.35	118.6	6.88	12.93	0.092	0.372	0.031	0.281
19:36	34.8	215.3	30.0	7.36	12.39	113.0	7.45	12.35	0.085	0.380	0.032	0.279
19:37	30.5	212.2	28.8	7.40	12.32	116.4	7.04	12.75	0.075	0.375	0.031	0.279
19:38	26.9	213.9	29.3	7.49	12.27	115.9	7.20	12.61	0.067	0.381	0.032	0.281
19:39	25.3	212.8	28.3	7.55	12.16	117.9	6.93	12.88	0.063	0.381	0.031	0.280
19:40	24.2	215.4	28.5	7.58	12.19	116.1	7.11	12.71	0.060	0.386	0.031	0.279
19:41	23.6	215.6	31.2	7.63	12.13	105.2	7.70	12.10	0.059	0.388	0.034	0.265

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Palm Beach Co. Solid Waste Authority  Compliance     10-27-1989
         CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
         OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME     ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
19:42     23.0     215.8      32.3      7.85     11.94     103.2      7.80     12.02     0.059     0.395     0.036     0.262
19:43     18.6     213.0      34.2      8.04     11.76      98.1      7.93     11.88     0.048     0.396     0.039     0.251
19:44     13.3     214.2      34.5      8.28     11.62     108.7      6.48     13.33     0.035     0.405     0.040     0.250
19:45     10.4     221.4      32.4      7.65     12.18     104.0      6.88     12.90     0.026     0.399     0.036     0.246

AVERAGE VALUES FOR THE LAST 15 MINUTES
19:45     25.9     213.3      29.4      7.59     12.17     111.3      7.19     12.62     0.064     0.383     0.032     0.269

------------------------------------------------------------------------------------------------------------------------
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
19:45     22.8     218.4      25.5      6.36     13.24     126.4      5.97     13.76     0.052     0.360     0.026     0.281
------------------------------------------------------------------------------------------------------------------------
19:46      3.1     218.8      29.9      7.49     12.21     106.9      7.09     12.70     0.020     0.390     0.032     0.257
19:47      6.9     215.6      29.1      7.83     11.97     113.9      7.27     12.56     0.017     0.394     0.032     0.277
19:48      6.3     216.3      28.0      7.74     12.03     109.9      7.23     12.58     0.016     0.393     0.031     0.267
19:49      6.4     217.6      28.3      7.69     12.06     107.0      7.39     12.39     0.016     0.393     0.031     0.263
19:50      5.9     218.1      29.0      7.74     12.01     109.8      6.96     12.83     0.015     0.396     0.032     0.262
19:51      6.3     221.0      28.2      7.52     12.21     105.5      7.34     12.44     0.016     0.394     0.031     0.258
19:52      8.2     219.6      27.3      7.58     12.12     105.0      7.11     12.66     0.020     0.394     0.030     0.253
19:53     10.1     216.7      27.3      7.60     12.12     103.9      7.31     12.47     0.025     0.389     0.030     0.254
19:54     11.3     217.1      26.0      7.74     12.01     101.9      7.32     12.45     0.029     0.394     0.029     0.249
19:55     18.8     214.7      25.0      7.66     12.09     101.2      7.05     12.74     0.047     0.387     0.027     0.243
19:56     25.6     215.6      24.7      7.63     12.12      99.3      7.42     12.35     0.064     0.388     0.027     0.245
19:57     28.7     215.2      23.7      7.62     12.14     105.8      6.88     12.80     0.072     0.387     0.026     0.251
19:58     33.2     216.1      24.2      7.46     12.30     117.3      6.29     13.50     0.082     0.384     0.026     0.267
19:59     38.7     221.2      23.5      7.08     12.61     122.0      6.07     13.70     0.093     0.382     0.025     0.273
20:00     41.8     222.6      23.2      6.83     12.82     131.8      5.66     14.12     0.099     0.378     0.024     0.287

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:00     17.1     217.8      26.5      7.55     12.19     109.4      6.96     12.82     0.042     0.390     0.029     0.260

20:01     49.5     224.2      21.6      6.56     13.08     133.0      5.67     14.10     0.114     0.373     0.022     0.290
20:02     50.9     224.6      21.5      6.35     13.26     130.4      5.63     14.15     0.116     0.369     0.022     0.284
20:03     39.2     226.8      20.4      6.24     13.35     127.3      5.79     13.96     0.089     0.369     0.020     0.280
20:04     28.2     222.8      23.2      6.24     13.33     135.1      5.36     14.40     0.064     0.363     0.023     0.289
20:05     21.8     222.9      21.8      6.21     13.37     121.5      6.57     13.20     0.049     0.362     0.022     0.281
20:06     18.2     220.3      21.9      6.52     12.99     127.6      5.89     13.92     0.042     0.366     0.022     0.282
20:07     13.8     221.2      21.8      6.62     12.98     123.1      5.80     13.94     0.032     0.370     0.022     0.271
20:08     11.6     223.0      22.0      6.61     13.03     132.5      5.31     14.45     0.027     0.373     0.022     0.282
20:09     10.0     225.1      20.9      6.28     13.36     132.5      5.53     14.26     0.023     0.368     0.021     0.286
20:10      9.8     222.6      20.1      6.02     13.56     133.8      5.64     14.14     0.022     0.357     0.020     0.291
20:11     10.2     223.2      19.9      6.08     13.47     126.0      6.01     13.76     0.023     0.360     0.020     0.281
20:12     10.3     221.3      20.3      6.23     13.32     133.9      5.65     14.14     0.023     0.360     0.020     0.292
20:13     10.3     219.3      20.9      6.36     13.23     129.6      5.47     14.25     0.024     0.360     0.021     0.279
20:14      9.2     220.2      23.2      6.25     13.36     140.2      4.90     14.85     0.021     0.359     0.023     0.291
20:15      8.8     219.2      23.1      5.87     13.75     141.2      4.66     15.05     0.020     0.348     0.022     0.289

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:15     20.1     222.4      21.5      6.30     13.30     131.2      5.59     14.17     0.046     0.364     0.021     0.284

20:16      9.6     217.5      25.5      5.48     14.07     144.1      4.70     15.05     0.021     0.337     0.024     0.295
20:17     10.0     218.2      24.2      5.33     14.18     138.3      4.92     14.79     0.021     0.335     0.023     0.287
20:18      9.4     221.7      25.5      5.39     14.11     150.2      4.60     15.15     0.020     0.341     0.024     0.306
20:19      9.1     219.2      22.0      5.22     14.28     141.5      5.23     14.57     0.019     0.334     0.020     0.300
20:20      9.2     221.6      19.8      5.48     14.02     137.5      5.21     14.58     0.020     0.343     0.019     0.291
```

Palm Beach Co. Solid Waste Authority Compliance 10-27-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
20:21	11.4	223.3	20.6	5.58	13.96	137.7	5.10	14.66	0.025	0.348	0.020	0.289
20:22	11.5	222.8	21.6	5.63	13.93	142.8	4.75	14.98	0.025	0.348	0.021	0.294
20:23	11.0	216.7	27.6	5.42	14.16	158.4	4.01	15.68	0.024	0.334	0.026	0.311
20:24	11.8	211.9	32.0	5.02	14.48	146.8	4.84	14.86	0.025	0.319	0.029	0.304
20:25	11.2	218.8	29.6	5.20	14.28	158.0	4.50	15.24	0.024	0.333	0.027	0.320
20:26	15.6	220.3	24.9	5.10	14.41	158.3	4.53	15.24	0.033	0.333	0.023	0.321
20:27	26.3	219.6	22.9	5.12	14.38	141.8	5.17	14.61	0.055	0.332	0.021	0.299
20:28	31.2	221.6	22.7	5.33	14.13	129.4	5.57	14.23	0.067	0.340	0.021	0.280

COMMENTS: End of Test 1-5

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1-5 Calibration Bias Check

DATE : 10-27-1989 TIME: 20:29 - 20:50

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.7
1	OUTLET	ppmSO2	49.6	49.1
3	OUTLET	ppmNOX	0.0	0.0
3	OUTLET	ppmNOX	240.0	236.5
4	OUTLET	ppmCO	0.0	-0.1
4	OUTLET	ppmCO	24.8	23.7
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	12.50	12.43
5	OUTLET	% CO2	0.00	0.17
5	OUTLET	% CO2	11.06	11.19
6	INLET	ppmSO2	0.0	5.2
6	INLET	ppmSO2	218.0	216.3
7	INLET	% O2	0.00	0.04
7	INLET	% O2	12.50	12.41
8	INLET	% CO2	0.00	0.46
8	INLET	% CO2	11.06	11.19

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery

TEST DATE: 10/26/89

RUN NUMBER: 1-PO-CEM-1 (OUTLET)

SPAN VALUES:
100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.8	1.4	0.60	4.8	4.00	3.40
SO2 UP-SCALE	51.0	50.8	-0.20	53.3	2.30	2.50
NOx ZERO GAS	0.5	0.0	-0.10	0.0	-0.10	0.00
NOx UP-SCALE	240.6	232.0	-1.72	235.1	-1.10	0.62
CO ZERO GAS	0.6	0.2	N/A	-0.1	N/A	-0.15
CO UP-SCALE	23.1	23.1	N/A	22.9	N/A	-0.10
O2 ZERO GAS	0.04	0.01	-0.12	0.02	-0.08	0.04
O2 UP-SCALE	12.51	12.48	-0.12	12.34	-0.68	-0.56
CO2 ZERO GAS	0.01	0.04	0.15	0.18	0.85	0.70
CO2 UP-SCALE	11.29	11.23	-0.30	11.42	0.65	0.95

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/27/89

RUN NUMBER: 1-PO-CEM-3 (OUTLET)

SPAN VALUES:
100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.2	1.6	1.40	5.0	4.80	3.40
SO2 UP-SCALE	49.9	49.4	-0.50	54.3	4.40	4.90
NOx ZERO GAS	0.0	0.0	0.00	-0.3	-0.06	-0.06
NOx UP-SCALE	241.7	232.7	-1.80	237.9	-0.76	1.04
CO ZERO GAS	0.7	0.0	N/A	-0.3	N/A	-0.15
CO UP-SCALE	22.8	23.7	N/A	23.5	N/A	-0.10
O2 ZERO GAS	0.02	0.01	-0.04	0.02	0.00	0.04
O2 UP-SCALE	12.52	12.41	-0.44	12.37	-0.60	-0.16
CO2 ZERO GAS	0.00	0.02	0.10	0.12	0.60	0.50
CO2 UP-SCALE	11.24	11.16	-0.40	11.23	-0.05	0.35

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \text{ X } 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \text{ X } 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery

TEST DATE: 10/27/89

RUN NUMBER: 1-PO-CEM-5 (OUTLET)

SPAN VALUES:
100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	-0.5	1.9	2.40	2.7	3.20	0.80
SO2 UP-SCALE	49.7	49.0	-0.70	49.1	-0.60	0.10
NOx ZERO GAS	0.0	-0.5	-0.10	0.0	0.00	0.10
NOx UP-SCALE	241.7	234.6	-1.42	236.5	-1.04	0.38
CO ZERO GAS	0.7	0.4	N/A	-0.1	N/A	-0.25
CO UP-SCALE	22.8	23.7	N/A	23.7	N/A	0.00
O2 ZERO GAS	0.02	0.03	0.04	0.02	0.00	-0.04
O2 UP-SCALE	12.52	12.34	-0.72	12.43	-0.36	0.36
CO2 ZERO GAS	0.00	0.12	0.60	0.17	0.85	0.25
CO2 UP-SCALE	11.24	11.12	-0.60	11.19	-0.25	0.35

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

APPENDIX B.1.b.3

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

b. ESP Outlet

3. Hydrogen Chloride and Hydrogen Fluoride

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility

LOCATION West Palm Beach FL

SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5

PORT INSIDE DIAMETER 4"

DUCT DEPTH FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97½"

NIPPLE LENGTH 9"

DEPTH OF DUCT 88½"

WIDTH (RECTANGULAR DUCT) 88½"

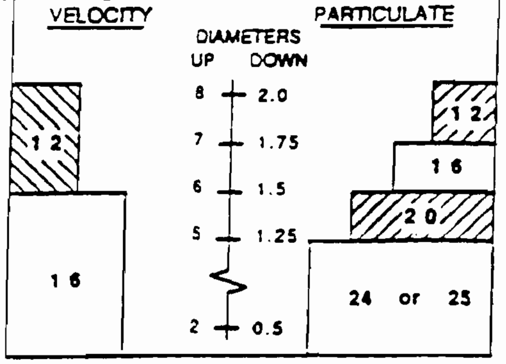
EQUIVALENT DIAMETER:
$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} =$ 88½"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88½" x 88½" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 ½	35 ½
3	50.0	44 ¼	53 ¼
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY
ENVIRONMENTALISTS, INC.

ORSAT FIELD DATA

Plant Name NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

Sampling Location UNIT 1 ESP OUTLET Fuel Type RDF

Run and/or Sample No. 1-ESPO-M3-1 Leak Test? ✓ Date 10/26/89 Operator MT

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	%O_2 B-A	%CO C-B	%N_2 100-C
0905	1125	12.3	19.1	—	6.8	—	
—	—	12.3	19.1		6.8		
1115	1145	12.3	19.1		6.8		
	Avg.	12.3		Avg.	6.8		80.9

Run and/or Sample No. 1-ESPO-A3-2 Leak Test? Date 10/26/89 Operator

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	%O_2 B-A	%CO C-B	%N_2 100-C
	Avg.			Avg.			

Run and/or Sample No. 1-ESPO-M3-3 Leak Test? Date 10/26/89 Operator

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	%O_2 B-A	%CO C-B	%N_2 100-C
	Avg.			Avg.			

ORSAT FIELD DATA

Plant Name NCRRRF

Sampling Location UNIT 1 ESPO Fuel Type RDF

Run and/or Sample No. 1-ESPO-M3-3 Leak Test? ✓ Date 10-27 Operator NYL

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
0905	1415	12.7	18.9	—	6.2	—	
—	—	12.7	18.9		6.2		
1331	1435	12.7	18.9		6.2		
	Avg.	12.7		Avg.	6.2		81.1

Run and/or Sample No. 1-ESPO-M3-4 Leak Test? ✓ Date 10-27 Operator DGB

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1515	1830	12.4	19.1	—	6.7	—	
—	—	12.5	19.0		6.5 ~~19.0~~		
1726	1900	12.5	19.1		6.6		
	Avg.	12.5		Avg.	6.6		79.9

Run and/or Sample No. 1-ESPO-M3-5 Leak Test? ✓ Date 10.27.89 Operator B. Rudd

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1815	2040	12.7	19.2	—	6.5	—	
—	2050	12.7	19.1		6.4		
2026	2100	12.7	19.2		6.5		
	Avg.	12.7		Avg.	6.5	—	80.8

F-1009
8/86

ISOKINETIC TYPE FIELD DATA SHEET 198

COMPANY NAME NCRRRF RUN NUMBER I-ESPO-M13B-1
ADDRESS West Palm Beach Fl. TIME START 0935
SAMPLING LOCATION Unit 1 ESP Outlet Duct TIME FINISH 1038
DATE 10-26-89 TEAM LEADER LCM TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -5.8
TRAIN LEAK CHECK VACUUM IN. HG 15 4
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- N/A M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 265 PRE
- ✓ THERMOCOUPLE @ 265 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0505 NOZZLE 505 DIAMETER .251
METER BOX N-10 T/C READOUT F6
UMBILICAL U-5 T/C PROBE 9-3
SAMPLE BOX 17 ORSAT PUMP NA
PROBE 913 PITOT 913 TEDLAR BAG NA

LEAK CHECK READINGS

B1E	
B2E	
B3E	
B4E	
B5E	
B6E	

FILTER #	TARE
WHATMAN 541	UNTARED

DELTA $H_@$	1.764			
METER TEMP	90			
EST. %H_2O	.23			
C FACTOR	.72			
STACK TEMP	260			
REF DELTA P	.82			
K-FACTOR	2.243			

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	C 1	0	803.961	.55	1.23	1.23	81	2	245	58	262	
2	2	2½	805.54	.55	1.23	1.23	81	2	245	58	261	
3	3	5	807.11	.49	1.10	1.10	82	2	245	56	260	
4	4	7½	808.58	.53	1.19	1.19	84	2	247	55	260	
5	5	10	810.12	.51	1.14	1.14	84	2	247	55	261	
6	D 1	12½/0	811.638	.56	1.26	1.26	84	2	248	54	258	
7	2	2½	813.22	.52	1.17	1.17	84	2	248	54	257	
8	3	5	814.76	.43	.96	.96	85	2	248	54	258	
9	4	7½	816.17	.44	.99	.99	85	2	248	52	258	
10	5	10	817.65	.54	1.21	1.21	89	2	245	52	259	
11	E 1	25/0	819.159	.47	1.05	1.05	90	2	245	52	257	
12	2	2½	820.63	.40	.90	.90	91	2	245	52	259	
13	3	5	822.00	.42	.94	.94	91	2	248	50	258	
14	4	7½	823.39	.56	1.26	1.26	92	2	250	50	259	
15	5	10	824.98	.52	1.17	1.17	94	2	250	50	260	
16	A 1	37½/0	826.523	.54	1.21	1.21	94	2	253	50	257	
17	2	2½	828.09	.55	1.23	1.23	94	2	253	50	263	
18	3	5	829.68	.47	1.05	1.05	95	2	253	51	265	
19	4	7½	831.14	.60	1.35	1.35	96	2	255	51	262	
20	5	10	832.77	.52	1.17	1.17	96	2	255	51	263	
21	B 1	50/0	834.336	.58	1.30	1.30	96	2	253	53	258	
22	2	2½	836.05	.57	1.28	1.28	97	2	255	53	262	
23	3	5	837.58	.65	1.46	1.46	98	2	255	53	262	
24	4	7½	838.95	.49	1.10	1.10	98	2	250	53	262	
25	5	10	840.80	.57	1.28	1.28	97	2	250	53	262	
		62½/off	842.377									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
62.5	38.416	0.5195	1.17	90	260

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER I-ESPO-MBB-3
ADDRESS West Palm Beach Fla TIME START ~~0935~~ 1150
SAMPLING LOCATION Unit 1 ESP Outlet Duct TIME FINISH 1259
DATE 10-28-89 TEAM LEADER Lcm TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O SEE BELOW -5.2
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 225 PRE
✓ THERMOCOUPLE @ 265 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0505 NOZZLE 505 DIAMETER .251
METER BOX N-10 T/C READOUT F6
UMBILICAL U-5 T/C PROBE 9-3
SAMPLE BOX 17 ORSAT PUMP NA
PROBE 9-13 PITOT 9-13 TEDLAR BAG NA

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
NA	

DELTA H@	1.764	1.764
METER TEMP	90	100
EST. %H_2O	23	23
C FACTOR	.72	.73
STACK TEMP	260	266
REF DELTA P	.82	.83
K-FACTOR	2.24	2.21
	K1	K-2

FYRITE

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #	Static Pressure in H_2O
1	C1	0	903.362	.53	1.19	1.19	88	2	245	60	275	X1	-4.9
2	2	2½	904.92	.49	1.09	1.09	88	2	245	58	265		-5.2
3	3	5	906.41	.44	.99	.99	88	2	247	58	269		-5.4
4	4	7½	907.88	.38	.85	.85	89	2	247	57	268		-5.0
5	5	10	909.17	.37	.83	.83	89	2	247	57	268		-5.0
6	D1	12½/0	910.473	.49	1.09	1.09	91	2	247	55	260		-5.2
7	2	2½	911.97	.42	.94	.94	92	2	250	55	265		-5.0
8	3	5	913.37	.40	.90	.90	94	2	250	55	265		-5.8
9	4	7½	914.71	.44	.99	.99	94	2	250	55	265		-4.8
10	5	10	916.14	.53	1.19	1.19	94	2	248	55	265		-5.9
11	E1	25/0	917.685	.52	1.17	1.17	94	2	248	55	260		-6.4
12	2	2½	919.23	.41	.92	.92	96	2	248	53	263		-5.7
13	3	5	920.64	.48	1.08	1.08	97	2	249	53	263		-6.4
14	4	7½	922.08	.45	1.00	1.00	98	2	249	53	263	K2	-4.8
15	5	10	923.52	.42	.94	.94	99	2	250	52	264		-4.3
16	A1	37½/0	924.904	.48	1.06	1.06	99	2	250	50	258		-5.4
17	2	2½	926.39	.48	1.06	1.06	100	2	250	50	265		-4.8
18	3	5	927.87	.47	1.04	1.04	100	2	250	50	266		-5.3
19	4	7½	929.34	.48	1.06	1.06	101	2	250	52	264		-5.4
20	5	10	930.93	.40	.89	.89	101	2	250	52	266		-4.8
21	B1	50/0	932.212	.47	1.04	1.04	101	2	248	52	259		-5.0
22	2	2½	933.74	.51	1.13	1.13	102	2	248	52	263		-5.1
23	3	5	935.19	.47	1.04	1.04	103	2	248	53	265		-4.7
24	4	7½	936.64	.44	.99	.99	104	2	248	53	265		-5.8
25	5	10	938.09	.45	1.00	1.00	104	2	248	53	264		-4.4
		62½/off	939.534										

62.5	36.172	0.4553	1.02	96	265
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

200

COMPANY NAME NCRRF
RUN NUMBER I-#PO-MBB-5
ADDRESS West Palm Beach Fla
TIME START 1845
SAMPLING LOCATION Unit 1 ESP Outlet Duct
TIME FINISH 1955
DATE 10-27-89
TEAM LEADER LCM
TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -5.9
TRAIN LEAK CHECK VACUUM IN. HG 15 65
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 265 PRE
✓ THERMOCOUPLE @ 265 POST

IDENTIFICATION NUMBERS

REAGENT BOX 1002 NOZZLE 605 DIAMETER .254
METER BOX N-10 T/C READOUT F-6
UMBILICAL U-5 T/C PROBE 9S
SAMPLE BOX 3 ORSAT PUMP NA
PROBE 944 PITOT PT43 TEDLAR BAG NA

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
NA	

DELTA H@	1.764	1.764		
METER TEMP	90	100		
EST. %H_2O	23	23		
C FACTOR	.72	.73		
STACK TEMP	260	260		
REF DELTA P	.80	.79		
K-FACTOR	K1	K2		

FYRITE

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #	K Rate
1	C 1	0	978.015	.45	1.04	1.04	84	2	280	58	255	K1	K1
2	2	2½	979.58	.47	1.08	1.08	84	2	280	58	259		
3	3	5	980.98	.47	1.08	1.08	84	2	280	57	259		
4	4	7½	982.46	.44	1.01	1.01	85	2	250	57	260		
5	5	10	983.90	.38	.87	.87	85	2	250	56	261		
6	D 1	12½/0	985.253	.46	1.06	1.06	85	2	253	56	257		
7	2	2½	986.76	.43	.99	.99	85	2	250	55	257		
8	3	5	988.19	.43	.99	.99	86	2	248	55	258		
9	4	7½	989.64	.44	1.01	1.01	86	2	248	53	257		
10	5	10	991.09	.50	1.15	1.15	88	2	247	53	258		
11	E 1	25/0	992.617	.48	1.10	1.10	88	2	247	53	257		
12	2	2½	994.12	.39	.90	.90	88	2	247	53	260		
13	3	5	995.52	.47	1.08	1.08	89	2	250	50	259		
14	4	7½	996.69	.49	1.13	1.13	59	2	250	50	259		
15	5	10	998.57	.53	1.22	1.22	90	2	250	50	260		
16	A 1	37½/0	1000.102	.54	1.24	1.24	92	2	258	53	257		
17	2	2½	1001.72	.57	1.31	1.31	92	3	248	53	259		
18	3	5	1003.32	.61	1.40	1.40	94	3	246	55	259		
19	4	7½	1004.98	.65	1.50	1.50	96	3	246	55	261		
20	5	10	1006.72	.58	1.33	1.33	96	3	246	57	262		
21	B 1	50/0	1008.325	.59	1.36	1.36	95	3	249	58	257		
22	2	2½	1010.09	.64	1.47	1.47	95	3	250	59	262		
23	3	5	1011.81	.60	1.38	1.38	96	3	250	59	262		
24	4	7½	1013.50	.47	1.08	1.08	96	2	250	59	262		
25	5	10	1014.71	.49	1.13	1.13	96	2	250	59	259		
		62½/0	1016.515										

62.5	38.500	.5001	1.16	90	259
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Facility EEI Ref# 6284

Sampling Location: Unit No. 1 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0505, 1002

Run Number	1-PO-M13B-1	1-PO-M13B-3	1-PO-M13B-5
Run Date	10/26	10/27	10/27

ANALYSIS OF MOISTURE CATCH

Reagent 1 (0.1N NaOH)			
Final Weight, g.	504.5	370.0	470.5
Tared Weight, g.	294.5	200.0	261.5
	==========	==========	==========
Water Catch,g.	210.0	170.0	209.0
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	210.0	170.0	209.0
Silica Gel:			
Final Weight, g.	208.5	209.0	209.0
Tared Weight, g.	200.0	200.0	200.0
	==========	==========	==========
ADSORBED WATER, g.	8.5	9.0	9.0
TOTAL WATER COLLECTED, g.	218.5	179.0	218.0

HCl Analytical Data Sheet

Job Name: North County Regional Resource Facility
Analyst: F. Jones Job Num. 6284
Sampling Location: Unit No.1 ESP Outlet Date: 11/17/89

Chloride Standard Calibration Curve by Linear Regression

Conc. (ug/ml)	Peak Area Run 1	Peak Area Run 2	% Diff.	Predicted Concentration (ug/ml)	Percent Deviation from Actual
5.00	9139	9012	0.70%	5.01	0.24%
10.00	18676	18047	1.71%	9.99	-0.15%
30.00	56382	55098	1.15%	30.00	0.01%
50.00	93979	93503	0.25%	50.35	0.71%

Standard Curve Slope 1867 Intercept -283

Method 13B Field Samples

Sample ID	Run 1 Area	Run 2 Area	Average	Percent Deviation	Dilution Factor	Sample Volume (ml)	HCl Catch (mg)
Blank	<454	<454	<454	0.00%	1	200	<0.08
1-PO-M13B-1	6536	7039	6788	3.71%	10	700	27.3
1-PO-M13B-3	3976	4028	4002	0.65%	10	900	21.2
1-PO-M13B-5	2905	2972	2939	1.14%	10	800	14.2

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-3-89
DATE REPORTED 11-29-89
89W8726

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-9

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: ESP OUTLET UNIT 1

1. 1-PO-M13B-1 FV 1700
2. 1-PO-M13B-3 FV 900
3. 1-PO-M13B-5 FV 800
4. METHOD CODE

RESULTS

	1	2	3	4
Fluoride, as F, ug	306	122	112	13B

ROGER C. OXFORD , CHEMIST

CUSTOMER Entropy

11-6-89

8726

11-9-89

LD BJ

	1	2	3	EPA Known
F	25ml $\frac{10ug \times .255}{25} = .102ug/ml$ $\frac{ug F \times M.R.}{ml\ sample} = ug/ml$	25ml $\frac{10ug \times .225}{25} = .09ug/ml$	25ml $\frac{10ug \times .245}{25} = .098ug/ml$	Actual Value = .21ug/ 25ml $\frac{10ug \times .54}{25} = .216ug/$
Distilled F	FV=1700ml 200ml ↓ 25ml $\frac{10ug \times .45}{25} = .18 ug/ml$	FV= 900ml 200ml ↓ 25ml $\frac{10ug \times .34}{25}$ .136 ug/ml	FV= 800ml 200ml ↓ 25ml $\frac{10ug \times .35}{25}$ .14ug/ml	~~200ml~~ 25ml $\frac{10ug \times .55}{25} = .22ug/$

Blk	1ug/ml
#1 $\frac{10ug \times <.12}{25} = <.05 ug/ml$ #2 $\frac{10ug \times <.12}{25} = <.05 ug/ml$	$\frac{20ug \times 1.25}{25} = 1.0 ug/ml$

CUSTODY SHEET FOR REAGENT BOX # 0505

Date of Makeup 19 Oct 1989 Initials BJG Locked? —

Individual Tare of Reagent: 200 mls. of 0.1N NaOH

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked
1-~~E~~SPO-M13B-1	10-26-89	SRD	—	10-26-89	40%	SRD	—
1-~~E~~SPO-M13B-2	10-26-89	SRD	—	10-26-89	30%	SRD	—
1-~~E~~SPO-M13B-3	10-27-89	SRD	—	10-27-89	40%	SRD	—

Received in Lab Date 10/30 Initials FJ Locked? ✓

Zero & Span Balance Initials FJ

Sampling Method: M13B

Filter #	Tare Weight (grams)	Used on Test
WHATMAN 541		

Remarks:

1-ESPO-M13B-2 Aborted

CUSTODY SHEET FOR REAGENT BOX # 1002

Date of Makeup 10/26/89 Initials Locked? ✓

Individual Tare of Reagent: 200 mls. of NAOH

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION Unit #1 ESP Outlet

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-ESPO-M13B-4	10-27-89	JRW	✓	10-27-89	60	JRW	✓
1-ESPO-M17B-5	10-27-89	JRW	✓	10-27-89			

	Date	Initials	Locked?
Received in Lab	10/30	FJ	V

Sampling Method: ______

Remarks:

Zero & Span Balance Initials FJ

Filter #	Tare Weight (grams)	Used on Test
Whatman 541		

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-9

JOB NAME: NORTH COUNTY BRRF

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-2-89

EXPECTED DATE OF RESULTS: 11-16-89

SAMPLE MATRIX: M13B. ESP Outlet. Unit 1.

TYPE OF ANALYSIS REQUESTED: Fluoride. See M13B Rules and Regulations.

Sample#	Sample ID.			
1	1-PO-M13B-1			
2	1-PO-M13B-3			
3	1-PO-M13B-5			

SUBMITTED BY: Richard Lebeau

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 62840-9 were shipped via Pony Express on 11-2-89 by RAT to OLI

Samples received at OLI on 11-3-89 by M. Congleton

Note any broken seals, leakage, spillage, and/or damage to the samples.

APPENDIX B.1.b.4

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

b. ESP Outlet

4. Lead and Particulate

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility

LOCATION West Palm Beach FL

SAMPLING LOCATION Units # 1 & 2 - ESP Outlet Duct

NO. OF PORTS 5

PORT INSIDE DIAMETER 4"

DUCT DEPTH FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"

NIPPLE LENGTH 9"

DEPTH OF DUCT 88 1/2"

WIDTH (RECTANGULAR DUCT) 88 1/2"

EQUIVALENT DIAMETER:

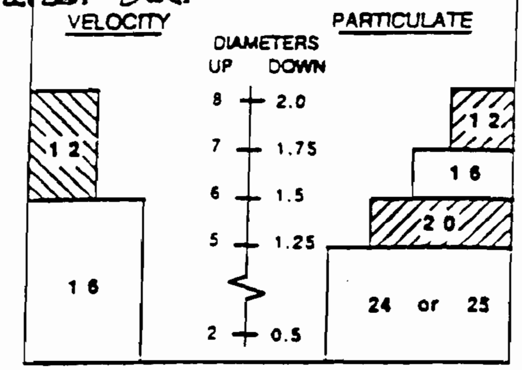
$D_E = \frac{2 \times DEPTH \times WIDTH}{DEPTH + WIDTH} = \frac{2(88.5)(88.5)}{(88.5+88.5)} =$ 88 1/2"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.6	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	68.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME North County Regional Resource Recovery Facility RUN NUMBER 1-ESPO-M5/12-1
ADDRESS West Palm Beach FL TIME START 0930
SAMPLING LOCATION Unit# 1- ESP Outlet Duct TIME FINISH 1251
DATE 10.23.89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.1 STATIC PRESSURE IN. H_2O -5.8
TRAIN LEAK CHECK VACUUM IN. HG 15 5 5
TRAIN LEAK RATE, CU.FT/MIN 0.008 0.002 0.003

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
N/A M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 250 PRE
✓ THERMOCOUPLE @ 252 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0562 NOZZLE 604 DIAMETER 0.254
METER BOX N.8 T/C READOUT F.69
UMBILICAL U.11 T/C PROBE 9.37
SAMPLE BOX 5 ORSAT PUMP N/A
PROBE 9.12 PITOT PT.12 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1	764.669
R	764.703
B 2	
R	
B 3	
R	
B 4	
R	
B 5	
R	
B 6	
R	

FILTER #	TARE
Quartz	0.4433

DELTA H@ 1.674
METER TEMP 90
EST. %H_2O 18
C FACTOR 0.75
STACK TEMP 250
REF DELTA P 0.340
K-FACTOR 0.0248649

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E.1	0/0	718.404	0.44	1.09	1.09	68	3	262	59	257	
2	2	5	721.28	0.38	0.94	0.94	77	3	243	62	249	
3	3	10	723.99	0.42	1.04	1.04	79	3	252	60	247	
4	4	15	726.82	0.55	1.37	1.37	82	3	255	57	249	
5	5	20	730.00	0.52	1.29	1.29	85	3	256	56	251	
6	A.1	25/0	733.133	0.58	1.44	1.44	89	3	262	66	258	
7	2	5	736.47	0.59	1.47	1.47	93	3	259	58	266	
8	3	10	739.86	0.41	1.02	1.02	97	3	255	53	256	
9	4	15	742.76	0.40	0.99	0.99	100	3	253	55	255	
10	5	20	745.59	0.53	1.32	1.32	99	3	261	55	255	
11	B.1	50/0	748.759	0.59	1.47	1.47	94	3	262	59	269	
12	2	5	752.16	0.56	1.39	1.39	94	3	258	61	270	
13	3	10	755.44	0.56	1.39	1.39	94	3	256	60	270	
14	4	15	758.80	0.42	1.04	1.04	95	3	248	61	265	
15	5	20	761.69	0.45	1.12	1.12	94	3	253	62	264	
16	C.1	75/0	764.669	0.55	1.37	1.37	92	3	238	66	265	1
17	2	5	768.03	0.53	1.32	1.32	92	3	244	60	272	
18	3	10	771.23	0.54	1.34	1.34	92	3	251	61	266	
19	4	15	774.51	0.57	1.42	1.42	93	3	253	62	268	
20	5	20	777.84	0.38	0.94	0.94	93	3	254	62	270	
21	D.1	100/0	780.716	0.53	1.32	1.32	91	3	255	66	260	
22	2	5	784.00	0.48	1.19	1.19	90	3	253	61	256	
23	3	10	787.06	0.48	1.19	1.19	90	3	257	63	257	
24	4	15	790.14	0.43	1.07	1.07	90	3	257	64	254	
25	5	20	793.10	0.51	1.27	1.27	90	4	254	64	251	
		125/OFF	796.254									

STOP 0932 START 1030

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	77.816	.4936	1.23	90	260

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER 1-ESPO-MS/12.2
ADDRESS West Palm Beach, FL
TIME START 1335
SAMPLING LOCATION Unit #1 - ESP Outlet Duct
TIME FINISH 1557
DATE 10.23.89 TEAM LEADER R. Rudd TECHNICIANS –
BAROMETRIC PRESSURE. IN. HG 30.1
STATIC PRESSURE IN. H_2O -6.7
TRAIN LEAK CHECK VACUUM IN. HG 15 5 5
TRAIN LEAK RATE, CU.FT/MIN 0.006 0.002 0.002

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- N/A M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 250 PRE
- ✓ THERMOCOUPLE @ 250 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0562 NOZZLE 505 DIAMETER 0.251
METER BOX N.8
T/C READOUT F.69
UMBILICAL U.11
T/C PROBE 9.3
SAMPLE BOX 33
ORSAT PUMP N/A
PROBE 9.13 PITOT PT.9.13 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E	844.763 844.823
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
Quartz	0.4681

DELTA H@	1.674			
METER TEMP	90			
EST. %H_2O	18			
C FACTOR	0.75			
STACK TEMP	260			
REF DELTA P	0.78			
K-FACTOR	0.0235897			

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E-1	0/0	796.421	0.51	1.20	1.20	81	3	250	67	268	
2	2	5	799.46	0.53	1.25	1.25	82	3	263	64	265	
3	3	10	802.62	0.51	1.20	1.20	84	3	271	65	265	
4	4	15	805.74	0.66	1.56	1.56	85	3	265	62	266	
5	5	20	809.28	0.61	1.44	1.44	86	3	261	60	269	
6	A-1	25/0	812.575	0.61	1.44	1.44	86	3	243	66	260	
7	2	5	815.98	0.62	1.46	1.46	87	3	252	61	270	
8	3	10	819.34	0.48	1.13	1.13	88	3	255	60	272	
9	4	15	822.37	0.56	1.32	1.32	89	3	257	58	271	
10	5	20	825.61	0.49	1.16	1.16	90	3	252	56	272	
11	B-1	50/0	828.617	0.62	1.46	1.46	89	3	254	62	271	
12	2	5	831.96	0.64	1.51	1.51	89	3	262	63	265	
13	3	10	835.39	0.63	1.49	1.49	89	3	260	61	263	
14	4	15	838.78	0.42	1.11	1.11	90	3	259	62	262	
15	5	20	841.75	0.50	1.18	1.18	90	3	252	63	263	
16	C-1	75/0	844.763	0.59	1.39	1.39	88	4	247	66	258	1
17	2	5	848.17	0.66	1.56	1.56	89	4	258	65	266	
18	3	10	851.61	0.58	1.37	1.37	89	4	261	62	267	
19	4	15	854.89	0.55	1.30	1.30	88	4	257	61	264	
20	5	20	858.11	0.40	0.94	0.94	89	3	255	62	263	
21	D-1	100/0	860.864	0.65	1.53	1.53	89	4	251	66	258	
22	2	5	864.34	0.60	1.42	1.42	90	4	253	62	261	
23	3	10	867.67	0.56	1.32	1.32	90	4	253	60	261	
24	4	15	870.98	0.55	1.30	1.30	91	4	252	62	262	
25	5	20	874.11	0.68	1.60	1.60	93	4	250	65	264	
		125/off	877.631									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	81.150	.5682	1.35	88	265

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NC RRRF **RUN NUMBER** 1-ESPO-M5/12-3
ADDRESS West Palm Beach, FL **TIME START** 1630
SAMPLING LOCATION Unit #1 - ESP Outlet Duct **TIME FINISH** 1851
DATE 10.23.89 **TEAM LEADER** B. Rudd **TECHNICIANS** –
BAROMETRIC PRESSURE. IN. HG 30.1 **STATIC PRESSURE IN. H_2O** -6.4
TRAIN LEAK CHECK VACUUM IN. HG 15 5 5
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.003 0.003

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- NA M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 250 PRE
- ✓ THERMOCOUPLE @ 253 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0562 NOZZLE 604 DIAMETER 0.254
METER BOX N.8 T/C READOUT F.69
UMBILICAL U.11 T/C PROBE 9-37
SAMPLE BOX 5 ORSAT PUMP N/A
PROBE 9.12 PITOT PT.12 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1	924.588
E 1	924.668
B 2	
E 2	
B 3	
E 3	
B 4	
E 4	
B 5	
E 5	
B 6	
E 6	

FILTER #	TARE
Quartz	0.4022

DELTA $H_@$ 1.674
METER TEMP 90
EST. %H_2O 18
C FACTOR 0.75
STACK TEMP 260
REF DELTA P 0.77
K-FACTOR 0.0238961

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E-1	0/0	877.832	0.54	1.29	1.29	85	3	233	62	262	
2	2	5	881.11	0.55	1.31	1.31	86	3	251	60	256	
3	3	10	884.25	0.60	1.43	1.43	88	3	254	55	258	
4	4	15	887.56	0.71	1.70	1.70	89	4	255	54	262	
5	5	20	891.19	0.56	1.34	1.34	90	3	252	55	261	
6	A-1	25/0	894.434	0.52	1.24	1.24	91	3	252	63	260	
7	2	5	897.54	0.47	1.12	1.12	92	3	253	58	269	
8	3	10	900.50	0.42	1.00	1.00	93	3	255	55	264	
9	4	15	903.32	0.43	1.03	1.03	94	3	255	57	266	
10	5	20	906.24	0.46	1.10	1.10	95	3	253	60	267	
11	B-1	50/0	909.113	0.43	1.03	1.03	94	3	254	61	266	
12	2	5	911.95	0.50	1.19	1.19	94	3	252	62	265	
13	3	10	915.02	0.61	1.46	1.46	95	3	253	64	263	
14	4	15	918.42	0.48	1.15	1.15	97	3	255	62	263	
15	5	20	921.36	0.56	1.34	1.34	98	3	257	62	264	
16	C-1	75/0	924.588	0.55	1.31	1.31	93	3	251	66	260	1
17	2	5	927.94	0.54	1.29	1.29	91	3	249	62	264	
18	3	10	931.01	0.48	1.15	1.15	91	3	247	60	261	
19	4	15	934.04	0.51	1.22	1.22	91	3	252	60	260	
20	5	20	937.12	0.46	1.10	1.10	90	3	253	59	260	
21	D-1	100/0	940.112	0.56	1.34	1.34	88	4	255	64	252	
22	2	5	943.37	0.54	1.29	1.29	88	4	248	58	259	
23	3	10	946.50	0.59	1.41	1.41	90	4	253	62	256	
24	4	15	949.81	0.50	1.19	1.19	91	4	255	63	255	
25	5	20	952.87	0.59	1.41	1.41	93	4	258	65	256	
		125/0	956.144									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	78.232	.5244	1.26	91	261

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0562

Run Number	1-PO-M5&12-1	1-PO-M5&12-2	1-PO-M5&12-3
Run Date	10/23	10/23	10/23

ANALYSIS OF MOISTURE CATCH

Reagent 1 (0.1N HNO3)			
Final Weight, g.	936.5	977.5	937.0
Tared Weight, g.	558.0	564.0	557.0
	==========	==========	==========
Water Catch,g.	378.5	413.5	380.0
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	378.5	413.5	380.0
Silica Gel:			
Final Weight, g.	219.5	422.0	420.0
Tared Weight, g.	200.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	19.5	22.0	20.0
TOTAL WATER COLLECTED, g.	398.0	435.5	400.0

PARTICULATE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 ESP Outlet

Date Received: 10/30 Date Analyzed: 11/8 Reagent Box(es): 0562

Run Number	1-PO-M5&12-1	1-PO-M5&12-2	1-PO-M5&12-3
Run Date	10/23	10/23	10/23
Sample ID/Container #	F / 1095	F / 1097	F / 1098
	77.5367	81.8527	77.1469
	✓77.5363	✓81.8524	✓77.1467
	77.5379	81.8540	77.1479
Tare Weight., g.	77.0945	81.3870	76.7439
SAMPLE WT., g.	0.4418	0.4654	0.4028
Sample ID/Container #	R / 2379	R / 2412	R / 2434
		106.6646	
	102.8142	✓106.6644	100.3851
	✓102.8140	106.6656	✓100.3848
Tare Wt., g.	102.8089	106.6479	100.3833
SAMPLE WT., g.	0.0051	0.0165	0.0015
Sum of Particulate, mg.	446.9	481.9	404.3
Total Filter Tare, mg.	443.3	468.1	402.2
Blank Residue, mg.	(200 ml) 0.4	(175 ml) 0.4	(200 ml) 0.4
TOTAL PARTICULATE CATCH, mg.	3.2	13.4	1.7

Blank Beaker #	2003
Final wt., mg.	99546.3
Tare wt., mg.	99545.9
Residue, mg.	0.4
Volume, ml.	200

---Legend---

✓ = Final Weight
L = Loose Particulate
F = Filter D = Dish
R = Rinse P = Pan

Notes and Comments

Concentration, mg/ml 0.002

Oxford Laboratories, Inc.

Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-6-89
DATE REPORTED 11-29-89
89W8746

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-11

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: M5/12 SAMPLE TRAIN

1. 1-PO-M5/12-1
2. 1-PO-M5/12-2
3. 1-PO-M5/12-3
4. 1-PO-M5/12-FB
5. 1-PO-M5/12-2 DUPLICATE
6. METHOD CODE

RESULTS

	1	2	3	4	5	6
Lead, as Pb, total ug	160	100	50.0	<10.0	100	SW846- 7000's

ROGER C. OXFORD , CHEMIST

Method 12, SW846.7000:
P.O. # 62840-10

11-13-89
89W8746

Entropy

	①	②	③	④
Pb	1.6 x100 $\boxed{160}$	1.0 x100 $\boxed{100}$	.50 x100 $\boxed{50.0}$	<.10 x100 $\boxed{<10.0}$
	⑤			
Pb	1.0 x100 $\boxed{100}$			

all samples F.V. 100ml.

①	②	③	④
1.66 x100 (166)	.97x100 (97.0)	.49 x100 (49.0)	<.10 x100 (<10.0)
1.61 x100 (161)	1.02x100 (102)	.48 x100 (48.0)	<.10 x100 (<10.0)

⑤

1.00 x100 (100)
.98 x100 (98.0)

Known addition
#2

sample = X2 + 2.5 ng/ml

2.96 = .51 x 2 = 1.02x100 = (102)
2.96 = .51 x2 = 1.02x100 = (102)
2.92 = .52 x 2 = 1.04 x100 (104)

Method 12, SW846.7000 :
P.O. # 62840-1B

11-13-89
89W8746

Entropy

	①	②	③	④
Pb	1.6 x100	1.0 x100	.50 x100	<.10 x100
	$\boxed{160}$	$\boxed{100}$	$\boxed{50.0}$	$\boxed{<10.0}$

	⑤
Pb	1.0 x100
	$\boxed{100}$

all samples F.V. 100ml.

CUSTODY SHEET FOR REAGENT BOX # 0562

Date of Makeup 10/19 Initials JFJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 0.1 N HNO3

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION ELECTRO STATIC PRECIPITATOR OUTLET (UNIT #1)

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-ESPO-M5/12-1	10/23/89	DGB	✓	10/23/89	80%	DGB	✓
1-ESPO-M5/12-2	10/23/89	DGB	✓	10/23/89	40%	SRD	✓
1-ESPO-M5/12-3	10/23/89	SRD	—	10/23/89	40%	PFD	—

	Date	Initials	Locked?
Received in Lab	10/30/89	PR	✓

Zero & Span Balance Initials PR

Sampling Method: M5/12

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	0.4433	1-ESPO-M5/12-
QUARTZ	0.4081	1-ESPO-M5/12-
QUARTZ	0.4022	1-ESPO-M5/12-

Remarks:

DOUBLE CHARGE SILICA GEL

2nd & 3rd RUNS

ENTROPY ENVIRONMENTALISTS, INC.

BEST AVAILABLE COPY

CUSTODY SHEET FOR REAGENT BOX # 0209

Date of Makeup 10/19 Initials JFJ Locked? ✓

Individual Tare of Reagent: 100 mls. of 0.1 N HNO_3

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT # 1 & 2 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked
1-ESPO-M5/12-FB	10-23-89	SRD	—	10-23-89	N/A	SRD	—
2-ESPO-M5/12-FB	10-24-89	SRD	—	10-24-89	N/A	SRD	—

Received in Lab Date 10/30/89 Initials PR Locked? ✓

Sampling Method: M5/12

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	.4437	1-ESPO-M5/12-
QUARTZ	.4421	2-ESPO-M5/12-

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-11

JOB NAME: NORTH COUNTY REGIONAL RRF

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-3-89

EXPECTED DATE OF RESULTS: 11-17-89

SAMPLE MATRIX: M5/12 Sample train (0.1N HNO_3)
Unit 1

TYPE OF ANALYSIS REQUESTED: Pb

Sample#	SampleID	Filter beaker #	Acetone beaker #	Components
1	1-PO-M5/12-1	1095	2379	Reagent, Front ½ rinse
2	-2	1097	2412	" " " "
3	-3	1098	2434	" " " "
4	-FB	1102	2527	" " " "
5	1-PO-M5/12-2	(dup)		

SUBMITTED BY:

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 6284 0-11 were shipped via Pony Express on 11-3-89 by RAT
to OLI

Samples received at OLI on 11-6-89
by MBC

Note any broken seals, leakage, spillage, and/or damage to the samples.

APPENDIX B.1.b.5

B. FIELD AND ANALYTICAL DATA

- 1. Unit No. 1
  - b. ESP Outlet
    - 5. Mercury

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility
LOCATION West Palm Beach FL
SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"
NIPPLE LENGTH 9"
DEPTH OF DUCT 88 1/2"
WIDTH (RECTANGULAR DUCT) 88 1/2"

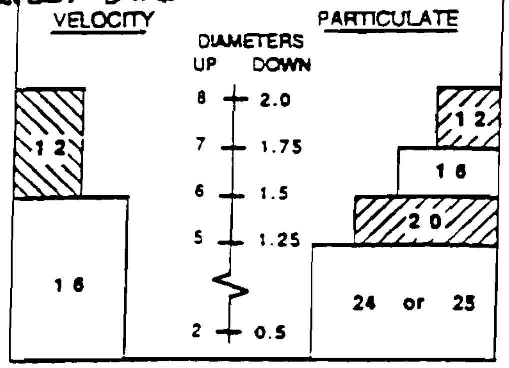
EQUIVALENT DIAMETER:
$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} = 88\tfrac{1}{2}$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.8	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.6	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

ENTROPY ENVIRONMENTALISTS, INC.

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME North County Regional Resource Recovery Facility **RUN NUMBER** I-ESPO-M101A-1
ADDRESS West Palm Beach Fla. **TIME START** 0930
SAMPLING LOCATION Unit 1 ESP outlet Duct **TIME FINISH** 1251
DATE 10-23-89 **TEAM LEADER** LCM **TECHNICIANS** —
BAROMETRIC PRESSURE. IN. HG 30.1 **STATIC PRESSURE IN. H_2O** -.62
TRAIN LEAK CHECK VACUUM IN. HG 15 6 5
TRAIN LEAK RATE, CU.FT/MIN 0.004 .000 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 275 PRE
✓ THERMOCOUPLE @ 270 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0507 NOZZLE ~~605~~ 606 DIAMETER ~~.316~~ .263
METER BOX N-10 T/C READOUT 5
UMBILICAL U-9 T/C PROBE 9-2
SAMPLE BOX 25 ORSAT PUMP NA
PROBE 9-10 PITOT 9-10 TEDLAR BAG NA

LEAK CHECK READINGS

B1 081.087
E1 081.188
B2
E2
B3
E3
B4
E4
B5
E5
B6
E6

FILTER #	TARE
QUARTZ	N/A

DELTA H@ 1.764
METER TEMP 90
EST. %H_2O 18
C FACTOR .86
STACK TEMP 250
REF DELTA P .61
K-FACTOR 3.0163

FYRITE
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	029.838	.51	1.54	1.54	85	3	245	58	265	
2	2	5	033.52	.49	1.48	1.48	90	3	240	58	260	
3	3	10	036.96	.45	1.36	1.36	91	3	245	55	263	
4	4	15	040.17	.56	1.69	1.69	91	3	247	57	260	
5	5	20	043.71	.46	1.39	1.39	93	3	250	57	264	
6	B 1	25/0	046.945	.61	1.84	1.84	94	4	251	56	261	
7	2	5	050.71	.60	1.81	1.81	97	4	251	55	260	
8	3	10	054.45	.45	1.48	1.48	100	4	250	55	263	
9	4	15	057.90	.44	1.33	1.33	101	3	250	56	263	
10	5	20	061.08	.54	1.63	1.63	100	4	253	57	261	
11	C 1	25/0	064.636	.56	1.69	1.69	100	4	253	57	255	
12	2	5	068.29	.47	1.42	1.42	99	4	258	57	258	
13	3	10	071.64	.46	1.39	1.39	99	3	258	58	261	
14	4	15	074.91	.35	1.06	1.06	100	2	258	59	260	
15	5	20	077.93	.45	1.36	1.36	100	3	255	59	260	
16	D 1	25/0	081.057	.49	1.48	1.48	98	4	257	57	251	1
17	2	5	084.49	.46	1.39	1.39	99	4	255	57	261	
18	3	10	087.78	.51	1.54	1.54	100	4	255	57	256	
19	4	15	091.28	.48	1.45	1.45	100	4	255	56	258	
20	5	20	094.72	.64	1.93	1.93	102	5	257	56	260	
21	E 1	25/0	098.718	.51	1.54	1.54	101	4	255	56	256	
22	2	5	102.30	.45	1.36	1.36	102	4	250	55	259	
23	3	10	105.50	.47	1.42	1.42	102	4	250	55	259	
24	4	15	108.86	.47	1.42	1.42	102	4	251	55	255	
25	5	20	112.20	.49	1.48	1.48	103	4	250	54	260	
		125/0ff	115.596									

0932
1030

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	85.632	.4946	1.50	98	259

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER I-ESPO-M101A-2
ADDRESS West Palm Beach Fla. TIME START 1335
SAMPLING LOCATION Unit 1 ESP outlet Duct TIME FINISH 1557
DATE 10-23-89 TEAM LEADER rcm TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.1 STATIC PRESSURE IN. H_2O -7.0
TRAIN LEAK CHECK VACUUM IN. HG 15 05 05
TRAIN LEAK RATE, CU.FT/MIN 0.008 0.000 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 275 PRE
✓ THERMOCOUPLE @ ____ POST

IDENTIFICATION NUMBERS

REAGENT BOX 0507 NOZZLE ~~606~~ 506 DIAMETER ~~.263~~ .241
METER BOX N-10 T/C READOUT 5
UMBILICAL U-9 T/C PROBE 9-6
SAMPLE BOX 4 ORSAT PUMP NA
PROBE 9.3 PITOT 9-3 TEDLAR BAG NA

LEAK CHECK READINGS

B	
1	163.780
E	
B	
2	
E	
B	
3	
E	
B	
4	
E	
B	
5	
E	
B	
6	
E	

FILTER #	TARE
Quartz	N/A

DELTA $H_@$ 1.764
METER TEMP 100
EST. %H_2O 18
C FACTOR .83
STACK TEMP 260
REF DELTA P .83
K-FACTOR 2.2216

FYRITE
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A1	0	115.772	.58	1.29	1.29	94	3	260	59	260	
2	2	5	119.01	.74	1.64	1.64	96	3	260	58	268	
3	3	10	122.60	.66	1.46	1.46	97	3	250	58	262	
4	4	15	126.03	.65	1.44	1.44	100	3	250	57	263	
5	5	20	129.45	.60	1.33	1.33	104	3	253	55	261	
6	B1	25/0	132.720	.66	1.46	1.46	106	3	250	54	258	
7	2	5	136.75	.67	1.48	1.48	109	3	251	54	260	
8	3	10	139.58	.60	1.33	1.33	110	3	251	53	261	
9	4	15	142.88	.52	1.15	1.15	110	3	250	53	261	
10	5	20	145.93	.53	1.17	1.17	110	3	250	50	260	
11	C1	50/0	149.037	.55	1.31	1.31	105	3	250	51	255	
12	2	5	152.29	.57	1.26	1.26	102	3	250	51	259	
13	3	10	155.48	.48	1.06	1.06	102	3	250	51	259	
14	4	15	158.44	.46	1.02	1.02	103	3	251	52	258	
15	5	20	161.35	.31	.69	.69	105	3	255	52	258	
16	D1	75/0	163.750	.58	1.29	1.29	106	3	255	53	257	1
17	2	5	167.02	.61	1.35	1.35	108	3	253	53	257	
18	3	10	170.34	.56	1.24	1.24	108	3	253	50	256	
19	4	15	173.57	.58	1.29	1.29	109	3	250	51	257	
20	5	20	117.00	.69	1.53	1.53	110	3	250	51	257	
21	E1	100/0	180.285	.62	1.37	1.37	110	3	253	52	255	
22	2	5	183.65	.54	1.20	1.20	111	3	253	52	258	
23	3	10	186.83	.56	1.24	1.24	113	3	253	52	258	
24	4	15	196.08	.60	1.33	1.33	114	3	250	54	259	
25	5	20	193.37	.65	1.44	1.44	115	3	250	54	258	
		125/0A	196.835									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	81.033	.5810	1.29	106	259

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

227

COMPANY NAME NCRRRF
RUN NUMBER I-#8PO-M101A-3
ADDRESS West Plm Beach Fla
TIME START 1630
SAMPLING LOCATION Unit 1 ESP Outlet Duct
TIME FINISH 1851
DATE 10-23-95
TEAM LEADER LCM
TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.1
STATIC PRESSURE IN. H_2O -6.6
TRAIN LEAK CHECK VACUUM IN. HG 15 07 05
TRAIN LEAK RATE, CU.FT/MIN .004 .002 .002

EQUIPMENT CHECKS

- ___ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- N/A M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 275 PRE
- ___ THERMOCOUPLE @ ___ POST

IDENTIFICATION NUMBERS

REAGENT BOX 0507
NOZZLE 606
DIAMETER .263
METER BOX N-10
T/C READOUT 5
UMBILICAL U-9
T/C PROBE 9-20
SAMPLE BOX 25
ORSAT PUMP N/A
PROBE 9-10
PITOT 9-10
TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
QUARTZ	N/A

DELTA H@ 1.764
METER TEMP 100
EST. %H_2O 18
C FACTOR .81
STACK TEMP 260
REF DELTA P .68
K-FACTOR 3.0168

FYRITE

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	196.959	.71	2.14	2.14	95	5	260	60	264	
2	2	5	201.52	.74	2.23	2.23	96	5	260	55	266	
3	3	10	205.57	.66	1.99	1.99	99	4	261	53	266	
4	4	15	209.50	.71	2.14	2.14	100	5	258	53	266	
5	5	20	213.69	.54	1.63	1.63	100	4	255	51	264	
6	B 1	25/0	217.263	.53	1.60	1.60	98	3	255	53	258	
7	2	5	220.82	.55	1.66	1.66	99	4	250	53	263	
8	3	10	224.44	.51	1.54	1.54	100	3	250	50	263	
9	4	15	228.01	.42	1.27	1.27	100	3	250	50	263	
10	5	20	231.20	.46	1.39	1.39	100	3	255	51	262	
11	C 1	50/0	234.530	.43	1.30	1.30	99	3	253	54	257	
12	2	5	237.77	.43	1.30	1.30	100	3	253	52	258	
13	3	10	241.00	.52	1.57	1.57	101	3	253	52	260	
14	4	15	244.57	.48	1.45	1.45	102	3	253	51	260	
15	5	20	247.94	.42	1.27	1.27	104	3	250	57	261	
16	D 1	75/0	251.137	.49	1.48	1.48	102	4	257	50	260	1
17	2	5	254.67	.45	1.36	1.36	102	3	257	50	259	
18	3	10	257.95	.46	1.39	1.39	102	3	250	50	260	
19	4	15	261.28	.46	1.39	1.39	100	3	250	50	260	
20	5	20	264.60	.54	1.63	1.63	100	3	250	50	261	
21	E 1	100/0	268.188	.53	1.60	1.60	99	4	253	54	255	
22	2	5	271.75	.46	1.39	1.39	100	4	250	58	259	
23	3	10	275.09	.59	1.78	1.78	100	5	250	55	259	
24	4	15	278.79	.60	1.81	1.81	99	5	253	55	261	
25	5	20	282.57	.59	1.78	1.78	99	5	253	54	262	
		125/0	286.353									

125 minutes
89.394 Vm
.5274 $(\sqrt{\Delta p})^2$
1.60 ΔH
100 tm
261 ts

F1010
9/89
pl

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility Ref# 6284

Sampling Location: Unit No. 1 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0507

Run Number	1-PO-M101A-1	1-PO-M101A-2	1-PO-M101A-3
Run Date	10/23	10/23	10/23

ANALYSIS OF MOISTURE CATCH

Reagent 1 (4% KMnO4/10% H2SO4)			
Final Weight, g.	1066.5	1060.0	1071.5
Tared Weight, g.	645.0	655.0	642.0
	==========	==========	==========
Water Catch,g.	421.5	405.0	429.5
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	421.5	405.0	429.5
Silica Gel:			
Final Weight, g.	217.0	420.5	421.5
Tared Weight, g.	200.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	17.0	20.5	21.5
TOTAL WATER COLLECTED, g.	438.5	425.5	451.0

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-2-89
DATE REPORTED 11-28-89
89W8691

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-1

ATTENTION: BRUCE HAWKS

<u>SAMPLE DESCRIPTION:</u> M101A 4% KMNO4

1. 1-ESPO-M101A-1
2. 1-ESPO-M101A-2
3. 1-ESPO-M101A-3
4. 1-ESPO-M101A-FB
5. METHOD CODE

RESULTS

	1	2	3	4	5
Mercury, as Hg, total ug	69.0	116	172	<2.50	101-A
Mercury, as Hg, total ug	71.9	121	180	<2.50	101-A

Roger Oxford
ROGER C. OXFORD , CHEMIST

P.O. # 62840 - 1.
Method Code 101-A

Entropy

11-13-89
89W8691

		Bkadj conc
Blank =	.005	.000
.1 =	.014	.009
.2 =	.025	.020
.3 =	.036	.031
.4 =	.047	.042
.5 =	.058	.053

	① F.V. = 1000	② FV = 100	③ FV = 1000	④ FV = 1000	⑤ FV = 1000
Hg	5mls. = .041 - .005 =	2mls. = .029 - .005 =	2mls. = .041 - .005	20mls. = .003 - .005	2mls. = .028 - .005
	.036	.024	.036	-.002	.023
	69.0	116	172	<.05/20 × 1000 =	112
				<2.50	

All samples F.V. 1000ml

	①	②	③	④	⑤
Hg	5mls. = .040 - .003 =	2mls. = .028 - .003 =	2mls. = .040 - .003	20mls. = .004 - .003	2mls. = .028 - .003
	.037	.025	.037	.001	.025
	71.9	121	180	<.05/20 × 1000 =	121
				<2.50	

		Bkadj conc
Blank	.003	.000
.1	.014	.011
.2	.023	.020
.3	.035	.032
.4	.044	.041
.5	.054	.051

CUSTODY SHEET FOR REAGENT BOX # 0507

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 250 mls. of $KMnO_4$

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION ESP Outlet Unit #1

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-ESPO-M101A-1	10/23-89	JRW	✓	10-23-89	60	JRW	✓
1-ESPO-M101A-2	10-23-89	JRW	✓	10-23-89	40	JRW	✓
1-ESPO-M101A-3	10-23-89	JRW	✓	10-23-89	40	JRW	✓

Received in Lab Date 10/30 Initials JFJ Locked? ✓

Sampling Method: Method 101A

Remarks:

Zero & Span Balance Initials JFJ

Filter #	Tare Weight (grams)	Used on Test
Quartz	Untared	

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0572

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 250 mls. of $KMnO_4$

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION ESP Outlet #1 & #2

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-ESPO-M101A-FB	10-23-89	JRW	✓	10-23-89	0	JRW	✓
2-ESPO-M101A-FB	10-24-89	JRW	✓	10-24-89	N/A	JRW	✓

	Date	Initials	Locked?
Received in Lab	10/30	JFJ	✓

Sampling Method: Method 101A

Remarks:

Zero & Span Balance Initials JFJ

Filter #	Tare Weight (grams)	Used on Test
Quartz	Untared	

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-1

JOB NAME: North County Regional R.R.

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-1-89

EXPECTED DATE OF RESULTS: 11-15-89

SAMPLE MATRIX: M101A - 4% KMnO4. Unit 1.

TYPE OF ANALYSIS REQUESTED: Hg (Particulate and gaseous). Refer to Method 101A, Rules and Regulations / June 8, 1982.

Sample#	Sample ID		Components	
1	1-ESPO-M101A-1		Reagent,	KMnO4 rinse, Filter.
2	1-ESPO-M101A-2		"	" " "
3	1-ESPO-M101A-3		"	" " "
4	1-ESPO-M101A-FB		"	" " "
5	1-ESPO-M101A-2 (dup)			

SUBMITTED BY:

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 6284 O-1 were
shipped via Pony Express on 11-1-89 by RAT
to OLI

Samples received at OLI on 11-6-89
by

Note any broken seals, leakage, spillage, and/or damage to the samples.

APPENDIX B.1.b.6

B. FIELD AND ANALYTICAL DATA

- 1. Unit No. 1
  - b. ESP Outlet
    - 6. Sulfuric Acid Mist

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility
LOCATION West Palm Beach FL
SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97½"
NIPPLE LENGTH 9"
DEPTH OF DUCT 88½"
WIDTH (RECTANGULAR DUCT) 88½"

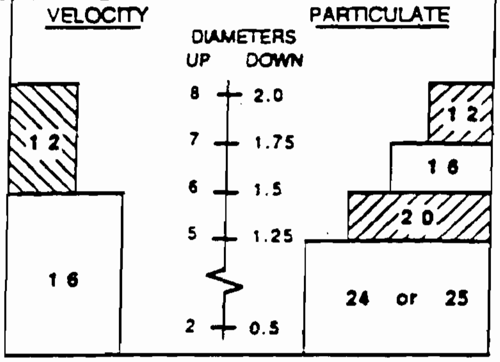
EQUIVALENT DIAMETER:
$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} =$ 88½"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88½" x 88½" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14 6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.6	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY ENVIRONMENTALISTS, INC.

F0003
4/24/89

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME North County Regional Resource Recovery Facility RUN NUMBER 1-ESPO-M8-1
ADDRESS West Palm Beach FL TIME START 0905
SAMPLING LOCATION Unit #1 - ESP Outlet Duct TIME FINISH 1115
DATE 12·26·89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -6.0
TRAIN LEAK CHECK VACUUM IN. HG 15 7
TRAIN LEAK RATE, CU.FT/MIN 0.003 0.002

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
✓ M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 265 PRE
✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0236 NOZZLE 504 DIAMETER 0.266
METER BOX N·7 T/C READOUT F.69
UMBILICAL U·11 T/C PROBE 9·4
SAMPLE BOX 37 ORSAT PUMP 2
PROBE 9·9 PITOT 9.9 TEDLAR BAG 25

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
N/A	UNTARED

DELTA H@ 1.780
METER TEMP 100
EST. %H_2O 22
C FACTOR 0.74
STACK TEMP 260
REF DELTA P 0.65
K-FACTOR 0.0283077

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A·1	0/0	733.800	0.66	1.87	1.87	93	4	234	65	266	
2	2	5	737.64	0.70	1.98	1.98	95	5	246	60	272	
3	3	10	741.61	0.58	1.64	1.64	96	4	252	57	271	
4	4	15	745.24	0.60	1.70	1.70	97	4	250	49	272	
5	5	20	749.01	0.53	1.50	1.50	98	4	256	48	282	
6	B·1	25/0	752.434	0.64	1.81	1.81	98	5	248	59	280	
7	2	5	756.33	0.71	2.01	2.01	98	5	253	56	268	
8	3	10	760.38	0.69	1.95	1.95	98	5	257	52	266	
9	4	15	764.36	0.59	1.67	1.67	98	5	261	53	262	
10	5	20	768.03	0.68	1.92	1.92	98	5	255	55	260	
11	C·1	50/0	771.957	0.55	1.56	1.56	98	5	253	63	259	
12	2	5	775.48	0.65	1.84	1.84	98	5	252	54	258	
13	3	10	779.37	0.49	1.39	1.39	98	5	254	57	257	
14	4	15	782.76	0.44	1.25	1.25	98	4	256	59	257	
15	5	20	785.90	0.35	0.99	0.99	98	4	253	62	258	
16	D·1	75/0	788.724	0.53	1.50	1.50	98	4	250	67	257	
17	2	5	792.41	0.54	1.53	1.53	99	5	254	60	256	
18	3	10	795.70	0.50	1.42	1.42	99	5	255	57	254	
19	4	15	799.15	0.51	1.44	1.44	99	5	256	58	253	
20	5	20	802.51	0.59	1.67	1.67	100	5	258	58	259	
21	E·1	100/0	806.140	0.56	1.59	1.59	100	5	248	64	258	
22	2	5	809.98	0.50	1.42	1.42	100	5	253	60	257	
23	3	10	813.17	0.49	1.39	1.39	100	5	255	56	252	
24	4	15	816.44	0.61	1.73	1.73	100	5	261	56	250	
25	5	20	820.14	0.58	1.64	1.64	100	5	267	59	250	
		125/off	823.752									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	89.952	.5674	1.62	98	261

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER 1-ESPO-M8-4
ADDRESS West Palm Beach FL
TIME START 1515
SAMPLING LOCATION Unit #1- ESP Outlet Duct
TIME FINISH 1726
DATE 10-27-89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -5.7
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.003 0002

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
✓ M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 255 PRE
✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0205 NOZZLE 604 DIAMETER 0.254
METER BOX N.7 T/C READOUT E.69
UMBILICAL U.11 T/C PROBE 9.37
SAMPLE BOX 5 ORSAT PUMP 2
PROBE 9.12 PITOT 9.12 TEDLAR BAG 15

LEAK CHECK READINGS

B 1 R	
B 2 R	
B 3 R	
B 4 R	
B 5 R	
B 6 R	

FILTER #	TARE
N/A	UNTARED

DELTA H@ 1.780
METER TEMP 100
EST. %H_2O 22
C FACTOR 0.74
STACK TEMP 260
REF DELTA P 0.77
K-FACTOR 0.023861

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A.1	0/0	985.000	0.50	1.19	1.19	82	2	254	63	253	
2	2	5	988.09	0.49	1.17	1.17	84	3	251	54	258	
3	3	10	991.10	0.48	1.15	1.15	86	3	250	51	261	
4	4	15	994.28	0.51	1.22	1.22	89	3	247	53	261	
5	5	20	997.20	0.52	1.24	1.24	92	3	245	55	262	
6	B.1	25/0	1000.321	0.52	1.24	1.24	97	3	252	59	257	
7	2	5	3.45	0.64	1.53	1.53	100	3	259	56	257	
8	3	10	6.98	0.70	1.67	1.67	103	3	258	55	260	
9	4	15	10.64	0.49	1.17	1.17	105	3	246	57	264	
10	5	20	13.75	0.47	1.12	1.12	106	3	241	58	268	
11	C.1	50/0	16.701	0.51	1.22	1.22	106	3	237	66	261	
12	2	5	19.85	0.52	1.24	1.24	104	3	242	60	252	
13	3	10	23.24	0.44	1.05	1.05	104	3	245	58	259	
14	4	15	26.03	0.42	1.00	1.00	103	3	256	58	260	
15	5	20	28.89	0.32	0.76	0.76	100	3	256	62	262	
16	D.1	75/0	31.383	0.48	1.15	1.15	98	3	246	67	263	
17	2	5	34.45	0.44	1.05	1.05	100	3	250	64	261	
18	3	10	37.68	0.45	1.08	1.08	99	3	253	60	261	
19	4	15	40.31	0.44	1.05	1.05	100	3	254	56	261	
20	5	20	43.22	0.50	1.19	1.19	100	3	248	55	265	
21	E.1	100/0	46.324	0.41	0.98	0.98	101	3	252	66	268	
22	2	5	49.14	0.38	0.91	0.91	101	3	243	60	268	
23	3	10	51.86	0.42	1.00	1.00	101	3	240	59	265	
24	4	15	54.38	0.49	1.17	1.17	101	3	244	62	261	
25	5	20	57.78	0.48	1.15	1.15	102	3	247	63	265	
		125/off	1060.827									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	75.827	.4781	1.15	99	261

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER 1-ESPO-M8-5
ADDRESS West Palm Beach, FL TIME START 1815
SAMPLING LOCATION Unit# 1-ESP Outlet Duct TIME FINISH 2026
DATE 10-27-89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -6.2
TRAIN LEAK CHECK VACUUM IN. HG 15 8
TRAIN LEAK RATE, CU.FT/MIN 0.005 0.002

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 255 PRE
- ✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0205 NOZZLE 504 DIAMETER 0.266
METER BOX N.7 T/C READOUT F.69
UMBILICAL U.11 T/C PROBE 9.4
SAMPLE BOX 37 ORSAT PUMP 2
PROBE 9.9 PITOT 9.9 TEDLAR BAG 16

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6	

FILTER #	TARE
N/A	UNTARED

DELTA $H_@$ 1.780
METER TEMP 100
EST. %H_2O 22
C FACTOR 0.74
STACK TEMP 260
REF DELTA P 0.65
K-FACTOR 0.0283077

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O		GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES		STACK TEMP. °F	LK CHK #
					IDEAL	ACTUAL			FILTER BOX °F	IMPINGER EXIT °F		
1	A.1	0/0	62.000	0.58	1.64	1.64	88	4	236	62	265	
2	2	5	65.62	0.56	1.59	1.59	90	4	239	59	271	
3	3	10	69.18	0.53	1.50	1.50	91	4	240	55	272	
4	4	15	72.59	0.53	1.50	1.50	92	4	254	57	272	
5	5	20	75.99	0.47	1.33	1.33	94	4	257	57	272	
6	B.1	25/0	79.288	0.51	1.44	1.44	95	4	262	65	269	
7	2	5	82.66	0.59	1.67	1.67	96	5	257	60	272	
8	3	10	86.29	0.60	1.70	1.70	98	5	254	58	273	
9	4	15	89.97	0.46	1.30	1.30	99	5	252	61	274	
10	5	20	93.21	0.50	1.42	1.42	100	5	251	61	273	
11	C.1	50/0	96.574	0.50	1.42	1.42	100	5	254	64	266	
12	2	5	99.93	0.57	1.61	1.61	100	5	257	60	269	
13	3	10	103.53	0.51	1.44	1.44	100	5	261	61	271	
14	4	15	106.94	0.40	1.13	1.13	100	4	263	65	271	
15	5	20	110.37	0.30	0.85	0.85	100	3	256	65	269	
16	D.1	75/0	112.694	0.52	1.47	1.47	100	4	255	60	262	
17	2	5	116.13	0.53	1.50	1.50	100	4	253	56	270	
18	3	10	119.57	0.50	1.42	1.42	100	5	248	53	267	
19	4	15	122.96	0.47	1.33	1.33	100	4	246	55	267	
20	5	20	126.24	0.49	1.39	1.39	100	4	243	57	267	
21	E.1	100/0	129.566	0.43	1.22	1.22	101	5	240	66	266	
22	2	5	132.58	0.38	1.08	1.08	101	5	246	59	268	
23	3	10	135.53	0.41	1.16	1.16	101	6	253	61	263	
24	4	15	138.58	0.53	1.50	1.50	101	7	256	62	266	
25	5	20	142.01	0.50	1.42	1.42	101	7	257	65	269	
		125/off	145.348									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	83.348	.4922	1.40	98	269

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 1 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0236, 0205

Run Number	1-PO-M8-1	1-PO-M8-4	1-PO-M8-5
Run Date	10/26	10/27	10/27

ANALYSIS OF MOISTURE CATCH

Reagent 1 (5% H2O2)			
Final Weight, g.	676.0	672.5	693.0
Tared Weight, g.	564.0	575.0	583.5
Water Catch, g.	112.0	97.5	109.5
Reagent 2 (80% IPA)			
Final Weight, g.	598.5	551.0	614.0
Tared Weight, g.	304.5	306.5	310.5
Water Catch, g.	294.0	244.5	303.5
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	406.0	342.0	413.0
Silica Gel:			
Final Weight, g.	447.5	442.5	450.5
Tared Weight, g.	400.0	400.0	400.0
ADSORBED WATER, g.	47.5	42.5	50.5
TOTAL WATER COLLECTED, g.	453.5	384.5	463.5

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SULFURIC ACID (H2SO4) ANALYTICAL RESULTS

EPA REFERENCE METHOD

Company Name: NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY EEI #: 6284

Sampling Location: UNIT NO. 1 ESP OUTLET

Date Analyzed: 11/28

Analyst: PR

Burette Size Used: 10 ml

Analytical Media: 80% IPA

RUN NUMBER	SAMPLE VOLUME mls (V)	ALIQUOT VOLUME mls (A)	ALIQUOT FACTOR (F)	TITRANT VOLUME mls (T1)	TITRANT VOLUME mls (T2)	TITRANT VOLUME mls (Tavg)	MASS H2SO4 mg (MH2SO4)
Reagent Blank	XXXXXX	20	XXXXXX	0.06	0.06	0.060	Tbavg
1-PO-M8-1	550	20	27.5	1.07	1.06	1.065	13.3
1-PO-M8-4	600	20	30.0	0.7	0.7	0.700	9.2
1-PO-M8-5	600	20	30.0	0.64	0.68	0.660	8.7

Where:

Tavg = (T + T) / 2

F = V / A

N = Volume H2SO4 * 0.02N / Volume BaCl2

MSO2 = 49.04 * (Tavg + Tbavg) * N * F

Titration Standardization against 0.02N H2SO4

H2SO4 Volume	BaCl2 Volume	BaCl2 Normality
5	10.25	0.0098
5	10.25	0.0098
5	10.20	0.0098
	Average	0.0098

For Run: 1-PO-M8-1

MH2SO4=49.04 *(1.065 - 0.06) * 0.0098 * 27.5

MH2SO4 = 13.3 mg

NOTE: Results reported to the nearest 0.1 mg. or four significant figures

BEST AVAILABLE COPY

CUSTODY SHEET FOR REAGENT BOX # 0236

Date of Makeup 10/13 Initials MG Locked? ✓

Individual Tare of Reagent: 200 gms. of 5% H_2O_2

Individual Tare of Reagent: 84 gms. of 80% IPA

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locke
1-ESPO-MB-1	10-26-89	SRD	✓	10-26-89	50%	PFD	✓
1-ESPO-MB-2	10-26-89	SRD	✓	10-26-89	40	JRW	✓
1-ESPO-MB-3	10-27-89	JRW	✓	10-27-89	40	JRW	✓

Received in Lab Date 10/31/89 Initials PR Locked? ✓

Zero & Span Balance Initials PR

Sampling Method: MB

Filter #	Tare Weight (grams)	Used on Test
N/A		

Remarks:

1-ESPO-MB-2 — Aborted

BEST AVAILABLE COPY

CUSTODY SHEET FOR REAGENT BOX # 0205

Date of Makeup 10/26 Initials FJ Locked? ✓

Individual Tare of Reagent: 200 gms. of 5% H_2O_2

Individual Tare of Reagent: 84 gms. of 80% IPA

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Faci

SAMPLING LOCATION Unit #1 ESP Outlet

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked
1-ESPO-M8-4	10-27-89	JRW	✓	10-27-89	60	JRW	✓
1-ESPO-M8-5	10-27-89	JRW	✓	10-27-89	60	JRW	✓

	Date	Initials	Locked?
Received in Lab	10/31/89	PR	✓

Sampling Method: M8

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
Unnumbered, Untared		

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX B.1.b.7

B. FIELD AND ANALYTICAL DATA

  1. Unit No. 1

    b. ESP Outlet

      7. Total Hydrocarbons as Methane

FIELD DATA AND RESULTS TABULATION

PLANT: North County Resource Recovery Facility, West Palm Beach, Florida
LOCATION: Unit No. 1 ESP Outlet
Method 25A Results
Run # 1-PO-M25A-1
Date: 10/26/89

	TAG	CAL	CAL FACTOR
PRETEST	30.4	30.30	1.003
POSTTEST	30.4	30.29	1.004
		AVG ---	1.004

TIME	THC (ppmvw) *	ADJUSTED CONCENTRATION (ppmvw) **
935	1.16	1.17
936	1.23	1.24
937	1.27	1.28
938	1.29	1.30
939	1.29	1.30
940	1.25	1.26
941	1.3	1.31
942	1.47	1.48
943	1.54	1.55
944	1.59	1.60
945	1.49	1.50
946	1.68	1.69
947	2.19	2.20
948	1.71	1.72
949	1.46	1.47
950	1.36	1.37
951	1.37	1.38
952	1.44	1.45
953	1.49	1.50
954	1.52	1.53
955	1.51	1.52
956	1.54	1.55
957	1.53	1.54
958	1.52	1.53
959	1.53	1.54
1000	1.53	1.54
1001	1.5	1.51
1002	1.5	1.51
1003	1.5	1.51
1004	1.48	1.49
1005	1.48	1.49
1006	1.55	1.56
1007	1.58	1.59
1008	1.64	1.65
1009	1.77	1.78
1010	1.64	1.65
1011	1.73	1.74
1012	1.8	1.81
1013	1.61	1.62
1014	1.35	1.36
1015	1.3	1.31
1016	1.26	1.27
1017	1.26	1.27
1018	1.19	1.20
1019	1.24	1.25
1020	1.23	1.24
1021	1.21	1.22
1022	1.23	1.24
1023	1.24	1.25
1024	1.18	1.19
1025	1.21	1.22
1026	1.28	1.29
1027	1.28	1.29
1028	1.29	1.30
1029	1.29	1.30
1030	1.39	1.40
1031	1.48	1.49
1032	1.66	1.67
1033	1.69	1.70
1034	1.52	1.53
	AVG ---	1.43

* As measured
** Adjusted for calibration factor

FIELD DATA AND RESULTS TABULATION

PLANT: North County Resource Recovery Facility, West Palm Beach, Florida
LOCATION: Unit No. 1 ESP Outlet
Method 25A Results
Run # 1-PO-M25A-3
Date: 10/27/89

	TAG	CAL	CAL FACTOR
PRETEST	30.4	30.29	1.004
POSTTEST	30.4	29.99	1.014
		AVG ---	1.009

TIME	THC (ppmvw) *	ADJUSTED CONCENTRATION (ppmvw) **
1206	0.82	0.83
1207	0.70	0.71
1208	0.67	0.68
1209	0.60	0.61
1210	0.59	0.60
1211	0.66	0.67
1212	0.61	0.62
1213	0.63	0.64
1214	0.67	0.68
1215	0.72	0.73
1216	0.56	0.57
1217	0.50	0.51
1218	0.44	0.44
1219	0.46	0.46
1220	0.40	0.40
1221	0.35	0.35
1222	0.33	0.33
1223	0.40	0.40
1224	0.42	0.42
1225	0.49	0.49
1226	0.72	0.73
1227	1.85	1.87
1228	1.13	1.14
1229	0.65	0.66
1230	0.57	0.58
1231	0.46	0.46
1232	0.39	0.39
1233	0.55	0.56
1234	0.51	0.52
1235	0.46	0.46
1236	0.46	0.46
1237	0.56	0.57
1238	0.59	0.60
1239	0.65	0.66
1240	0.94	0.95
1241	0.81	0.82
1242	0.68	0.69
1243	0.63	0.64
1244	0.59	0.60
1245	0.52	0.53
1246	0.49	0.49
1247	0.41	0.41
1248	0.46	0.46
1249	0.45	0.45
1250	0.45	0.45
1251	0.44	0.44
1252	0.52	0.53
1253	0.56	0.57
1254	0.57	0.58
1255	0.65	0.66
1256	0.64	0.65
1257	0.60	0.61
1258	0.58	0.59
1259	0.61	0.62
1300	0.65	0.66
1301	0.52	0.53
1302	0.46	0.46
1303	0.46	0.46
1304	0.46	0.46
1305	0.62	0.63
	AVG ---	0.585

* As measured
** Adjusted for calibration factor

FIELD DATA AND RESULTS TABULATION

PLANT: North County Resource Recovery Facility, West Palm Beach, Florida
LOCATION: Unit No. 1 ESP Outlet
Method 25A Results
Run # 1-PO-M25A-4
Date: 10/27/89

	TAG	CAL	CAL FACTOR
PRETEST	30.4	30.65	0.992
POSTTEST	30.4	30.21	1.006
		AVG ---	0.999

TIME	THC (ppmvw) *	ADJUSTED CONCENTRATION (ppmvw) **
1546	1.08	1.08
1547	1.07	1.07
1548	1.11	1.11
1549	1.21	1.22
1550	1.20	1.21
1551	1.21	1.22
1552	1.23	1.24
1553	1.24	1.25
1554	1.22	1.23
1555	1.24	1.25
1556	1.26	1.27
1557	1.33	1.34
1558	1.30	1.31
1559	1.27	1.28
1600	1.29	1.30
1601	1.25	1.26
1602	1.25	1.26
1603	1.26	1.27
1604	1.27	1.28
1605	1.45	1.46
1606	1.39	1.40
1607	1.42	1.43
1608	1.40	1.41
1609	1.46	1.47
1610	1.55	1.56
1611	1.48	1.49
1612	1.42	1.43
1613	1.40	1.41
1614	1.46	1.47
1615	1.67	1.68
1616	1.55	1.56
1617	1.45	1.46
1618	1.41	1.42
1619	1.41	1.42
1620	1.52	1.53
1621	1.73	1.74
1622	1.81	1.82
1623	1.56	1.57
1624	1.45	1.46
1625	1.57	1.58
1626	1.78	1.79
1627	1.79	1.80
1628	1.61	1.62
1629	1.43	1.44
1630	1.31	1.32
1631	1.32	1.33
1632	1.26	1.27
1633	1.27	1.28
1634	1.80	1.81
1635	1.54	1.55
1636	1.44	1.45
1637	1.92	1.93
1638	1.70	1.71
1639	1.46	1.47
1640	1.95	1.96
1641	1.94	1.95
1642	1.56	1.57
1643	1.40	1.41
1644	1.36	1.37
1645	1.73	1.74
	AVG ---	1.42

* As measured
** Adjusted for calibration factor

B. FIELD AND ANALYTICAL DATA

1. Unit No. 1

c. Stack, Plume Opacity

01

1-8-M9-1A

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: W. C. R. R. F

ADDRESS: 45 ~~X~~ ST

CITY: WEST PALM B | STATE: FL | ZIP: —

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: INCIN. #1 | OPERATING MODE: CONT

CONTROL EQUIPMENT: ESP | OPERATING MODE: CONT

DESCRIBE EMISSION POINT
START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL: START ≈270' STOP ≈270' | HEIGHT RELATIVE TO OBSERVER: START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER: START ≈1000' STOP ≈1000' | DIRECTION FROM OBSERVER: START N-NW STOP N-NW

DESCRIBE EMISSIONS
START NO VE DETECTED STOP SAME

EMISSION COLOR: START NA STOP NA | PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☑ YES ☐ | IS WATER DROPLET PLUME: ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START ≈12' ABOVE STOP SAME

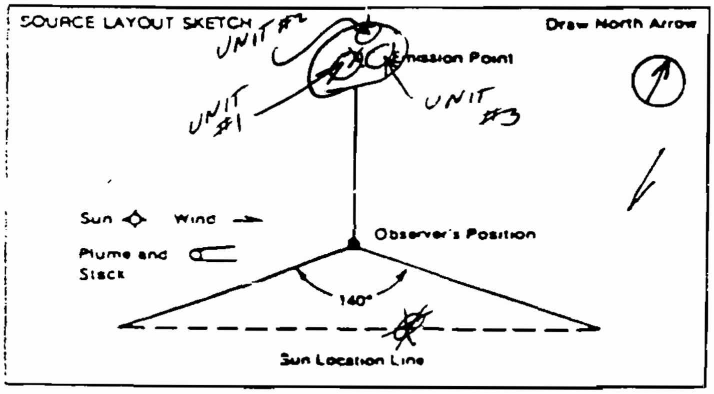
DESCRIBE BACKGROUND
START SKY STOP SKY

BACKGROUND COLOR: START BL ~~WHG~~ STOP SAME | SKY CONDITIONS: START 50% d STOP 30% d

WIND SPEED: START 5-10 STOP 8-15 | WIND DIRECTION: START N STOP NE

AMBIENT TEMP: START 67°F STOP 79°F | WET BULB TEMP: 63°F | RH, percent: 80%

SOURCE LAYOUT SKETCH



COMMENTS
* SLANT ∢ = 17°
UNITS #1 & #2 ON-LINE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE
DATE

OBSERVATION DATE: 10/23/89 | START TIME: 1033 | STOP TIME: 1133

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS: MIN 0 MAX 0 | HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD: —

NUMBER OF READINGS ≥ 10 %: 0 | MINUTES OPACITY ≥ 10 %: 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B. WINEGAR

OBSERVER'S SIGNATURE: J. B. Winegar | DATE: 10/23/89

ORGANIZATION: —

CERTIFIED BY: ETA | DATE: 9/20/89

VERIFIED BY: | DATE:

0/

1-8-m9-1B

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: N. C. R. R. F

ADDRESS: 45 th ST

CITY: WEST PALM B.
STATE: FL
ZIP: —
PHONE:
SOURCE ID NUMBER:

PROCESS EQUIPMENT: INCIN #1
OPERATING MODE: CONT
CONTROL EQUIPMENT: ESP
OPERATING MODE: CONT

DESCRIBE EMISSION POINT
START ≈12' DIAM DUCT STOP IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL: START ≈270' STOP ≈270'
HEIGHT RELATIVE TO OBSERVER: START ≈270' STOP ≈270'
DISTANCE FROM OBSERVER: *START ≈1000' STOP ≈1000'
DIRECTION FROM OBSERVER: START N-NW STOP N-NW

DESCRIBE EMISSIONS
START NO VE DETECTED STOP SAME

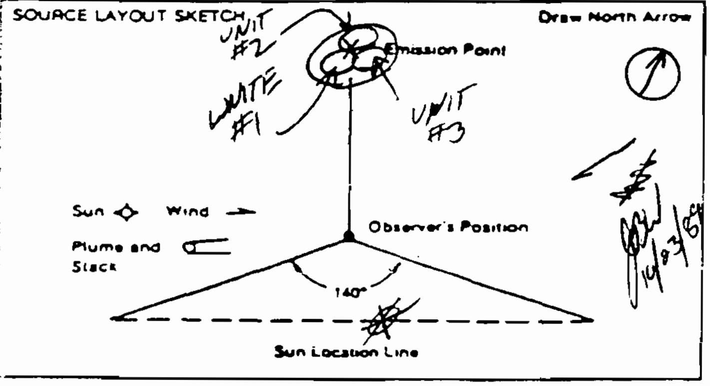
EMISSION COLOR: START NA STOP NA
PLUME TYPE: CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☑ YES ☐
IS WATER DROPLET PLUME: ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START ≈12' ABOVE STOP SAME

DESCRIBE BACKGROUND
START SKY STOP SKY

BACKGROUND COLOR: START BL-WH-GR STOP SAME
SKY CONDITIONS: START 30%cl STOP 30%cl
WIND SPEED: START 8-15 STOP 8-15
WIND DIRECTION: START NE STOP NE
AMBIENT TEMP: START 79°F STOP 80°F
WET BULB TEMP: 68°F
RH, percent: 56%

SOURCE LAYOUT SKETCH



COMMENTS
* SLANT ∢ = 17°

UNITS #1 + #2 ON-LINE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE
DATE

OBSERVATION DATE: 10/23/89
START TIME: 1138
STOP TIME: 1238

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS: MIN 0 MAX 0
HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD:
NUMBER OF READINGS ≥ 10 %: 0 →
MINUTES OPACITY ≥ 10 %: 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B. WINEGAR
OBSERVER'S SIGNATURE: J B. Winegar
DATE: 10/23/89
ORGANIZATION:
CERTIFIED BY: ETA
DATE: 9/20/89
VERIFIED BY:
DATE:

0/

1-8-m9-2A

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: N. C. R. R. F
ADDRESS: 45 th ST
CITY: WEST PALM B
STATE: FL
ZIP: —
PHONE:
SOURCE ID NUMBER:

PROCESS EQUIPMENT: INCIN #1
OPERATING MODE: CONT
CONTROL EQUIPMENT: ESP
OPERATING MODE: CONT

DESCRIBE EMISSION POINT
START ≈12' DIAM DUCT ~~STOP~~ IN COMMON STACK

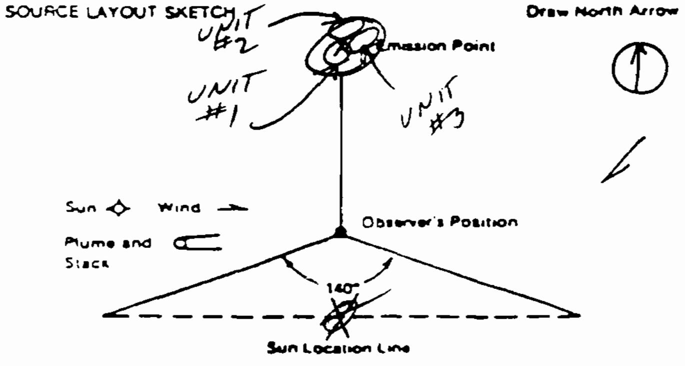
HEIGHT ABOVE GROUND LEVEL: START ≈270' STOP ≈270'
HEIGHT RELATIVE TO OBSERVER: START ≈270' STOP ≈270'
DISTANCE FROM OBSERVER: START ≈900' STOP ≈900'
DIRECTION FROM OBSERVER: START N STOP N

DESCRIBE EMISSIONS
START NO VE DETECTED STOP SAME
EMISSION COLOR: START NA STOP NA
PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐
WATER DROPLETS PRESENT: NO ☑ YES ☐
IS WATER DROPLET PLUME: ATTACHED ☐ NA DETACHED ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND: START SKY STOP SKY
BACKGROUND COLOR: START BL-WH ~~CL~~ STOP SAME
SKY CONDITIONS: START 40%cl STOP 40%cl
WIND SPEED: START 10-15 STOP 8-12
WIND DIRECTION: START NE STOP NE
AMBIENT TEMP: START 82°F STOP 84°F
WET BULB TEMP: 70°F
RH, percent: 54%

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS
* SLANT ∡ = 18°
UNITS #1 + #2 ON-LINE

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TITLE
DATE

OBSERVATION DATE: 10/23/89
START TIME: 1340
STOP TIME: 1440

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS: MIN 0 MAX 0
HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD: —
NUMBER OF READINGS ≥ 10 %: 0
MINUTES OPACITY ≥ 10 %: 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B. WINEGAR
OBSERVER'S SIGNATURE: J B. Winegar
DATE: 10/23/89
ORGANIZATION: —
CERTIFIED BY: ETA
DATE: 9/20/89
VERIFIED BY:
DATE:

0/

1-8-M9-20

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME N. C. R. R. F

ADDRESS 45 ~~TH~~ ST

CITY WEST PALM B | STATE FL | ZIP —

PHONE | SOURCE ID NUMBER —

PROCESS EQUIPMENT INCIN. #1 | OPERATING MODE CONT

CONTROL EQUIPMENT ESP | OPERATING MODE CONT

DESCRIBE EMISSION POINT

START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL START ≈270' STOP ≈270' | HEIGHT RELATIVE TO OBSERVER START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER *START ≈900' STOP ≈900' | DIRECTION FROM OBSERVER START N STOP N

DESCRIBE EMISSIONS

START NO VE DETECTED STOP SAME

EMISSION COLOR START NA STOP NA | PLUME TYPE CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT NO ☑ YES ☐ | IS WATER DROPLET PLUME ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED

START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND

START SKY STOP SKY

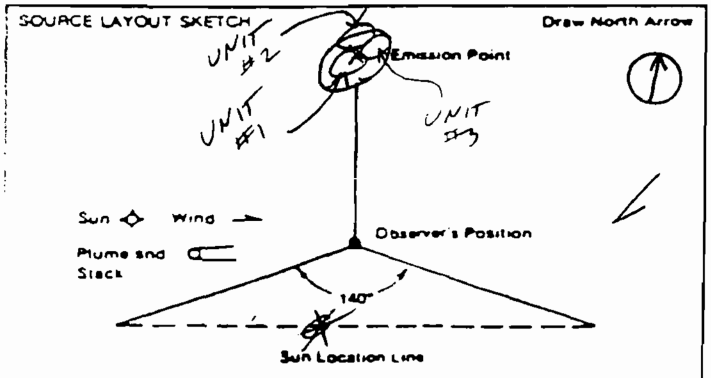
BACKGROUND COLOR START BL-WH-GR STOP SAME | SKY CONDITIONS START 40%cld STOP 40%cld

WIND SPEED START 8-12 STOP 8-12 | WIND DIRECTION START NE STOP NE

AMBIENT TEMP START 84°F STOP 83°F | WET BULB TEMP 71°F | RH, percent 52%

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS

* SLANT ∠ = 18°

UNITS #1 + #2 ON-LINE

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SIGNATURE

TITLE

DATE

OBSERVATION DATE 10/23/89 | START TIME 1440 | STOP TIME 1540

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS MIN 0 MAX 0 | HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD —

NUMBER OF READINGS ≥ 10 % 0 → | MINUTES OPACITY ≥ 10 % 0 × 0.25 = 0

OBSERVER'S NAME (PRINT) JAMES B WINEGAR

OBSERVER'S SIGNATURE J B. W | DATE 10/23/89

ORGANIZATION —

CERTIFIED BY ETA | DATE 9/20/89

VERIFIED BY | DATE

0/ 1-8-m9-3A

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: N.C. R. R. F

ADDRESS: 45 TH ST

CITY: WEST PALM B STATE: FL ZIP: —

PHONE: SOURCE ID NUMBER:

PROCESS EQUIPMENT: INCIN #1 OPERATING MODE: CONT

CONTROL EQUIPMENT: ESP OPERATING MODE: CONT

DESCRIBE EMISSION POINT
START ≃12' DIAM DUCT ~~STOP~~ IN COMMON ST

HEIGHT ABOVE GROUND LEVEL START ≃270' STOP ≃270'

HEIGHT RELATIVE TO OBSERVER START ≃270' STOP ≃270'

DISTANCE FROM OBSERVER START ≃400' STOP ≃400

DIRECTION FROM OBSERVER START E STOP E

DESCRIBE EMISSIONS
START NO VE DETECTED STOP SAME

EMISSION COLOR START NA STOP NA

PLUME TYPE CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT NO ☑ YES ☐

IS WATER DROPLET PLUME ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START ≃20' ABOVE STOP SAME

DESCRIBE BACKGROUND
START SKY STOP SKY

BACKGROUND COLOR START BL STOP BL+WH

SKY CONDITIONS START 30%cl STOP 30%cl

WIND SPEED START 8-12 STOP 8-12

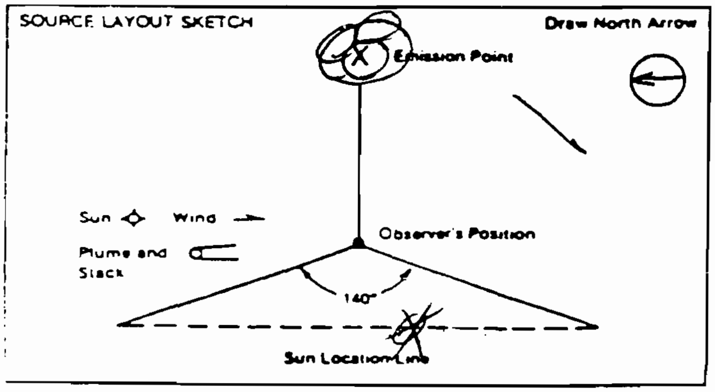
WIND DIRECTION START NE STOP NE

AMBIENT TEMP START 82°F STOP 79°F

WET BULB TEMP 71°F

RH, percent 54%

SOURCE LAYOUT SKETCH



COMMENTS
* SLANT ∡ = 32°
UNITS #1 & #2 ON-LINE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS
SIGNATURE
TITLE
DATE

OBSERVATION DATE: 10/23/89 START TIME: 1636 STOP TIME: 1736

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS MIN 0 MAX 0

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD

NUMBER OF READINGS ≥ 10 % 0 →

MINUTES OPACITY ≥ 10 % 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B. WINEGAR

OBSERVER'S SIGNATURE: J B. W DATE: 10/23/89

ORGANIZATION:

CERTIFIED BY: ETA DATE: 9/20/89

VERIFIED BY: DATE:

0/

1-8-m9-3B

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: N. C. R. R. F

ADDRESS: 45th ST

CITY: WEST PALM B. | STATE: FL | ZIP: —

PHONE: | SOURCE ID NUMBER: —

PROCESS EQUIPMENT: INCIN #1 | OPERATING MODE: CONT

CONTROL EQUIPMENT: ESP | OPERATING MODE: CONT

DESCRIBE EMISSION POINT
START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST

HEIGHT ABOVE GROUND LEVEL: START ≈270' STOP ≈270'

HEIGHT RELATIVE TO OBSERVER: START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER: * START ≈400' STOP ≈400'

DIRECTION FROM OBSERVER: START ~~NE~~ E STOP ~~NE~~ E
JBW 10/23/89 JBW 10/23/89

DESCRIBE EMISSIONS
START NO VE DETECTED STOP SAME

EMISSION COLOR: START NA STOP NA

PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐

IS WATER DROPLET PLUME: ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND
START SKY STOP SKY

BACKGROUND COLOR: START BL+WH STOP BL-WH-GR

SKY CONDITIONS: START 30%cld STOP 30%cld

WIND SPEED: START 8-12 STOP 5-10

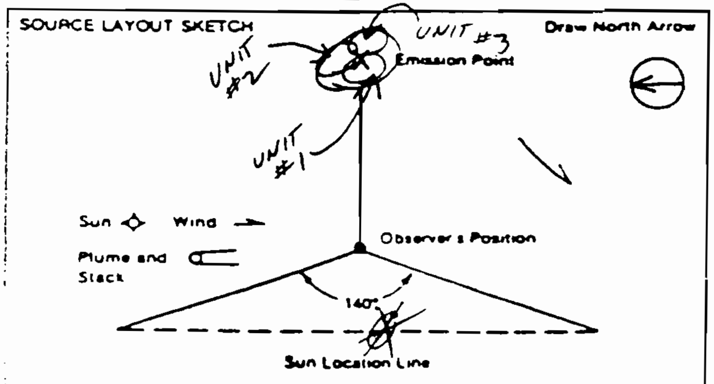
WIND DIRECTION: START NE STOP NE

AMBIENT TEMP: START 79°F STOP 76°F

WET BULB TEMP: 68°F

RH, percent: 50%

SOURCE LAYOUT SKETCH



COMMENTS
← SLANT Δ = 32°
UNITS #1 + #2 ON-LINE

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TITLE
DATE

OBSERVATION DATE: 10/23/89 | START TIME: 1743 | STOP TIME: 1843

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS: MIN 0 MAX 0

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD

NUMBER OF READINGS ≥ 10 %: 0 →

MINUTES OPACITY ≥ 10 %: 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B. WINEGAR

OBSERVER'S SIGNATURE: | DATE: 10/23/89

ORGANIZATION: —

CERTIFIED BY: ETA | DATE: 9/20/89

VERIFIED BY: | DATE:

Best Available Copy

VISIBLE EMISSIONS EVALUATOR

This is to certify that

James [illegible] Ninegar

met the specifications of Federal Reference Method 9 and qualified as a visible emissions evaluator. Maximum deviation on white and black smoke did not exceed 7.5% opacity and no single error exceeding 15% opacity was incurred during the certification test conducted by Eastern Technical Associates of Raleigh, North Carolina. This certificate [illegible] of issue.

Thomas Rose
President

[illegible]1057
Number

Vice President

Asheville
Location

David Savage
Program Manager

September 20, 1989
Date of Issue

APPENDIX B.2.a.1

B. FIELD AND ANALYTICAL DATA
  2. Unit No. 2
    a. Dry Scrubber Inlet
      1. Carbon Dioxide, Oxygen, and Sulfur Dioxide

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Calibration Error Check

DATE : 10-25-1989 TIME: 10:53 - 11:30

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.6
1	OUTLET	ppmSO2	49.6	50.8
1	OUTLET	ppmSO2	90.7	90.7
3	OUTLET	ppmNOX	0.0	0.7
3	OUTLET	ppmNOX	240.0	240.2
3	OUTLET	ppmNOX	455.0	455.6
4	OUTLET	ppmCO	0.0	0.0
4	OUTLET	ppmCO	24.8	23.9
4	OUTLET	ppmCO	64.3	62.4
4	OUTLET	ppmCO	149.6	149.8
2	OUTLET	% O2	0.00	0.00
2	OUTLET	% O2	11.93	11.95
2	OUTLET	% O2	20.90	20.90
5	OUTLET	% CO2	0.00	-0.00
5	OUTLET	% CO2	11.06	11.33
5	OUTLET	% CO2	17.50	17.53
6	INLET	ppmSO2	0.0	1.2
6	INLET	ppmSO2	218.0	219.3
6	INLET	ppmSO2	454.1	453.5
7	INLET	% O2	0.00	0.00
7	INLET	% O2	11.93	11.96
7	INLET	% O2	20.90	20.91
8	INLET	% CO2	0.00	0.01
8	INLET	% CO2	11.06	11.07
8	INLET	% CO2	17.50	17.50

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 1 Calibration Bias Check Unit 2

DATE : 10-25-1989 TIME: 11:30 - 11:55

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.0
1	OUTLET	ppmSO2	49.6	49.0
3	OUTLET	ppmNOX	0.0	0.7
3	OUTLET	ppmNOX	240.0	233.1
4	OUTLET	ppmCO	0.0	0.7
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	11.93	11.84
5	OUTLET	% CO2	0.00	0.02
5	OUTLET	% CO2	11.06	11.26
6	INLET	ppmSO2	0.0	3.2
6	INLET	ppmSO2	218.0	215.3
7	INLET	% O2	0.00	0.01
7	INLET	% O2	11.93	11.77
8	INLET	% CO2	0.00	0.04
8	INLET	% CO2	11.06	11.02

BEST AVAILABLE COPY

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:31	27.7	208.9	14.9	6.27	13.23	148.7	6.28	13.26	0.063	0.341	0.015	0.338
12:32	26.1	211.8	14.8	6.46	13.08	152.6	5.98	13.55	0.060	0.350	0.015	0.339
12:33	27.0	211.6	15.0	6.37	13.18	158.0	5.58	13.95	0.062	0.348	0.015	0.343
12:34	31.0	215.5	15.3	6.08	13.44	153.2	6.06	13.49	0.069	0.347	0.015	0.343
12:35	32.5	215.7	15.8	6.17	13.30	145.1	6.27	13.26	0.073	0.350	0.016	0.329
12:36	32.8	216.3	15.4	6.37	13.14	146.5	6.23	13.29	0.075	0.355	0.015	0.332
12:37	36.0	214.2	14.5	6.33	13.16	152.6	5.83	13.70	0.082	0.351	0.014	0.336
12:38	32.3	214.7	14.4	6.32	13.17	154.2	5.89	13.64	0.073	0.352	0.014	0.341
12:39	36.6	213.0	14.3	6.17	13.30	151.8	5.81	13.71	0.083	0.345	0.014	0.334
12:40	41.6	213.0	15.0	6.32	13.18	155.7	5.62	13.87	0.095	0.349	0.015	0.338
12:41	44.0	210.7	14.8	6.12	13.38	159.7	5.52	14.00	0.099	0.340	0.015	0.345
12:42	48.9	212.8	14.3	5.94	13.50	158.3	5.43	14.08	0.108	0.340	0.014	0.340
12:43	50.2	213.9	14.2	5.98	13.50	156.5	5.71	13.82	0.112	0.342	0.014	0.342
12:44	52.2	213.7	13.9	5.97	13.46	152.9	5.78	13.74	0.116	0.342	0.014	0.336
12:45	47.4	214.1	14.3	6.12	13.35	157.8	5.58	13.95	0.106	0.346	0.014	0.342

AVERAGE VALUES FOR THE LAST 15 MINUTES

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:45	37.8	213.3	14.7	6.20	13.29	153.6	5.84	13.69	0.085	0.347	0.015	0.339
12:46	49.7	212.4	14.4	5.97	13.48	146.7	6.37	13.18	0.110	0.340	0.014	0.335
12:47	50.7	212.1	14.8	6.28	13.15	146.0	6.18	13.34	0.115	0.346	0.015	0.329
12:48	49.5	212.7	14.9	6.46	13.01	147.1	6.18	13.38	0.114	0.352	0.015	0.332
12:49	50.4	211.6	14.3	6.47	13.02	148.7	6.02	13.55	0.116	0.350	0.014	0.332
12:50	51.3	212.7	14.1	6.35	13.14	145.1	6.32	13.26	0.117	0.349	0.014	0.330
12:51	52.9	214.7	14.0	6.41	13.05	139.1	6.70	12.85	0.121	0.354	0.014	0.325
12:52	51.0	211.4	14.1	6.72	12.74	151.4	5.77	13.80	0.119	0.356	0.014	0.332
12:53	51.1	210.8	14.1	6.60	12.95	137.7	7.12	12.46	0.119	0.352	0.014	0.332
12:54	49.3	207.3	14.1	6.71	12.73	140.2	6.69	12.93	0.115	0.349	0.014	0.328
12:55	45.7	206.0	14.4	6.97	12.57	143.3	6.75	12.84	0.109	0.353	0.015	0.336
12:56	45.4	205.9	14.6	7.00	12.53	139.6	7.13	12.41	0.109	0.354	0.015	0.337
12:57	41.9	204.6	15.5	7.16	12.40	145.9	6.70	12.87	0.101	0.356	0.016	0.341
12:58	41.5	203.6	14.4	6.95	12.57	145.7	6.86	12.68	0.099	0.348	0.015	0.345
12:59	38.8	196.6	14.6	7.04	12.47	153.4	6.65	12.92	0.093	0.339	0.015	0.358
13:00	38.7	192.1	14.2	7.08	12.43	147.7	6.98	12.58	0.093	0.332	0.015	0.352

Test 2-1 Begins

AVERAGE VALUES FOR THE LAST 15 MINUTES

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
13:00	47.2	207.6	14.4	6.68	12.82	145.2	6.56	13.00	0.110	0.349	0.015	0.336
13:01	38.1	192.7	14.5	7.22	12.33	149.8	6.76	12.80	0.092	0.336	0.015	0.352
13:02	40.3	196.5	14.0	7.00	12.53	147.4	6.90	12.67	0.096	0.337	0.015	0.350
13:03	41.1	199.8	14.2	7.06	12.47	145.1	6.97	12.55	0.099	0.345	0.015	0.346
13:04	38.8	198.6	14.7	7.16	12.37	155.8	6.52	13.05	0.094	0.345	0.016	0.360
13:05	39.9	197.5	14.5	6.98	12.53	149.4	6.91	12.62	0.095	0.339	0.015	0.355
13:06	40.0	198.1	16.0	7.11	12.40	158.8	6.09	13.45	0.096	0.343	0.017	0.356
13:07	40.1	199.6	16.5	6.73	12.78	155.7	6.38	13.18	0.094	0.336	0.017	0.356
13:08	41.2	201.4	15.9	6.58	12.83	144.6	6.97	12.61	0.095	0.336	0.016	0.345
13:09	37.5	201.5	17.2	6.99	12.48	144.9	6.64	12.92	0.089	0.346	0.018	0.337
13:10	37.3	206.1	19.0	6.92	12.60	147.2	6.34	13.22	0.089	0.352	0.019	0.336
13:11	37.3	211.1	19.7	6.58	12.93	144.6	6.51	13.07	0.087	0.352	0.019	0.334
13:12	38.2	212.1	19.1	6.54	12.89	142.3	6.58	12.99	0.088	0.353	0.018	0.330
13:13	37.6	208.6	17.9	6.67	12.79	139.1	6.56	13.02	0.088	0.350	0.018	0.322
13:14	37.8	207.9	17.8	6.81	12.65	141.0	6.49	13.08	0.089	0.352	0.018	0.325
13:15	37.4	207.4	18.5	6.86	12.62	140.7	6.49	13.06	0.088	0.353	0.019	0.324

BEST AVAILABLE COPY

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
         CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
         OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME     ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU

AVERAGE VALUES FOR THE LAST 15 MINUTES
13:15    38.8      202.6     16.4      6.88      12.61     147.1     6.61      12.95     0.092     0.345     0.017     0.342

13:16    38.0      206.6     18.2      6.78      12.72     146.9     6.10      13.49     0.089     0.349     0.019     0.330
13:17    40.0      207.0     18.4      6.50      12.98     144.0     6.49      13.10     0.092     0.343     0.019     0.332
13:18    41.9      210.2     17.9      6.46      12.99     146.8     6.22      13.37     0.096     0.348     0.018     0.332
13:19    42.3      211.4     18.4      6.55      12.91     142.5     6.47      13.09     0.098     0.352     0.019     0.328
13:20    39.8      211.7     19.1      6.62      12.88     145.8     6.27      13.33     0.093     0.354     0.019     0.331
13:21    41.4      211.8     18.6      6.34      13.09     138.0     6.87      12.72     0.094     0.347     0.019     0.327
13:22    39.8      211.0     19.1      6.69      12.75     144.8     6.23      13.32     0.093     0.355     0.020     0.328
13:23    39.8      210.8     18.9      6.64      12.89     142.3     6.56      13.05     0.093     0.353     0.019     0.329
13:24    40.2      211.1     18.1      6.60      12.85     145.0     6.03      13.57     0.093     0.353     0.018     0.324
13:25    41.0      211.7     17.0      6.52      13.01     140.8     6.49      13.15     0.095     0.352     0.017     0.324
13:26    44.3      213.4     17.3      6.36      13.10     140.1     6.33      13.25     0.101     0.350     0.017     0.319
13:27    43.0      219.8     18.4      6.51      13.01     142.4     6.30      13.31     0.099     0.365     0.019     0.324
13:28    44.0      220.7     18.2      6.32      13.18     145.2     6.05      13.61     0.100     0.361     0.018     0.325
13:29    42.6      217.6     18.5      6.24      13.26     141.1     6.45      13.17     0.096     0.354     0.018     0.324
13:30    40.8      216.6     18.8      6.43      13.11     150.6     5.90      13.71     0.094     0.357     0.019     0.334

AVERAGE VALUES FOR THE LAST 15 MINUTES
13:30    41.2      212.7     18.3      6.50      12.98     143.7     6.32      13.28     0.095     0.353     0.018     0.327

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
13:30    41.3      209.1     16.0      6.57      12.93     147.4     6.33      13.23     0.096     0.348     0.016     0.336
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13:31    45.2      218.5     18.4      6.23      13.28     146.5     6.20      13.41     0.102     0.356     0.018     0.331
13:32    47.1      216.6     17.9      6.38      13.13     147.4     6.05      13.58     0.108     0.356     0.018     0.330
13:33    48.4      218.2     17.7      6.26      13.25     144.1     6.31      13.30     0.110     0.356     0.018     0.328
13:34    51.7      221.3     19.3      6.32      13.20     153.8     5.63      13.99     0.118     0.363     0.019     0.334
13:35    53.8      222.0     18.5      6.10      13.42     156.2     5.51      14.11     0.121     0.358     0.018     0.337
13:36    59.6      222.8     17.7      5.95      13.57     155.0     5.39      14.22     0.132     0.356     0.017     0.332
13:37    60.3      223.1     17.9      5.77      13.74     157.0     5.23      14.38     0.132     0.352     0.017     0.333
13:38    58.3      225.6     17.8      5.60      13.91     151.2     5.62      14.00     0.127     0.352     0.017     0.329
13:39    59.1      226.4     17.4      5.56      13.89     151.0     5.56      14.06     0.128     0.352     0.016     0.327
13:40    58.3      224.3     17.3      5.73      13.75     155.5     5.20      14.36     0.128     0.353     0.017     0.329
13:41    59.6      221.8     17.2      5.70      13.84     158.1     5.46      14.15     0.130     0.348     0.016     0.340
13:42    61.1      219.2     18.5      5.43      13.97     156.9     5.30      14.28     0.131     0.338     0.017     0.334
13:43    56.4      220.5     17.0      5.64      13.85     157.4     5.11      14.46     0.123     0.345     0.016     0.331
13:44    64.1      219.4     15.6      5.46      14.00     158.9     5.25      14.34     0.138     0.339     0.015     0.337
13:45    62.1      221.1     15.9      5.41      14.01     160.3     5.15      14.43     0.133     0.341     0.015     0.338

AVERAGE VALUES FOR THE LAST 15 MINUTES
13:45    56.3      221.4     17.6      5.84      13.65     153.9     5.53      14.07     0.124     0.351     0.017     0.333

13:46    58.7      220.7     15.5      5.53      13.93     154.4     5.56      14.07     0.127     0.343     0.015     0.334
13:47    62.6      224.8     15.4      5.53      13.89     146.2     5.86      13.72     0.135     0.349     0.015     0.323
13:48    60.6      224.7     16.7      5.81      13.68     154.1     5.24      14.37     0.133     0.356     0.016     0.327
13:49    56.8      224.6     17.6      5.59      13.90     151.2     5.56      14.04     0.123     0.350     0.017     0.327
13:50    53.8      223.2     16.8      5.60      13.85     154.5     5.38      14.24     0.117     0.348     0.016     0.330
13:51    48.1      217.8     15.8      5.63      13.83     154.1     5.35      14.25     0.104     0.341     0.015     0.329
13:52    42.6      218.2     15.4      5.56      13.91     154.4     5.41      14.17     0.092     0.340     0.015     0.331
13:53    39.7      217.1     15.3      5.64      13.82     157.8     5.29      14.30     0.086     0.340     0.015     0.336
13:54    36.8      216.8     15.3      5.58      13.87     150.1     5.83      13.81     0.080     0.338     0.015     0.331
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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
       CHAN 1   CHAN 3   CHAN 4   CHAN 2   CHAN 5   CHAN 6   CHAN 7   CHAN 8   OUTLET   OUTLET   OUTLET   INLET
       OUTLET   OUTLET   OUTLET   OUTLET   OUTLET   INLET    INLET    INLET    lb SO2   lb NOX   lb CO    lb SO2
TIME   ppmSO2   ppmNOX   ppmCO    % O2     % CO2    ppmSO2   % O2     % CO2    MBTU     MBTU     MBTU     MBTU
13:55    34.9    215.8     15.6     5.74    13.68    151.6     5.51    14.10    0.076    0.340    0.015    0.327
13:56    32.9    218.7     15.9     5.88    13.60    158.8     5.04    14.53    0.073    0.348    0.015    0.333
13:57    34.1    219.3     17.2     5.46    14.03    159.3     5.63    13.98    0.073    0.339    0.016    0.346
13:58    36.5    219.2     17.0     5.56    13.86    154.1     5.24    14.36    0.079    0.341    0.016    0.327
13:59    34.6    219.9     15.6     5.50    13.97    141.5     6.36    13.31    0.075    0.341    0.015    0.323
14:00    33.5    219.2     15.2     5.78    13.60    131.8     6.74    12.90    0.074    0.346    0.015    0.309

AVERAGE VALUES FOR THE LAST 15 MINUTES
14:00    44.4    220.0     16.0     5.63    13.83    151.6     5.60    14.01    0.096    0.344    0.015    0.329
      TEST 2-1 ENDS
14:01    29.3    217.7     16.3     6.35    13.12    131.5     6.61    13.02    0.067    0.357    0.016    0.306
14:02    27.0    213.0     17.7     6.43    13.06    129.8     6.61    13.02    0.062    0.351    0.018    0.302
14:03    27.2    214.6     19.1     6.35    13.12    131.9     6.57    13.05    0.062    0.352    0.019    0.306
14:04    27.5    214.7     21.2     6.33    13.15    136.0     6.22    13.41    0.063    0.352    0.021    0.308
14:05    28.6    216.7     18.8     6.26    13.20    133.1     6.54    13.08    0.065    0.354    0.019    0.308
14:06    30.3    212.0     18.5     6.39    13.06    130.5     6.66    12.94    0.069    0.349    0.019    0.304
14:07    30.2    207.6     19.2     6.62    12.82    132.6     6.48    13.18    0.070    0.347    0.020    0.305
14:08    28.2    211.0     18.5     6.73    12.73    124.2     6.99    12.61    0.066    0.356    0.019    0.296
14:09    26.9    211.5     17.7     6.85    12.61    128.3     6.49    13.15    0.064    0.360    0.018    0.296
14:10    27.0    212.8     18.7     6.94    12.56    132.7     6.00    13.62    0.064    0.364    0.019    0.296
14:11    25.9    213.9     17.7     6.74    12.80    134.3     6.17    13.46    0.061    0.361    0.018    0.303
14:12    27.2    214.5     17.8     6.60    12.86    129.3     6.39    13.24    0.063    0.358    0.018    0.296
14:13    27.3    212.3     17.8     6.51    12.96    126.2     6.60    13.02    0.063    0.352    0.018    0.293
14:14    28.2    211.6     16.5     6.61    12.85    133.2     6.02    13.58    0.065    0.354    0.017    0.297
14:15    30.2    215.4     14.9     6.43    13.09    134.9     6.07    13.57    0.069    0.356    0.015    0.302

AVERAGE VALUES FOR THE LAST 15 MINUTES
14:15    28.1    213.3     18.0     6.54    12.93    131.2     6.43    13.20    0.065    0.355    0.018    0.301

14:16    32.0    214.4     15.0     6.09    13.36    135.0     5.87    13.75    0.072    0.346    0.015    0.298
14:17    31.3    214.4     15.4     6.05    13.44    137.7     5.62    14.00    0.070    0.345    0.015    0.304
14:18    34.3    214.0     16.2     5.84    13.62    131.4     6.12    13.52    0.076    0.339    0.016    0.295
14:19    32.4    213.5     16.0     6.13    13.33    132.0     5.92    13.67    0.073    0.345    0.016    0.293
14:20    30.3    213.6     16.3     6.02    13.46    134.0     6.05    13.59    0.068    0.343    0.016    0.300
14:21    31.4    214.4     16.9     5.96    13.48    126.2     6.50    13.12    0.070    0.343    0.016    0.291
14:22    30.9    211.5     16.8     6.30    13.14    123.3     6.51    13.13    0.070    0.346    0.017    0.284
14:23    29.8    212.2     17.2     6.55    12.92    133.6     6.43    13.21    0.069    0.353    0.017    0.306
14:24    28.8    211.1     17.9     6.60    12.95    144.0     6.16    13.50    0.067    0.353    0.018    0.324
14:25    33.4    212.7     16.2     6.32    13.19    136.8     6.73    12.93    0.076    0.349    0.016    0.321
14:26    35.9    211.3     15.4     6.50    12.99    137.4     6.03    13.57    0.083    0.350    0.016    0.307
14:27    36.0    216.1     16.0     6.39    13.19    137.9     6.06    13.59    0.082    0.356    0.016    0.309
14:28    37.9    217.7     15.4     6.14    13.34    133.0     6.28    13.30    0.085    0.352    0.015    0.302
14:29    38.1    216.6     16.2     6.36    13.16    139.0     5.69    13.92    0.087    0.356    0.016    0.303
14:30    37.5    215.8     15.6     6.10    13.43    133.2     6.21    13.41    0.084    0.348    0.015    0.301

AVERAGE VALUES FOR THE LAST 15 MINUTES
14:30    33.3    214.0     16.2     6.22    13.27    134.4     6.15    13.48    0.075    0.348    0.016    0.303

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
14:30    40.5    217.2     17.0     6.06    13.42    142.8     5.93    13.69    0.090    0.350    0.017    0.316
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14:31    37.8    213.3     15.4     6.11    13.36    133.8     6.06    13.52    0.085    0.344    0.015    0.299
14:32    37.7    213.5     15.3     6.23    13.26    140.2     5.66    13.96    0.085    0.348    0.016    0.305
14:33    37.3    214.8     15.7     6.05    13.46    131.5     6.23    13.34    0.084    0.345    0.015    0.298
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Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
14:34	34.7	211.6	15.6	6.26	13.25	130.4	6.35	13.26	0.079	0.345	0.015	0.297
14:35	34.4	211.5	16.6	6.32	13.16	128.4	6.28	13.31	0.078	0.347	0.017	0.292
14:36	33.3	211.4	17.8	6.60	12.93	125.6	6.28	13.32	0.077	0.353	0.018	0.285
14:37	33.3	209.2	17.5	6.53	13.02	129.2	6.15	13.49	0.077	0.348	0.018	0.291
14:38	33.2	211.4	17.3	6.42	13.13	126.3	6.25	13.36	0.076	0.349	0.017	0.286
14:39	33.0	211.4	17.4	6.38	13.16	118.8	6.69	12.90	0.075	0.348	0.017	0.278
14:40	28.6	212.5	18.6	6.62	12.92	121.1	6.47	13.19	0.066	0.355	0.019	0.279
14:41	25.4	213.9	19.0	6.67	12.91	117.5	6.61	12.98	0.059	0.359	0.019	0.273
14:42	28.1	213.7	18.9	6.78	12.82	127.3	6.47	13.16	0.066	0.362	0.019	0.293
14:43	30.3	211.6	17.9	6.67	12.91	123.2	6.65	13.00	0.071	0.355	0.018	0.287
14:44	32.8	211.4	18.0	6.81	12.79	121.3	6.54	13.06	0.077	0.358	0.019	0.281
14:45	32.6	211.9	20.0	7.06	12.60	125.5	6.07	13.57	0.078	0.366	0.021	0.281

AVERAGE VALUES FOR THE LAST 15 MINUTES

14:45	32.8	212.2	17.4	6.50	13.05	126.7	6.32	13.29	0.076	0.352	0.018	0.288

COMMENTS: End of Test 1 Unit 2

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1/ Pre-test 2 Calibration Bias Check

DATE : 10-25-1989 TIME: 14:46 - 15:22

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.9
1	OUTLET	ppmSO2	49.6	51.3
3	OUTLET	ppmNOX	0.0	1.5
3	OUTLET	ppmNOX	240.0	238.5
4	OUTLET	ppmCO	0.0	0.1
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.01
2	OUTLET	% O2	11.93	11.76
5	OUTLET	% CO2	0.00	0.10
5	OUTLET	% CO2	11.06	11.36
6	INLET	ppmSO2	0.0	6.7
6	INLET	ppmSO2	218.0	219.2
7	INLET	% O2	0.00	0.04
7	INLET	% O2	11.93	11.69
8	INLET	% CO2	0.00	0.26
8	INLET	% CO2	11.06	11.14

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Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
15:35	35.3	213.8	20.0	6.76	12.89	124.0	6.35	13.28	0.083	0.361	0.020	0.283
15:36	36.1	213.8	19.8	6.70	12.89	116.8	6.87	12.76	0.084	0.360	0.020	0.276
15:37	34.3	217.1	20.7	6.90	12.73	116.0	6.78	12.87	0.081	0.370	0.022	0.273
15:38	32.5	216.6	20.6	6.98	12.68	114.4	6.96	12.67	0.078	0.372	0.021	0.273
15:39	32.3	215.3	21.1	7.18	12.48	110.2	7.13	12.48	0.078	0.375	0.022	0.266
15:40	29.7	213.4	22.0	7.29	12.43	117.8	6.53	13.13	0.072	0.374	0.023	0.272
15:41	29.5	212.7	20.7	7.07	12.56	108.8	7.20	12.41	0.071	0.367	0.022	0.264
15:42	30.2	211.9	20.6	7.31	12.37	111.6	6.96	12.67	0.074	0.373	0.022	0.266
15:43	32.6	214.8	20.7	7.30	12.41	110.0	7.05	12.57	0.080	0.377	0.022	0.264
15:44	33.7	215.5	21.6	7.19	12.47	106.6	7.30	12.29	0.082	0.375	0.023	0.260
15:45	32.9	213.9	21.8	7.40	12.30	110.2	7.17	12.47	0.081	0.379	0.023	0.267
15:46	33.1	210.4	20.7	7.42	12.26	104.3	7.81	11.81	0.081	0.373	0.022	0.265
15:47	32.6	207.7	21.0	7.90	11.84	105.2	7.67	11.97	0.083	0.381	0.023	0.264
15:48	30.6	208.7	21.8	8.10	11.71	108.1	7.55	12.08	0.079	0.389	0.025	0.269
15:49	29.1	200.4	24.6	8.26	11.56	107.7	7.58	12.06	0.076	0.379	0.028	0.268
15:50	29.3	201.5	27.5	8.36	11.49	107.0	7.70	11.96	0.078	0.384	0.032	0.269
15:51	28.8	198.4	30.3	8.43	11.44	105.8	7.63	12.03	0.077	0.380	0.035	0.265
15:52	28.1	201.0	27.7	8.28	11.57	103.0	7.87	11.82	0.074	0.380	0.032	0.262
15:53	27.2	195.2	31.3	8.45	11.38	100.7	8.10	11.62	0.073	0.374	0.037	0.261
15:54	25.3	192.9	40.6	8.73	11.16	101.6	7.71	11.94	0.069	0.379	0.048	0.256
15:55	25.9	203.3	39.2	8.54	11.38	110.0	6.88	12.77	0.070	0.393	0.046	0.261
15:56	29.8	212.2	34.3	7.88	11.95	115.2	6.49	13.14	0.076	0.389	0.038	0.266
15:57	33.4	206.6	35.2	7.54	12.20	119.2	6.31	13.35	0.083	0.369	0.038	0.271
15:58	35.8	205.9	36.1	7.31	12.37	114.9	6.74	12.91	0.087	0.362	0.039	0.269
15:59	38.3	209.9	33.1	7.39	12.31	117.7	6.85	12.85	0.094	0.371	0.036	0.278
16:00	41.3	210.6	32.1	7.37	12.28	110.8	7.11	12.55	0.101	0.372	0.034	0.267
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:00	31.2	204.3	30.4	8.00	11.79	108.8	7.33	12.32	0.080	0.378	0.034	0.266
AVERAGE VALUES FOR THE LAST HOUR: 26 MINUTES OF VALID DATA												
16:00	31.8	208.6	26.3	7.62	12.12	110.7	7.17	12.48	0.079	0.375	0.029	0.267
Begin 2-2												
16:01	40.4	207.7	31.4	7.62	12.09	113.4	6.85	12.85	0.101	0.374	0.034	0.268
16:02	44.3	212.3	29.9	7.39	12.34	114.7	6.63	13.04	0.109	0.375	0.032	0.267
16:03	52.1	215.9	29.0	6.99	12.66	113.4	6.75	12.93	0.124	0.371	0.030	0.266
16:04	54.9	217.2	30.0	7.11	12.52	111.3	6.70	12.99	0.132	0.376	0.032	0.260
16:05	54.8	218.9	30.2	7.05	12.58	107.4	7.09	12.57	0.131	0.378	0.032	0.258
16:06	55.8	217.9	30.5	7.12	12.55	112.1	6.63	13.06	0.135	0.377	0.032	0.261
16:07	56.6	211.6	30.0	7.09	12.49	102.6	7.53	12.11	0.136	0.366	0.031	0.255
16:08	54.3	210.3	31.7	7.54	12.14	106.1	7.00	12.66	0.135	0.376	0.034	0.253
16:09	57.1	212.4	32.4	7.28	12.42	114.1	6.44	13.24	0.139	0.372	0.035	0.262
16:10	56.9	212.8	30.8	6.99	12.61	107.7	5.97	12.68	0.136	0.365	0.032	0.257
16:11	49.4	213.0	30.4	7.09	12.55	106.0	7.06	12.62	0.119	0.368	0.032	0.254
16:12	40.8	213.7	30.6	7.05	12.56	105.2	6.87	12.75	0.098	0.369	0.032	0.249
16:13	35.3	216.2	30.6	6.89	12.73	104.9	7.02	12.57	0.084	0.369	0.032	0.251
16:14	30.3	214.5	30.0	7.01	12.57	100.4	7.24	12.40	0.072	0.369	0.031	0.244
16:15	26.9	212.4	29.6	7.17	12.47	103.4	6.98	12.68	0.065	0.370	0.031	0.247
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:15	47.3	213.8	30.5	7.16	12.49	108.2	6.92	12.75	0.114	0.372	0.032	0.257
16:16	25.6	211.6	27.9	7.15	12.46	100.7	7.18	12.49	0.062	0.368	0.030	0.244

BEST AVAILABLE COPY

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
16:17	25.1	211.8	28.0	7.25	12.38	100.9	6.96	12.71	0.061	0.370	0.030	0.240
16:18	23.7	213.1	28.4	7.14	12.49	100.3	7.04	12.62	0.057	0.370	0.030	0.240
16:19	22.1	212.7	27.9	7.14	12.51	102.2	7.06	12.62	0.053	0.369	0.029	0.245
16:20	21.8	213.1	27.1	7.08	12.54	98.2	7.40	12.29	0.052	0.368	0.028	0.241
16:21	21.9	209.7	27.7	7.26	12.35	95.5	7.43	12.19	0.053	0.367	0.030	0.235
16:22	20.7	208.9	26.4	7.49	12.19	99.3	7.26	12.38	0.051	0.372	0.029	0.242
16:23	21.1	209.0	24.7	7.51	12.17	97.9	7.46	12.17	0.052	0.373	0.027	0.242
16:24	22.6	211.2	25.3	7.49	12.21	101.1	7.14	12.50	0.056	0.376	0.027	0.244
16:25	23.5	212.9	25.4	7.33	12.33	96.7	7.37	12.28	0.058	0.375	0.027	0.237
16:26	22.9	210.8	25.5	7.47	12.20	95.4	7.48	12.13	0.057	0.375	0.028	0.236
16:27	23.9	211.4	26.0	7.48	12.21	95.7	7.49	12.19	0.059	0.376	0.028	0.237
16:28	24.3	207.5	26.1	7.64	12.04	87.7	7.94	11.69	0.061	0.374	0.029	0.225
16:29	24.0	204.3	26.7	7.83	11.89	90.2	7.60	11.97	0.061	0.373	0.030	0.225
16:30	24.8	208.5	27.2	7.73	12.04	95.7	7.15	12.52	0.062	0.378	0.030	0.231

AVERAGE VALUES FOR THE LAST 15 MINUTES

16:30	23.2	210.4	26.7	7.40	12.27	97.2	7.33	12.32	0.057	0.372	0.029	0.238

16:31	26.8	211.5	26.5	7.38	12.32	97.7	6.82	12.81	0.066	0.374	0.028	0.230
16:32	29.3	210.0	26.1	7.22	12.39	92.5	7.64	11.99	0.071	0.367	0.028	0.232
16:33	29.1	203.6	27.8	7.74	11.93	89.1	7.96	11.69	0.073	0.369	0.031	0.229
16:34	29.5	204.7	29.1	7.80	11.90	89.7	7.77	11.78	0.075	0.373	0.032	0.227
16:35	32.5	209.9	28.5	7.65	12.04	93.1	7.41	12.19	0.081	0.378	0.031	0.229
16:36	34.0	209.8	27.0	7.62	12.01	93.0	7.56	11.99	0.085	0.377	0.030	0.231
16:37	37.7	214.8	27.8	7.59	12.06	93.2	7.41	12.15	0.094	0.385	0.030	0.230
16:38	39.5	217.5	28.6	7.42	12.23	95.2	7.26	12.32	0.097	0.385	0.031	0.232
16:39	41.4	216.4	28.3	7.24	12.37	99.6	6.69	12.83	0.101	0.378	0.030	0.233
16:40	44.9	217.1	26.2	6.87	12.68	100.1	6.75	12.83	0.106	0.370	0.027	0.235
16:41	48.9	219.9	27.2	6.82	12.70	104.6	6.20	13.32	0.115	0.373	0.028	0.236
16:42	43.8	222.1	28.1	6.56	12.92	106.4	6.39	13.13	0.101	0.370	0.028	0.243
16:43	43.7	225.6	28.1	6.44	13.08	124.6	6.05	13.50	0.100	0.373	0.028	0.279
16:44	49.1	224.9	27.8	6.22	13.24	127.0	6.11	13.49	0.111	0.366	0.027	0.285
16:45	48.6	226.2	27.7	6.21	13.22	123.8	6.48	13.09	0.110	0.368	0.027	0.285

AVERAGE VALUES FOR THE LAST 15 MINUTES

16:45	38.6	215.6	27.6	7.12	12.47	102.0	6.97	12.61	0.092	0.374	0.029	0.242

16:46	48.1	223.2	27.1	6.42	13.01	122.5	6.53	13.07	0.110	0.368	0.027	0.283
16:47	46.6	223.7	26.9	6.56	12.90	118.2	6.85	12.71	0.108	0.372	0.027	0.279
16:48	44.8	222.0	26.8	6.78	12.68	124.0	6.39	13.16	0.105	0.375	0.028	0.284
16:49	44.6	220.4	25.6	6.67	12.82	125.0	6.37	13.23	0.104	0.370	0.026	0.286
16:50	47.3	219.5	23.7	6.50	12.97	125.8	6.10	13.49	0.109	0.364	0.024	0.282
16:51	47.8	222.9	22.9	6.44	13.06	124.8	6.12	13.49	0.110	0.368	0.023	0.280
16:52	46.0	224.9	23.1	6.31	13.17	127.6	5.75	13.86	0.105	0.368	0.023	0.280
16:53	44.8	224.8	22.6	6.08	13.39	122.8	6.31	13.30	0.100	0.362	0.022	0.279
16:54	40.7	223.7	23.5	6.38	13.13	129.4	5.50	14.12	0.093	0.368	0.024	0.279
16:55	43.9	224.7	21.9	5.95	13.54	125.3	6.00	13.63	0.098	0.359	0.021	0.279
16:56	43.4	227.2	22.2	6.08	13.39	124.6	5.93	13.67	0.097	0.366	0.022	0.276
16:57	40.7	224.6	22.5	6.17	13.30	122.4	5.97	13.62	0.092	0.364	0.022	0.272
16:58	39.9	221.1	21.3	6.18	13.29	126.1	5.68	13.93	0.088	0.359	0.021	0.275
16:59	40.8	219.8	20.2	6.05	13.48	129.8	5.67	13.94	0.091	0.354	0.020	0.283
17:00	42.6	221.3	20.6	6.00	13.44	119.7	6.48	13.12	0.095	0.355	0.020	0.276

END 2.2

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU

AVERAGE VALUES FOR THE LAST 15 MINUTES
17:00    44.1     222.9     23.4      6.30     13.17     124.5      6.11     13.49     0.100     0.365     0.023     0.280

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
17:00    38.3     215.7     27.0      7.00     12.60     108.0      6.83     12.79     0.091     0.371     0.028     0.254
------------------------------------------------------------------------------------------------------------------------
17:01    40.1     218.6     21.2      6.41     13.10     106.1      5.97     13.40     0.092     0.360     0.021     0.236
17:02    40.9     218.9     20.2      6.12     13.41      77.2     10.41      8.47     0.092     0.354     0.020     0.483
17:03    42.9     219.5     18.9      6.08     13.38      33.3     20.27      0.54     0.096     0.354     0.019     1.740
17:04    44.5     219.5     19.4      6.18     13.31      19.1     20.41      0.46     0.100     0.356     0.019     1.279
17:05    43.8     219.7     20.0      6.33     13.16      10.6     20.56      0.39     0.100     0.360     0.020     1.031
17:06    44.4     218.1     19.1      6.17     13.33       6.8     20.63      0.37     0.100     0.354     0.019     0.829
17:07    45.2     216.9     18.0      5.93     13.57       5.8     20.65      0.36     0.100     0.346     0.017     0.787
17:08    48.6     213.3     19.9      5.87     13.57       5.9     20.67      0.36     0.107     0.339     0.019     0.845
17:09    44.8     215.0     20.3      6.30     13.18       5.6     20.68      0.36     0.102     0.352     0.020     0.834
17:10    43.5     216.1     19.3      6.23     13.28       5.5     20.68      0.36     0.098     0.352     0.019     0.837
17:11    46.0     214.8     19.1      6.10     13.38       5.3     20.68      0.36     0.103     0.347     0.019     0.795
17:12    45.9     218.7     19.5      6.14     13.35       5.5     20.69      0.36     0.103     0.354     0.019     0.875
17:13    42.7     216.6     19.2      6.48     13.03       5.2     20.70      0.36     0.098     0.359     0.019     0.836
17:14    41.5     217.5     19.2      6.58     12.87       5.2     20.70      0.35     0.096     0.363     0.019     0.876
17:15    37.1     215.5     18.2      6.82     12.73       4.9     20.71      0.35     0.087     0.366     0.019     0.962

AVERAGE VALUES FOR THE LAST 15 MINUTES
17:15    43.5     217.3     19.4      6.25     13.24      20.1     18.96      1.79     0.098     0.354     0.019     0.883

17:16    36.7     215.3     17.8      6.76     12.75      22.4     17.13      3.48     0.086     0.364     0.018     0.619
17:17    34.8     213.7     18.6      6.95     12.57     107.3      7.30     12.41     0.083     0.366     0.019     0.262
17:18    32.8     213.8     19.2      7.21     12.39     122.1      6.49     13.18     0.080     0.373     0.020     0.281
17:19    32.4     214.6     19.2      6.93     12.65     128.7      6.24     13.43     0.077     0.367     0.020     0.291
17:20    33.6     215.9     18.4      6.52     13.04     139.7      5.55     14.07     0.078     0.358     0.019     0.302
17:21    36.7     216.2     18.1      6.16     13.36     128.4      6.28     13.34     0.083     0.350     0.018     0.292
17:22    35.7     217.4     18.7      6.21     13.28     131.7      6.00     13.62     0.081     0.353     0.019     0.294
17:23    36.1     219.8     19.6      6.03     13.45     126.6      6.51     13.10     0.081     0.353     0.019     0.292
17:24    35.4     220.8     20.0      6.23     13.23     133.5      5.86     13.77     0.080     0.360     0.020     0.295
17:25    34.7     222.4     21.2      6.10     13.43     139.5      5.66     13.95     0.078     0.359     0.021     0.304
17:26    37.5     223.1     20.6      5.76     13.71     137.8      5.77     13.83     0.082     0.352     0.020     0.302
17:27    38.0     222.8     19.7      5.93     13.54     143.4      5.45     14.15     0.084     0.356     0.019     0.308
17:28    39.8     219.9     19.2      5.83     13.66     138.8      5.87     13.76     0.088     0.348     0.019     0.306
17:29    40.1     214.9     18.9      5.90     13.53     140.2      5.74     13.86     0.089     0.342     0.018     0.307
17:30    40.7     212.2     19.3      6.10     13.40     133.8      6.37     13.24     0.091     0.342     0.019     0.306

AVERAGE VALUES FOR THE LAST 15 MINUTES
17:30    36.3     217.5     19.2      6.31     13.20     124.9      6.81     12.88     0.083     0.356     0.019     0.317

17:31    40.6     209.9     19.1      6.21     13.21     128.5      6.74     12.90     0.092     0.341     0.019     0.301
17:32    39.8     212.4     19.0      6.49     12.97     122.7      6.88     12.76     0.092     0.352     0.019     0.291
17:33    38.0     216.1     20.2      6.80     12.70     123.6      6.68     12.99     0.089     0.366     0.021     0.289
17:34    35.9     217.5     21.0      6.86     12.71     123.2      6.60     13.09     0.085     0.370     0.022     0.286
17:35    32.3     215.4     20.4      6.66     12.88     124.6      6.52     13.22     0.075     0.361     0.021     0.288
17:36    31.5     214.5     19.7      6.73     12.83     126.4      6.35     13.40     0.074     0.361     0.020     0.288
17:37    33.2     212.6     20.4      6.73     12.87     130.5      6.17     13.64     0.071     0.358     0.021     0.294
17:38    31.8     215.9     20.9      6.40     13.16     130.9      5.99     13.82     0.073     0.356     0.021     0.292
17:39    32.8     217.1     21.3      6.31     13.25     132.4      5.97     13.86     0.075     0.355     0.021     0.294
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Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
17:40	33.7	219.3	21.2	6.21	13.32	132.0	5.94	13.85	0.076	0.356	0.021	0.293
17:41	35.2	220.7	21.2	6.17	13.38	136.0	5.75	14.06	0.079	0.358	0.021	0.298
17:42	36.8	219.6	21.3	5.82	13.65	129.9	6.00	13.78	0.081	0.348	0.021	0.289
17:43	35.2	223.4	21.8	6.04	13.46	135.4	5.52	14.23	0.081	0.359	0.021	0.292
17:44	36.5	222.3	21.5	5.86	13.64	134.9	5.79	13.97	0.080	0.353	0.021	0.296
17:45	38.5	220.4	21.2	5.65	13.78	131.8	5.78	13.94	0.084	0.345	0.020	0.289
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:45	35.3	217.1	20.7	6.33	13.19	129.5	6.18	13.57	0.080	0.356	0.021	0.292
17:46	37.3	219.7	21.1	5.83	13.63	136.2	5.45	14.28	0.082	0.348	0.020	0.293
17:47	35.8	217.5	19.1	5.69	13.78	133.6	5.77	13.98	0.078	0.342	0.018	0.293
17:48	36.0	214.4	18.0	5.89	13.56	136.6	5.55	14.15	0.080	0.341	0.017	0.295
17:49	35.9	219.2	18.1	5.78	13.69	135.7	5.69	14.00	0.079	0.346	0.017	0.296
17:50	35.8	219.1	18.1	5.85	13.58	139.3	5.53	14.14	0.079	0.348	0.017	0.301
17:51	34.6	216.1	17.4	5.88	13.59	149.4	5.17	14.50	0.077	0.344	0.017	0.315
17:52	39.5	214.2	16.3	5.43	14.00	140.0	5.93	13.74	0.085	0.331	0.015	0.311
17:53	41.1	212.4	17.2	5.70	13.69	154.7	5.13	14.51	0.090	0.334	0.016	0.326
17:54	41.5	209.3	16.7	5.55	13.88	148.8	5.48	14.18	0.090	0.326	0.016	0.320
17:55	44.0	211.4	16.3	5.58	13.80	144.6	5.53	14.13	0.095	0.329	0.015	0.313
17:56	41.0	212.7	16.1	5.82	13.62	150.1	5.15	14.48	0.090	0.337	0.016	0.316
17:57	42.4	213.1	15.7	5.54	13.88	144.0	5.70	13.98	0.092	0.331	0.015	0.315
17:58	43.3	214.7	16.1	5.64	13.74	142.0	5.70	13.97	0.094	0.336	0.015	0.310
17:59	41.8	214.5	16.8	5.78	13.62	147.9	5.20	14.45	0.092	0.339	0.016	0.313
18:00	41.6	214.2	16.5	5.66	13.77	146.1	5.49	14.19	0.091	0.336	0.016	0.315
AVERAGE VALUES FOR THE LAST 15 MINUTES												
18:00	39.4	214.9	17.3	5.71	13.72	143.3	5.50	14.18	0.086	0.338	0.017	0.309
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
18:00	38.6	216.7	19.2	6.15	13.34	104.5	9.36	10.60	0.087	0.351	0.019	0.450
18:01	42.7	213.6	16.6	5.60	13.81	140.0	5.81	13.88	0.093	0.333	0.016	0.308
18:02	41.4	216.0	16.7	5.76	13.65	147.3	4.94	14.70	0.091	0.341	0.016	0.306
18:03	40.4	216.0	16.1	5.57	13.89	138.4	5.82	13.86	0.087	0.337	0.015	0.305
18:04	41.7	214.1	17.0	5.67	13.68	130.6	6.19	13.51	0.091	0.336	0.016	0.295
18:05	39.6	216.3	17.5	6.03	13.39	133.2	5.68	13.96	0.088	0.347	0.017	0.291
18:06	37.0	212.4	17.7	6.08	13.40	146.0	4.95	14.72	0.083	0.342	0.017	0.304
18:07	38.1	212.7	16.8	5.58	13.88	142.0	5.36	14.32	0.083	0.332	0.016	0.303
18:08	41.8	218.1	16.4	5.47	13.95	139.4	5.40	14.28	0.090	0.338	0.015	0.299
18:09	40.6	219.4	17.0	5.45	13.98	134.2	6.00	13.72	0.087	0.339	0.016	0.299
18:10	39.3	218.3	16.6	5.70	13.72	132.9	5.83	13.87	0.086	0.343	0.016	0.293
18:11	37.8	219.6	17.5	5.93	13.55	130.7	6.05	13.68	0.084	0.350	0.017	0.292

COMMENTS: End of Test 2-2

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 2/ Pre-test 3 Calibration Bias Check Unit 2

DATE : 10-25-1989 TIME: 18:12 - 18:40

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.7
1	OUTLET	ppmSO2	49.6	49.8
3	OUTLET	ppmNOX	0.0	1.6
3	OUTLET	ppmNOX	240.0	238.3
4	OUTLET	ppmCO	0.0	0.1
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.00
2	OUTLET	% O2	11.93	11.60
5	OUTLET	% CO2	0.00	0.10
5	OUTLET	% CO2	11.06	11.36
6	INLET	ppmSO2	0.0	5.3
6	INLET	ppmSO2	218.0	216.4
7	INLET	% O2	0.00	0.02
7	INLET	% O2	11.93	11.76
8	INLET	% CO2	0.00	0.38
8	INLET	% CO2	11.06	11.22

Palm Beach Co. Solid Waste Authority Compliance   10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
18:54	41.1	204.5	26.8	7.19	12.45	99.1	7.48	12.26	0.099	0.356	0.028	0.245
18:55	38.8	203.7	29.4	7.43	12.29	96.1	7.46	12.24	0.096	0.361	0.032	0.237
18:56	37.4	202.0	29.6	7.39	12.30	92.3	7.84	11.88	0.092	0.357	0.032	0.235
18:57	33.9	199.0	30.2	7.71	11.98	37.8	8.12	11.62	0.085	0.360	0.033	0.228
18:58	32.8	196.9	30.9	7.97	11.77	89.8	7.90	11.81	0.084	0.364	0.035	0.229
18:59	32.2	195.2	30.9	8.00	11.77	94.6	7.59	12.12	0.083	0.361	0.035	0.236
19:00	30.7	195.5	30.8	7.88	11.87	92.1	7.73	11.97	0.078	0.359	0.034	0.232
19:01	30.9	198.9	29.9	7.91	11.88	102.3	7.04	12.69	0.079	0.366	0.033	0.245
19:02	35.8	204.1	28.3	7.40	12.32	103.2	6.95	12.73	0.088	0.361	0.030	0.246
19:03	39.2	206.7	28.1	7.23	12.44	111.2	6.37	13.32	0.095	0.361	0.030	0.254
19:04	41.8	212.1	27.2	6.80	12.83	112.3	6.57	13.14	0.098	0.359	0.028	0.260
19:05	45.8	212.1	26.9	6.69	12.88	108.5	6.65	13.04	0.107	0.356	0.027	0.253
19:06	47.5	214.5	26.8	6.73	12.89	110.9	6.51	13.17	0.111	0.362	0.027	0.256
19:07	48.8	215.4	26.3	6.57	12.99	109.5	6.58	13.09	0.113	0.359	0.027	0.254
19:08	45.5	215.2	26.1	6.77	12.83	116.5	6.05	13.64	0.107	0.364	0.027	0.261
19:09	48.4	214.6	23.4	6.47	13.13	116.6	6.16	13.53	0.111	0.355	0.024	0.263
19:10	50.7	215.0	21.6	6.41	13.17	107.7	6.96	12.71	0.116	0.354	0.022	0.256
19:11	49.5	214.4	22.3	6.70	12.85	112.2	6.55	13.12	0.116	0.360	0.023	0.260
19:12	48.2	213.6	23.3	6.78	12.83	114.6	6.47	13.22	0.113	0.361	0.024	0.264
19:13	47.0	213.7	23.7	6.65	12.95	114.4	6.45	13.24	0.110	0.358	0.024	0.263
19:14	44.3	215.6	23.7	6.68	12.95	120.0	6.06	13.64	0.103	0.362	0.024	0.268
19:15	43.5	216.3	22.7	6.33	13.28	117.1	6.35	13.36	0.099	0.355	0.023	0.267
19:16	41.8	214.2	22.4	6.43	13.15	113.8	6.52	13.21	0.096	0.353	0.022	0.263
19:17	39.8	213.3	22.8	6.65	12.97	118.2	6.05	13.66	0.093	0.357	0.023	0.264
19:18	39.1	216.4	22.6	6.43	13.22	119.9	6.10	13.57	0.090	0.357	0.023	0.269
19:19	38.0	214.7	22.5	6.26	13.29	116.3	6.05	13.65	0.086	0.350	0.022	0.260
19:20	33.6	212.9	21.6	6.39	13.24	120.3	5.91	13.77	0.077	0.350	0.022	0.266

AVERAGE VALUES FOR THE LAST 15 MINUTES

19:20	44.4	214.6	23.4	6.55	13.05	115.2	6.32	13.37	0.103	0.357	0.024	0.262

AVERAGE VALUES FOR THE LAST HOUR: 27 MINUTES OF VALID DATA

19:20	41.0	209.3	26.0	6.96	12.69	108.0	6.76	12.94	0.097	0.359	0.027	0.253

19:21	34.9	211.6	21.2	6.11	13.44	110.0	6.57	13.14	0.078	0.342	0.021	0.255
19:22	31.1	211.9	22.5	6.48	13.09	114.0	6.23	13.47	0.072	0.351	0.023	0.258
19:23	27.9	214.0	22.2	6.51	13.13	120.2	5.88	13.82	0.064	0.355	0.022	0.266
19:24	27.8	216.2	22.9	6.19	13.41	113.6	6.39	13.33	0.063	0.351	0.023	0.260
19:25	24.7	216.8	22.8	6.40	13.20	117.6	5.88	13.84	0.057	0.357	0.023	0.260
19:26	22.7	216.9	22.6	6.34	13.32	118.0	5.94	13.78	0.052	0.356	0.023	0.262
19:27	22.9	215.5	21.6	6.20	13.41	119.2	6.01	13.72	0.052	0.350	0.021	0.266
19:28	22.8	216.3	21.2	6.14	13.47	119.7	5.78	13.97	0.051	0.350	0.021	0.263
19:29	22.9	218.7	21.9	6.14	13.50	118.2	6.04	13.73	0.052	0.354	0.022	0.264
19:30	22.4	217.5	21.9	6.19	13.41	121.8	5.76	14.01	0.051	0.353	0.022	0.267
19:31	23.8	218.1	21.0	6.11	13.53	120.2	6.06	13.71	0.053	0.352	0.021	0.269
19:32	25.1	216.6	20.5	6.17	13.43	116.7	6.06	13.74	0.057	0.351	0.020	0.266
19:33	26.1	216.9	20.4	5.24	13.39	125.8	5.60	14.19	0.059	0.353	0.020	0.273
19:34	28.9	217.8	20.3	6.00	13.64	123.7	5.78	14.01	0.064	0.349	0.020	0.272
19:35	29.8	217.6	20.8	5.99	13.60	120.3	5.95	13.91	0.066	0.349	0.020	0.265

AVERAGE VALUES FOR THE LAST 15 MINUTES

19:35	26.3	216.2	21.6	6.21	13.40	118.7	5.99	13.76	0.059	0.352	0.021	0.264

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
19:36	29.6	215.5	19.9	6.11	13.51	118.5	6.35	13.43	0.066	0.348	0.020	0.270
19:37	30.8	213.0	17.6	6.06	13.49	108.5	6.93	12.86	0.069	0.343	0.017	0.258
19:38	31.1	211.5	19.6	6.68	12.92	119.4	6.03	13.76	0.073	0.355	0.020	0.267
19:39	28.5	208.1	21.2	6.62	13.05	112.5	6.80	13.00	0.066	0.348	0.022	0.265
19:40	30.6	214.9	21.0	6.67	12.95	114.1	6.83	12.99	0.071	0.361	0.021	0.269
19:41	32.8	213.1	21.2	6.87	12.79	109.7	7.02	12.78	0.078	0.363	0.022	0.263
19:42	33.8	210.4	20.2	7.09	12.59	107.5	7.29	12.47	0.081	0.364	0.021	0.262
19:43	35.3	208.8	19.8	7.34	12.34	114.1	6.70	13.10	0.086	0.368	0.021	0.267
19:44	35.9	217.5	19.7	7.42	12.40	149.7	4.33	15.37	0.088	0.385	0.021	0.300
19:45	46.1	222.0	20.4	5.84	13.93	178.4	3.37	16.22	0.101	0.352	0.020	0.338
19:46	58.8	212.3	34.1	4.52	15.02	178.4	3.84	15.78	0.119	0.310	0.030	0.347
19:47	64.3	216.5	48.9	4.37	15.07	169.8	3.97	15.62	0.129	0.313	0.043	0.333
19:48	61.7	215.0	30.1	4.46	14.98	171.8	4.10	15.49	0.125	0.312	0.027	0.339
19:49	62.2	207.4	24.8	4.24	15.13	148.0	4.91	14.77	0.124	0.297	0.022	0.307
19:50	57.2	213.2	19.2	5.04	14.42	144.0	5.31	14.39	0.120	0.321	0.018	0.307
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:50	42.6	213.3	23.8	5.95	13.64	136.3	5.59	14.14	0.093	0.343	0.023	0.293
19:51	53.1	213.7	17.0	5.22	14.27	143.1	5.16	14.55	0.112	0.325	0.016	0.302
19:52	47.0	210.2	19.1	5.55	13.99	144.7	4.92	14.80	0.102	0.327	0.018	0.301
19:53	44.0	210.4	15.2	5.35	14.22	141.2	5.25	14.47	0.094	0.323	0.014	0.300
19:54	42.6	208.4	13.1	5.48	14.06	140.5	5.20	14.53	0.092	0.323	0.012	0.297
19:55	39.4	207.0	13.1	5.54	14.04	139.7	5.28	14.45	0.085	0.322	0.012	0.297
19:56	36.7	205.3	12.8	5.52	14.05	133.6	5.78	13.99	0.079	0.319	0.012	0.293
19:57	34.9	206.9	12.9	5.84	13.75	144.5	4.76	14.98	0.077	0.328	0.012	0.297
19:58	31.0	205.9	13.0	5.69	14.00	142.8	4.92	14.79	0.068	0.323	0.012	0.297
19:59	32.1	205.3	13.1	5.34	14.25	132.4	5.53	14.24	0.069	0.315	0.012	0.286
20:00	31.0	207.3	13.8	5.60	13.98	132.5	5.33	14.43	0.067	0.324	0.013	0.283
20:01	29.7	207.5	13.8	5.65	13.99	129.9	5.63	14.16	0.065	0.325	0.013	0.282
20:02	31.9	208.8	14.3	5.70	13.91	126.0	5.59	14.18	0.070	0.328	0.014	0.273
20:03	29.3	208.6	14.4	5.89	13.77	129.3	5.58	14.20	0.065	0.332	0.014	0.280
20:04	29.2	207.1	13.8	5.80	13.83	125.8	5.81	14.00	0.064	0.328	0.013	0.277
20:05	30.6	207.3	14.3	5.93	13.71	122.8	5.89	13.89	0.068	0.331	0.014	0.272
AVERAGE VALUES FOR THE LAST 15 MINUTES												
20:05	36.2	208.0	14.2	5.61	13.99	135.3	5.37	14.38	0.078	0.325	0.014	0.289
20:06	28.8	205.8	15.1	6.12	13.54	120.0	6.11	13.69	0.065	0.333	0.015	0.269
20:07	30.3	206.4	15.3	6.21	13.45	115.8	6.38	13.43	0.068	0.335	0.015	0.265
20:08	39.3	203.9	15.5	6.51	13.15	117.9	6.23	13.57	0.091	0.338	0.016	0.267
20:09	33.0	203.5	15.3	6.65	13.04	117.6	6.36	13.45	0.077	0.341	0.016	0.269
20:10	25.5	205.0	15.4	6.66	13.02	105.6	7.04	12.75	0.059	0.344	0.016	0.253
20:11	23.1	203.8	16.0	7.11	12.60	114.0	6.30	13.53	0.056	0.353	0.017	0.259
20:12	23.7	205.2	15.1	6.87	12.87	113.8	6.27	13.55	0.056	0.349	0.017	0.258
20:13	23.1	207.1	16.0	6.74	12.98	110.8	6.58	13.22	0.054	0.349	0.016	0.257
20:14	25.1	203.7	15.7	6.74	12.95	110.7	6.57	13.24	0.059	0.343	0.016	0.257
20:15	27.6	205.4	16.1	6.84	12.86	105.2	7.28	12.51	0.065	0.349	0.017	0.256
20:16	28.2	202.9	16.4	7.07	12.63	114.1	6.44	13.38	0.068	0.350	0.017	0.262
20:17	31.7	205.2	17.0	7.06	12.71	119.7	6.24	13.56	0.076	0.354	0.018	0.271
20:18	38.5	206.0	16.9	6.68	13.04	117.5	6.45	13.34	0.090	0.346	0.017	0.270
20:19	46.3	205.5	16.5	6.60	13.07	119.7	6.43	13.36	0.108	0.343	0.017	0.275
20:20	56.3	205.7	16.7	6.62	13.06	115.8	6.66	13.12	0.131	0.344	0.017	0.270

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:20     32.0     205.0     16.0     6.70     13.00     114.5     6.49     13.31     0.075     0.345     0.016     0.264

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
20:20     34.3     210.6     18.9     6.12     13.51     126.2     5.86     13.90     0.076     0.341     0.019     0.278
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20:21     61.0     203.9     17.9     6.78     12.88     116.0     6.63     13.15     0.143     0.345     0.018     0.270
20:22     66.8     204.9     17.5     6.87     12.81     111.5     6.94     12.85     0.158     0.349     0.018     0.265
20:23     73.5     205.9     17.7     6.96     12.70     107.8     7.36     12.41     0.175     0.353     0.018     0.264
20:24     71.3     204.5     18.3     7.23     12.46     112.4     6.85     12.96     0.173     0.357     0.019     0.266
20:25     71.6     205.4     18.1     7.28     12.49     122.5     6.17     13.63     0.175     0.360     0.019     0.276
20:26     72.1     207.2     17.8     6.77     12.95     117.0     6.80     13.01     0.169     0.350     0.018     0.275
20:27     63.7     206.8     18.1     6.78     12.86     110.8     7.17     12.61     0.150     0.350     0.019     0.268
20:28     51.0     205.9     19.5     7.04     12.62     110.6     7.02     12.77     0.122     0.355     0.020     0.265
20:29     41.8     205.8     20.1     7.22     12.49     107.8     7.26     12.50     0.102     0.359     0.021     0.262
20:30     35.4     201.5     19.7     7.27     12.42     104.9     7.62     12.12     0.086     0.353     0.021     0.262
20:31     32.5     195.0     19.6     7.55     12.17     102.9     7.57     12.17     0.081     0.349     0.021     0.256
20:32     29.5     193.9     19.4     7.70     12.06     105.2     7.39     12.35     0.074     0.351     0.021     0.258
20:33     28.7     195.1     19.2     7.66     12.11     108.4     7.43     12.29     0.072     0.352     0.021     0.267
20:34     29.1     194.8     18.8     7.54     12.17     107.1     7.41     12.32     0.072     0.348     0.020     0.264
20:35     29.3     197.3     19.3     7.52     12.20     109.8     7.25     12.49     0.073     0.352     0.021     0.267

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:35     50.5     201.9     18.7     7.21     12.49     110.3     7.13     12.64     0.122     0.352     0.020     0.266

20:36     29.4     198.8     19.6     7.58     12.16     116.5     6.94     12.80     0.073     0.356     0.021     0.277
20:37     30.9     202.6     20.3     7.32     12.38     116.1     6.95     12.78     0.075     0.356     0.022     0.276
20:38     30.4     206.0     20.8     7.20     12.47     111.1     7.37     12.34     0.074     0.359     0.022     0.273
20:39     30.1     201.7     20.9     7.31     12.35     115.1     7.03     12.69     0.074     0.354     0.022     0.276
20:40     29.3     200.9     21.8     7.41     12.29     111.2     7.33     12.38     0.072     0.356     0.024     0.272
20:41     29.7     200.6     21.4     7.48     12.22     115.6     7.08     12.66     0.074     0.357     0.023     0.278
20:42     34.6     204.6     21.2     7.40     12.30     114.5     7.25     12.47     0.085     0.362     0.023     0.278
20:43     37.9     207.7     21.8     7.42     12.28     114.5     6.96     12.77     0.093     0.368     0.023     0.273
20:44     40.1     208.7     22.9     7.35     12.34     117.6     6.94     12.77     0.098     0.368     0.025     0.280
20:45     40.2     212.3     22.2     7.22     12.44     112.2     7.33     12.38     0.097     0.371     0.024     0.274
20:46     35.6     211.2     22.5     7.25     12.39     112.6     7.01     12.70     0.086     0.370     0.024     0.269
20:47     33.1     209.7     22.2     7.41     12.28     120.9     6.60     13.14     0.081     0.371     0.024     0.281
20:48     37.2     210.7     21.4     7.20     12.49     117.6     7.03     12.69     0.090     0.367     0.023     0.281
20:49     38.7     211.5     20.7     7.06     12.57     122.8     6.50     13.23     0.093     0.365     0.022     0.283
20:50     36.4     216.7     20.2     6.96     12.71     125.6     6.45     13.29     0.087     0.371     0.021     0.269

AVERAGE VALUES FOR THE LAST 15 MINUTES
20:50     34.2     206.9     21.3     7.30     12.38     116.2     6.98     12.74     0.084     0.363     0.023     0.277

20:51     28.4     217.2     20.2     6.72     12.89     129.2     6.26     13.48     0.066     0.366     0.021     0.293
20:52     20.9     216.5     20.7     6.64     12.97     129.6     6.43     13.30     0.049     0.363     0.021     0.297
20:53     16.8     214.2     20.5     6.58     12.99     127.8     6.55     13.20     0.039     0.357     0.021     0.296
20:54     12.5     212.9     21.1     6.78     12.82     124.9     6.53     13.22     0.029     0.360     0.022     0.289
20:55      9.7     215.6     20.7     6.76     12.88     129.5     6.24     13.53     0.023     0.364     0.021     0.293
20:56     11.0     217.7     20.0     6.50     13.12     134.7     5.89     13.86     0.025     0.361     0.020     0.298
20:57     14.6     217.7     19.7     6.42     13.20     130.8     6.26     13.51     0.034     0.359     0.020     0.297
20:58     23.0     220.3     19.4     6.39     13.20     131.9     6.09     13.68     0.053     0.363     0.019     0.296
20:59     36.2     217.4     20.1     6.46     13.14     122.4     6.54     13.22     0.083     0.360     0.020     0.283
```

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
21:00	52.5	215.1	20.5	6.67	12.95	130.4	6.16	13.58	0.122	0.361	0.021	0.294
21:01	72.8	215.7	20.7	6.60	12.98	125.7	6.33	13.44	0.169	0.360	0.021	0.286
21:02	88.9	217.5	20.0	6.65	12.95	124.2	6.25	13.52	0.207	0.364	0.020	0.281
21:03	98.3	219.0	20.4	6.54	13.06	121.3	6.45	13.31	0.227	0.364	0.021	0.279
21:04	91.0	217.3	19.6	6.62	12.98	123.5	6.36	13.39	0.211	0.363	0.020	0.282
21:05	75.6	218.6	18.7	6.49	13.09	122.4	6.19	13.57	0.174	0.362	0.019	0.276
AVERAGE VALUES FOR THE LAST 15 MINUTES												
21:05	43.5	216.9	20.2	6.59	13.01	127.2	6.30	13.45	0.101	0.362	0.020	0.289

COMMENTS: End of Test 2-3

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 3 Calibration Bias Check Unit 2

DATE : 10-25-1989 TIME: 21:05 - 21:34

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.6
1	OUTLET	ppmSO2	49.6	53.9
3	OUTLET	ppmNOX	0.0	1.5
3	OUTLET	ppmNOX	240.0	240.3
4	OUTLET	ppmCO	0.0	0.5
4	OUTLET	ppmCO	24.8	21.2
2	OUTLET	% O2	0.00	0.00
2	OUTLET	% O2	11.93	11.73
5	OUTLET	% CO2	0.00	0.18
5	OUTLET	% CO2	11.06	11.44
6	INLET	ppmSO2	0.0	3.0
6	INLET	ppmSO2	218.0	213.5
7	INLET	% O2	0.00	0.05
7	INLET	% O2	11.93	11.68
8	INLET	% CO2	0.00	0.48
8	INLET	% CO2	11.06	11.30

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/25/89

RUN NUMBER: 2-SI-CEM-1 (INLET)

SPAN VALUES:
500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	1.2	3.2	0.40	6.7	1.10	0.70
SO2 UP-SCALE	219.3	215.3	-0.80	219.2	-0.02	0.78
O2 ZERO GAS	0.00	0.01	0.04	0.04	0.16	0.12
O2 UP-SCALE	11.96	11.77	-0.76	11.69	-1.08	-0.32
CO2 ZERO GAS	0.01	0.04	0.15	0.26	1.25	1.10
CO2 UP-SCALE	11.07	11.02	-0.25	11.14	0.35	0.60

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery

TEST DATE: 10/25/89

RUN NUMBER: 2-SI-CEM-2 (INLET)

SPAN VALUES:
500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	1.2	6.7	1.10	5.3	0.82	-0.28
SO2 UP-SCALE	219.3	219.2	-0.02	216.4	-0.58	-0.56
O2 ZERO GAS	0.00	0.04	0.16	0.02	0.08	-0.08
O2 UP-SCALE	11.96	11.69	-1.08	11.76	-0.80	0.28
CO2 ZERO GAS	0.01	0.26	1.25	0.38	1.85	0.60
CO2 UP-SCALE	11.07	11.14	0.35	11.22	0.75	0.40

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/25/89

RUN NUMBER: 2-SI-CEM-3 (INLET)

SPAN VALUES:
500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	1.2	5.3	0.82	3.0	0.36	-0.46
SO2 UP-SCALE	219.3	216.4	-0.58	213.5	-1.16	-0.58
O2 ZERO GAS	0.00	0.02	0.08	0.05	0.20	0.12
O2 UP-SCALE	11.96	11.76	-0.80	11.68	-1.12	-0.32
CO2 ZERO GAS	0.01	0.38	1.85	0.48	2.35	0.50
CO2 UP-SCALE	11.07	11.22	0.75	11.30	1.15	0.40

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

B. FIELD AND ANALYTICAL DATA

  2. Unit No. 2

    a. Dry Scrubber Inlet

      2. Hydrogen Chloride and Hydrogen Fluoride

Preliminary Field Data

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
LOCATION WEST PALM BEACH, FL
SAMPLING LOCATION UNITS 1 & 2 DRY SCRUBBER INLET

NO. OF PORTS 3
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 100 1/8"
NIPPLE LENGTH 12"
DEPTH OF DUCT 88 1/8"
WIDTH (RECTANGULAR DUCT) 88 1/8"

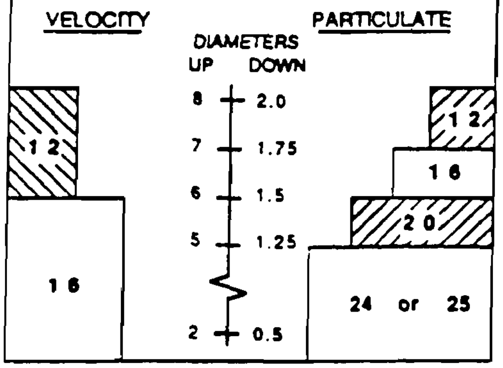
EQUIVALENT DIAMETER:
$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} =$ 88 1/8"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	5'	5'
DIAMETERS	<1	<1

STACK AREA = 88 1/8 x 88 1/8" = 7766 IN^2

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8"	20 7/8"
2	20.0	26 5/8"	38 5/8"
3	30.0	44"	56"
4	40.0	61 5/8"	73 5/8"
5	50.0	79"	91"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											98.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY ENVIRONMENTALISTS, INC.

ORSAT FIELD DATA

Plant Name North County Resource Recovery Facility

Sampling Location Unit #2 Dry Scrubber Inlet Fuel Type RDF

Run and/or Sample No. 2-DSI-M3-1 Leak Test? ✓ Date 10-25-89 Operator JRw

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1250	1500	12.2	19.3	—	7.1	—	80.7
↓	1515	12.1	19.2	—	7.1 ~~6.9~~ DGB	—	80.8
1420	1530	12.1	19.2	—	7.1 ~~6.9~~ DGB	—	80.8
	Avg.	12.1		Avg.	7.1 ~~7.0~~ DGB	—	80.8

Run and/or Sample No. 2-DSI-M3-2 Leak Test? ✓ Date 10-25-89 Operator JRw

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1600	1835	12.1	19.2	—	7.1	—	80.8
↓	1850	12.3	19.3	—	7.0	—	80.7
1800	1905	12.2	19.3	—	7.1	—	80.7
	Avg.	12.2		Avg.	7.1	—	80.7

Run and/or Sample No. 2-DSI-M3-3 Leak Test? ✓ Date 10-25-89 Operator JRw

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1920	2115	12.1	19.2	—	6.9	—	80.8
↓	2125	12.0	19.1	—	7.1	—	80.9
2030	2135	12.1	19.2	—	7.1	—	80.8
	Avg.	12.1		Avg.	7.1	—	80.8

F-1009
8/86

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NC RRRF
RUN NUMBER 2-DS1-M13B-1
ADDRESS W. PALM BCH, FL
TIME START 1300
SAMPLING LOCATION UNIT 2 DRY SCRUBBER INLET
TIME FINISH 1420
DATE 10-25-89
TEAM LEADER MJF
TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -2.75
TRAIN LEAK CHECK VACUUM IN. HG 15 12(F)
TRAIN LEAK RATE, CU.FT/MIN 0.002 0.003

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
— M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 89 PRE
✓ THERMOCOUPLE @ 93 POST

IDENTIFICATION NUMBERS

REAGENT BOX 2/3
NOZZLE ~~506~~ 606
DIAMETER ~~0.244~~ 0.263
METER BOX N5
T/C READOUT F21
UMBILICAL DU U9
T/C PROBE 10-33
SAMPLE BOX 42
ORSAT PUMP —
PROBE 9-8
PITOT —
TEDLAR BAG —

LEAK CHECK READINGS

B 1 R
B 2 R
B 3 R
B 4 R
B 5 R
B 6 R

FILTER #	TARE
WH, 541	—

DELTA H@ 1.90
METER TEMP 115
EST. %H_2O 16
C FACTOR 0.91
STACK TEMP 360
REF DELTA P ~~0.45~~ 0.61
K-FACTOR ~~2.16~~ 3.02

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O		GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES		STACK TEMP. °F	LK CHK #	STAT. PRES,
					IDEAL	ACTUAL			FILTER BOX °F	IMPINGER EXIT °F			
1	B 1	0	985.463	0.24	0.72	0.72	91	2	245	66	341		1,85
2	2	4	987.30	0.28	0.84	0.84	92	2	245	66	346		2,60
3	3	8	989.25	0.48	1.45	1.45	92	4	245	66	346		2,75
4	4	12	991.69	0.52	1.57	1.57	94	5	245	62	347		2.50
5	5	16	994.34	0.54	1.63	1.63	96	5	245	62	347		2.10
6	C 1	20/0	997.012	0.32	0.97	0.97	99	4	250	60	346		2.00
7	2	4	999.11	0.50	1.51	1.51	101	5	250	60	351		2,70
8	3	8	1001.69	0.50	1.51	1.51	104	6	250	60	351		3,20
9	4	12	4.40	0.35	1.06	1.06	106	5	250	60	349		2,45
10	5	16	6.53	0.43	1.30	1.30	107	6	250	60	350		2,60
11	A 1	40/0	8.937	0.30	0.90	0.90	109	5	250	60	350		2,50
12	2	4	11.25	0.85	2.56	2.56	112	11	250	60	356		3.00
13	3	8	14.54	0.88	2.65	2.65	114	12	250	60	356		3.60
14	4	12	17.86	0.75	2.26	2.26	115	11	250	60	351		2.75
15	5	16	21.05	0.64	1.93	1.93	117	10	250	60	348		3,30
16		60/OFF	1024.034										
17													
18													
19													
20													
21													
22													
23													
24													
25													

60	38.571	.4871	1.52	103	349
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF **RUN NUMBER** 2-DSI-M13B-2
ADDRESS W. PALM BCH., FL **TIME START** 1600
SAMPLING LOCATION UNIT 2 DRY SCRUBBER INLET **TIME FINISH** 1758
DATE 10-25-89 **TEAM LEADER** MH **TECHNICIANS** DPP
BAROMETRIC PRESSURE. IN. HG 30.0 **STATIC PRESSURE IN. H_2O** -2.8
TRAIN LEAK CHECK VACUUM IN. HG 15 12 ① 13 ② 14 ③ 14 Ⓕ
TRAIN LEAK RATE, CU.FT/MIN 0.003 0.003 0.003 0.003 0.003

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- — M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 92 PRE
- ✓ THERMOCOUPLE @ 90 POST

IDENTIFICATION NUMBERS

REAGENT BOX 213 NOZZLE ~~509~~ 604 DIAMETER 0.254
METER BOX N5 T/C READOUT F21
UMBILICAL U9 T/C PROBE 9-6
SAMPLE BOX 33 ORSAT PUMP —
PROBE 9-3 PITOT TEDLAR BAG —

LEAK CHECK READINGS

B1E	36.917 36.169 .748
B2E	8.895 38.883 .012
B3E	5.588 45.490 .088
B4E	4.252 54.233 .019
B5E	
B6E	

FILTER #	TARE
WH.541	—

DELTA $H_@$	1.90			
METER TEMP	115			
EST. $\%H_2O$	16			
C FACTOR	0.91			
STACK TEMP	360			
REF DELTA P	0.70			
K-FACTOR	2.63			

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #	STAT. PRES.
1	B1	0	24.216	0.36	0.94	0.44	98	2	245	65	350		2.80
2	2	4	26.26	0.52	1.37	1.37	98	2	245	65	360		3.00
3	3	8	28.82	0.54	1.42	1.42	98	2	245	65	361		3.0
4	4	12	31.69	0.38	1.00	1.00	100	2	245	65	360		3.2
5	5	16	33.63	0.59	1.55	1.55	102	2	245	65	359		3.05
6	A1	20/0	36.169	0.38	1.00	1.00	105	2	245	60	349	X	2.75
7	2	4	38.883	0.74	1.95	1.95	107	3	245	60	355	X	3.00
8	3	8	41.69	0.53	1.39	1.39	113	10	240	60	350		2.75
9	4	12	44.18	0.48	1.26	1.26	114	14	240	60	350	X	2.75
10	5	16	46.95	0.48	1.26	1.26	120	3	240	60	352		2.75
11	A1	40/0	49.230	0.45	1.18	1.18	123	5	240	60	347		2.50
12	2	4	51.68	0.90	2.37	2.37	123	11	240	60	354		2.40
13	3	8	54.233	0.84	2.21	2.21	123	3	250	63	350	X	
14	4	12	56.498										
15	5	16											
16		60/OFF											
17													
18													
19													
20													
21													
22													
23													
24													
25													

51	31.405	0.5416	1.45	110	354
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NC RRRF
RUN NUMBER 2-DSI-M13B-3
ADDRESS W. PALM BCH, FL
TIME START 1920
SAMPLING LOCATION UNIT 2 DSI
TIME FINISH 2026
DATE 10-25-89 TEAM LEADER MJ TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -2.60
TRAIN LEAK CHECK VACUUM IN. HG 15 15 ① 17 Ⓕ
TRAIN LEAK RATE, CU.FT/MIN 0.002 0.003 0.008

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- — M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 88 PRE
- ✓ THERMOCOUPLE @ 86 POST

IDENTIFICATION NUMBERS

REAGENT BOX 213 NOZZLE 606 DIAMETER 0.263
METER BOX N5 T/C READOUT F21
UMBILICAL U9 T/C PROBE 10-33
SAMPLE BOX 42 ORSAT PUMP —
PROBE 9-8 PITOT TEDLAR BAG —

LEAK CHECK READINGS

B 1 E	9.182 79.169 .013
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
WH. 541	—

DELTA $H_@$ 1.90
METER TEMP 115
EST. $\%H_2O$ 16
C FACTOR 0.91
STACK TEMP 360
REF DELTA P 0.62
K-FACTOR 2.97

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	B1	0	56.653	0.28	0.83	0.83	98	3	240	66	349	
2	2	4	58.58	0.30	0.89	0.89	98	4	240	66	353	
3	3	8	60.60	0.50	1.48	1.48	99	7	240	66	354	
4	4	12	63.15	0.39	1.16	1.16	99	6	240	62	353	
5	5	16	65.39	0.49	1.45	1.45	102	7	240	62	351	
6	C1	20/0	67.917	0.36	1.07	1.07	102	6	240	62	348	
7	2	4	70.32	0.53	1.57	1.57	104	6	245	62	349	
8	3	8	72.69	0.39	1.16	1.16	106	7	245	62	349	
9	4	12	74.95	0.28	0.83	0.83	107	6	245	62	344	
10	5	16	76.93	0.38	1.13	1.13	109	7	250	62	344	
11	A1	40/0	79.169	0.30	0.89	0.89	109	10	250	62	342	X
12	2	4	81.26	0.76	2.26	2.26	111	12	250	62	344	
13	3	8	84.14	0.74	2.20	2.05	112	14	250	62	342	
14	4	12	86.61	0.69	2.05	1.00	114	17	250	62	344	
15	5	16	87.048									
16		60/OFF										
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
53.5	30.382	.4429	1.27	105	348

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Facility EEI Ref# 6284

Sampling Location: Unit No. 2 Dry Scrubber Inlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0213

Run Number	2-SI-M13B-1	2-SI-M13B-2	2-SI-M13B-23
Run Date	10/25	10/25	10/25

ANALYSIS OF MOISTURE CATCH

Reagent 1 (0.1N NaOH)			
Final Weight, g.	448.5	426.5	525.0
Tared Weight, g.	296.0	296.0	400.0
Water Catch, g.	152.5	130.5	125.0
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch, g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	152.5	130.5	125.0
Silica Gel:			
Final Weight, g.	212.0	211.0	209.5
Tared Weight, g.	200.0	200.0	200.0
ADSORBED WATER, g.	12.0	11.0	9.5
TOTAL WATER COLLECTED, g.	164.5	141.5	134.5

HCl Analytical Data Sheet

Job Name: North County Regional Resource Facility
Analyst: F. Jones Job Num. 6284
Sampling Location: Unit No.2 Dry Scrubber Inlet Date: 11/17/89

Chloride Standard Calibration Curve by Linear Regression

Conc. (ug/ml)	Peak Area Run 1	Peak Area Run 2	% Diff.	Predicted Concentration (ug/ml)	Percent Deviation from Actual
5.00	9139	9012	0.70%	5.01	0.24%
10.00	18676	18047	1.71%	9.99	-0.15%
30.00	56382	55098	1.15%	30.00	0.01%
50.00	93979	93503	0.25%	50.35	0.71%

Standard Curve Slope 1867 Intercept -283

Method 13B Field Samples

Sample ID	Run 1 Area	Run 2 Area	Average	Percent Deviation	Dilution Factor	Sample Volume (ml)	HCl Catch (mg)
Blank	<454	<454	<454	0.00%	1	200	<0.08
2-SI-M13B-1	89573	90102	89838	0.29%	20	900	893.5
2-SI-M13B-2	72353	74036	73195	1.15%	20	1000	809.4
2-SI-M13B-3	53313	52617	52965	0.66%	20	1250	733.2

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-3-89
DATE REPORTED 11-29-89
89W8725

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC P.O. # 62840-8
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: DRY SCRUBBER INLET UNIT 2

1. 2-SI-M13B-1 FV 900
2. 2-SI-M13B-2 FV 1000
3. 2-SI-M13B-3 FV 1250
4. METHOD CODE

RESULTS

	1	2	3	4
Fluoride, as F, ug	11800	4200	7250	13B

ROGER C. OXFORD , CHEMIST

BEST AVAILABLE COPY

Entropy

11-6-89
8725
11-8-89
LD

	1	2	3	EPA Known
F	FV=900ml 25ml $\frac{100ug \times 1.55}{25} = 6.2ug/ml$ 5580ug $\frac{ugF \times \text{Meter Reading}}{ml\ sample} = ug/ml$	FV=1000ml 25ml $\frac{100ug \times .78}{25} = 3.12ug/ml$ 3120ug	FV=1250ml 25ml $\frac{100ug \times 1.15}{25} = 4.6\ ug/ml$ 5750ug	Actual Value=.21ug $\frac{10ug \times .56}{25} = .22ug/m$
Distilled F	200ml → 10ml $\frac{100ug \times 1.31}{10} = 13.1ug/ml$	200ml → 25ml $\frac{100ug \times 1.05}{25} = 4.2ug/ml$	200ml → 25ml $\frac{100ug \times 1.45}{25} = 5.8ug/ml$	→ 25m $\frac{10ug \times .53}{25} = .21ug/$

Blk	1ug/ml
200ml → 25ml $\frac{20ug \times .43}{25} = .344ug/ml$ 200ml → 25ml $\frac{20ug \times .50}{25} = .40ug/ml$	200ml → 25ml $\frac{50ug \times .50}{25} = 1.0\ ug/ml$ *Blanks distilled following samples #2+#3. Standard distilled behind

CUSTODY SHEET FOR REAGENT BOX # 0213

Date of Makeup 19 Oct 1989 Initials BJH Locked? ✓

Individual Tare of Reagent: 200 mls. of 0.1N NaOH

Individual Tare of Reagent: mls. of

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #2 DRY SCRUBBER INLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
2-DSI-M13B-1	10-25-89	SRD	✓	10-25-89	50%	SRD	✓
2-DSI-M13B-2	10-25-89	SRD	✓	10-25-89	50%	SRD	✓
2-DSI-M13B-3	10-25-89	SRD	✓	10-26-89	40%	PFD	✓

Received in Lab Date 10/30 Initials FJ Locked? ✓

Sampling Method: M13B

Remarks: DOUBLE CHARGED NaOH REAGENTS FOR 2-DSI-M13B-3

Zero & Span Balance Initials FJ

Filter #	Tare Weight (grams)	Used on Test
WHATMAN	541	

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 62840-8

JOB NAME: NORTH COUNTY RRRF.

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-2-89

EXPECTED DATE OF RESULTS: 11-16-89

SAMPLE MATRIX: M13B. Dry Scrubber Inlet. Unit 2.

TYPE OF ANALYSIS REQUESTED: Fluoride. See Rules & Regulations.

Sample#	Sample ID			
1	2-SI-M13B-1			
2	2-SI-M13B-2			
3	2-SI-M13B-3			

SUBMITTED BY: Richard Lebeau

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 6284 0-8 were shipped via Pony Express on 11-2-89 by RAI to OLI

Samples received at OLI on 11-3-89 by M. Congleton

Note any broken seals, leakage, spillage, and/or damage to the samples.

B. FIELD AND ANALYTICAL DATA

- 2. Unit No. 2
  - a. Dry Scrubber Inlet
    - 3. Particulate

Preliminary Field Data

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
LOCATION WEST PALM BEACH, FL
SAMPLING LOCATION UNITS 1 + 2 DRY SCRUBBER INLET

NO. OF PORTS 3
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 100 1/8"
NIPPLE LENGTH 12"
DEPTH OF DUCT 88 1/8"
WIDTH (RECTANGULAR DUCT) 88 1/8"

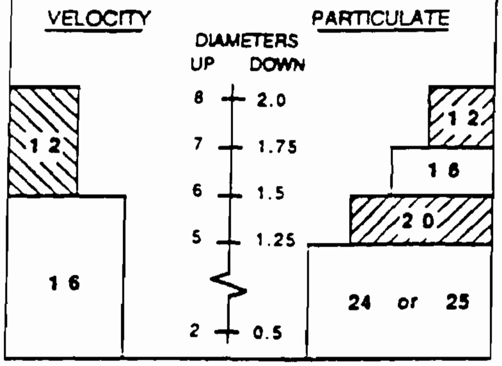
EQUIVALENT DIAMETER:
$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(\quad)(\quad)}{(\quad + \quad)} =$ 88 1/8"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	5'	5'
DIAMETERS	< 1	< 1

STACK AREA = 88 1/8 × 88 1/8" = 7766 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8"	20 7/8"
2	20.0	26 3/8"	38 3/8"
3	30.0	44"	56"
4	40.0	61 5/8"	73 5/8"
5	50.0	79"	91"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

F0003
4/24/89

NTROPY
NVIRONMENTALISTS, INC

ORSAT FIELD DATA

Plant Name NORTH COUNTY RRRF

Sampling Location UNIT 2 DRY SCRUBBER INLET Fuel Type RDF

Run and/or Sample No. 2-DSI-M3-1 Leak Test? ✓ Date 10-24 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1225	1415	10.7	19.2	—	8.5	—	
TO	To	10.7	19.2		8.5		
1349	1435	10.7	19.2		8.5		
	Avg.	10.7		Avg.	8.5		80.8

Run and/or Sample No. 2-DSI-M3-2 Leak Test? ✓ Date 10-24 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1522	1710	13.4	18.9	—	5.5	—	
TO	TO	13.4	18.9		5.5		
1642	1730	13.4	18.9		5.5		
	Avg.	13.4		Avg.	5.5		81.1

Run and/or Sample No. 2-DSI-M3-3 Leak Test? ✓ Date 10-24 Operator MH

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1824	2020	12.7	19.0	—	6.3	—	
TO	To	12.7	19.0		6.3		
1945	2040	12.7	19.0		6.3		
	Avg.	12.7		Avg.	6.3		81.0

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY RRRF
RUN NUMBER 2-DS1-M5-1
ADDRESS W. PALM BCH., FL.
TIME START 1225
SAMPLING LOCATION UNIT 2 DRY SCRUBBER INLET
TIME FINISH 1348
DATE 10-24-89
TEAM LEADER MW
TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.2
STATIC PRESSURE IN. H_2O -3.5
TRAIN LEAK CHECK VACUUM IN. HG 15 11 Ⓕ
TRAIN LEAK RATE, CU.FT/MIN 0.002 0.002

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 80 PRE
- ✓ THERMOCOUPLE @ 82 POST

IDENTIFICATION NUMBERS

REAGENT BOX 231
NOZZLE GL161
DIAMETER 0.260
METER BOX N5
T/C READOUT F21
UMBILICAL 21
T/C PROBE 9-8
SAMPLE BOX 13
ORSAT PUMP 16
PROBE 9-2
PITOT PT-21
TEDLAR BAG 21

LEAK CHECK READINGS

B 1 R	
B 2 R	
B 3 R	
B 4 R	
B 5 R	
B 6 R	

FILTER #	TARE
QUARTZ	0.4675

DELTA H@	1.90			
METER TEMP	105			
EST. %H_2O	16			
C FACTOR	0.90			
STACK TEMP	350			
REF DELTA P	0.65			
K-FACTOR	2.83			

FYRITE 10.5

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	754.737	0.40	1.13	1.13	96	2	225	65	345	
2	2	5	757.78	1.10	3.11	3.11	97	5	235	65	362	
3	3	10	762.20	1.01	2.86	2.86	99	5	240	65	362	
4	4	15	766.31	0.85	2.41	2.41	102	5	240	65	362	
5	5	20	770.35	0.89	2.52	2.52	104	6	240	65	362	
6	B 1	25/0	774.562	0.34	0.96	0.96	104	4	240	62	346	
7	2	5	777.25	0.39	1.10	1.10	105	4	240	62	360	
8	3	10	779.99	0.57	1.61	1.61	106	6	240	62	362	
9	4	15	783.35	0.39	1.10	1.10	108	6	240	62	360	
10	5	20	786.23	0.64	1.81	1.81	109	7	240	62	360	
11	C 1	50/0	789.907	0.50	1.42	1.42	109	6	240	62	366	
12	2	5	793.05	0.86	2.43	2.43	111	10	240	62	367	
13	3	10	797.16	0.69	1.95	1.95	112	10	240	62	367	
14	4	15	801.01	0.60	1.70	1.70	112	10	240	62	366	
15	5	20	804.53	0.60	1.70	1.70	113	10	240	62	365	
16		75/0	808.028									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
75	53.291	0.6350	1.85	106	361

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH COUNTY RRRF
RUN NUMBER 2-DSI-MS-2
ADDRESS W. PALM BCH., FL.
TIME START 1522
SAMPLING LOCATION UNIT 2 DRY SCRUBBER INLET
TIME FINISH 1642
DATE 10-24-89 TEAM LEADER MH TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.2
STATIC PRESSURE IN. H_2O -2.75
TRAIN LEAK CHECK VACUUM IN. HG 15 11(F)
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.004

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 85 PRE
- ✓ THERMOCOUPLE @ 85 POST

IDENTIFICATION NUMBERS

REAGENT BOX 231 NOZZLE GL87 DIAMETER 0.266
METER BOX N5 T/C READOUT F21
UMBILICAL 21 T/C PROBE 9-69
SAMPLE BOX 22 ORSAT PUMP 16
PROBE 9-4 PITOT PT-10 TEDLAR BAG 21

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	0.4608

DELTA H@	1.90			
METER TEMP	105			
EST. %H_2O	16			
C FACTOR	0.90			
STACK TEMP	360			
REF DELTA P	0.60			
K-FACTOR	3.07			

FYRITE 13.0

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A1	0	808.577	0.39	1.27	1.27	92	2	225	66	341	
2	2	5	811.69	0.85	2.61	2.61	94	3	225	66	344	
3	3	10	815.88	0.87	2.67	2.67	97	4	225	66	343	
4	4	15	820.00	0.90	2.76	2.76	100	5	225	66	352	
5	5	20	824.32	0.82	2.51	2.51	102	5	235	62	354	
6	B1	25/0	828.369	0.33	1.01	1.01	104	4	245	62	347	
7	2	5	831.11	0.46	1.41	1.41	106	5	250	62	353	
8	3	10	834.24	0.58	1.78	1.78	108	7	250	62	356	
9	4	15	837.69	0.36	1.10	1.10	109	7	250	62	357	
10	5	20	840.59	0.53	1.63	1.63	110	9	240	62	349	
11	C1	50/0	843.902	0.40	1.23	1.23	110	7	235	62	343	
12	2	5	846.82	0.65	1.99	1.99	112	10	235	62	338	
13	3	10	850.53	0.45	1.38	1.38	113	9	235	62	335	
14	4	15	853.69	0.37	1.13	1.13	114	9	235	62	332	
15	5	20	856.66	0.42	1.29	1.29	115	10	235	62	330	
16		75/OFF	859.648									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
75	51.071	.5418	1.72	106	345

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NORTH CO. RRRF
RUN NUMBER 2-~~D~~SI-MS-3
ADDRESS W. PALM BCH., FL.
TIME START 1824
SAMPLING LOCATION UNIT 2 DRY SCRUBBER INLET
TIME FINISH 1945
DATE 10-24-89 TEAM LEADER MJt
TECHNICIANS DPP
BAROMETRIC PRESSURE. IN. HG 30.2
STATIC PRESSURE IN. H_2O -2.75
TRAIN LEAK CHECK VACUUM IN. HG 15 12(F)
TRAIN LEAK RATE, CU.FT/MIN 0.005 0.003

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 82 PRE
- ✓ THERMOCOUPLE @ 80 POST

IDENTIFICATION NUMBERS

REAGENT BOX 231 NOZZLE GL161 DIAMETER 0.260
METER BOX NS T/C READOUT F21
UMBILICAL 21 T/C PROBE 9-8
SAMPLE BOX 13 ORSAT PUMP 16
PROBE 9-2 PITOT PT-21 TEDLAR BAG 21

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	0.4631

DELTA H@ 1.90
METER TEMP 105
EST. %H_2O 16
C FACTOR 0.90
STACK TEMP 360
REF DELTA P 0.65
K-FACTOR 2.83

FYRITE 11.0

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O		GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES		STACK TEMP. °F	LK CHK #
					IDEAL	ACTUAL			FILTER BOX °F	IMPINGER EXIT °F		
1	A 1	0	860.152	0.31	0.88	0.88	88	2	240	66	341	
2	2	5	862.69	0.69	1.95	1.95	88	2	235	66	347	
3	3	10	866.31	0.75	2.12	2.12	90	4	240	66	348	
4	4	15	870.18	0.62	1.76	1.76	94	5	235	66	346	
5	5	20	873.59	0.69	1.95	1.95	97	5	240	66	344	
6	B 1	25/0	877.231	0.29	0.82	0.82	98	5	240	61	342	
7	2	5	879.69	0.35	0.99	0.99	100	5	240	61	348	
8	3	10	882.35	0.39	1.10	1.10	103	5	240	61	349	
9	4	15	885.16	0.30	0.85	0.85	104	5	240	61	351	
10	5	20	887.75	0.46	1.30	1.30	105	6	240	61	350	
11	C 1	50/0	890.667	0.42	1.19	1.19	106	6	240	61	353	
12	2	5	893.64	0.71	2.01	2.01	108	10	240	65	356	
13	3	10	897.25	0.60	1.70	1.70	108	10	240	65	361	
14	4	15	900.69	0.50	1.42	1.42	108	10	240	65	360	
15	5	20	903.98	0.48	1.36	1.36	109	10	240	65	357	
16		75/OFF	907.093									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
75	46.941	0.4916	1.43	100	350

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 2 Dry Scrubber Inlet

Date Received: 10/31 Date Analyzed: 10/31 Reagent Box(es): 0231

Run Number	2-SI-M5-1	2-SI-M5-2	2-SI-M5-3
Run Date	10/24	10/24	10/24

ANALYSIS OF MOISTURE CATCH

Reagent 1 (5% HNO3/ 10% H2O2)			
Final Weight, g.	783.0	878.5	758.0
Tared Weight, g.	583.5	592.5	570.0
	==========	==========	==========
Water Catch, g.	199.5	286.0	188.0
Reagent 2 (4% KMnO4 / 10% H2SO4)			
Final Weight, g.	348.0	338.5	338.5
Tared Weight, g.	344.5	333.0	334.5
	==========	==========	==========
Water Catch, g.	3.5	5.5	4.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	203.0	291.5	192.0
Silica Gel:			
Final Weight, g.	213.5	212.5	221.0
Tared Weight, g.	200.0	200.0	200.0
	==========	==========	==========
ADSORBED WATER, g.	13.5	12.5	21.0
TOTAL WATER COLLECTED, g.	216.5	304.0	213.0

PARTICULATE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 2 Dry Scrubber Inlet

Date Received: 10/31 Date Analyzed: 11/8 Reagent Box(es): 0231

Run Number	2-SI-M5-1	2-SI-M5-2	2-SI-M5-3
Run Date	10/24	10/24	10/24
Sample ID/Container #	F / 1107	F / 1108	F / 1109
	==========	==========	==========
		87.2403	89.3531
	87.7073	✓87.2388	✓89.3526
	✓87.7071	87.2694	89.3538
	87.7102	87.2624	89.3552
	87.7122	87.3201	89.3675
Tare Weight., g.	78.0016	75.5484	82.1792
	==========	==========	==========
SAMPLE WT., g.	9.7055	11.6904	7.1734
Sample ID/Container #	R / 2561	R / 2567	R / 2568
	==========	==========	==========
	99.3322	96.6870	103.7965
	✓99.3319	✓96.6865	✓103.7962
	99.3344	96.6904	103.7989
	99.5590	97.8282	104.4375
Tare Wt., g.	98.6923	95.2781	103.2909
	==========	==========	==========
SAMPLE WT., g.	0.6396	1.4084	0.5053
Sum of Particulate, mg.	10345.1	13098.8	7678.7
Total Filter Tare, mg.	467.5	460.8	463.1
Blank Residue, mg.	(250 ml) 0.5	(350 ml) 0.7	(300 ml) 0.6
	==========	==========	==========
TOTAL PARTICULATE CATCH, mg.	9877.1	12637.3	7215.0

Blank Beaker #	2003
Final wt., mg.	99546.3
Tare wt., mg.	99545.9
Residue, mg.	0.4
Volume, ml.	200

---Legend---

✓ = Final Weight

L = Loose Particulate

F = Filter D = Dish

R = Rinse P = Pan

Notes and Comments

Concentration, mg/ml 0.002

ENTROPY

CUSTODY SHEET FOR REAGENT BOX # 0331

Date of Makeup 10/19 Initials FJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 5% HNO_3 / 10% H_2O_2

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #2 DRY SCRUBBER INLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
2-DSI-MS-1	10-24-89	PFD	✓	10-24-89	40%	PFD	✓
2-DSI-MS-2	10-24-89	PFD	✓	10-24-89	20%	PFD	✓
2-DSI-MS-3	10-24-89	PFD	✓	10-24-89	40%	PFD	✓

Received in Lab Date 10/31/89 Initials PR Locked? ✓

Sampling Method: MS

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	0.4675	2-DSI-MS-1
QUARTZ	0.4608	2-DSI-MS-2
QUARTZ	0.4631	2-DSI-MS-3

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0215

Date of Makeup 10/19 Initials FJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 5% HNO_3 / 10% H_2O_2

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 & 2 DRY SCRUBBER INLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-DSI-M5-FB	10-23-89	PFD	✓	10-23-89	—	PFD	✓
2-DSI-M5-FB	10-24-89	PFD	✓	10-24-89	—	PFD	✓

	Date	Initials	Locked?
Received in Lab	10/31/89	PR	✓

Sampling Method: M5

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	0.4675	1-DSI-M5-FB
QUARTZ	0.4664	2-DSI-M5-F

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX B.2.a.4

B. FIELD AND ANALYTICAL DATA
    2. Unit No. 2
        a. Dry Scrubber Inlet
            4. Sulfuric Acid Mist

Preliminary Field Data

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY
LOCATION WEST PALM BEACH, FL
SAMPLING LOCATION UNITS 1+2 DRY SCRUBBER INLET

NO. OF PORTS 3
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 100 1/8"
NIPPLE LENGTH 12"
DEPTH OF DUCT 88 1/8"
WIDTH (RECTANGULAR DUCT) 88 1/8"

EQUIVALENT DIAMETER:
$D_E = \frac{2 \times DEPTH \times WIDTH}{DEPTH + WIDTH} = \frac{2(\quad)(\quad)}{(\quad + \quad)} =$ 88 1/8"

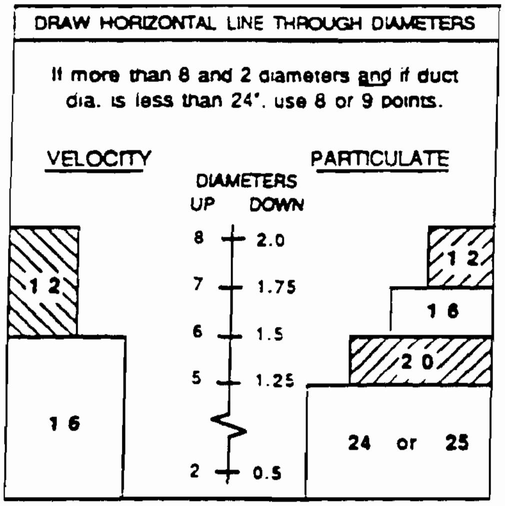
DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE

	UPSTREAM	DOWNSTREAM
	5'	5'
DIAMETERS	<1	<1

STACK AREA = 88 1/8 × 88 1/8" = 7766 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8"	20 7/8"
2	20.0	26 3/8"	38 3/8"
3	30.0	44"	56"
4	40.0	61 5/8"	73 5/8"
5	50.0	79"	91"
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

F0003
4/24/89

ENTROPY
ENVIRONMENTALISTS, INC

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRF RUN NUMBER D-DSI-M8-1
ADDRESS West Palm Beach Fla. TIME START 12:50
SAMPLING LOCATION Dry Scrubber Inlet TIME FINISH 14:20
DATE 10-25-89 TEAM LEADER DDH TECHNICIANS DP
BAROMETRIC PRESSURE. IN. HG 30.00 STATIC PRESSURE IN. H_2O -2.6
TRAIN LEAK CHECK VACUUM IN. HG 15" 13"
TRAIN LEAK RATE, CU.FT/MIN 0.0000 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 360 PRE
✓ THERMOCOUPLE @ 360 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0567 NOZZLE ~~606~~ 506 DIAMETER ~~.263~~ .241
METER BOX N 20 T/C READOUT F-5
UMBILICAL U19 T/C PROBE 9-20
SAMPLE BOX 25 ORSAT PUMP 18
PROBE 9-10 PITOT / TEDLAR BAG 25

LEAK CHECK READINGS

B 1	39.195
E 1	39.287
B 2	
E 2	
B 3	
E 3	
B 4	
E 4	
B 5	
E 5	
B 6	
E 6	

FILTER #	TARE
N/A	N/A

DELTA H@	1.813	1.813		
METER TEMP	~~100~~	90		
EST. %H_2O	16	16		
C FACTOR	.85	.85		
STACK TEMP	360	360		
REF DELTA P	~~.63~~	.89		
K-FACTOR	~~2.9206249~~	2.0624157		

FYRITE
11
11
11
11

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O		GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES		STACK TEMP. °F	LK CHK #
					IDEAL	ACTUAL			FILTER BOX °F	IMPINGER EXIT °F		
1	A 1	0	11.451	.34	.70	.70	89	2	250	41	345	
2	2	5	13.823	.85	1.76	1.76	88	3	250	43	355	
3	3	10	17.200	.81	1.67	1.67	90	3	250	43	357	
4	4	15	20.853	.76	1.57	1.57	91	3	250	44	357	
5	5	20	24.290	.77	1.59	1.59	92	4	250	44	359	
6	B 1	25/0	27.665	.32	.66	.66	95	5	250	44	353	
7	2	30	29.800	.35	.72	.72	97	8	250	44	363	
8	3	35	32.190	.43	.89	.89	98	11	250	44	355	
9	4	40	34.220	.36	.74	.74	98	12	250	44	356	
10	5	45	37.090	.51	1.05	.85	98	13	250	44	354	
11	C 1	50	39.287	.33	.68	.68	99	2	250	44	350	
12	2	55	41.540	.37	.76	.76	100	2	250	45	356	
13	3	60	43.900	.55	1.14	1.14	101	4	250	45	358	
14	4	65	46.750	.42	.87	.87	100	9	250	45	355	
15	5	70	49.200	.44	.91	.91	101	9	250	45	353	
16	OFF	75	51.902									
17												
18												
19												
20												
21												
22												
23												
24												
25												
			40.359									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
75	~~40.451~~	0.4916	1.03	96	355

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET 304

COMPANY NAME ACRRF RUN NUMBER 2-DSI-M8-2
ADDRESS West Palm Beach Fla. TIME START 16:00
SAMPLING LOCATION Dryer Scrubber Inlet TIME FINISH 18:03
DATE 10-25-89 TEAM LEADER DDH TECHNICIANS DDH DB
BAROMETRIC PRESSURE. IN. HG 30.00 STATIC PRESSURE IN. H_2O ~~-6.2~~ 2.6
TRAIN LEAK CHECK VACUUM IN. HG 15" 15"
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 360 PRE
- ✓ THERMOCOUPLE @ 360 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0567 NOZZLE 506 DIAMETER .241
METER BOX N-20 T/C READOUT F5
UMBILICAL U19 T/C PROBE 10-11
SAMPLE BOX 22 ORSAT PUMP 16
PROBE 9-1 PITOT ____ TEDLAR BAG 21

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
n/a	n/a

DELTA H@	1.813			
METER TEMP	100			
EST. %H_2O	16			
C FACTOR	.90			
STACK TEMP	360			
REF DELTA P	.84			
K-FACTOR	2.1904762			

FYRITE
11
11
11
11

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	59.054	.31	.68	.68	91	2	225	44	351	
2	2	4	61.500	1.00	2.19	2.19	92	2	235	45	364	
3	3	8	63.000	.80	1.75	1.75	98	2	240	45	360	
4	4	12	66.500	.80	1.75	1.75	98	2	240	45	360	
5	5	16	69.380	.90	1.97	1.97	99	5	245	45	364	
6	B 1	20/0	72.359	.28	.61	.61	100	5	250	45	358	
7	2	24	74.150	.43	.94	.94	100	5	250	45	358	
8	3	28	76.500	.44	.96	.96	100	5	250	46	359	
9	4	32	79.000	.32	.70	.70	100	5	250	46	359	
10	5	36	80.210	.55	1.20	1.20	100	5	250	46	359	
11	C 1	40/0	82.418	.40	.88	.88	101	7	250	46	359	
12	2	44	84.500	.69	1.51	1.51	102	10	250	46	355	
13	3	48	87.000	.45	.99	.99	103	11	250	46	352	
14	4	52	89.160	.38	.83	.83	103	10	250	46	350	
15	5	56	91.220	.37	.81	.81	105	11	250	46	348	
16	off	60	93.241									
17												
18												
19												
20												
21												
22												
23												
24												
25												

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
60	34.187	0.5192	1.19	99	357

.241

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ISOKINETIC TYPE FIELD DATA SHEET

305

COMPANY NAME NC RRRF
RUN NUMBER 2-DST-M8-3
ADDRESS West Palm Beach Fla.
TIME START 19:20
SAMPLING LOCATION Dryer Scrubber Inlet
TIME FINISH 20:30
DATE 10-25-89 TEAM LEADER DDH TECHNICIANS DP
BAROMETRIC PRESSURE. IN. HG 30.00 STATIC PRESSURE IN. H_2O -2.6
TRAIN LEAK CHECK VACUUM IN. HG 15" 13"
TRAIN LEAK RATE, CU.FT/MIN ~~0.000~~ 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 360 PRE
- ✓ THERMOCOUPLE @ 360 POST

IDENTIFICATION NUMBERS

REAGENT BOX 056 NOZZLE 506 DIAMETER .241
METER BOX N-20 T/C READOUT F-5
UMBILICAL U19 T/C PROBE 9-20
SAMPLE BOX 25 ORSAT PUMP 16
PROBE 9-10 PITOT — TEDLAR BAG 18

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
N/A	N/A

DELTA H@ 1.813
METER TEMP 100
EST. %H_2O 15
C FACTOR .90
STACK TEMP 360
REF DELTA P ~~506~~ .84
K-FACTOR 2.1904762

FYRITE
11
11
11
11

C_p .88

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	99.370	.32	.70	.70	90	2	235	44	350	
2	2	4	101.249	.80	1.75	1.75	91	5	245	44	356	
3	3	8	103.270	.87	1.91	1.91	92	5	250	44	357	
4	4	12	106.240	.84	1.84	1.84	94	6	250	44	355	
5	5	16	109.190	.71	1.56	1.56	94	5	250	44	355	
6	B 1	20	111.909	.34	.74	.74	93	4	250	45	348	
7	2	24	113.740	.39	.85	.85	95	4	250	45	358	
8	3	28	115.600	.40	.88	.88	97	8	250	47	354	
9	4	32	117.722	.35	.77	.77	97	8	250	47	360	
10	5	36	119.630	.59	1.29	1.29	97	10	250	47	360	
11	C 1	40	122.044	.36	.79	.79	98	8	250	47	362	
12	2	44	123.965	.63	1.38	1.38	95	10	250	47	358	
13	3	48	126.240	.60	1.31	1.31	95	13	250	47	359	
14	4	52	128.682	.40	.88	.88	95	10	250	47	356	
15	5	56	130.720	.44	.96	.96	99	11	250	47	360	
16	off	60	132.842									
17												
18												
19												
20												
21												
22												
23												
24												
25												

60	33472	0.5199	1.17	95	357
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI **Ref#** 6284

Sampling Location: Unit No. 2 Dry Scrubber Inlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0567

Run Number	2-SI-M8-1	2-SI-M8-2	2-SI-M8-3
Run Date	10/25	10/25	10/25

ANALYSIS OF MOISTURE CATCH

Reagent 1 (5% H2O2)			
Final Weight, g.	758.0	748.0	710.5
Tared Weight, g.	686.5	689.5	687.5
Water Catch,g.	71.5	58.5	23.0
Reagent 2 (80% IPA)			
Final Weight, g.	364.5	360.5	393.0
Tared Weight, g.	306.0	306.0	308.0
Water Catch,g.	58.5	54.5	85.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	130.0	113.0	108.0
Silica Gel:			
Final Weight, g.	429.5	427.5	425.5
Tared Weight, g.	400.0	400.0	400.0
ADSORBED WATER, g.	29.5	27.5	25.5
TOTAL WATER COLLECTED, g.	159.5	140.5	133.5

SULFURIC ACID (H2SO4) ANALYTICAL RESULTS

EPA REFERENCE METHOD

Company Name: NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY EEI #: 6284

Sampling Location: UNIT NO. 2 DRY SCRUBBER INLET

Date Analyzed: 11/28

Analyst: PR

Burette Size Used: 10 ml

Analytical Media: 80% IPA

RUN NUMBER	SAMPLE VOLUME mls (V)	ALIQUOT VOLUME mls (A)	ALIQUOT FACTOR (F)	TITRANT VOLUME mls (T1)	TITRANT VOLUME mls (T2)	TITRANT VOLUME mls (Tavg)	MASS H2SO4 mg (MH2SO4)
Reagent Blank	XXXXXX	20	XXXXXX	0.06	0.06	0.060	Tbavg
2-SI-M8-1	600	20	30.0	0.16	0.16	0.160	1.4
2-SI-M8-2	650	20	32.5	0.26	0.28	0.270	3.3
2-SI-M8-3	600	20	30.0	0.77	0.78	0.775	10.3

Where:

Tavg = (T + T) / 2

F = V / A

N = Volume H2SO4 * 0.02N / Volume BaCl2

MSO2 = 49.04 * (Tavg + Tbavg) * N * F

Titration Standardization against 0.02N H2SO4

H2SO4 Volume	BaCl2 Volume	BaCl2 Normality
5	10.25	0.0098
5	10.25	0.0098
5	10.20	0.0098
	Average	0.0098

For Run: 2-SI-M8-1

MH2SO4=49.04 *(0.160 - 0.06) * 0.0098 * 30

MH2SO4 = 1.4 mg

NOTE: Results reported to the nearest 0.1 mg. or four significant figures

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CUSTODY SHEET FOR REAGENT BOX # 0567

Date of Makeup 10/13 Initials MGJ Locked? ✓

Individual Tare of Reagent: 200 gms. of 5% H_2O_2

Individual Tare of Reagent: 84 gms. of 80% IPA

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION Unit #2 Dry Scrubber Inlet

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locke
2-DSI-M8-1	10-25-89	PFD	—	10-25-89	40%	PFD	—
2-DSI-M8-2	10-25-89	PFD	—	10-25-89	40%	PFD	—
2-DSI-M8-3	10-25-89	JRW	—	10-25-89	60	JRW	—

	Date	Initials	Locked?
Received in Lab	10/31/89	M	✓

Sampling Method: M8

Remarks: DOUBLE CHARGE SILICA GEL

Zero & Span Balance Initials M

Filter #	Tare Weight (grams)	Used on Test
Unnumbered, Untared		
"	"	

ENTROPY ENVIRONMENTALISTS, INC.

APPENDIX B.2.b.1

B. FIELD AND ANALYTICAL DATA

2. Unit No. 2

b. ESP Outlet

1. Beryllium

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility
LOCATION West Palm Beach FL
SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"
NIPPLE LENGTH 9"
DEPTH OF DUCT 88 1/2"
WIDTH (RECTANGULAR DUCT) 88 1/2"

EQUIVALENT DIAMETER:

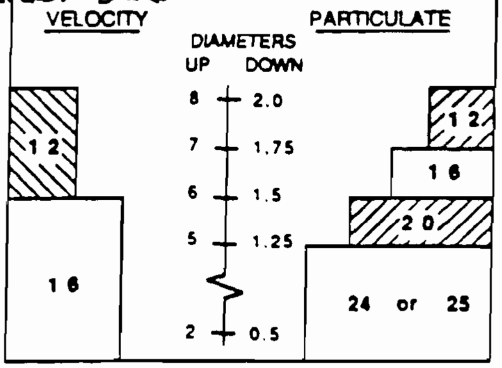
$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} = 88\tfrac{1}{2}"$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY
ENVIRONMENTALISTS, INC.

ORSAT FIELD DATA

Plant Name NORTH COUNTY RRRF

Sampling Location UNIT 2 ESP OUTLET Fuel Type RDF

Run and/or Sample No. 2-ESPO-M3-1 Leak Test? ✓ Date 10-24 Operator MP

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1145	1445	9.9	19.3	—	9.4	—	
To	To	10.0	19.4		9.4		
1400	1505	10.0	19.4		9.4		
	Avg.	10.0		Avg.	9.4		80.6

Run and/or Sample No. 2-ESPO-M3-2 Leak Test? ✓ Date 10-24 Operator MP

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1440	2000	12.0	19.1	—	7.1	—	
To	To	12.0	19.1		7.1		
1655	2020	12.0	19.1		7.1		
	Avg.	12.0		Avg.	7.1		80.9

Run and/or Sample No. 2-ESPO-M3-3 Leak Test? ✓ Date 10-24 Operator MP

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	$\%O_2$ B-A	%CO C-B	$\%N_2$ 100-C
1755	2040	12.2	19.2	—	7.0	—	
To	To	12.2	19.2		7.0		
2011	2100	12.2	19.2		7.0		
	Avg.	12.2		Avg.	7.0		80.8

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER 2 - ESPO-M104-1

ADDRESS West Palm Beach Fla TIME START 11:45

SAMPLING LOCATION Unit # 2 ESP Outlet Duct TIME FINISH 14:00

DATE 10-24-89 TEAM LEADER DDH TECHNICIANS DDH

BAROMETRIC PRESSURE. IN. HG 29.90 STATIC PRESSURE IN. H_2O -2.2

TRAIN LEAK CHECK VACUUM IN. HG 15" 10"

TRAIN LEAK RATE, CU.FT/MIN 0.001 0.001

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 250 PRE
- ✓ THERMOCOUPLE @ 250 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0569 NOZZLE 504 DIAMETER .266

METER BOX N7 T/C READOUT F-6

UMBILICAL U5 T/C PROBE 9-4

SAMPLE BOX 17 ORSAT PUMP 2

PROBE 9-9 PITOT — TEDLAR BAG 25

LEAK CHECK READINGS

B1	
E	
B2	
E	
B3	
E	
B4	
E	
B5	
E	
B6	
E	

FILTER #	TARE
n/A	n/A

					FYRITE
DELTA H@	1.780	1.780			11
METER TEMP	100	100			12
EST. %H_2O	~~18~~	23			11
C FACTOR	~~.80~~	.74			11
STACK TEMP	260	260			
REF DELTA P	~~.59~~	.65			
K-FACTOR	~~3.1186444~~	2.8307692		~~.88~~	C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	C 1	0	447.666	.60	1.70	1.70	90	2	230	48	259	
2	2	5	451.488	.62	1.76	1.76	92	2	235	49	259	
3	3	10	455.080	.58	1.64	1.64	92	3	240	50	258	
4	4	15	458.700	.53	1.50	1.50	92	3	240	52	258	
5	5	20	462.170	.51	1.44	1.44	92	3	240	52	259	
6	D 1	25/0	465.541	.68	1.92	1.92	90	3	264	52	247	
7	2	30	469.490	.58	1.64	1.64	92	3	261	52	261	
8	3	35	473.075	.69	1.95	1.95	93	3	275	52	261	
9	4	40	476.950	.70	1.98	1.98	94	3	270	52	262	
10	5	45	480.880	.68	1.92	1.92	95	3	260	52	261	
11	E 1	50/0	484.768	.50	1.42	1.42	95	3	253	52	258	
12	2	55	488.110	.65	1.84	1.84	96	3	253	52	258	
13	3	60	491.770	.61	1.73	1.73	96	3	250	53	262	
14	4	65	495.490	.60	1.70	1.70	97	3	250	53	262	
15	5	70	499.180	.69	1.95	1.95	98	3	250	52	260	
16	A 1	75/0	503.120	.60	1.70	1.70	97	3	250	52	259	
17	2	80	506.770	.60	1.70	1.70	98	3	250	50	259	
18	3	85	510.450	.62	1.76	1.76	98	3	250	51	256	
19	4	90	514.200	.68	1.92	1.92	100	3	250	52	258	
20	5	95	517.920	.76	2.15	2.15	100	3	250	52	259	
21	B 1	100/0	522.995	.72	2.04	2.04	100	3	250	52	250	
22	2	105	526.000	.64	1.81	1.81	100	3	250	53	260	
23	3	110	529.830	.57	1.61	1.61	100	3	250	52	260	
24	4	115	533.440	.51	1.44	1.44	100	3	250	51	260	
25	5	120	536.960	.56	1.59	1.59	100	3	250	51	260	
	Off	125	540.223									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	92.607	.6173	1.75	96	259

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER 2-ESPO-M104-2
ADDRESS West Palm Beach Fla.
TIME START 14:40
SAMPLING LOCATION Unit No. 2 ESP Outlet Duct
TIME FINISH 16:55
DATE 10-24-89 TEAM LEADER DDH
TECHNICIANS DDH
BAROMETRIC PRESSURE. IN. HG 29.90
STATIC PRESSURE IN. H_2O -6.4
TRAIN LEAK CHECK VACUUM IN. HG 15" 5"
TRAIN LEAK RATE, CU.FT/MIN 0.001 0.001

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
✓ M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 250 PRE
✓ THERMOCOUPLE @ 250 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0569 NOZZLE 605 DIAMETER 0.241
METER BOX N7 T/C READOUT F-6
UMBILICAL 115 T/C PROBE 9-5
SAMPLE BOX 37 ORSAT PUMP 2
PROBE 9-14 PITOT 43 TEDLAR BAG 15

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
N/A	N/A

DELTA H@ 1.780
METER TEMP 100
EST. %H_2O 23
C FACTOR .74
STACK TEMP 260
REF DELTA P .65 .74
K-FACTOR ~~2.8302692~~ 2.4864865

FYRITE
11
13
12
12

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	C 1	0	540.434	.48	1.19	1.19	92	2	260	38	258	
2	2	5	543.514	.61	1.52	1.52	93	2	260	44	259	
3	3	10	546.950	.60	1.49	1.49	95	2	258	45	258	
4	4	15	550.430	.44	1.09	1.09	96	2	259	44	259	
5	5	20	553.370	.40	.99	.99	97	2	260	44	259	
6	D 1	25/0	556.223	.47	1.17	1.17	94	2	260	44	258	
7	2	30	559.269	.49	1.22	1.22	97	2	250	45	261	
8	3	35	562.320	.61	1.52	1.52	98	2	250	46	261	
9	4	40	565.810	.64	1.59	1.59	95	2	250	46	261	
10	5	45	569.320	.66	1.64	1.64	96	2	250	47	261	
11	E 1	50/0	572.904	.40	.99	.99	96	2	250	47	260	
12	2	55	575.725	.62	1.54	1.54	96	2	250	47	260	
13	3	60	579.200	.60	1.49	1.49	96	2	250	48	262	
14	4	65	582.500	.71	1.76	1.76	100	3	250	49	262	
15	5	70	586.200	.68	1.69	1.69	100	3	255	51	263	
16	A 1	75/0	589.851	.33	.82	.82	97	3	255	51	255	
17	2	80	592.435	.53	1.32	1.32	97	3	256	51	261	
18	3	85	595.420	.50	1.24	1.24	97	3	260	51	261	
19	4	90	598.600	.52	1.29	1.29	97	3	260	51	262	
20	5	95	601.740	.60	1.49	1.49	97	3	260	50	262	
21	B 1	100/0	605.160	.45	1.12	1.12	99	3	260	51	262	
22	2	105	608.170	.50	1.24	1.24	100	3	260	51	256	
23	3	110	611.270	.45	1.12	1.12	100	3	260	51	255	
24	4	115	614.287	.50	1.24	1.24	100	3	260	51	256	
25	5	120	617.420	.52	1.29	1.29	100	3	260	51	259	
		125	620.575									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	80.141	0.5281	1.32	97	260

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER FPO-M04-3
ADDRESS West Palm Beach Fla.
TIME START 17:30
SAMPLING LOCATION Unit No. 2 ESP Outlet Duct
TIME FINISH 20:11
DATE 10-24-89 TEAM LEADER DDH
TECHNICIANS DDH
BAROMETRIC PRESSURE. IN. HG 29.96
STATIC PRESSURE IN. H_2O -5.0
TRAIN LEAK CHECK VACUUM IN. HG 15" 5"
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 260 PRE
- ✓ THERMOCOUPLE @ 260 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0569 NOZZLE 504 DIAMETER .266
METER BOX N-7
T/C READOUT F-6
UMBILICAL U5
T/C PROBE 9-4
SAMPLE BOX 17
ORSAT PUMP 2
PROBE 9-9 PITOT —
TEDLAR BAG 18

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
n/A	n/A

DELTA H@ 1.780
METER TEMP 100
EST. %H_2O 23
C FACTOR .74
STACK TEMP 260
REF DELTA P .65
K-FACTOR 2.8307692

FYRITE 12
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	C 1	0	621.121	.49	1.38	1.38	80	2	250	38	260	
2	2	5	624.280	.55	1.56	1.56	90	2	250	38	259	
3	3	10	627.710	.46	1.30	1.30	92	2	250	39	261	
4	4	15	631.120	.36	1.02	1.02	92	2	250	39	257	
5	5	20	633.930	.34	.96	.96	92	2	250	39	257	
6	D 1	25/0	636.525	.47	1.33	1.33	94	2	250	39	253	
7	2	30	639.780	.42	1.19	1.19	96	2	250	43	261	
8	3	35	642.800	.50	1.42	142	97	2	250	43	261	
9	4	40	646.175	.53	1.50	1.50	98	2	250	43	261	
10	5	45	649.700	.55	1.56	1.56	100	3	240	42	261	
11	E 1	50/0	653.097	.44	1.25	1.25	98	3	245	42	254	
12	2	55	656.266	.50	1.42	1.42	99	3	245	42	262	
13	3	60	659.655	.49	1.39	1.39	100	3	250	42	262	
14	4	65	662.291	.59	1.67	1.67	100	3	250	42	262	
15	5	70	666.600	.57	1.61	1.61	100	3	250	42	261	
16	A 1	75/0	670.199	.43	1.22	1.22	100	3	250	42	255	
17	2	80	673.355	.52	1.47	1.47	100	3	250	42	260	
18	3	85	676.660	.51	1.44	1.44	100	3	250	43	261	
19	4	90	680.099	.54	1.53	1.53	100	3	250	43	258	
20	5	95	683.585	.51	1.44	1.44	100	3	250	43	259	
21	B 1	100/0	687.994	.50	1.41	1.41	101	3	250	43	261	
22	2	105	690.360	.44	1.24	1.24	101	3	250	43	261	
23	3	110	693.750	.46	1.30	1.30	101	3	250	43	260	
24	4	115	697.020	.44	1.25	1.25	102	3	250	43	261	
25	5	120	700.300	.49	1.39	1.39	102	3	250	43	261	
	off	125	703.497									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	82.376	.4821	1.37	98	260

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 2 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0569

Run Number	2-PO-M104-1	2-PO-M104-2	2-PO-M104-3
Run Date	10/24	10/24	10/24

ANALYSIS OF MOISTURE CATCH

Reagent 1 (H2O)			
Final Weight, g.	987.5	1011.5	973.0
Tared Weight, g.	571.5	569.5	570.5
	==========	==========	==========
Water Catch, g.	416.0	442.0	402.5
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	416.0	442.0	402.5
Silica Gel:			
Final Weight, g.	431.5	421.5	417.5
Tared Weight, g.	400.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	31.5	21.5	17.5
TOTAL WATER COLLECTED, g.	447.5	463.5	420.0

Oxford Laboratories, Inc.

Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-2-89
DATE REPORTED 11-29-89
89W8694

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-4

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: M104 TRAIN UNIT 2

1. 2-ESPO-M104-1
2. 2-ESPO-M104-2
3. 2-ESPO-M104-3
4. 2-ESPO-M104-FB
5. METHOD CODE

RESULTS

	1	2	3	4	5
Beryllium, as Be, total ug	<.500	<.500	<.500	<.500	Method Code 104, SW846-7000's

ROGER C. OXFORD , CHEMIST

PO # 62840-4
Method ① 104
SW846-7000s

Entropy

89W 8694
11-9-89

① Be <.05 × 10 = <.500	② <.05 × 10 = <.500	③ <.05 × 10 = <.50
④ Be <.05 × 10 = <.500	O.A.C. 25ug spike with Blank Pad 2.40 x 10 = 24.0 96% Recovery	

CUSTODY SHEET FOR REAGENT BOX # 0569

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 200 mls. of dH2O

Individual Tare of Reagent: ____ mls. of ____

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT # 2 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
2-ESPO-M104-1	10-24-89	SRD	✓	10-24-89	50%	SRD	✓
2-ESPO-M104-2	10-24-89	SRD	✓	10-24-89	30%	SRD	✓
2-ESPO-M104-3	10-24-89	SRD	✓	10-24-89	50%	SRD	✓

	Date	Initials	Locked?
Received in Lab	10/30/89	PR	✓

Sampling Method: M104

Remarks: [redacted]

DOUBLE CHARGE SILICA GEL

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	UNTARED	

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0602

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 200 mls. of dH_2O

Individual Tare of Reagent: ____ mls. of ____

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #1 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locke
1-ESPO-M104-FB	10-23-89	SRD	✓	10-23-89	N/A	SRD	✓
2-ESPO-M104-FB	10-24-89	SRD	✓	10-24-89	N/A	SRD	✓

	Date	Initials	Locked?
Received in Lab	10/30/89	PR	✓

Sampling Method: M104

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	UNTARED	

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-4

JOB NAME: NORTH COUNTY REGIONAL RRF.

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-1-89

EXPECTED DATE OF RESULTS: 11-15-89

SAMPLE MATRIX: M104 Sample train. Unit 2.

TYPE OF ANALYSIS REQUESTED: Be (particulate and gaseous) Refer to Method 104, Rules and Regulations, April 6, 1973.

Sample#	SampleID.	Components
1	2-ESPO-M104-1	Reagent, Acetone rinse, filter
2	2-ESPO-M104-2	Reagent 1of2, 2of2, acetone rinse, filter
3	2-ESPO-M104-3	Reagent, acetone rinse, filter.
4	2-ESPO-M104-FB	" " " "

SUBMITTED BY:

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 6287 0-4 were
sh~~ipped vi~~a Hand delivered on 11-1-89 by RAT
to OLI

Samples received at OLI on 11-2-89
by M. Congleton

Note any broken seals, leakage, spillage, and/or damage to the samples.

L-0009
1/87

APPENDIX B.2.b.2

B. FIELD AND ANALYTICAL DATA

- 2. Unit No. 2
    - b. ESP Outlet
        - 2. Carbon Dioxide, Carbon Monoxide, Nitrogen Oxides, Oxygen, and Sulfur Dioxide

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Preliminary Calibration Error Check

DATE : 10-25-1989 TIME: 10:53 - 11:30

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	0.6
1	OUTLET	ppmSO2	49.6	50.8
1	OUTLET	ppmSO2	90.7	90.7
3	OUTLET	ppmNOX	0.0	0.7
3	OUTLET	ppmNOX	240.0	240.2
3	OUTLET	ppmNOX	455.0	455.6
4	OUTLET	ppmCO	0.0	0.0
4	OUTLET	ppmCO	24.8	23.9
4	OUTLET	ppmCO	64.3	62.4
4	OUTLET	ppmCO	149.6	149.8
2	OUTLET	% O2	0.00	0.00
2	OUTLET	% O2	11.93	11.95
2	OUTLET	% O2	20.90	20.90
5	OUTLET	% CO2	0.00	-0.00
5	OUTLET	% CO2	11.06	11.33
5	OUTLET	% CO2	17.50	17.53
6	INLET	ppmSO2	0.0	1.2
6	INLET	ppmSO2	218.0	219.3
6	INLET	ppmSO2	454.1	453.5
7	INLET	% O2	0.00	0.00
7	INLET	% O2	11.93	11.96
7	INLET	% O2	20.90	20.91
8	INLET	% CO2	0.00	0.01
8	INLET	% CO2	11.06	11.07
8	INLET	% CO2	17.50	17.50

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Pre-test 1 Calibration Bias Check Unit 2

DATE : 10-25-1989 TIME: 11:30 - 11:55

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	1.0
1	OUTLET	ppmSO2	49.6	49.0
3	OUTLET	ppmNOX	0.0	0.7
3	OUTLET	ppmNOX	240.0	233.1
4	OUTLET	ppmCO	0.0	0.7
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.02
2	OUTLET	% O2	11.93	11.84
5	OUTLET	% CO2	0.00	0.02
5	OUTLET	% CO2	11.06	11.26
6	INLET	ppmSO2	0.0	3.2
6	INLET	ppmSO2	218.0	215.3
7	INLET	% O2	0.00	0.01
7	INLET	% O2	11.93	11.77
8	INLET	% CO2	0.00	0.04
8	INLET	% CO2	11.06	11.02

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
12:31	27.7	208.9	14.9	6.27	13.23	148.7	6.28	13.26	0.063	0.341	0.015	0.338
12:32	26.1	211.8	14.8	6.46	13.08	152.6	5.98	13.55	0.060	0.350	0.015	0.339
12:33	27.0	211.6	15.0	6.37	13.18	158.0	5.58	13.95	0.062	0.348	0.015	0.343
12:34	31.0	215.5	15.3	6.08	13.44	153.2	6.06	13.49	0.069	0.347	0.015	0.343
12:35	32.5	215.7	15.8	6.17	13.30	145.1	6.27	13.26	0.073	0.350	0.016	0.329
12:36	32.8	216.3	15.4	6.37	13.14	146.5	6.23	13.29	0.075	0.355	0.015	0.332
12:37	36.0	214.2	14.5	6.33	13.16	152.6	5.83	13.70	0.082	0.351	0.014	0.336
12:38	32.3	214.7	14.4	6.32	13.17	154.2	5.89	13.64	0.073	0.352	0.014	0.341
12:39	36.6	213.0	14.3	6.17	13.30	151.8	5.81	13.71	0.083	0.345	0.014	0.334
12:40	41.6	213.0	15.0	6.32	13.18	155.7	5.62	13.87	0.095	0.349	0.015	0.338
12:41	44.0	210.7	14.8	6.12	13.38	159.7	5.52	14.00	0.099	0.340	0.015	0.345
12:42	48.9	212.8	14.3	5.94	13.50	158.3	5.43	14.08	0.108	0.340	0.014	0.340
12:43	50.2	213.9	14.2	5.98	13.50	156.5	5.71	13.82	0.112	0.342	0.014	0.342
12:44	52.2	213.7	13.9	5.97	13.46	152.9	5.78	13.74	0.116	0.342	0.014	0.336
12:45	47.4	214.1	14.3	6.12	13.35	157.8	5.58	13.95	0.106	0.346	0.014	0.342

AVERAGE VALUES FOR THE LAST 15 MINUTES

12:45	37.8	213.3	14.7	6.20	13.29	153.6	5.84	13.69	0.085	0.347	0.015	0.339

12:46	49.7	212.4	14.4	5.97	13.48	146.7	6.37	13.18	0.110	0.340	0.014	0.335
12:47	50.7	212.1	14.8	6.28	13.15	146.0	6.18	13.34	0.115	0.346	0.015	0.329
12:48	49.5	212.7	14.9	6.46	13.01	147.1	6.18	13.38	0.114	0.352	0.015	0.332
12:49	50.4	211.6	14.3	6.47	13.02	148.7	6.02	13.55	0.116	0.350	0.014	0.332
12:50	51.3	212.7	14.1	6.35	13.14	145.1	6.32	13.26	0.117	0.349	0.014	0.330
12:51	52.9	214.7	14.0	6.41	13.05	139.1	6.70	12.85	0.121	0.354	0.014	0.325
12:52	51.0	211.4	14.1	6.72	12.74	151.4	5.77	13.80	0.119	0.356	0.014	0.332
12:53	51.1	210.8	14.1	6.60	12.95	137.7	7.12	12.46	0.119	0.352	0.014	0.332
12:54	49.3	207.3	14.1	6.71	12.73	140.2	6.69	12.93	0.115	0.349	0.014	0.328
12:55	45.7	206.0	14.4	6.97	12.57	143.3	6.75	12.84	0.109	0.353	0.015	0.336
12:56	45.4	205.9	14.6	7.00	12.53	139.6	7.13	12.41	0.109	0.354	0.015	0.337
12:57	41.9	204.6	15.5	7.16	12.40	145.9	6.70	12.87	0.101	0.356	0.016	0.341
12:58	41.5	203.6	14.4	6.95	12.57	145.7	6.88	12.68	0.099	0.348	0.015	0.345
12:59	38.8	196.6	14.6	7.04	12.47	153.4	6.65	12.92	0.093	0.339	0.015	0.358
13:00	38.7	192.1	14.2	7.08	12.43	147.7	6.98	12.58	0.093	0.332	0.015	0.352

Test 2-1 Begins

AVERAGE VALUES FOR THE LAST 15 MINUTES

13:00	47.2	207.6	14.4	6.68	12.82	145.2	6.56	13.00	0.110	0.349	0.015	0.336

13:01	38.1	192.7	14.5	7.22	12.33	149.8	6.76	12.80	0.092	0.336	0.015	0.352
13:02	40.3	196.5	14.0	7.00	12.53	147.4	6.90	12.67	0.096	0.337	0.015	0.350
13:03	41.1	199.8	14.2	7.06	12.47	145.1	6.97	12.55	0.099	0.345	0.015	0.346
13:04	38.8	198.6	14.7	7.16	12.37	155.8	6.52	13.05	0.094	0.345	0.016	0.360
13:05	39.9	197.5	14.5	6.98	12.53	149.4	6.91	12.62	0.095	0.339	0.015	0.355
13:06	40.0	198.1	16.0	7.11	12.40	158.8	6.09	13.45	0.096	0.343	0.017	0.356
13:07	40.1	199.6	16.5	6.73	12.78	155.7	6.38	13.18	0.094	0.336	0.017	0.356
13:08	41.2	201.4	15.9	6.58	12.83	144.6	6.97	12.61	0.095	0.336	0.016	0.345
13:09	37.5	201.5	17.2	6.99	12.48	144.9	6.64	12.92	0.089	0.346	0.018	0.337
13:10	37.3	206.1	18.0	6.92	12.60	147.2	6.34	13.22	0.089	0.352	0.019	0.336
13:11	37.3	211.1	19.7	6.58	12.93	144.6	6.51	13.07	0.087	0.352	0.019	0.334
13:12	39.2	212.1	19.1	6.54	12.89	142.3	6.58	12.99	0.088	0.353	0.018	0.330
13:13	37.6	208.6	17.9	6.67	12.79	139.1	6.56	13.02	0.088	0.350	0.018	0.322
13:14	37.8	207.9	17.8	6.81	12.65	141.0	6.49	13.08	0.089	0.352	0.018	0.325
13:15	37.4	207.4	18.5	6.86	12.62	140.7	6.49	13.08	0.088	0.353	0.019	0.324

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:15	38.8	202.6	16.4	6.88	12.61	147.1	6.61	12.95	0.092	0.345	0.017	0.342
13:16	38.0	206.6	18.2	6.78	12.72	146.9	6.10	13.49	0.089	0.349	0.019	0.330
13:17	40.0	207.0	18.4	6.50	12.98	144.0	6.49	13.10	0.092	0.343	0.019	0.332
13:18	41.9	210.2	17.9	6.46	12.99	146.8	6.22	13.37	0.096	0.348	0.018	0.332
13:19	42.3	211.4	18.4	6.55	12.91	142.5	6.47	13.09	0.098	0.352	0.019	0.328
13:20	39.8	211.7	19.1	6.62	12.88	145.8	6.27	13.33	0.093	0.354	0.019	0.331
13:21	41.4	211.8	18.6	6.34	13.09	138.0	6.87	12.72	0.094	0.347	0.019	0.327
13:22	39.8	211.0	19.1	6.69	12.75	144.8	6.23	13.32	0.093	0.355	0.020	0.328
13:23	39.8	210.8	18.9	6.64	12.89	142.3	6.56	13.05	0.093	0.353	0.019	0.329
13:24	40.2	211.1	18.1	6.60	12.85	145.0	6.03	13.57	0.093	0.353	0.018	0.324
13:25	41.0	211.7	17.0	6.52	13.01	140.8	6.49	13.15	0.095	0.352	0.017	0.324
13:26	44.3	213.4	17.3	6.36	13.10	140.1	6.33	13.25	0.101	0.350	0.017	0.319
13:27	43.0	219.8	18.4	6.51	13.01	142.4	6.30	13.31	0.099	0.365	0.019	0.324
13:28	44.0	220.7	18.2	6.32	13.18	145.2	6.05	13.61	0.100	0.361	0.018	0.325
13:29	42.6	217.6	18.5	6.24	13.26	141.1	6.45	13.17	0.096	0.354	0.018	0.324
13:30	40.8	216.6	18.8	6.43	13.11	150.6	5.90	13.71	0.094	0.357	0.019	0.334
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:30	41.2	212.7	18.3	6.50	12.98	143.7	6.32	13.28	0.095	0.353	0.018	0.327
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
13:30	41.3	209.1	16.0	6.57	12.93	147.4	6.33	13.23	0.096	0.348	0.016	0.336
13:31	45.2	218.5	18.4	6.23	13.28	146.5	6.20	13.41	0.102	0.356	0.018	0.331
13:32	47.1	216.6	17.9	6.38	13.13	147.4	6.05	13.58	0.109	0.356	0.018	0.330
13:33	48.4	218.2	17.7	6.26	13.25	144.1	6.31	13.30	0.110	0.356	0.018	0.328
13:34	51.7	221.3	19.3	6.32	13.20	153.8	5.63	13.99	0.118	0.363	0.019	0.334
13:35	53.8	222.0	18.5	6.10	13.42	156.2	5.51	14.11	0.121	0.358	0.018	0.337
13:36	59.6	222.8	17.7	5.95	13.57	155.0	5.39	14.22	0.132	0.356	0.017	0.332
13:37	60.3	223.1	17.9	5.77	13.74	157.0	5.23	14.38	0.132	0.352	0.017	0.333
13:38	58.3	225.6	17.8	5.60	13.91	151.2	5.62	14.00	0.127	0.352	0.017	0.329
13:39	59.1	226.4	17.4	5.56	13.89	151.0	5.56	14.06	0.128	0.352	0.016	0.327
13:40	58.3	224.3	17.3	5.73	13.75	155.5	5.20	14.36	0.128	0.353	0.017	0.329
13:41	59.6	221.8	17.2	5.70	13.84	158.1	5.46	14.15	0.130	0.348	0.016	0.340
13:42	61.1	219.2	18.5	5.43	13.97	156.9	5.30	14.28	0.131	0.338	0.017	0.334
13:43	56.4	220.5	17.0	5.64	13.85	157.4	5.11	14.46	0.123	0.345	0.016	0.331
13:44	64.1	219.4	15.6	5.46	14.00	158.9	5.25	14.34	0.138	0.339	0.015	0.337
13:45	62.1	221.1	15.9	5.41	14.01	160.3	5.15	14.43	0.133	0.341	0.015	0.338
AVERAGE VALUES FOR THE LAST 15 MINUTES												
13:45	56.3	221.4	17.6	5.84	13.65	153.9	5.53	14.07	0.124	0.351	0.017	0.333
13:46	58.7	220.7	15.5	5.53	13.93	154.4	5.56	14.07	0.127	0.343	0.015	0.334
13:47	62.6	224.8	15.4	5.53	13.89	146.2	5.86	13.72	0.135	0.349	0.015	0.323
13:48	60.6	224.7	16.7	5.81	13.68	154.1	5.24	14.37	0.133	0.356	0.016	0.327
13:49	56.8	224.6	17.6	5.59	13.90	151.2	5.56	14.04	0.123	0.350	0.017	0.327
13:50	53.8	223.2	16.8	5.60	13.85	154.5	5.38	14.24	0.117	0.348	0.016	0.330
13:51	48.1	217.8	15.8	5.63	13.83	154.1	5.35	14.25	0.104	0.341	0.015	0.329
13:52	42.6	218.2	15.4	5.56	13.91	154.4	5.41	14.17	0.092	0.340	0.015	0.331
13:53	39.7	217.1	15.3	5.64	13.82	157.8	5.29	14.30	0.086	0.340	0.015	0.336
13:54	36.8	216.8	15.3	5.58	13.87	150.1	5.83	13.31	0.080	0.338	0.015	0.331

BEST AVAILABLE COPY

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
13:55	34.9	215.8	15.6	5.74	13.68	151.6	5.51	14.10	0.076	0.340	0.015	0.327
13:56	32.9	218.7	15.9	5.88	13.60	158.8	5.04	14.53	0.073	0.348	0.015	0.333
13:57	34.1	219.3	17.2	5.46	14.03	159.3	5.63	13.98	0.073	0.339	0.016	0.346
13:58	36.5	219.2	17.0	5.56	13.86	154.1	5.24	14.36	0.079	0.341	0.016	0.327
13:59	34.6	219.9	15.6	5.50	13.97	141.5	6.36	13.31	0.075	0.341	0.015	0.323
14:00	33.5	219.2	15.2	5.78	13.60	131.8	6.74	12.90	0.074	0.346	0.015	0.309
AVERAGE VALUES FOR THE LAST 15 MINUTES												
14:00	44.4	220.0	16.0	5.63	13.83	151.6	5.60	14.01	0.096	0.344	0.015	0.329

↑ TEST 2-1 ENDS

14:01	29.3	217.7	16.3	6.35	13.12	131.5	6.61	13.02	0.067	0.357	0.016	0.306
14:02	27.0	213.0	17.7	6.43	13.06	129.8	6.61	13.02	0.062	0.351	0.018	0.302
14:03	27.2	214.6	19.1	6.35	13.12	131.9	6.57	13.05	0.062	0.352	0.019	0.306
14:04	27.5	214.7	21.2	6.33	13.15	136.0	6.22	13.41	0.063	0.352	0.021	0.308
14:05	28.6	216.7	18.8	6.26	13.20	133.1	6.54	13.08	0.065	0.354	0.019	0.308
14:06	30.3	212.0	18.5	6.39	13.06	130.5	6.66	12.94	0.069	0.349	0.019	0.304
14:07	30.2	207.6	19.2	6.62	12.82	132.6	6.48	13.18	0.070	0.347	0.020	0.305
14:08	28.2	211.0	18.5	6.73	12.73	124.2	6.99	12.61	0.066	0.356	0.019	0.296
14:09	26.9	211.5	17.7	6.85	12.61	128.3	6.49	13.15	0.064	0.360	0.018	0.296
14:10	27.0	212.8	18.7	6.94	12.56	132.7	6.00	13.62	0.064	0.364	0.019	0.296
14:11	25.9	213.9	17.7	6.74	12.80	134.3	6.17	13.46	0.061	0.361	0.018	0.303
14:12	27.2	214.5	17.8	6.60	12.86	129.3	6.39	13.24	0.063	0.358	0.018	0.296
14:13	27.3	212.3	17.8	6.51	12.96	126.2	6.60	13.02	0.063	0.352	0.018	0.293
14:14	28.2	211.6	16.5	6.61	12.85	133.2	6.02	13.58	0.065	0.354	0.017	0.297
14:15	30.2	215.4	14.9	6.43	13.09	134.9	6.07	13.57	0.069	0.356	0.015	0.302
AVERAGE VALUES FOR THE LAST 15 MINUTES												
14:15	28.1	213.3	18.0	6.54	12.93	131.2	6.43	13.20	0.065	0.355	0.018	0.301
14:16	32.0	214.4	15.0	6.09	13.36	135.0	5.87	13.75	0.072	0.346	0.015	0.298
14:17	31.3	214.4	15.4	6.05	13.44	139.7	5.62	14.00	0.070	0.345	0.015	0.304
14:18	34.3	214.0	16.2	5.84	13.62	131.4	6.12	13.52	0.076	0.339	0.016	0.295
14:19	32.4	213.5	16.0	6.13	13.33	132.0	5.92	13.67	0.073	0.345	0.016	0.293
14:20	30.3	213.6	16.3	6.02	13.46	134.0	6.05	13.59	0.068	0.343	0.016	0.300
14:21	31.4	214.4	16.9	5.96	13.48	126.2	6.50	13.12	0.070	0.343	0.016	0.291
14:22	30.9	211.5	16.8	6.30	13.14	123.3	6.51	13.13	0.070	0.346	0.017	0.284
14:23	29.8	212.2	17.2	6.55	12.92	133.6	6.43	13.21	0.069	0.353	0.017	0.306
14:24	28.8	211.1	17.9	6.60	12.95	144.0	6.16	13.50	0.067	0.353	0.018	0.324
14:25	33.4	212.7	16.2	6.32	13.19	136.8	6.73	12.93	0.076	0.349	0.016	0.321
14:26	35.9	211.3	15.4	6.50	12.99	137.4	6.03	13.57	0.083	0.350	0.016	0.307
14:27	36.0	216.1	16.0	6.39	13.19	137.9	6.06	13.59	0.082	0.356	0.016	0.309
14:28	37.9	217.7	15.4	6.14	13.34	133.0	6.28	13.30	0.085	0.352	0.015	0.302
14:29	38.1	216.6	16.2	6.36	13.16	139.0	5.69	13.92	0.087	0.356	0.016	0.303
14:30	37.5	215.9	15.6	6.10	13.43	133.2	6.21	13.41	0.084	0.348	0.015	0.301
AVERAGE VALUES FOR THE LAST 15 MINUTES												
14:30	33.3	214.0	16.2	6.22	13.27	134.4	6.15	13.48	0.075	0.348	0.016	0.303
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
14:30	40.5	217.2	17.0	6.06	13.42	142.8	5.93	13.69	0.090	0.350	0.017	0.316
14:31	37.8	213.3	15.4	6.11	13.36	133.8	6.06	13.52	0.085	0.344	0.015	0.299
14:32	37.7	213.5	16.3	6.23	13.26	140.2	5.66	13.96	0.085	0.348	0.016	0.305
14:33	37.3	214.8	15.7	6.05	13.46	131.5	6.23	13.34	0.084	0.345	0.015	0.298

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
14:34	34.7	211.6	15.6	6.26	13.25	130.4	6.35	13.26	0.079	0.345	0.015	0.297
14:35	34.4	211.5	16.6	6.32	13.16	128.4	6.28	13.31	0.078	0.347	0.017	0.292
14:36	33.3	211.4	17.8	6.60	12.93	125.6	6.28	13.32	0.077	0.353	0.018	0.285
14:37	33.3	209.2	17.5	6.53	13.02	129.2	6.15	13.49	0.077	0.348	0.018	0.291
14:38	33.2	211.4	17.3	6.42	13.13	126.3	6.25	13.36	0.076	0.349	0.017	0.286
14:39	33.0	211.4	17.4	6.38	13.16	118.8	6.69	12.90	0.075	0.348	0.017	0.278
14:40	28.6	212.5	18.6	6.62	12.92	121.1	6.47	13.19	0.066	0.355	0.019	0.279
14:41	25.4	213.9	19.0	6.67	12.91	117.5	6.61	12.98	0.059	0.359	0.019	0.273
14:42	28.1	213.7	18.9	6.78	12.82	127.3	6.47	13.16	0.066	0.362	0.019	0.293
14:43	30.3	211.6	17.9	6.67	12.91	123.2	6.65	13.00	0.071	0.355	0.018	0.287
14:44	32.8	211.4	18.0	6.81	12.79	121.3	6.54	13.06	0.077	0.358	0.019	0.281
14:45	32.6	211.9	20.0	7.06	12.60	125.5	6.07	13.57	0.078	0.366	0.021	0.281

AVERAGE VALUES FOR THE LAST 15 MINUTES

14:45	32.8	212.2	17.4	6.50	13.05	126.7	6.32	13.29	0.076	0.352	0.018	0.288

COMMENTS: End of Test 1 Unit 2

CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 1/ Pre-test 2 Calibration Bias Check

DATE : 10-25-1989 TIME: 14:46 - 15:22

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.9
1	OUTLET	ppmSO2	49.6	51.3
3	OUTLET	ppmNOX	0.0	1.5
3	OUTLET	ppmNOX	240.0	238.5
4	OUTLET	ppmCO	0.0	0.1
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.01
2	OUTLET	% O2	11.93	11.76
5	OUTLET	% CO2	0.00	0.10
5	OUTLET	% CO2	11.06	11.36
6	INLET	ppmSO2	0.0	6.7
6	INLET	ppmSO2	218.0	219.2
7	INLET	% O2	0.00	0.04
7	INLET	% O2	11.93	11.69
8	INLET	% CO2	0.00	0.26
8	INLET	% CO2	11.06	11.14

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
15:35     35.3     213.8     20.0      6.76     12.89     124.0      6.35     13.28     0.083     0.361     0.020     0.283
15:36     36.1     213.8     19.8      6.70     12.89     116.8      6.87     12.76     0.084     0.360     0.020     0.276
15:37     34.3     217.1     20.7      6.90     12.73     116.0      6.78     12.87     0.081     0.370     0.022     0.273
15:38     32.5     216.6     20.6      6.98     12.68     114.4      6.96     12.67     0.078     0.372     0.021     0.273
15:39     32.3     215.3     21.1      7.18     12.48     110.2      7.13     12.48     0.078     0.375     0.022     0.266
15:40     29.7     213.4     22.0      7.29     12.43     117.8      6.53     13.13     0.072     0.374     0.023     0.272
15:41     29.5     212.7     20.7      7.07     12.56     108.8      7.20     12.41     0.071     0.367     0.022     0.264
15:42     30.2     211.9     20.6      7.31     12.37     111.6      6.96     12.67     0.074     0.373     0.022     0.266
15:43     32.6     214.8     20.7      7.30     12.41     110.0      7.05     12.57     0.080     0.377     0.022     0.264
15:44     33.7     215.5     21.6      7.19     12.47     106.6      7.30     12.29     0.082     0.375     0.023     0.260
15:45     32.9     213.9     21.8      7.40     12.30     110.2      7.17     12.47     0.081     0.379     0.023     0.267

15:46     33.1     210.4     20.7      7.42     12.26     104.3      7.81     11.81     0.081     0.373     0.022     0.265
15:47     32.6     207.7     21.0      7.90     11.84     105.2      7.67     11.97     0.083     0.381     0.023     0.264
15:48     30.6     208.7     21.8      8.10     11.71     108.1      7.55     12.08     0.079     0.389     0.025     0.269
15:49     29.1     200.4     24.6      8.26     11.56     107.7      7.58     12.06     0.076     0.379     0.028     0.268
15:50     29.3     201.5     27.5      8.36     11.49     107.0      7.70     11.96     0.078     0.384     0.032     0.269
15:51     28.8     198.4     30.3      8.43     11.44     105.8      7.63     12.03     0.077     0.380     0.035     0.265
15:52     28.1     201.0     27.7      8.28     11.57     103.0      7.87     11.82     0.074     0.380     0.032     0.262
15:53     27.2     195.2     31.3      8.45     11.38     100.7      8.10     11.62     0.073     0.374     0.037     0.261
15:54     25.3     192.9     40.6      8.73     11.16     101.6      7.71     11.94     0.069     0.379     0.048     0.256
15:55     25.9     203.3     39.2      8.54     11.38     110.0      6.88     12.77     0.070     0.393     0.046     0.261
15:56     29.8     212.2     34.3      7.88     11.95     115.2      6.49     13.14     0.076     0.389     0.038     0.266
15:57     33.4     206.6     35.2      7.54     12.20     119.2      6.31     13.35     0.083     0.369     0.038     0.271
15:58     35.8     205.9     36.1      7.31     12.37     114.9      6.74     12.91     0.087     0.362     0.039     0.269
15:59     38.3     209.9     33.1      7.39     12.31     117.7      6.85     12.85     0.094     0.371     0.036     0.278
16:00     41.3     210.6     32.1      7.37     12.28     110.8      7.11     12.55     0.101     0.372     0.034     0.267

AVERAGE VALUES FOR THE LAST 15 MINUTES
16:00     31.2     204.3     30.4      8.00     11.79     108.8      7.33     12.32     0.080     0.378     0.034     0.266

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AVERAGE VALUES FOR THE LAST HOUR: 26 MINUTES OF VALID DATA
16:00     31.8     208.6     26.3      7.62     12.12     110.7      7.17     12.48     0.079     0.375     0.029     0.267
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16:01     40.4     207.7     31.4      7.62     12.09     113.4      6.85     12.85     0.101     0.374     0.034     0.268
16:02     44.3     212.3     29.9      7.39     12.34     114.7      6.63     13.04     0.109     0.375     0.032     0.267
16:03     52.1     215.9     29.0      6.99     12.66     113.4      6.75     12.93     0.124     0.371     0.030     0.266
16:04     54.9     217.2     30.0      7.11     12.52     111.3      6.70     12.99     0.132     0.376     0.032     0.260
16:05     54.8     218.9     30.2      7.05     12.58     107.4      7.09     12.57     0.131     0.378     0.032     0.258
16:06     55.8     217.9     30.5      7.12     12.55     112.1      6.63     13.06     0.135     0.377     0.032     0.261
16:07     56.6     211.6     30.0      7.09     12.49     102.6      7.53     12.11     0.136     0.366     0.031     0.255
16:08     54.3     210.3     31.7      7.54     12.14     106.1      7.00     12.66     0.135     0.376     0.034     0.253
16:09     57.1     212.4     32.4      7.28     12.42     114.1      6.44     13.24     0.139     0.372     0.035     0.262
16:10     56.9     212.8     30.8      6.99     12.61     107.7      6.97     12.68     0.136     0.365     0.032     0.257
16:11     49.4     213.0     30.4      7.09     12.55     106.0      7.06     12.62     0.119     0.368     0.032     0.254
16:12     40.8     213.7     30.6      7.05     12.56     105.2      6.87     12.75     0.098     0.369     0.032     0.249
16:13     35.3     216.2     30.6      6.89     12.73     104.9      7.02     12.67     0.084     0.369     0.032     0.251
16:14     30.3     214.5     30.0      7.01     12.57     100.4      7.24     12.40     0.072     0.369     0.031     0.244
16:15     26.9     212.4     29.6      7.17     12.47     103.4      6.98     12.68     0.065     0.370     0.031     0.247

AVERAGE VALUES FOR THE LAST 15 MINUTES
16:15     47.3     213.8     30.5      7.16     12.49     108.2      6.92     12.75     0.114     0.372     0.032     0.257

16:16     25.6     211.6     27.9      7.15     12.46     100.7      7.18     12.49     0.062     0.368     0.030     0.244
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Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
16:17	25.1	211.8	28.0	7.25	12.38	100.9	6.96	12.71	0.061	0.370	0.030	0.240
16:18	23.7	213.1	28.4	7.14	12.49	100.3	7.04	12.62	0.057	0.370	0.030	0.240
16:19	22.1	212.7	27.9	7.14	12.51	102.2	7.06	12.62	0.053	0.369	0.029	0.245
16:20	21.8	213.1	27.1	7.08	12.54	98.2	7.40	12.29	0.052	0.368	0.028	0.241
16:21	21.9	209.7	27.7	7.26	12.35	95.5	7.43	12.19	0.053	0.367	0.030	0.235
16:22	20.7	208.9	26.4	7.49	12.19	99.3	7.26	12.38	0.051	0.372	0.029	0.242
16:23	21.1	209.0	24.7	7.51	12.17	97.9	7.46	12.17	0.052	0.373	0.027	0.242
16:24	22.6	211.2	25.3	7.49	12.21	101.1	7.14	12.50	0.056	0.376	0.027	0.244
16:25	23.5	212.9	25.4	7.33	12.33	96.7	7.37	12.28	0.058	0.375	0.027	0.237
16:26	22.9	210.8	25.5	7.47	12.20	95.4	7.48	12.13	0.057	0.375	0.028	0.236
16:27	23.9	211.4	26.0	7.48	12.21	95.7	7.49	12.19	0.059	0.376	0.028	0.237
16:28	24.3	207.5	26.1	7.64	12.04	87.7	7.94	11.69	0.061	0.374	0.029	0.225
16:29	24.0	204.3	26.7	7.83	11.89	90.2	7.60	11.97	0.061	0.373	0.030	0.225
16:30	24.8	208.5	27.2	7.73	12.04	95.7	7.15	12.52	0.062	0.378	0.030	0.231
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:30	23.2	210.4	26.7	7.40	12.27	97.2	7.33	12.32	0.057	0.372	0.029	0.238
16:31	26.8	211.5	26.5	7.38	12.32	97.7	6.82	12.81	0.066	0.374	0.028	0.230
16:32	29.3	210.0	26.1	7.22	12.39	92.5	7.64	11.99	0.071	0.367	0.028	0.232
16:33	29.1	203.6	27.8	7.74	11.93	89.1	7.96	11.69	0.073	0.369	0.031	0.229
16:34	29.5	204.7	29.1	7.80	11.90	89.7	7.77	11.78	0.075	0.373	0.032	0.227
16:35	32.5	209.9	28.5	7.65	12.04	93.1	7.41	12.19	0.081	0.378	0.031	0.229
16:36	34.0	209.8	27.0	7.62	12.01	93.0	7.56	11.99	0.085	0.377	0.030	0.231
16:37	37.7	214.8	27.8	7.59	12.06	93.2	7.41	12.15	0.094	0.385	0.030	0.230
16:38	39.5	217.5	28.6	7.42	12.23	95.2	7.26	12.32	0.097	0.385	0.031	0.232
16:39	41.4	216.4	28.3	7.24	12.37	99.6	6.69	12.83	0.101	0.378	0.030	0.233
16:40	44.9	217.1	26.2	6.87	12.68	100.1	6.75	12.83	0.106	0.370	0.027	0.235
16:41	48.9	219.9	27.2	6.82	12.70	104.6	6.20	13.32	0.115	0.373	0.028	0.236
16:42	43.8	222.1	28.1	6.56	12.92	106.4	6.39	13.13	0.101	0.370	0.028	0.243
16:43	43.7	225.6	29.1	6.44	13.08	124.6	6.05	13.50	0.100	0.373	0.028	0.279
16:44	49.1	224.9	27.8	6.22	13.24	127.0	6.11	13.49	0.111	0.366	0.027	0.285
16:45	48.6	226.2	27.7	6.21	13.22	123.8	6.48	13.09	0.110	0.368	0.027	0.285
AVERAGE VALUES FOR THE LAST 15 MINUTES												
16:45	38.6	215.6	27.6	7.12	12.47	102.0	6.97	12.61	0.092	0.374	0.029	0.242
16:46	48.1	223.2	27.1	6.42	13.01	122.5	6.53	13.07	0.110	0.368	0.027	0.283
16:47	46.6	223.7	26.9	6.56	12.90	118.2	6.85	12.71	0.108	0.372	0.027	0.279
16:48	44.8	222.0	26.8	6.78	12.68	124.0	6.39	13.16	0.105	0.375	0.028	0.284
16:49	44.6	220.4	25.6	6.67	12.82	125.0	6.37	13.23	0.104	0.370	0.026	0.286
16:50	47.3	219.5	23.7	6.50	12.97	125.8	6.10	13.49	0.109	0.364	0.024	0.282
16:51	47.8	222.9	22.9	6.44	13.06	124.8	6.12	13.49	0.110	0.368	0.023	0.280
16:52	46.0	224.9	23.1	6.31	13.17	127.6	5.75	13.86	0.105	0.368	0.023	0.280
16:53	44.8	224.8	22.6	6.08	13.38	122.8	6.31	13.30	0.100	0.362	0.022	0.279
16:54	40.7	223.7	23.5	6.38	13.13	129.4	5.50	14.12	0.093	0.368	0.024	0.279
16:55	43.9	224.7	21.9	5.95	13.54	125.3	6.00	13.63	0.098	0.359	0.021	0.279
16:56	43.4	227.2	22.2	6.08	13.39	124.6	5.93	13.67	0.097	0.366	0.022	0.276
16:57	40.7	224.6	22.5	6.17	13.30	122.4	5.97	13.62	0.092	0.364	0.022	0.272
16:58	38.9	221.1	21.3	6.18	13.29	126.1	5.68	13.93	0.088	0.359	0.021	0.275
16:59	40.8	219.8	20.2	6.05	13.48	129.8	5.67	13.94	0.091	0.354	0.020	0.283
17:00	42.6	221.3	20.6	6.00	13.44	119.7	5.48	13.12	0.095	0.355	0.020	0.276

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:00	44.1	222.9	23.4	6.30	13.17	124.5	6.11	13.49	0.100	0.365	0.023	0.280
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
17:00	38.3	215.7	27.0	7.00	12.60	108.0	6.83	12.79	0.091	0.371	0.028	0.254
17:01	40.1	218.6	21.2	6.41	13.10	106.1	5.97	13.40	0.092	0.360	0.021	0.236
17:02	40.9	218.9	20.2	6.12	13.41	77.2	10.41	8.47	0.092	0.354	0.020	0.483
17:03	42.9	219.5	18.9	6.08	13.38	33.3	20.27	0.54	0.096	0.354	0.019	1.740
17:04	44.5	219.5	19.4	6.18	13.31	19.1	20.41	0.46	0.100	0.356	0.019	1.279
17:05	43.8	219.7	20.0	6.33	13.16	10.6	20.56	0.39	0.100	0.360	0.020	1.031
17:06	44.4	218.1	19.1	6.17	13.33	6.8	20.63	0.37	0.100	0.354	0.019	0.829
17:07	45.2	216.9	18.0	5.93	13.57	5.8	20.65	0.36	0.100	0.346	0.017	0.787
17:08	48.6	213.3	19.9	5.87	13.57	5.9	20.67	0.36	0.107	0.339	0.019	0.845
17:09	44.8	215.0	20.3	6.30	13.18	5.6	20.68	0.36	0.102	0.352	0.020	0.834
17:10	43.5	216.1	19.3	6.23	13.28	5.5	20.68	0.36	0.098	0.352	0.019	0.837
17:11	46.0	214.8	19.1	6.10	13.38	5.3	20.68	0.36	0.103	0.347	0.019	0.795
17:12	45.9	218.7	19.5	6.14	13.35	5.5	20.69	0.36	0.103	0.354	0.019	0.875
17:13	42.7	216.6	19.2	6.48	13.03	5.2	20.70	0.36	0.098	0.359	0.019	0.836
17:14	41.5	217.5	19.2	6.58	12.87	5.2	20.70	0.35	0.096	0.363	0.019	0.876
17:15	37.1	215.5	18.2	6.82	12.73	4.9	20.71	0.35	0.087	0.366	0.019	0.962
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:15	43.5	217.3	19.4	6.25	13.24	20.1	18.96	1.79	0.098	0.354	0.019	0.883
17:16	36.7	215.3	17.8	6.76	12.75	22.4	17.13	3.48	0.086	0.364	0.018	0.619
17:17	34.8	213.7	18.6	6.95	12.57	107.3	7.30	12.41	0.083	0.366	0.019	0.262
17:18	32.8	213.8	19.2	7.21	12.39	122.1	6.49	13.18	0.080	0.373	0.020	0.281
17:19	32.4	214.6	19.2	6.93	12.65	128.7	6.24	13.43	0.077	0.367	0.020	0.291
17:20	33.6	215.9	16.4	6.52	13.04	139.7	5.55	14.07	0.078	0.358	0.019	0.302
17:21	36.7	216.2	19.1	6.16	13.36	128.4	6.28	13.34	0.083	0.350	0.018	0.292
17:22	35.7	217.4	18.7	6.21	13.28	131.7	6.00	13.62	0.081	0.353	0.019	0.294
17:23	36.1	219.8	19.6	6.03	13.45	126.6	6.51	13.10	0.081	0.353	0.019	0.292
17:24	35.4	220.8	20.0	6.23	13.23	133.5	5.86	13.77	0.080	0.360	0.020	0.295
17:25	34.7	222.4	21.2	6.10	13.43	139.5	5.66	13.95	0.078	0.359	0.021	0.304
17:26	37.5	223.1	20.6	5.76	13.71	137.8	5.77	13.83	0.082	0.352	0.020	0.302
17:27	38.0	222.8	19.7	5.93	13.54	143.4	5.45	14.15	0.084	0.356	0.019	0.308
17:28	39.8	219.9	19.2	5.83	13.66	138.8	5.87	13.76	0.088	0.348	0.019	0.306
17:29	40.1	214.9	18.9	5.90	13.53	140.2	5.74	13.86	0.089	0.342	0.018	0.307
17:30	40.7	212.2	19.3	6.10	13.40	133.8	6.37	13.24	0.091	0.342	0.019	0.306
AVERAGE VALUES FOR THE LAST 15 MINUTES												
17:30	36.3	217.5	19.2	6.31	13.20	124.9	6.81	12.88	0.083	0.356	0.019	0.317
17:31	40.6	209.9	19.1	6.21	13.21	128.5	6.74	12.90	0.092	0.341	0.019	0.301
17:32	39.8	212.4	19.0	6.49	12.97	122.7	6.88	12.76	0.092	0.352	0.019	0.291
17:33	38.0	216.1	20.2	6.80	12.70	123.6	6.66	12.99	0.089	0.366	0.021	0.289
17:34	35.9	217.5	21.0	6.86	12.71	123.2	6.60	13.09	0.085	0.370	0.022	0.286
17:35	32.3	215.4	20.4	6.66	12.88	124.6	6.52	13.22	0.075	0.361	0.021	0.288
17:36	31.5	214.5	19.7	6.73	12.83	126.4	6.35	13.40	0.074	0.361	0.020	0.288
17:37	31.2	212.6	20.4	6.73	12.87	130.5	6.17	13.64	0.071	0.358	0.021	0.294
17:38	31.8	215.9	20.9	6.40	13.16	130.9	5.99	13.82	0.073	0.356	0.021	0.292
17:39	32.8	217.1	21.3	6.31	13.25	132.4	5.97	13.86	0.075	0.355	0.021	0.294

END

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
17:40    33.7     219.3      21.2      6.21     13.32     132.0      5.94     13.85     0.076     0.356     0.021     0.293
17:41    35.2     220.7      21.2      6.17     13.38     136.0      5.75     14.06     0.079     0.358     0.021     0.298
17:42    36.8     219.6      21.3      5.82     13.65     129.9      6.00     13.78     0.081     0.348     0.021     0.289
17:43    36.2     223.4      21.8      6.04     13.46     135.4      5.52     14.23     0.081     0.359     0.021     0.292
17:44    36.5     222.3      21.5      5.86     13.64     134.9      5.79     13.97     0.080     0.353     0.021     0.296
17:45    38.5     220.4      21.2      5.65     13.78     131.8      5.78     13.94     0.084     0.345     0.020     0.289

AVERAGE VALUES FOR THE LAST 15 MINUTES
17:45    35.3     217.1      20.7      6.33     13.19     129.5      6.18     13.57     0.080     0.356     0.021     0.292

17:46    37.3     219.7      21.1      5.83     13.63     136.2      5.45     14.28     0.082     0.348     0.020     0.293
17:47    35.8     217.5      19.1      5.69     13.78     133.6      5.77     13.98     0.078     0.342     0.018     0.293
17:48    36.0     214.4      18.0      5.89     13.56     136.6      5.55     14.15     0.080     0.341     0.017     0.295
17:49    35.9     219.2      18.1      5.78     13.69     135.7      5.69     14.00     0.079     0.346     0.017     0.296
17:50    35.8     219.1      18.1      5.85     13.58     139.3      5.53     14.14     0.079     0.348     0.017     0.301
17:51    34.6     216.1      17.4      5.88     13.59     149.4      5.17     14.50     0.077     0.344     0.017     0.315
17:52    39.5     214.2      16.3      5.43     14.00     140.0      5.93     13.74     0.085     0.331     0.015     0.311
17:53    41.1     212.4      17.2      5.70     13.69     154.7      5.13     14.51     0.090     0.334     0.016     0.326
17:54    41.5     209.3      16.7      5.55     13.88     148.8      5.48     14.18     0.090     0.326     0.016     0.320
17:55    44.0     211.4      16.3      5.58     13.80     144.6      5.53     14.13     0.095     0.329     0.015     0.313
17:56    41.0     212.7      16.1      5.82     13.62     150.1      5.15     14.48     0.090     0.337     0.016     0.316
17:57    42.4     213.1      15.7      5.54     13.88     144.0      5.70     13.98     0.092     0.331     0.015     0.315
17:58    43.3     214.7      16.1      5.64     13.74     142.0      5.70     13.97     0.094     0.336     0.015     0.310
17:59    41.8     214.5      16.8      5.78     13.62     147.9      5.20     14.45     0.092     0.339     0.016     0.313
18:00    41.6     214.2      16.5      5.66     13.77     146.1      5.49     14.19     0.091     0.336     0.016     0.315

AVERAGE VALUES FOR THE LAST 15 MINUTES
18:00    39.4     214.9      17.3      5.71     13.72     143.3      5.50     14.18     0.086     0.338     0.017     0.309

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AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA
18:00    38.6     216.7      19.2      6.15     13.34     104.5      9.36     10.60     0.087     0.351     0.019     0.450
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18:01    42.7     213.6      16.6      5.60     13.81     140.0      5.81     13.88     0.093     0.333     0.016     0.308
18:02    41.4     216.0      16.7      5.76     13.65     147.3      4.94     14.70     0.091     0.341     0.016     0.306
18:03    40.4     216.0      16.1      5.57     13.89     138.4      5.82     13.86     0.087     0.337     0.015     0.305
18:04    41.7     214.1      17.0      5.67     13.68     130.6      6.19     13.51     0.091     0.336     0.016     0.295
18:05    39.6     216.3      17.5      6.03     13.39     133.2      5.68     13.96     0.088     0.347     0.017     0.291
18:06    37.0     212.4      17.7      6.08     13.40     146.0      4.95     14.72     0.083     0.342     0.017     0.304
18:07    38.1     212.7      16.8      5.58     13.88     142.0      5.36     14.32     0.083     0.332     0.016     0.303
18:08    41.8     213.1      16.4      5.47     13.95     139.4      5.40     14.28     0.090     0.338     0.015     0.299
18:09    40.6     219.4      17.0      5.45     13.98     134.2      6.00     13.72     0.087     0.339     0.016     0.299
18:10    39.3     218.3      16.6      5.70     13.72     132.9      5.83     13.87     0.086     0.343     0.016     0.293
18:11    37.8     219.6      17.5      5.93     13.55     130.7      6.05     13.68     0.084     0.350     0.017     0.292

COMMENTS: End of Test 2-2
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CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 2/ Pre-test 3 Calibration Bias Check Unit 2

DATE : 10-25-1989 TIME: 18:12 - 18:40

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.7
1	OUTLET	ppmSO2	49.6	49.8
3	OUTLET	ppmNOX	0.0	1.6
3	OUTLET	ppmNOX	240.0	238.3
4	OUTLET	ppmCO	0.0	0.1
4	OUTLET	ppmCO	24.8	23.5
2	OUTLET	% O2	0.00	0.00
2	OUTLET	% O2	11.93	11.60
5	OUTLET	% CO2	0.00	0.10
5	OUTLET	% CO2	11.06	11.36
6	INLET	ppmSO2	0.0	5.3
6	INLET	ppmSO2	218.0	216.4
7	INLET	% O2	0.00	0.02
7	INLET	% O2	11.93	11.76
8	INLET	% CO2	0.00	0.38
8	INLET	% CO2	11.06	11.22

BEST AVAILABLE COPY

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
        CHAN 1   CHAN 3   CHAN 4   CHAN 2   CHAN 5   CHAN 6   CHAN 7   CHAN 8   OUTLET   OUTLET   OUTLET   INLET
        OUTLET   OUTLET   OUTLET   OUTLET   OUTLET   INLET    INLET    INLET    lb SO2   lb NOX   lb CO    lb SO2
TIME    ppmSO2   ppmNOX   ppmCO    % O2     % CO2    ppmSO2   % O2     % CO2    MBTU     MBTU     MBTU     MBTU
18:54    41.1    204.5    26.8     7.19    12.45     99.1     7.48    12.26    0.099    0.356    0.028    0.245
18:55    38.8    203.7    29.4     7.43    12.29     96.1     7.46    12.24    0.096    0.361    0.032    0.237
18:56    37.4    202.0    29.6     7.39    12.30     92.3     7.84    11.88    0.092    0.357    0.032    0.235
18:57    33.9    199.0    30.2     7.71    11.98     87.8     8.12    11.62    0.085    0.360    0.033    0.228
18:58    32.8    196.9    30.9     7.97    11.77     89.8     7.90    11.81    0.084    0.364    0.035    0.229
18:59    32.2    195.2    30.9     8.00    11.77     94.6     7.59    12.12    0.083    0.361    0.035    0.236
19:00    30.7    195.5    30.8     7.88    11.87     92.1     7.73    11.97    0.078    0.359    0.034    0.232
19:01    30.9    198.9    29.9     7.91    11.88    102.3     7.04    12.69    0.079    0.366    0.033    0.245
19:02    35.8    204.1    28.3     7.40    12.32    103.2     6.95    12.73    0.088    0.361    0.030    0.246
19:03    39.2    206.7    28.1     7.23    12.44    111.2     6.37    13.32    0.095    0.361    0.030    0.254
19:04    41.8    212.1    27.2     6.80    12.83    112.3     6.57    13.14    0.098    0.359    0.028    0.260
19:05    45.8    212.1    26.9     6.69    12.88    108.5     6.65    13.04    0.107    0.356    0.027    0.253

19:06    47.5    214.5    26.8     6.73    12.89    110.9     6.51    13.17    0.111    0.362    0.027    0.256
19:07    48.8    215.4    26.3     6.57    12.99    109.5     6.58    13.09    0.113    0.359    0.027    0.254
19:08    45.5    215.2    26.1     6.77    12.83    116.5     6.05    13.64    0.107    0.364    0.027    0.261
19:09    48.4    214.6    23.4     6.47    13.13    116.6     6.16    13.53    0.111    0.355    0.024    0.263
19:10    50.7    215.0    21.6     6.41    13.17    107.7     6.96    12.71    0.116    0.354    0.022    0.256
19:11    49.5    214.4    22.3     6.70    12.85    112.2     6.55    13.12    0.116    0.360    0.023    0.260
19:12    48.2    213.6    23.3     6.78    12.83    114.6     6.47    13.22    0.113    0.361    0.024    0.264
19:13    47.0    213.7    23.7     6.65    12.95    114.4     6.45    13.24    0.110    0.358    0.024    0.263
19:14    44.3    215.6    23.7     6.68    12.95    120.0     6.06    13.64    0.103    0.362    0.024    0.268
19:15    43.5    216.3    22.7     6.33    13.28    117.1     6.35    13.36    0.099    0.355    0.023    0.267
19:16    41.8    214.2    22.4     6.43    13.15    113.8     6.52    13.21    0.096    0.353    0.022    0.263
19:17    39.8    213.3    22.8     6.65    12.97    118.2     6.05    13.66    0.093    0.357    0.023    0.264
19:18    39.1    216.4    22.6     6.43    13.22    119.9     6.10    13.57    0.090    0.357    0.023    0.269
19:19    38.0    214.7    22.5     6.26    13.29    116.3     6.05    13.65    0.086    0.350    0.022    0.260
19:20    33.6    212.9    21.6     6.39    13.24    120.3     5.91    13.77    0.077    0.350    0.022    0.266

AVERAGE VALUES FOR THE LAST 15 MINUTES
19:20    44.4    214.6    23.4     6.55    13.05    115.2     6.32    13.37    0.103    0.357    0.024    0.262

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AVERAGE VALUES FOR THE LAST HOUR: 27 MINUTES OF VALID DATA
19:20    41.0    209.3    26.0     6.96    12.69    108.0     6.76    12.94    0.097    0.359    0.027    0.253
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19:21    34.9    211.6    21.2     6.11    13.44    110.0     6.57    13.14    0.078    0.342    0.021    0.255
19:22    31.1    211.9    22.5     6.48    13.09    114.0     6.23    13.47    0.072    0.351    0.023    0.258
19:23    27.9    214.0    22.2     6.51    13.13    120.2     5.88    13.82    0.064    0.355    0.022    0.266
19:24    27.8    216.2    22.9     6.19    13.41    113.6     6.39    13.33    0.063    0.351    0.023    0.260
19:25    24.7    216.8    22.8     6.40    13.20    117.6     5.88    13.84    0.057    0.357    0.023    0.260
19:26    22.7    216.9    22.6     6.34    13.32    118.0     5.94    13.78    0.052    0.356    0.023    0.262
19:27    22.9    215.5    21.6     6.20    13.41    119.2     6.01    13.72    0.052    0.350    0.021    0.266
19:28    22.8    216.3    21.2     6.14    13.47    119.7     5.78    13.97    0.051    0.350    0.021    0.263
19:29    22.9    218.7    21.9     6.14    13.50    118.2     6.04    13.73    0.052    0.354    0.022    0.264
19:30    22.4    217.5    21.9     6.19    13.41    121.8     5.76    14.01    0.051    0.353    0.022    0.267
19:31    22.8    218.1    21.0     6.11    13.53    120.2     6.06    13.71    0.053    0.352    0.021    0.269
19:32    25.1    216.6    20.5     6.17    13.43    118.7     6.06    13.74    0.057    0.351    0.020    0.266
19:33    26.1    216.9    20.4     6.24    13.39    125.8     5.60    14.19    0.059    0.353    0.020    0.273
19:34    28.9    217.8    20.3     6.00    13.64    123.7     5.78    14.01    0.064    0.349    0.020    0.272
19:35    29.8    217.6    20.8     5.99    13.60    120.3     5.85    13.91    0.066    0.349    0.020    0.265

AVERAGE VALUES FOR THE LAST 15 MINUTES
19:35    26.3    216.2    21.6     6.21    13.40    118.7     5.99    13.76    0.059    0.352    0.021    0.264
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Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
19:36	29.6	215.5	19.9	6.11	13.51	118.5	6.35	13.43	0.066	0.348	0.020	0.270
19:37	30.8	213.0	17.6	6.06	13.49	108.5	6.93	12.86	0.069	0.343	0.017	0.258
19:38	31.1	211.5	19.6	6.68	12.92	119.4	6.03	13.76	0.073	0.355	0.020	0.267
19:39	28.5	208.1	21.2	6.62	13.05	112.5	6.80	13.00	0.066	0.348	0.022	0.265
19:40	30.6	214.9	21.0	6.67	12.95	114.1	6.83	12.99	0.071	0.361	0.021	0.269
19:41	32.8	213.1	21.2	6.87	12.79	109.7	7.02	12.78	0.078	0.363	0.022	0.263
19:42	33.8	210.4	20.2	7.09	12.59	107.5	7.29	12.47	0.081	0.364	0.021	0.262
19:43	35.3	208.8	19.8	7.34	12.34	114.1	6.70	13.10	0.086	0.368	0.021	0.267
19:44	35.9	217.5	19.7	7.42	12.40	149.7	4.33	15.37	0.088	0.385	0.021	0.300
19:45	46.1	222.0	20.4	5.84	13.93	178.4	3.37	16.22	0.101	0.352	0.020	0.338
19:46	58.8	212.3	34.1	4.52	15.02	178.4	3.84	15.78	0.119	0.310	0.030	0.347
19:47	64.3	216.5	48.9	4.37	15.07	169.8	3.97	15.62	0.129	0.313	0.043	0.333
19:48	61.7	215.0	30.1	4.46	14.98	171.8	4.10	15.49	0.125	0.312	0.027	0.339
19:49	62.2	207.4	24.8	4.24	15.13	148.0	4.91	14.77	0.124	0.297	0.022	0.307
19:50	57.2	213.2	19.2	5.04	14.42	144.0	5.31	14.39	0.120	0.321	0.018	0.307
AVERAGE VALUES FOR THE LAST 15 MINUTES												
19:50	42.6	213.3	23.8	5.95	13.64	136.3	5.59	14.14	0.093	0.343	0.023	0.293
19:51	53.1	213.7	17.0	5.22	14.27	143.1	5.16	14.55	0.112	0.325	0.016	0.302
19:52	47.0	210.2	19.1	5.55	13.99	144.7	4.92	14.80	0.102	0.327	0.018	0.301
19:53	44.0	210.4	15.2	5.35	14.22	141.2	5.25	14.47	0.094	0.323	0.014	0.300
19:54	42.6	208.4	13.1	5.48	14.06	140.5	5.20	14.53	0.092	0.323	0.012	0.297
19:55	39.4	207.0	13.1	5.54	14.04	139.7	5.28	14.45	0.085	0.322	0.012	0.297
19:56	36.7	205.3	12.8	5.52	14.05	133.6	5.78	13.99	0.079	0.319	0.012	0.293
19:57	34.9	206.9	12.9	5.84	13.75	144.5	4.76	14.98	0.077	0.328	0.012	0.297
19:58	31.0	205.9	13.0	5.69	14.00	142.8	4.92	14.79	0.068	0.323	0.012	0.297
19:59	32.1	205.3	13.1	5.34	14.25	132.4	5.53	14.24	0.069	0.315	0.012	0.286
20:00	31.0	207.3	13.8	5.60	13.98	132.5	5.33	14.43	0.067	0.324	0.013	0.283
20:01	29.7	207.5	13.8	5.65	13.99	129.9	5.63	14.16	0.065	0.325	0.013	0.282
20:02	31.9	208.8	14.3	5.70	13.91	126.0	5.59	14.18	0.070	0.328	0.014	0.273
20:03	29.3	208.6	14.4	5.89	13.77	129.3	5.58	14.20	0.065	0.332	0.014	0.280
20:04	29.2	207.1	13.8	5.80	13.83	125.8	5.81	14.00	0.064	0.328	0.013	0.277
20:05	30.6	207.3	14.3	5.93	13.71	122.8	5.89	13.89	0.068	0.331	0.014	0.272
AVERAGE VALUES FOR THE LAST 15 MINUTES												
20:05	36.2	208.0	14.2	5.61	13.99	135.3	5.37	14.38	0.078	0.325	0.014	0.289
20:06	28.8	205.8	15.1	6.12	13.54	120.0	6.11	13.69	0.065	0.333	0.015	0.269
20:07	30.3	206.4	15.3	6.21	13.45	115.8	6.38	13.43	0.068	0.335	0.015	0.265
20:08	39.3	203.8	15.5	6.51	13.15	117.9	6.23	13.57	0.091	0.338	0.016	0.267
20:09	33.0	203.5	15.3	6.65	13.04	117.6	6.36	13.45	0.077	0.341	0.016	0.269
20:10	25.5	205.0	15.4	6.66	13.02	105.6	7.04	12.75	0.059	0.344	0.016	0.253
20:11	23.1	203.8	16.0	7.11	12.60	114.0	6.30	13.53	0.056	0.353	0.017	0.259
20:12	23.7	205.2	15.1	6.87	12.87	113.8	6.27	13.55	0.056	0.349	0.017	0.258
20:13	23.1	207.1	16.0	6.74	12.98	110.8	6.58	13.22	0.054	0.349	0.016	0.257
20:14	25.1	203.7	15.7	6.74	12.95	110.7	6.57	13.24	0.059	0.343	0.016	0.257
20:15	27.6	205.4	16.1	6.84	12.86	105.2	7.28	12.51	0.065	0.349	0.017	0.256
20:16	22.2	202.8	16.4	7.07	12.63	114.1	6.44	13.38	0.068	0.350	0.017	0.262
20:17	31.7	205.2	17.0	7.06	12.71	119.7	6.24	13.56	0.076	0.354	0.018	0.271
20:18	33.5	206.0	16.9	6.68	13.04	117.5	6.45	13.34	0.090	0.346	0.017	0.270
20:19	46.3	205.5	16.5	6.60	13.07	119.7	6.43	13.36	0.108	0.343	0.017	0.275
20:20	55.3	205.7	16.7	6.62	13.06	115.8	6.66	13.12	0.131	0.344	0.017	0.270

Palm Beach Co. Solid Waste Authority Compliance 10-25-1989

TIME	CHAN 1 OUTLET ppmSO2	CHAN 3 OUTLET ppmNOX	CHAN 4 OUTLET ppmCO	CHAN 2 OUTLET % O2	CHAN 5 OUTLET % CO2	CHAN 6 INLET ppmSO2	CHAN 7 INLET % O2	CHAN 8 INLET % CO2	OUTLET lb SO2 MBTU	OUTLET lb NOX MBTU	OUTLET lb CO MBTU	INLET lb SO2 MBTU
AVERAGE VALUES FOR THE LAST 15 MINUTES												
20:20	32.0	205.0	16.0	6.70	13.00	114.5	6.49	13.31	0.075	0.345	0.016	0.264
AVERAGE VALUES FOR THE LAST HOUR: 60 MINUTES OF VALID DATA												
20:20	34.3	210.6	18.9	6.12	13.51	126.2	5.86	13.90	0.076	0.341	0.019	0.278
20:21	61.0	203.9	17.9	6.78	12.88	116.0	6.63	13.15	0.143	0.345	0.018	0.270
20:22	66.8	204.9	17.5	6.87	12.81	111.5	6.94	12.85	0.158	0.349	0.018	0.265
20:23	73.5	205.9	17.7	6.96	12.70	107.8	7.36	12.41	0.175	0.353	0.018	0.264
20:24	71.3	204.5	18.3	7.23	12.46	112.4	6.85	12.96	0.173	0.357	0.019	0.266
20:25	71.6	205.4	18.1	7.28	12.49	122.5	6.17	13.63	0.175	0.360	0.019	0.276
20:26	72.1	207.2	17.8	6.77	12.95	117.0	6.80	13.01	0.169	0.350	0.018	0.275
20:27	63.7	206.8	18.1	6.78	12.86	110.8	7.17	12.61	0.150	0.350	0.019	0.268
20:28	51.0	205.9	19.5	7.04	12.62	110.6	7.02	12.77	0.122	0.355	0.020	0.265
20:29	41.8	205.8	20.1	7.22	12.49	107.8	7.26	12.50	0.102	0.359	0.021	0.262
20:30	35.4	201.5	19.7	7.27	12.42	104.9	7.62	12.12	0.086	0.353	0.021	0.262
20:31	32.5	195.0	19.6	7.55	12.17	102.9	7.57	12.17	0.081	0.349	0.021	0.256
20:32	29.5	193.9	19.4	7.70	12.06	105.2	7.39	12.35	0.074	0.351	0.021	0.258
20:33	28.7	195.1	19.2	7.66	12.11	108.4	7.43	12.29	0.072	0.352	0.021	0.267
20:34	29.1	194.8	18.8	7.54	12.17	107.1	7.41	12.32	0.072	0.348	0.020	0.264
20:35	29.3	197.3	19.3	7.52	12.20	109.8	7.25	12.49	0.073	0.352	0.021	0.267
AVERAGE VALUES FOR THE LAST 15 MINUTES												
20:35	50.5	201.9	18.7	7.21	12.49	110.3	7.13	12.64	0.122	0.352	0.020	0.266
20:36	29.4	198.8	19.6	7.58	12.16	116.5	6.94	12.80	0.073	0.356	0.021	0.277
20:37	30.9	202.6	20.3	7.32	12.38	116.1	6.95	12.78	0.075	0.356	0.022	0.276
20:38	30.4	206.0	20.8	7.20	12.47	111.1	7.37	12.34	0.074	0.359	0.022	0.273
20:39	30.1	201.7	20.9	7.31	12.35	115.1	7.03	12.69	0.074	0.354	0.022	0.276
20:40	29.3	200.9	21.8	7.41	12.29	111.2	7.33	12.38	0.072	0.356	0.024	0.272
20:41	29.7	200.6	21.4	7.48	12.22	115.6	7.08	12.66	0.074	0.357	0.023	0.278
20:42	34.6	204.6	21.2	7.40	12.30	114.5	7.25	12.47	0.085	0.362	0.023	0.278
20:43	37.9	207.7	21.8	7.42	12.28	114.5	6.96	12.77	0.093	0.368	0.023	0.273
20:44	40.1	208.7	22.9	7.35	12.34	117.6	6.94	12.77	0.098	0.368	0.025	0.280
20:45	40.2	212.3	22.2	7.22	12.44	112.2	7.33	12.38	0.097	0.371	0.024	0.274
20:46	35.6	211.2	22.5	7.25	12.39	112.6	7.01	12.70	0.086	0.370	0.024	0.269
20:47	33.1	209.7	22.2	7.41	12.28	120.9	6.60	13.14	0.081	0.371	0.024	0.281
20:48	37.2	210.7	21.4	7.20	12.49	117.6	7.03	12.69	0.090	0.367	0.023	0.281
20:49	38.7	211.5	20.7	7.06	12.57	122.8	6.50	13.23	0.093	0.365	0.022	0.283
20:50	36.4	216.7	20.2	6.96	12.71	125.6	6.45	13.28	0.087	0.371	0.021	0.289
AVERAGE VALUES FOR THE LAST 15 MINUTES												
20:50	34.2	206.9	21.3	7.30	12.38	116.2	6.98	12.74	0.084	0.363	0.023	0.277
20:51	28.4	217.2	20.2	6.72	12.89	129.2	6.26	13.48	0.066	0.366	0.021	0.293
20:52	20.9	216.5	20.7	6.64	12.97	129.6	6.43	13.30	0.049	0.363	0.021	0.297
20:53	16.8	214.2	20.5	6.58	12.99	127.8	6.55	13.20	0.039	0.357	0.021	0.296
20:54	12.5	212.9	21.1	6.78	12.82	124.9	6.53	13.22	0.029	0.360	0.022	0.289
20:55	9.7	215.6	20.7	6.76	12.88	129.5	6.24	13.53	0.023	0.364	0.021	0.293
20:56	11.0	217.7	20.0	6.50	13.12	134.7	5.89	13.86	0.025	0.361	0.020	0.298
20:57	14.6	217.7	19.7	6.42	13.20	130.8	6.26	13.51	0.034	0.359	0.020	0.297
20:58	23.0	220.3	19.4	6.39	13.20	131.9	6.09	13.68	0.053	0.363	0.019	0.296
20:59	36.2	217.4	20.1	6.46	13.14	122.4	6.54	13.22	0.083	0.360	0.020	0.283

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Palm Beach Co. Solid Waste Authority  Compliance     10-25-1989
        CHAN 1    CHAN 3    CHAN 4    CHAN 2    CHAN 5    CHAN 6    CHAN 7    CHAN 8    OUTLET    OUTLET    OUTLET    INLET
        OUTLET    OUTLET    OUTLET    OUTLET    OUTLET    INLET     INLET     INLET     lb SO2    lb NOX    lb CO     lb SO2
TIME    ppmSO2    ppmNOX    ppmCO     % O2      % CO2     ppmSO2    % O2      % CO2     MBTU      MBTU      MBTU      MBTU
21:00     52.5     215.1      20.5      6.67     12.95     130.4      6.16     13.58     0.122     0.361     0.021     0.294
21:01     72.8     215.7      20.7      6.60     12.98     125.7      6.33     13.44     0.169     0.360     0.021     0.286
21:02     88.9     217.5      20.0      6.65     12.95     124.2      6.25     13.52     0.207     0.364     0.020     0.281
21:03     98.3     219.0      20.4      6.54     13.06     121.3      6.45     13.31     0.227     0.364     0.021     0.279
21:04     91.0     217.3      19.6      6.62     12.98     123.5      6.36     13.39     0.211     0.363     0.020     0.282
21:05     75.6     218.6      18.7      6.49     13.09     122.4      6.19     13.57     0.174     0.362     0.019     0.276

AVERAGE VALUES FOR THE LAST 15 MINUTES
21:05     43.5     216.9      20.2      6.59     13.01     127.2      6.30     13.45     0.101     0.362     0.020     0.289

COMMENTS: End of Test 2-3
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CALIBRATION SUMMARY

SOURCE: Palm Beach Co. Solid Waste Authority Compliance

REASON: Post-test 3 Calibration Bias Check Unit 2

DATE : 10-25-1989 TIME: 21:05 - 21:34

A/D CHAN	MONITOR DESCRIPTION	UNITS	GAS VALUE	MONITOR RESPONSE
1	OUTLET	ppmSO2	0.0	2.6
1	OUTLET	ppmSO2	49.6	53.9
3	OUTLET	ppmNOX	0.0	1.5
3	OUTLET	ppmNOX	240.0	240.3
4	OUTLET	ppmCO	0.0	0.5
4	OUTLET	ppmCO	24.8	21.2
2	OUTLET	% O2	0.00	0.00
2	OUTLET	% O2	11.93	11.73
5	OUTLET	% CO2	0.00	0.18
5	OUTLET	% CO2	11.06	11.44
6	INLET	ppmSO2	0.0	3.0
6	INLET	ppmSO2	218.0	213.5
7	INLET	% O2	0.00	0.05
7	INLET	% O2	11.93	11.68
8	INLET	% CO2	0.00	0.48
8	INLET	% CO2	11.06	11.30

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery

TEST DATE: 10/25/89

RUN NUMBER: 2-PO-CEM-1 (OUTLET)

SPAN VALUES:

100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.6	1.0	0.40	2.9	2.30	1.90
SO2 UP-SCALE	50.8	49.0	-1.80	51.3	0.50	2.30
NOx ZERO GAS	0.7	0.7	0.00	1.5	0.16	0.16
NOx UP-SCALE	240.2	233.1	-1.42	238.5	-0.34	1.08
CO ZERO GAS	0.0	0.7	N/A	0.1	N/A	-0.30
CO UP-SCALE	23.9	23.5	N/A	23.5	N/A	0.00
O2 ZERO GAS	0.00	0.02	0.08	0.01	0.04	-0.04
O2 UP-SCALE	11.95	11.84	-0.44	11.76	-0.76	-0.32
CO2 ZERO GAS	0.00	0.02	0.10	0.10	0.50	0.40
CO2 UP-SCALE	11.33	11.26	-0.35	11.36	0.15	0.50

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery

TEST DATE: 10/25/89

RUN NUMBER: 2-PO-CEM-2 (OUTLET)

SPAN VALUES:
100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.6	2.9	2.30	2.7	2.10	-0.20
SO2 UP-SCALE	50.8	51.3	0.50	49.8	-1.00	-1.50
NOx ZERO GAS	0.7	1.5	0.16	1.6	0.18	0.02
NOx UP-SCALE	240.2	238.5	-0.34	238.3	-0.38	-0.04
CO ZERO GAS	0.0	0.1	N/A	0.1	N/A	0.00
CO UP-SCALE	23.9	23.5	N/A	23.5	N/A	0.00
O2 ZERO GAS	0.00	0.01	0.04	0.00	0.00	-0.04
O2 UP-SCALE	11.95	11.76	-0.76	11.60	-1.40	-0.64
CO2 ZERO GAS	0.00	0.10	0.50	0.10	0.50	0.00
CO2 UP-SCALE	11.33	11.36	0.15	11.36	0.15	0.00

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery TEST DATE: 10/25/89

RUN NUMBER: 2-PO-CEM-3 (OUTLET)

SPAN VALUES:
100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		INITIAL VALUES		FINAL VALUES		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.6	2.7	2.10	2.6	2.00	-0.10
SO2 UP-SCALE	50.8	49.8	-1.00	53.9	3.10	4.10
NOx ZERO GAS	0.7	1.6	0.18	1.5	0.16	-0.02
NOx UP-SCALE	240.2	238.3	-0.38	240.3	0.02	0.40
CO ZERO GAS	0.0	0.1	N/A	0.5	N/A	0.20
CO UP-SCALE	23.9	23.5	N/A	21.2	N/A	-1.15
O2 ZERO GAS	0.00	0.00	0.00	0.00	0.00	0.00
O2 UP-SCALE	11.95	11.60	-1.40	11.73	-0.88	0.52
CO2 ZERO GAS	0.00	0.10	0.50	0.18	0.90	0.40
CO2 UP-SCALE	11.33	11.36	0.15	11.44	0.55	0.40

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

APPENDIX B.2.b.3

B. FIELD AND ANALYTICAL DATA

  2. Unit No. 2

    b. ESP Outlet

      3. Hydrogen Chloride and Hydrogen Fluoride

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility

LOCATION West Palm Beach FL

SAMPLING LOCATION Units # 1 & 2 - ESP Outlet Duct

NO. OF PORTS 5

PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97½"

NIPPLE LENGTH 9"

DEPTH OF DUCT 88½"

WIDTH (RECTANGULAR DUCT) 88½"

EQUIVALENT DIAMETER:

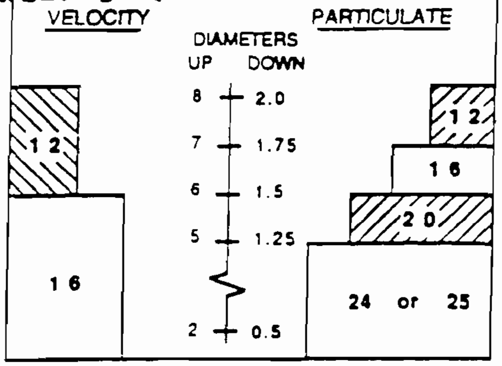
$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} = 88½$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88½" x 88½" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8⅞	17⅞
2	30.0	26½	35½
3	50.0	44¼	53¼
4	70.0	62	71
5	90.0	79⅝	88⅝
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14 6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.6	85.4	75.0	63.4	37.5	29.8	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

F0003
4/24/89

ENTROPY ENVIRONMENTALISTS, INC.

ORSAT FIELD DATA

Plant Name North County Resource Recovery Facility

Sampling Location Unit #2 ESP Outlet Fuel Type RDF

Run and/or Sample No. 2-ESPO-M3-1 Leak Test? ✓ Date 10-25-89 Operator JRW

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	%O_2 B-A	%CO C-B	%N_2 100-C
1230	1530	12.5	19.1	—	6.6	—	80.9
—	—	12.4	19.1	—	6.7	—	80.9
1442	1600	12.5	19.1	—	6.6	—	80.9
	Avg.	12.5		Avg.	6.6	—	80.9

Run and/or Sample No. 2-ESPO-M3-2 Leak Test? ✓ Date 10-25-89 Operator DGB

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	%O_2 B-A	%CO C-B	%N_2 100-C
1530	1845	12.4	19.6	—	7.2	—	80.4
—	—	12.3	19.7	—	7.4	—	80.3
1743	1915	12.4	19.7	—	7.3	—	80.3
	Avg.	12.4		Avg.	7.3	—	80.3

Run and/or Sample No. 2-ESPO-M3-3 Leak Test? ✓ Date 10-25-89 Operator JRW

Time of Sample Collection	Time of Analysis	CO_2 Reading A	O_2 Reading B	CO Reading C	%O_2 B-A	%CO C-B	%N_2 100-C
1850	2145	12.2	19.3	—	7.1 ~~6.1~~ DGB	—	80.7
—	2155	12.2	19.3	—	7.1 ~~6.1~~ DGB	—	80.7
2102	2210	12.1	19.3	—	7.2 ~~6.2~~ DGB	—	80.7
	Avg.	12.2		Avg.	7.1 ~~6.1~~ DGB	—	80.7

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER ~~II-4~~ RO M130-1
ADDRESS West Palm Beach Fla
TIME START 1300
SAMPLING LOCATION Unit 2 ESP outlet duct
TIME FINISH 1412
DATE 10-25-89 TEAM LEADER KCM TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -5.45
TRAIN LEAK CHECK VACUUM IN. HG 15 04
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 275 PRE
✓ THERMOCOUPLE @ 268 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0600 NOZZLE 665 DIAMETER .254
METER BOX N-10 T/C READOUT F6
UMBILICAL U-5 T/C PROBE 9-5
SAMPLE BOX 3 ORSAT PUMP N/A
PROBE 9-14 PITOT PT43 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
Whatman	541

DELTA H@	1.764	1.764		
METER TEMP	160	90		
EST. %H_2O	23	23		
C FACTOR	.73	.72		
STACK TEMP	260	260		
REF DELTA P	.78	.80		
K-FACTOR	2.3589 K1	2.3 K2		

FYRITE
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #	
1	C 1	0	643.526	.56	1.29	1.29	85	1	250	59	264		K-2
2	2	2½	645.51	.57	1.31	1.31	85	1	250	59	264		
3	3	5	646.83	.48	1.10	1.10	86	1	250	59	264		
4	4	7½	648.39	.44	1.01	1.01	86	1	250	58	264		
5	5	10	649.88	.41	.94	.94	89	1	250	60	264		
6	D 1	12½/0	651.013	.52	1.20	1.20	90	2	250	64	258		
7	2	2½	652.59	.55	1.27	1.27	92	2	250	60	264		
8	3	5	654.21	.64	1.47	1.47	94	2	250	60	264		
9	4	7½	655.75	.65	1.50	1.50	96	2	250	58	264		
10	5	10	657.65	.77	1.77	1.77	97	2	250	56	265		
11	E 1	25/0	659.497	.48	1.10	1.10	97	2	245	50	260		
12	2	2½	660.99	.60	1.38	1.38	97	2	245	50	264		
13	3	5	662.64	.62	1.43	1.43	96	2	247	49	265		
14	4	7½	664.34	.64	1.47	1.47	96	2	247	49	265		
15	5	10	666.06	.56	1.29	1.29	96	2	246	48	265		
16	A 1	37½/0	667.680	.36	.83	.83	96	2	244	50	259		
17	2	2½	668.99	.56	1.29	1.29	98	2	244	50	261		
18	3	5	670.63	.46	1.09	1.09	98	2	246	49	266		K-1
19	4	7½	672.09	.44	1.04	1.04	98	2	246	49	261		
20	5	10	673.58	.48	1.16	1.16	97	2	246	52	262		
21	B 1	50/0	675.098	.45	1.06	1.06	95	2	249	55	258		
22	2	2½	677.18	.51	1.20	1.20	95	2	253	56	261		
23	3	5	678.75	.49	1.16	1.16	99	2	255	56	261		
24	4	7½	680.30	.49	1.16	1.16	94	2	255	56	261		
25	5	10	681.83	.56	1.32	1.32	94	2	253	56	262		
		62½/off	683.452										

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
62½	39.926	0.5284	1.23	94	262

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER ~~II~~ 2-ESPO-M13B-2
ADDRESS West Palm Beach Fla.
TIME START 1600
SAMPLING LOCATION Unit 2 ESP Outlet Duct
TIME FINISH 1710
DATE 10-25-89 TEAM LEADER LCM
TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O SEE BELOW -6.05
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.001

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 275 PRE
✓ THERMOCOUPLE @ 265 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0660 NOZZLE 565 DIAMETER .251
METER BOX N-10 T/C READOUT F-6
UMBILICAL U-5 T/C PROBE 9-3
SAMPLE BOX 17 ORSAT PUMP NA
PROBE 9-13 PITOT
TEDLAR BAG NA

LEAK CHECK READINGS

B 1	
E	
B 2	
E	
B 3	
E	
B 4	
E	
B 5	
E	
B 6	
E	

FILTER #	TARE
WHATMAN 541	—

DELTA H@	1.764	1.764		
METER TEMP	90	100		
EST. %H_2O	23	23		
C FACTOR	.86	.78		
STACK TEMP	260	260		
REF DELTA P	.81	.82		
K-FACTOR	2.271	2.243		

FYRITE
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	~~MR CHK~~ # Static Pressure in H_2O
1	E 1	0	683.698	.62	1.39	1.39	91	2	265	64	262	-6.4
2	2	2½	685.39	.69	1.55	1.55	91	2	265	64	261	-6.8
3	3	5	687.22	.65	1.46	1.46	92	2	265	60	261	-6.7
4	4	7½	688.85	.56	1.26	1.26	92	2	264	60	261	-6.7
5	5	10	690.48	.45	1.01	1.01	93	2	260	55	261	-6.5
6	D 1	12½/0	691.955	.61	1.37	1.37	93	2	258	54	258	-6.6
7	2	2½	693.60	.53	1.19	1.19	93	2	258	52	262	-5.7
8	3	5	695.18	.58	1.30	1.30	93	2	255	50	262	-6.0
9	4	7½	696.81	.64	1.44	1.44	93	2	255	50	262	-5.8
10	5	10	698.51	.59	1.32	1.32	94	2	255	50	262	-5.9
11	E 1	25/0	700.156	.46	1.03	1.03	95	2	253	50	257	-6.2
12	2	2½	701.61	.60	1.35	1.35	96	2	250	50	261	-5.8
13	3	5	703.26	.57	1.28	1.28	97	2	250	49	262	-6.3
14	4	7½	704.88	.59	1.32	1.32	98	2	250	48	262	-5.2
15	5	10	706.53	.63	1.41	1.41	98	2	247	48	262	-6.5
16	A 1	37½/0	708.222	.49	1.10	1.10	98	2	247	49	258	-6.4
17	2	2½	709.73	.53	1.19	1.19	99	2	247	51	260	-5.5
18	3	5	711.31	.48	1.08	1.08	99	2	248	52	255	-6.0
19	4	7½	712.80	.48	1.08	1.08	99	2	250	52	255	-5.8
20	5	10	714.33	.50	1.12	1.12	99	2	250	50	260	-6.6
21	B 1	50/0	715.860	.57	1.28	1.28	98	2	250	53	258	-6.0
22	2	2½	717.47	.48	1.08	1.08	99	2	251	53	259	-5.4
23	3	5	718.97	.51	1.14	1.14	100	2	251	52	255	-5.8
24	4	7½	720.55	.44	.99	.99	100	2	250	52	258	-5.7
25	5	10	721.95	.50	1.12	1.12	100	2	250	52	260	-5.0
		62½/off	723.418									

62½ minutes
39.720 Vm
.5479 $(\sqrt{\Delta p})^2$
1.23 ΔH
96 tm
260 ts

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER ~~II-#~~ 2 PO-M13B-3
ADDRESS West Palm Beach Fla
TIME START 1920
SAMPLING LOCATION Unit 2 ESP Outlet duct
TIME FINISH 2030
DATE 10-~~24~~ 23-89
TEAM LEADER LCM
TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -4.8
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- NA M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 265 PRE
- ✓ THERMOCOUPLE @ 265 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0600
NOZZLE ~~605~~ 505
DIAMETER ~~.254~~ .251
METER BOX N-10
T/C READOUT F-6
UMBILICAL U-5
T/C PROBE 95
SAMPLE BOX 3
ORSAT PUMP NA
PROBE 944
PITOT PPT-43
TEDLAR BAG NA

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
WHATMAN 541	—

DELTA H@	1.764	1.764		
METER TEMP	100	90		
EST. %H_2O	23	23		
C FACTOR	.73	.72		
STACK TEMP	260	260		
REF DELTA P	.88	.8[illegible]		
K-FACTOR	~~2.3589~~ 2.2716 K1	~~2.30~~ 2.2435 K-2		

FYRITE

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #	
1	C 1	0	723.563	.50	1.12	1.12	83	2	265	60	258		K-2
2	2	2½	725.10	.69	1.55	1.55	83	2	265	58	258		
3	3	5	726.85	.56	1.26	1.26	84	2	263	55	259		
4	4	7½	728.42	.53	1.19	1.19	84	2	260	55	259		
5	5	10	729.97	.46	1.03	1.03	84	2	260	53	260		
6	D 1	12½/0	731.431	.45	1.01	1.01	84	2	260	53	258		
7	2	2½	732.88	.50	1.12	1.12	84	2	258	52	259		
8	3	5	734.44	.65	1.46	1.46	85	2	258	50	261		
9	4	7½	736.13	.70	1.57	1.57	86	2	258	50	262		
10	5	10	737.88	.75	1.68	1.68	90	2	255	50	262		
11	E 1	25/0	739.741	.35	.79	.79	91	2	255	50	261		
12	2	2½	741.04	.43	.96	.96	92	2	250	50	261		
13	3	5	742.45	.43	.96	.96	95	2	250	48	262		
14	4	7½	743.91	.44	.99	.99	95	2	248	48	262		
15	5	10	745.33	.50	1.12	1.12	95	2	245	48	262		
16	A 1	37½/0	746.849	.38	.85	.85	92	2	247	48	260		
17	2	2½	748.19	.42	.94	.94	91	2	249	48	258		
18	3	5	749.60	.45	1.01	1.01	91	2	249	48	260		
19	4	7½	751.06	.40	.90	.90	90	2	250	48	257		
20	5	10	752.45	.49	1.10	1.10	90	2	250	48	259		
21	B 1	50/0	753.946	.37	.83	.83	89	2	250	50	255		
22	2	2½	755.27	.53	1.19	1.19	89	2	250	50	257		
23	3	5	756.83	.48	1.08	1.08	89	2	250	50	258		
24	4	7½	758.37	.46	1.03	1.03	89	2	250	52	258		
25	5	10	759.83	.52	1.17	1.17	89	2	251	52	266		
		62½/[illegible]	761.364										

62½	37.801	.4927	1.12	89	259
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Facility EEI Ref# 6284

Sampling Location: Unit No. 2 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0600

Run Number	2-PO-M13B-1	2-PO-M13B-2	2-PO-M13B-3
Run Date	10/25	10/25	10/25

ANALYSIS OF MOISTURE CATCH

Reagent 1 (0.1N NaOH)			
Final Weight, g.	455.5	500.0	483.5
Tared Weight, g.	294.5	296.5	293.5
Water Catch, g.	161.0	203.5	190.0
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch, g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch, g.	0.0	0.0	0.0
CONDENSED WATER, g.	161.0	203.5	190.0
Silica Gel:			
Final Weight, g.	208.5	210.0	209.0
Tared Weight, g.	200.0	200.0	200.0
ADSORBED WATER, g.	8.5	10.0	9.0
TOTAL WATER COLLECTED, g.	169.5	213.5	199.0

HCl Analytical Data Sheet

Job Name: North County Regional Resource Facility
Analyst: F. Jones Job Num. 6284
Sampling Location: Unit No.2 ESP Outlet Date: 11/17/89

Chloride Standard Calibration Curve by Linear Regression

Conc. (ug/ml)	Peak Area Run 1	Peak Area Run 2	% Diff.	Predicted Concentration (ug/ml)	Percent Deviation from Actual
5.00	9139	9012	0.70%	5.01	0.24%
10.00	18676	18047	1.71%	9.99	-0.15%
30.00	56382	55098	1.15%	30.00	0.01%
50.00	93979	93503	0.25%	50.35	0.71%

Standard Curve Slope 1867 Intercept -283

Method 13B Field Samples

Sample ID	Run 1 Area	Run 2 Area	Average	Percent Deviation	Dilution Factor	Sample Volume (ml)	HCl Catch (mg)
Blank	<454	<454	<454	0.00%	1	200	<0.08
2-PO-M13B-1	6315	6508	6412	1.51%	10	800	29.5
2-PO-M13B-2	6933	6608	6771	2.40%	10	700	27.2
2-PO-M13B-3	6189	6367	6278	1.42%	10	800	28.9

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-3-89
DATE REPORTED 11-29-89
89W8727

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-10

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: ESP OUTLET UNIT 2

1. 2-PO-M13B-1 FV 800
2. 2-PO-M13B-2 FV 700
3. 2-PO-M13B-3 FV 800
4. METHOD CODE

RESULTS

	1	2	3	4
Fluoride, as F, ug	96.0	77.0	73.6	13B

ROGER C. OXFORD , CHEMIST

Entropy

11-6-89

8727

11-10-89

LD

	1	2	3	EPA Known
F	25ml $\frac{10ug = .22}{25} = .088ug/ml$ $\frac{ugF \times m.R.}{ml\ sample} = ug/ml$	25ml $\frac{10ug = .19}{25} = .076ug/ml$	25ml $\frac{10ug = .17}{25} = .068ug/ml$	Actual Value = .21ug $\frac{10 \times .54}{25} = .216ug/ml$
Distilled F	200ml ↓ 25ml $\frac{10ug \times .29}{25} = .12ug/ml$	200ml ↓ 25ml $\frac{10ug \times .275}{25} = .11ug/ml$	200ml ↓ 25 $\frac{10ug \times .23}{25} = .092ug/ml$	↓ $\frac{10ug \times .54}{25} = .216$

Blk

$\frac{10ug \times .15}{25} = .06ug/ml$

$\frac{10ug \times .12}{25} = .05ug/ml$

CUSTODY SHEET FOR REAGENT BOX # 0650

Date of Makeup 19 Oct 1989 Initials BJB Locked? ✓

Individual Tare of Reagent: 200 mls. of 0.1N NaOH

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT # 2 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked
2-ESPO-M13B-1	10-25-89	SRD	—	10-25-89	50%	SRD	—
2-ESPO-M13B-2	10-25-89	SRD	—	10-25 89	50%	SRD	—
2-ESPO-M13B-3	10-25 89	SRD	—	10-25 89	40%	SRD	—

Received in Lab Date 10/30 Initials FJ Locked? ✓

Sampling Method: M13B

Remarks:

Zero & Span Balance Initials FJ

Filter #	Tare Weight (grams)	Used on Test
N/A	N/A	

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 62840-10 JOB NAME: NORTH COUNTY RRRF

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-2-89 EXPECTED DATE OF RESULTS: 11-16-89

SAMPLE MATRIX: M13B. ESP outlet. Unit 2.

TYPE OF ANALYSIS REQUESTED: Fluoride. See M13B Rules and Regulations.

Sample#	SampleID			
1	2-PO-M13B-1			
2	2-PO-M13B-2			
3	2-PO-M13B-3			

SUBMITTED BY:

L-0005a
8/86

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 6284 0-10 were
shipped via Pony Express on 11-2-89 by RAT
to OLI

Samples received at OLI on 11-3-89
by

Note any broken seals, leakage, spillage, and/or damage to the samples.

L-0009
1/87

APPENDIX B.2.b.4

B. FIELD AND ANALYTICAL DATA
  2. Unit No. 2
    b. ESP Outlet
      4. Lead and Particulate

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility

LOCATION West Palm Beach FL

SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5

PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"

NIPPLE LENGTH 9"

DEPTH OF DUCT 88 1/2"

WIDTH (RECTANGULAR DUCT) 88 1/2"

EQUIVALENT DIAMETER:

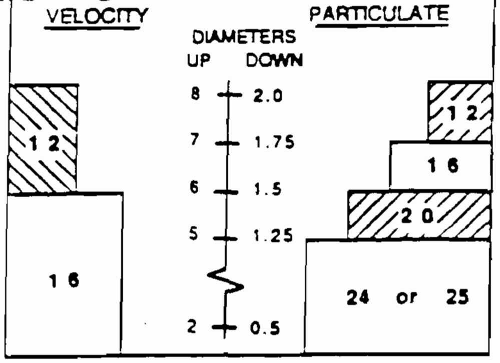
$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} = 88\tfrac{1}{2}$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	36.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	88.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME North County Regional Resource Recovery Facility
RUN NUMBER 2-ESPO-MS2-1
ADDRESS West Palm Beach FL
TIME START 1145
SAMPLING LOCATION Unit # 2 - ESP Outlet Duct
TIME FINISH 1400
DATE 10.24.89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 29.9
STATIC PRESSURE IN. H_2O -6.9
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.006 0.004

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
N/A M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 255 PRE
✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0506 NOZZLE 505 DIAMETER 0.251
METER BOX N.8 T/C READOUT F.64
UMBILICAL U.11 T/C PROBE 9.3
SAMPLE BOX 33 ORSAT PUMP N/A
PROBE 9.13 PITOT 9.13 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
Quartz	0.4607

DELTA H@	~~1.674~~	1.674		
METER TEMP	90	90		
EST. %H_2O	18	22		
C FACTOR	0.75	0.70		
STACK TEMP	260	260		
REF DELTA P	0.79	0.85		
K-FACTOR	0.0232911	0.0216471		

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E·1	0/0	4.607	0.46	1.00	1.00	66	3	250	64	259	
2	2	5	7.45	0.58	1.26	1.26	68	3	253	59	261	
3	3	10	10.51	0.60	1.30	1.30	71	3	255	58	262	
4	4	15	13.63	0.61	1.32	1.32	74	3	261	58	263	
5	5	20	16.81	0.69	1.49	1.49	77	4	262	54	262	
6	A·1	25/0	20.172	0.52	1.13	1.13	82	3	254	66	263	
7	2	5	23.17	0.58	1.26	1.26	87	3	252	60	264	
8	3	10	26.30	0.52	1.13	1.13	90	3	250	57	264	
9	4	15	29.31	0.54	1.17	1.17	92	3	250	59	265	
10	5	20	32.36	0.60	1.30	1.30	93	3	253	61	266	
11	B·1	50/0	35.575	0.54	1.17	1.17	93	3	256	64	260	
12	2	5	38.64	0.55	1.19	1.19	93	3	255	60	266	
13	3	10	41.76	0.52	1.13	1.13	94	3	256	58	267	
14	4	15	44.80	0.51	1.10	1.10	94	3	257	58	265	
15	5	20	47.76	0.66	1.43	1.43	94	4	254	60	268	
16	C·1	75/0	51.168	0.61	1.32	1.32	95	4	248	65	261	
17	2	5	54.43	0.72	1.56	1.56	96	4	253	62	269	
18	3	10	57.94	0.66	1.43	1.43	96	4	255	60	267	
19	4	15	61.32	0.49	1.06	1.06	95	3	258	58	270	
20	5	20	64.32	0.58	1.26	1.26	94	3	254	59	268	
21	D-1	100/0	67.503	0.75	1.62	1.62	90	4	259	64	260	
22	2	5	71.13	0.64	1.39	1.39	88	4	255	60	270	
23	3	10	74.50	0.66	1.43	1.43	87	4	253	57	270	
24	4	15	77.88	0.64	1.39	1.39	87	4	251	58	270	
25	5	20	81.24	0.65	1.41	1.41	87	4	250	58	269	
		125/off	84.540									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	79.933	0.5930	1.29 ~~1.33~~	87 ~~1.29~~	265

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NC RRRF
RUN NUMBER 2-ESP0-M5/12-2
ADDRESS West Palm Beach, FL
TIME START 1440
SAMPLING LOCATION Unit # 2 - ESP Outlet Duct
TIME FINISH 1655
DATE 10.24.89
TEAM LEADER B. Rudd
TECHNICIANS –
BAROMETRIC PRESSURE. IN. HG 29.9
STATIC PRESSURE IN. H_2O -5.4
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.008 0.002

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
N/A M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 255 PRE
✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0506
NOZZLE 604
DIAMETER 0.54
METER BOX N.8
T/C READOUT F.69
UMBILICAL U.11
T/C PROBE 9.37
SAMPLE BOX 5
ORSAT PUMP N/A
PROBE 9.12
PITOT PT-12
TEDLAR BAG N/A

LEAK CHECK READINGS

B	
1	
E	
B	
2	
E	
B	
3	
E	
B	
4	
E	
B	
5	
E	
B	
6	
E	

FILTER #	TARE
Quartz	0.4647

DELTA H@	1.574			
METER TEMP	90			
EST. %H_2O	22			
C FACTOR	0.70			
STACK TEMP	260			
REF DELTA P	0.81			
K-FACTOR	0.02276			

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E.1	0/0	84.710	0.43	0.98	0.98	85	3	243	64	265	
2	2	5	87.53	0.54	1.23	1.23	85	3	248	57	265	
3	3	10	90.62	0.57	1.29	1.29	87	3	253	56	266	
4	4	15	93.82	0.52	1.18	1.18	88	3	255	56	266	
5	5	20	96.92	0.54	1.23	1.23	89	3	259	58	263	
6	A.1	25/0	100.052	0.43	0.98	0.98	89	3	262	63	260	
7	2	5	102.88	0.47	1.07	1.07	89	3	265	60	266	
8	3	10	105.76	0.48	1.09	1.09	90	3	260	62	262	
9	4	15	108.75	0.46	1.04	1.04	92	3	254	63	258	
10	5	20	111.67	0.52	1.18	1.18	93	3	251	64	260	
11	B.1	50/0	114.721	0.58	1.32	1.32	92	4	246	62	259	
12	2	5	117.95	0.49	1.11	1.11	91	3	252	62	260	
13	3	10	120.94	0.51	1.16	1.16	91	4	253	60	255	
14	4	15	124.03	0.50	1.14	1.14	90	4	255	60	255	
15	5	20	127.04	0.62	1.41	1.41	90	4	257	58	256	
16	C.1	75/0	130.389	0.55	1.25	1.25	87	4	252	66	262	
17	2	5	133.53	0.58	1.32	1.32	86	4	250	61	262	
18	3	10	136.77	0.51	1.16	1.16	87	4	247	58	257	
19	4	15	139.87	0.39	0.89	0.89	87	4	246	55	253	
20	5	20	142.62	0.34	0.77	0.77	88	3	251	55	253	
21	D.1	100/0	145.168	0.49	1.11	1.11	88	4	254	65	244	
22	2	5	148.15	0.44	1.00	1.00	89	4	257	62	245	
23	3	10	151.01	0.52	1.18	1.18	91	4	259	63	252	
24	4	15	154.07	0.54	1.23	1.23	93	4	262	64	255	
25	5	20	157.19	0.57	1.29	1.29	92	4	260	66	256	
		125/off	160.380									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	75.670	.5015	1.14	89	258

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

360

COMPANY NAME NCRRRF
RUN NUMBER 3-ESPO-M5/12-3
ADDRESS West Palm Beach, FL
TIME START 1755
SAMPLING LOCATION Unit # 2 - ESP Outlet Duct
TIME FINISH 2011
DATE 10.24.89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 29.9
STATIC PRESSURE IN. H_2O − 5.0
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.006 0.002

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
N/A M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 255 PRE
✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 506 NOZZLE 505 DIAMETER 0.251
METER BOX N.8 T/C READOUT F-69
UMBILICAL U-11 T/C PROBE 9-3
SAMPLE BOX 33 ORSAT PUMP N/A
PROBE 9.13 PITOT 9.13 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
Quartz	0.4683

DELTA H@ 1.674
METER TEMP 90
EST. %H_2O 22
C FACTOR 0.70
STACK TEMP 260
REF DELTA P 0.85
K-FACTOR 0.024471

FYRITE
C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	E.1	0/0	160.558	0.38	0.82	0.82	78	3	258	64	270	
2	2	5	163.20	0.54	1.17	1.17	78	3	243	60	267	
3	3	10	166.19	0.45	0.97	0.97	81	3	246	55	264	
4	4	15	169.01	0.44	0.95	0.95	83	3	248	53	264	
5	5	20	171.75	0.45	0.97	0.97	84	3	251	53	263	
6	A.1	25/0	174.515	0.34	0.74	0.74	85	3	255	64	264	
7	2	5	176.99	0.39	0.84	0.84	87	3	252	61	263	
8	3	10	179.61	0.39	0.84	0.84	89	3	250	56	263	
9	4	15	182.19	0.40	0.87	0.87	90	3	254	53	268	
10	5	20	184.92	0.44	0.95	0.95	90	3	259	55	270	
11	B.1	50/0	187.618	0.51	1.10	1.10	90	3	258	62	262	
12	2	5	190.59	0.46	1.00	1.00	90	3	262	60	268	
13	3	10	193.45	0.44	0.95	0.95	91	3	260	56	268	
14	4	15	196.22	0.47	1.02	1.02	91	3	253	55	267	
15	5	20	199.10	0.56	1.21	1.21	91	4	251	56	268	
16	C.1	75/0	202.124	0.57	1.23	1.23	91	4	250	58	263	
17	2	5	205.31	0.57	1.23	1.23	92	4	247	58	269	
18	3	10	208.45	0.56	1.21	1.21	92	4	245	60	271	
19	4	15	211.56	0.60	1.30	1.30	92	4	248	61	270	
20	5	20	214.81	0.35	0.76	0.76	92	3	253	63	270	
21	D.1	100/0	217.328	0.54	1.17	1.17	92	4	250	66	269	
22	2	5	220.36	0.43	0.93	0.93	91	3	252	62	271	
23	3	10	223.05	0.56	1.21	1.21	91	4	254	60	272	
24	4	15	226.12	0.54	1.17	1.17	90	4	255	60	272	
25	5	20	229.28	0.53	1.15	1.15	90	4	256	63	269	
		125/off	232.239									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	71.681	0.4733	1.03	88	267

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility   EEI Ref# 6284

Sampling Location: Unit No. 2 ESP Outlet

Date Received: 10/30   Date Analyzed: 10/30   Reagent Box(es): 0506

Run Number	2-PO-M5&12-1	2-PO-M5&12-2	2-PO-M5&12-3
Run Date	10/24	10/24	10/24

ANALYSIS OF MOISTURE CATCH

Reagent 1 (0.1N HNO3)			
Final Weight, g.	943.5	1006.0	929.5
Tared Weight, g.	571.0	580.5	565.5
	==========	==========	==========
Water Catch,g.	372.5	425.5	364.0
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	372.5	425.5	364.0
Silica Gel:			
Final Weight, g.	420.0	419.0	418.5
Tared Weight, g.	400.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	20.0	19.0	18.5
TOTAL WATER COLLECTED, g.	392.5	444.5	382.5

PARTICULATE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 2 ESP Outlet

Date Received: 10/30 Date Analyzed: 11/8 Reagent Box(es): 0506

Run Number	2-PO-M5&12-1	2-PO-M5&12-2	2-PO-M5&12-
Run Date	10/24	10/24	10/24
Sample ID/Container #	F / 1099	F / 1100	F / 1101
	76.0216 ✓76.0211 76.0229	76.6280 ✓76.6277 76.6295	✓78.7595 78.7596 78.7602
Tare Weight., g.	75.5650	76.1195	78.2948
SAMPLE WT., g.	0.4561	0.5082	0.4647
Sample ID/Container #	R / 2442	R / 2443	R / 2525
	102.9556 ✓102.9554	102.1806 ✓102.1804	101.6081 ✓101.6080
Tare Wt., g.	102.9431	102.1726	101.6005
SAMPLE WT., g.	0.0123	0.0078	0.0075
Sum of Particulate, mg.	468.4	516.0	472.2
Total Filter Tare, mg.	460.7	464.7	468.3
Blank Residue, mg.	(250 ml) 0.5	(150 ml) 0.3	(200 ml) 0.4
TOTAL PARTICULATE CATCH, mg.	7.2	51.0	3.5

Blank Beaker # 2003
Final wt., mg. 99546.3
Tare wt., mg. 99545.9
Residue, mg. 0.4
Volume, ml. 200

---Legend---
✓ = Final Weight
L = Loose Particulate
F = Filter D = Dish
R = Rinse P = Pan

Notes and Comments

Concentration, mg/ml 0.002

Oxford Laboratories, Inc.

Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-6-89
DATE REPORTED 11-29-89
89W8748

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-13

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: 0.1N HNO3 UNIT 2

1. 2-PO-M5/12-1
2. 2-PO-M5/12-2
3. 2-PO-M5/12-3
4. 2-PO-M5/12-FB
5. METHOD CODE

RESULTS

	1	2	3	4	5
Lead, as Pb, total ug	50.0	60.0	30.0	<10.0	SW846-7000

ROGER C. OXFORD , CHEMIST

P.O. # 62840-13
Method 12 - SW846-7000s

Entropy

11-13-89
89W8748

	1	2	3	4
Pb	.50 x100 50.0	.60 x100 60.0	.30 x 100 30.0	<.10 x100 <10.0

All samples F.V. 100 ml

#1	#2	#3	#4
.49 x100 49.0	.58 x100 58.0	.30 x100 30.0	<.10 x100 <10.0
.50 x100 50.0	.62 x100 62.0	.31 x100 31.0	<.10 x100 <10.0

Known additions
#2
sample = x2 + 2.5 ug/ml

2.88 = .29 x2 = .58 x100 = 58.0
2.85 = .29 x 2 = .58 x 100 = 58.0
2.76 = .30 x 2 = .60 x100 60.0

P.O. # 62840-13
Method 12 - SW846-7000s

Entropy

11-13-89
89W8748

	1	2	3	4
Pb	.50 x100 $\boxed{50.0}$	.60 x100 $\boxed{60.0}$	.30 x 100 $\boxed{30.0}$	<.10 x100 $\boxed{<10.0}$

All samples F.V. 100 ml

CUSTODY SHEET FOR REAGENT BOX # 0506

Date of Makeup 10/19 Initials JFJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 0.1 N HNO_3

Individual Tare of Reagent: ____ mls. of ____

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT # 2 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
2-ESPO-M5/12-1	10-24-89	SRD	✓	10-24-89	40%	SRD	✓
2-ESPO-M5/12-2	10-24-89	SRD	✓	10-24-89	40	JRW	—
2-ESPO-M5/12-3	10-24-89	JRW	✓	10-24-89	50	JRW	—

Received in Lab Date 10/30/89 Initials PR Locked? ✓

Sampling Method: M5/12

Remarks:

DOUBLE CHARGE SILICA GEL

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
Quartz	0.4607	2-ESPO-M5/1
"	0.4647	2-ESPO-M5/1
"	0.4683	2-ESPO-M5/1

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0309

Date of Makeup 10/19 Initials JFJ Locked? ✓

Individual Tare of Reagent: 200 mls. of 0.1 N HNO_3

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT # 1 & 2 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-ESPO-M5/12-FB	10-23-89	SRD	—	10-23-89	N/A	SRD	—
2-ESPO-M5/12-FB	10-24-89	SRD	✓	10-24-89	N/A	SRD	—

Received in Lab Date 10/30/89 Initials PR Locked? ✓

Sampling Method: M5/12

Remarks:

Zero & Span Balance Initials PR

Filter #	Tare Weight (grams)	Used on Test
QUARTZ	.4437	1-ESPO-M5/12-F
QUARTZ	.4421	2-ESPO-M5/12-FB

ENTROPY
ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-13

JOB NAME: NCRRRF

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-3-89

EXPECTED DATE OF RESULTS: 11-17-89

SAMPLE MATRIX: 0.1 N HNO_3, Unit 2.

TYPE OF ANALYSIS REQUESTED: Pb

Sample #	Sample ID	Filter beaker #	Acetone beaker #	Components
1	2-PO-M5/12-1	1099	2442	Reagent, Front ½ rinse
2	-2	1100	2443	" " " "
3	-3	1101	2525	" " " "
4	-FB	1103	2528	" " " "

SUBMITTED BY: Richard Lebeau

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

INTERLABORATORY SAMPLE TRANSFER CHAIN-OF-CUSTODY FORM

Please return this form along with the analytical results.

The samples referenced on EEI Purchase Order Number: 62840-13 were shipped via Pony Express on 11-3-89 by RAT to OLI

Samples received at OLI on 11-6-89 by MBC

Note any broken seals, leakage, spillage, and/or damage to the samples.

L-0009
1/87

APPENDIX B.2.b.5

B. FIELD AND ANALYTICAL DATA

  2. Unit No. 2

    b. ESP Outlet

      5. Mercury

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility
LOCATION West Palm Beach FL
SAMPLING LOCATION Units #1&2 - ESP Outlet Duct

NO. OF PORTS 5
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"
NIPPLE LENGTH 9"
DEPTH OF DUCT 88 1/2"
WIDTH (RECTANGULAR DUCT) 88 1/2"

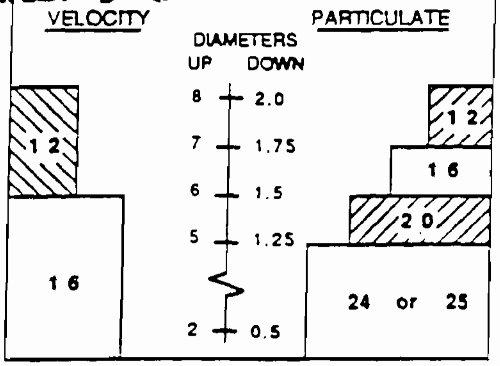
EQUIVALENT DIAMETER:
$D_E = \frac{2 \times DEPTH \times WIDTH}{DEPTH + WIDTH} = \frac{2(88.5)(88.5)}{(88.5+88.5)} =$ 88 1/2"

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

ENTROPY
ENVIRONMENTALISTS, INC.

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF RUN NUMBER 2-#$PD101A-1 372
ADDRESS PALM BEACH Fla. TIME START 1145
SAMPLING LOCATION Unit 2 ESP outlet Duct TIME FINISH 1400
DATE 10-24-89 TEAM LEADER LCM TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 29.9 STATIC PRESSURE IN. H_2O -7.4
TRAIN LEAK CHECK VACUUM IN. HG 15 05
TRAIN LEAK RATE, CU.FT/MIN 0.000 0.000

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- NA M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 275 PRE
- ✓ THERMOCOUPLE @ 265 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0553 NOZZLE 506 DIAMETER .241
METER BOX N-10 T/C READOUT 5
UMBILICAL U-9 T/C PROBE 9-6
SAMPLE BOX 4 ORSAT PUMP NA
PROBE 9-3 PITOT 9-3 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	n/a

DELTA H@	1.764	1.764		
METER TEMP	100	100		
EST. %H_2O	18	23		
C FACTOR	.81	.73		
STACK TEMP	260	260		
REF DELTA P	.81	.92		
K-FACTOR	K1	2 K2		

FYRITE
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	360.129	.44	.88	.88	91	1	250	57	259	
2	2	5	362.85	.53	1.06	1.06	93	2	250	56	262	
3	3	10	365.80	43	.86	.86	93	2	250	56	258	
4	4	15	368.47	.50	1.00	1.00	94	2	253	54	261	
5	5	20	371.41	.66	1.32	1.32	98	3	253	50	262	
6	B 1	25/0	374.663	.55	1.10	1.10	99	2	252	50	258	
7	2	5	377.67	.55	1.10	1.10	101	2	250	49	262	
8	3	10	380.74	.52	1.04	1.04	102	2	250	49	262	
9	4	15	383.69	.54	1.08	1.08	95	2	248	49	261	
10	5	20	386.70	.60	1.20	1.20	95	2	248	50	263	
11	C 1	50/0	389.837	.56	1.12	1.12	94	2	250	50	258	
12	2	5	392.90	.62	1.24	1.24	93	2	250	50	260	
13	3	10	396.09	.54	1.08	1.08	95	2	251	50	261	
14	4	15	399.08	.50	1.00	1.00	96	2	251	53	262	
15	5	20	402.09	.50	1.00	1.00	98	2	253	54	262	
16	D 1	75/0	404.948	.65	1.30	1.30	99	2	250	54	261	
17	2	5	408.22	.66	132	1.32	100	2	250	54	[illegible]	
18	3	10	411.53	.78	1.56	1.56	102	3	255	53	264	
19	4	15	415.15	.82	1.64	1.64	104	3	253	53	265	
20	5	20	418.79	.79	1.58	1.58	102	3	250	53	264	
21	E 1	100/0	422.424	.59	1.18	1.18	98	2	250	54	263	
22	2	5	425.58	.69	1.38	1.38	97	2	248	54	266	
23	3	16	428.95	.62	1.24	1.24	97	2	248	54	266	
24	4	15	432.17	.57	1.14	1.14	97	2	248	54	266	
25	5	20	435.51	60	1.20	1.20	96	2	248	55	265	
		125/off	438.393									

K-2

125	78.264	0.5884	1.18	97	262
minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER ~~1~~ 2-ESPO-M101A-2
ADDRESS Palm Beach Fla
TIME START 1440
SAMPLING LOCATION Unit 2 ESP outlet Duct
TIME FINISH 1655
DATE 10-24-89 TEAM LEADER LCM
TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 29.9
STATIC PRESSURE IN. H_2O -5.8
TRAIN LEAK CHECK VACUUM IN. HG 15 07
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 275 PRE
✓ THERMOCOUPLE @ ____ POST

IDENTIFICATION NUMBERS

REAGENT BOX 0553 NOZZLE 606 DIAMETER .263
METER BOX N-10 T/C READOUT 5
UMBILICAL U-9 T/C PROBE 9-20
SAMPLE BOX 25 ORSAT PUMP WA
PROBE 9-10 PITOT 9-10 TEDLAR BAG NA

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
QUARTZ	N/A

DELTA H@ 1.764
METER TEMP 90
EST. %H_2O 23
C FACTOR .72
STACK TEMP 260
REF DELTA P .69
K-FACTOR 2.667

FYRITE
C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A1	0	438.550	~~709~~ .41	1.09	1.09	88	2	243	58	265	
2	2	5	441.58	.48	1.28	1.28	91	3	250	55	265	
3	3	10	444.84	.46	1.23	1.23	93	3	250	55	263	
4	4	15	448.02	.44	1.17	1.17	94	3	250	54	265	
5	5	20	451.15	.47	1.25	1.25	95	3	253	50	266	
6	B1	25/0	454.459	.48	1.28	1.28	92	3	248	51	261	
7	2	5	457.69	.44	1.17	1.17	94	3	247	51	262	
8	3	10	460.82	.47	1.25	1.25	94	3	247	50	264	
9	4	15	464.03	.43	1.15	1.15	94	3	250	50	264	
10	5	20	467.13	.56	1.49	1.49	92	3	250	50	266	
11	C1	50/0	470.635	.61	1.63	1.63	91	3	249	52	261	
12	2	5	474.26	.55	1.47	1.47	91	3	249	52	264	
13	3	10	477.72	.55	1.47	1.47	91	3	255	51	266	
14	4	15	481.29	.46	1.23	1.23	90	3	256	50	265	
15	5	20	~~8~~484.44	.55	1.47	1.47	89	3	254	50	265	
16	D4	75/0	487.841	.51	1.36	1.36	89	3	252	53	261	
17	2	5	491.15	.49	1.30	1.30	89	3	250	53	266	
18	3	10	494.40	.57	1.52	1.52	91	4	280	50	266	
19	4	15	497.90	.58	1.55	1.55	94	4	255	50	266	
20	5	20	501.46	.55	1.47	1.47	95	4	258	50	265	
21	E1	100/0	504.932	.44	1.17	1.17	93	~~4~~3	254	55	262	
22	2	5	508.04	.46	1.23	1.23	94	3	252	55	266	
23	3	10	511.21	.45	1.20	1.20	95	3	255	54	267	
24	4	15	514.37	.48	1.28	1.28	95	3	255	54	266	
25	5	20	517.63	.51	1.36	1.36	93	3	258	55	266	
		125/00	520.933									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	82.383	0.4946	1.32	92	265

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

COMPANY NAME NCRRRF
RUN NUMBER ~~II~~ 2-#$PO-101A-3
ADDRESS West Palm Beach Fla
TIME START 1735
SAMPLING LOCATION Unit 2 ESP Outlet Duct
TIME FINISH 2011
DATE 10-24-89 TEAM LEADER LCM
TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 29.9
STATIC PRESSURE IN. H_2O -5.0
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.000

EQUIPMENT CHECKS

✓ PITOTS, PRETEST
✓ PITOTS, POSTTEST
NA M3 SAMPLING SYS/TED BAG
✓ THERMOCOUPLE @ 275 PRE
✓ THERMOCOUPLE @ 266 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0553 NOZZLE 506 DIAMETER .241
METER BOX N-10 T/C READOUT 5
UMBILICAL U-9 T/C PROBE 7-6
SAMPLE BOX 4 ORSAT PUMP NA
PROBE 9-3 PITOT 9-3 TEDLAR BAG NA

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
QUARTZ	N/A

DELTA H@ 1.764
METER TEMP 90
EST. %H_2O 23
C FACTOR .72
STACK TEMP 260
REF DELTA P .93
K-FACTOR 1.978

FYRITE

C_p .84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A 1	0	521.106	.36	.88	.78	84	2	255	55	263	
2	2	5	523.68	.44	.87	.87	87	2	255	53	264	
3	3	10	526.35	.34	.67	.67	91	2	255	50	265	
4	4	15	528.79	.37	.73	.73	94	2	253	50	266	
5	5	20	531.38	.39	.77	.77	95	2	250	50	268	
6	B 1	25/0	533.835	.39	.77	.77	94	2	250	53	261	
7	2	5	536.45	.36	.71	.71	94	2	253	53	264	
8	3	10	538.88	.39	.77	.77	95	2	253	51	266	
9	4	15	541.44	.37	.73	.73	95	2	251	51	262	
10	5	20	544.06	.46	.91	.91	94	2	255	51	264	
11	C 1	50/0	546.763	.49	.97	.97	91	2	245	53	258	
12	2	5	549.64	.51	1.01	1.01	92	2	247	53	263	
13	3	10	522.56	.45	.89	.89	92	2	250	53	262	
14	4	15	555.29	.45	.85	.85	92	2	250	53	263	
15	5	20	558.05	.31	.61	.61	92	2	250	55	263	
16	D 1	75/0	560.358	.52	1.03	1.03	90	2	250	55	286	
17	2	5	563.51	.47	.93	.93	90	2	287	50	289	
18	3	10	566.10	.70	1.38	1.38	91	3	253	50	266	
19	4	15	569.49	.61	1.21	1.21	91	2	253	50	266	
20	5	20	572.70	.60	1.19	1.19	91	2	250	50	266	
21	E 1	100/0	575.779	.44	.87	.87	89	2	250	54	254	
22	2	5	578.48	.47	.93	.93	89	2	250	52	260	
23	3	10	581.25	.50	.99	.99	90	2	248	52	264	
24	4	15	584.15	.47	.93	.93	90	2	248	52	266	
25	5	20	586.96	.46	.91	.91	90	2	248	53	266	
		125/0	589.741									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	68.635	0.4487	~~0.900~~ 0.895	91	263

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility Ref.# 6284

Sampling Location: Unit No. 2 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0553

Run Number	2-PO-M101A-1	2-PO-M101A-2	2-PO-M101A-3
Run Date	10/24	10/24	10/24

ANALYSIS OF MOISTURE CATCH

Reagent 1 (4% KMnO4/10% H2SO4)			
Final Weight, g.	1024.0	1098.5	1000.0
Tared Weight, g.	645.5	633.5	657.5
Water Catch,g.	378.5	465.0	342.5
Reagent 2 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch,g.	0.0	0.0	0.0
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	378.5	465.0	342.5
Silica Gel:			
Final Weight, g.	216.5	219.0	220.0
Tared Weight, g.	200.0	200.0	200.0
ADSORBED WATER, g.	16.5	19.0	20.0
TOTAL WATER COLLECTED, g.	395.0	484.0	362.5

Oxford Laboratories, Inc.
Analytical and Consulting Chemists
1316 South Fifth Street
Wilmington, N.C. 28401
(919) 763-9793

DATE RECEIVED 11-2-89
DATE REPORTED 11-28-89
89W8692

PAGE 1 OF 1

ENTROPY ENVIRONMENTALIST INC
P.O. BOX 12291
RESEARCH TRIANGLE PK , N.C. 27709-2291

P.O. # 62840-2

ATTENTION: BRUCE HAWKS

SAMPLE DESCRIPTION: M101A 4% KMNO4

1. 2-ESPO-M101A-1
2. 2-ESPO-M101A-2
3. 2-ESPO-M101A-3
4. 2-ESPO-M101A-FB
5. METHOD CODE

RESULTS

	1	2	3	4	5
Mercury, as Hg, total ug	50.3	33.5	44.7	<2.50	101-A
Mercury, as Hg, total ug	50.3	36.6	46.4	<2.50	101-A

Roger Oxford
ROGER C. OXFORD , CHEMIST

P.O. # 62840-2
method 101-A

Entropy

11-13-89
89W8692

		Bk adjusted
Blank :	.005	.000
.1 =	.014	.009
.2 =	.025	.020
.3 :	.636	.031
.4 =	.047	.042
.5 :	.058	.053

	① F.V. = 1000	② F.V. = 1000	③ FV = 1000	④ FV = 1000
Hg	5 mls. = .031 - .005 = .026 50.3	5 mls. = .022 - .005 = .017 33.5	5 mls. = .028 - .005 = .023 44.7	20 mls. = .003 - .005 = -.002 <.05/20 × 1000 = <2.50

All Samples F.V. 1000 ml

	①	②	③	④
Hg	5 mls. = .029 - .003 = .026 50.3	5 mls. = .022 - .003 .019 36.6	5 mls. = .027 - .003 .024 46.4	20 mls. = .003 - .003 .000 <.05/20 × 1000 <2.50

		Bk adj.
Blank	.005	.000
.1	.014	.011
.2	.023	.020
.3	.035	.032
.4	.044	.041
.5	.054	.051

CUSTODY SHEET FOR REAGENT BOX # 0553

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 250 mls. of $KMnO_4$

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION Unit #2 ESP Outlet

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
2-ESPO-M101A-1	10-24-89	JRW	✓	10-24-89	40	JRW	—
2-ESPO-M101A-2	10-24-89	JRW	✓	10-24-89	60	JRW	—
2-ESPO-M101A-3	10-24-89	JRW	✓	10-25-89	80	JRW	—

	Date	Initials	Locked?
Received in Lab	10/30	JFJ	✓

Zero & Span Balance Initials JFJ

Sampling Method: ______

Filter #	Tare Weight (grams)	Used on Test
Quartz,	Untared	

Remarks:

ENTROPY ENVIRONMENTALISTS, INC.

CUSTODY SHEET FOR REAGENT BOX # 0572

Date of Makeup 10/19/89 Initials PR Locked? ✓

Individual Tare of Reagent: 250 mls. of KMnO4

Individual Tare of Reagent: ______ mls. of ______

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME North County Regional Resource Recovery Facility

SAMPLING LOCATION ESP Outlet #1 & #2

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locked?
1-ESPO-M101A-FB	10-23-89	JRw	✓	10-23-89	0	JRw	✓
2-ESPO-M101A-FB	10-24-89	JRw	✓	10-24-89	N/A	JRw	✓

Received in Lab Date 10/30 Initials JFd Locked? ✓

Sampling Method: Method 101A

Remarks:

Zero & Span Balance Initials JFd

Filter #	Tare Weight (grams)	Used on Test
Quartz	Untared	

ENTROPY ENVIRONMENTALISTS, INC.

ENTROPY
ENVIRONMENTALISTS INC.

POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919-781-3550

REQUEST FOR ANALYSIS

Page 1

PURCHASE ORDER # 6284 0-2

JOB NAME: North County Regional RRF.

LABORATORY: OLI

DATE SAMPLES WERE TRANSMITTED: 11-1-89

EXPECTED DATE OF RESULTS: 11-15-89

SAMPLE MATRIX: M101A - 4% KMnO4 Unit 2.

TYPE OF ANALYSIS REQUESTED: Hg. (Particulate and gaseous) Refer to M101A Rules and Regulati June 8, 1982.

Sample#	SampleID	Components
1	2-ESPO-M101A-1	Reagent, KMnO4 rinse, Filter.
2	2-ESPO-M101A-2	" " " "
3	2-ESPO-M101A-3	" " " "
4	2-ESPO-M101A-FB	" " " "

SUBMITTED BY: Richard

APPENDIX B.2.b.6

B. FIELD AND ANALYTICAL DATA

2. Unit No. 2

b. ESP Outlet

6. Sulfuric Acid Mist

Preliminary Field Data

PLANT NAME North County Regional Resource Recovery Facility
LOCATION West Palm Beach FL
SAMPLING LOCATION Units # 1 & 2 - ESP Outlet Duct

NO. OF PORTS 5
PORT INSIDE DIAMETER 4"

DUCT DEPTH
FROM INSIDE FAR WALL TO OUTSIDE OF PORT 97 1/2"
NIPPLE LENGTH 9"
DEPTH OF DUCT 88 1/2"
WIDTH (RECTANGULAR DUCT) 88 1/2"

EQUIVALENT DIAMETER:

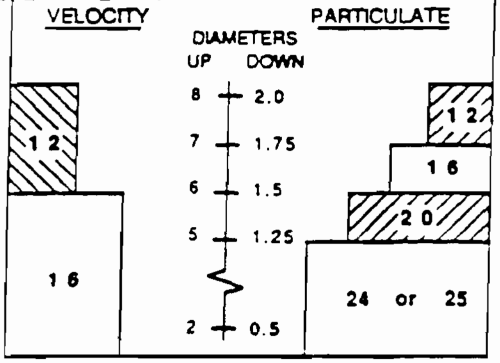
$$D_E = \frac{2 \times \text{DEPTH} \times \text{WIDTH}}{\text{DEPTH} + \text{WIDTH}} = \frac{2(88.5)(88.5)}{(88.5+88.5)} = 88\tfrac{1}{2}$$

DISTANCE FROM PORTS TO NEAREST FLOW DISTURBANCE	UPSTREAM	DOWNSTREAM
	332"	74"
DIAMETERS	3.75	0.84

STACK AREA = 88 1/2" x 88 1/2" = 7,832 IN²

DRAW HORIZONTAL LINE THROUGH DIAMETERS

If more than 8 and 2 diameters and if duct dia. is less than 24", use 8 or 9 points.



LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

	4	6	8	10	12	14	16	18	20	22	24
1	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3	75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4	93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5		85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6		95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7			89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8			96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9				91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10				97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11					93.3	85.4	78.0	70.4	61.2	39.3	32.3
12					97.9	90.1	83.1	76.4	69.4	60.7	39.8
13						94.3	87.5	81.2	75.0	68.5	60.2
14						98.2	91.5	85.4	79.6	73.8	67.7
15							95.1	89.1	83.5	78.2	72.8
16							98.4	92.5	87.1	82.0	77.0
17								95.6	90.3	85.4	80.6
18								98.6	93.3	88.4	83.9
19									96.1	91.3	86.8
20									98.7	94.0	89.5
21										96.5	92.1
22										98.9	94.5
23											96.8
24											98.9

LOCATION OF TRAVERSE POINTS IN RECTANGULAR STACKS

	2	3	4	5	6	7	8	9	10	11	12
1	25.0	16.7	12.5	10.0	8.3	7.1	6.3	5.6	5.0	4.5	4.2
2	75.0	50.0	37.5	30.0	25.0	21.4	18.8	16.7	15.0	13.6	12.5
3		83.3	62.5	50.0	41.7	35.7	31.3	27.8	25.0	22.7	20.8
4			87.5	70.0	58.3	50.0	43.8	38.9	35.0	31.8	29.2
5				90.0	75.0	64.3	56.3	50.0	45.0	40.9	37.5
6					91.7	78.6	68.8	61.1	55.0	50.0	45.8
7						92.9	81.3	72.2	65.0	59.1	54.2
8							93.8	83.3	75.0	68.2	62.5
9								94.4	85.0	77.3	70.8
10									95.0	86.4	79.2
11										95.5	87.5
12											95.8

POINT	% OF DUCT DEPTH	DISTANCE FROM INSIDE WALL	DISTANCE FROM OUTSIDE OF PORT
1	10.0	8 7/8	17 7/8
2	30.0	26 1/2	35 1/2
3	50.0	44 1/4	53 1/4
4	70.0	62	71
5	90.0	79 5/8	88 5/8
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

F0003
4/24/89

ENTROPY ENVIRONMENTALISTS, INC.

ISOKINETIC TYPE FIELD DATA SHEET

383

COMPANY NAME NORTH COUNTY REGIONAL RESOURCES RECOVERY FACILITY RUN NUMBER 2-PD-M8-1
ADDRESS WEST PALM BEACH, FL TIME START 1230
SAMPLING LOCATION UNIT # 2 - ESP OUTLET DUCT TIME FINISH 1442
DATE 10-25-89 TEAM LEADER B. RUDD TECHNICIANS ~
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -6.0
TRAIN LEAK CHECK VACUUM IN. HG 15 5
TRAIN LEAK RATE, CU.FT/MIN 0.004 0.006

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- N/A M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 255 PRE
- ✓ THERMOCOUPLE @ 254 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0508 NOZZLE 604 DIAMETER 0.254
METER BOX N8 T/C READOUT F-69
UMBILICAL U-11 T/C PROBE 9-37
SAMPLE BOX 5 ORSAT PUMP 2 N/A
PROBE 9-12 PITOT 9-12 TEDLAR BAG N/A

LEAK CHECK READINGS

B 1 E
B 2 E
B 3 E
B 4 E
B 5 E
B 6 E

FILTER #	TARE
Quartz	UNTARED

DELTA H@ 1.674
METER TEMP 90
EST. %H_2O 22
C FACTOR 0.70
STACK TEMP 260
REF DELTA P 0.82
K-FACTOR 0.022439

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A-1	0/0	258.134	0.37	0.83	0.83	74	3	234	65	266	
2	2	5	260.72	0.45	1.01	1.01	75	3	248	60	265	
3	3	10	263.54	0.44	0.99	0.99	77	3	253	54	262	
4	4	15	266.43	0.48	1.08	1.08	80	3	254	55	261	
5	5	20	269.26	0.51	1.14	1.14	83	3	257	57	263	
6	B-1	25/0	272.279	0.49	1.10	1.10	85	3	253	64	261	
7	2	5	275.24	0.45	1.01	1.01	87	3	252	61	265	
8	3	10	278.08	0.50	1.12	1.12	89	3	257	60	262	
9	4	15	281.07	0.51	1.14	1.14	92	3	255	62	264	
10	5	20	284.13	0.58	1.30	1.30	94	3	252	57	263	
11	C-1	50/0	287.270	0.60	1.35	1.35	92	4	248	66	260	
12	2	5	290.55	0.61	1.37	1.37	92	4	251	60	261	
13	3	10	293.83	0.52	1.17	1.17	92	4	249	56	263	
14	4	15	296.88	0.39	0.88	0.88	91	3	254	55	262	
15	5	20	299.56	0.49	1.10	1.10	91	3	255	58	260	
16	D-1	75/0	302.502	0.49	1.10	1.10	90	3	250	65	254	
17	2	5	305.47	0.50	1.12	1.12	90	3	252	61	253	
18	3	10	308.46	0.62	1.39	1.39	91	4	256	57	250	
19	4	15	311.25	0.60	1.35	1.35	91	4	258	59	244	
20	5	20	315.01	0.60	1.35	1.35	93	4	254	62	257	
21	E-1	100/0	318.246	0.45	1.01	1.01	92	4	251	66	251	
22	2	5	321.09	0.55	1.23	1.23	93	4	252	61	249	
23	3	10	324.22	0.52	1.17	1.17	93	4	253	62	249	
24	4	15	327.28	0.56	1.26	1.26	94	4	255	59	252	
25	5	20	330.45	0.52	1.17	1.17	95	4	261	62	254	
		125/OFF	333.499									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	75.365	.5099	1.15	89	258

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

384

COMPANY NAME NC RRRF RUN NUMBER 2-4810-M8-2
ADDRESS West Palm Beach FL TIME START 1530
SAMPLING LOCATION Unit #2 - ESP Outlet Duct TIME FINISH 1743
DATE 10.25.89 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0 STATIC PRESSURE IN. H_2O -6.1
TRAIN LEAK CHECK VACUUM IN. HG 15 9
TRAIN LEAK RATE, CU.FT/MIN 0.007 0.004

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 255 PRE
- ✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0508 NOZZLE 504 DIAMETER 0.266
METER BOX N 8 T/C READOUT F-69
UMBILICAL U-11 T/C PROBE 9.4
SAMPLE BOX 37 ORSAT PUMP 2
PROBE 9.9 PITOT 9.9 TEDLAR BAG 16

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	**TARE**
N/A	Untared

					FYRITE
DELTA H@	1.674		1.674		
METER TEMP	90		100		
EST. %H_2O	22		22		
C FACTOR	0.70		0.71		
STACK TEMP	260		260		
REF DELTA P	0.70		0.65		
K-FACTOR	0.0262857		0.0270788		C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A-1	0/0	334.600	0.46	1.21	1.21	90	4	236	66	257	
2	2	5	337.67	0.50	1.31	1.31	90	4	247	61	272	
3	3	10	340.84	0.49	1.29	1.29	90	4	264	53	273	
4	4	15	344.06	0.48	1.26	1.26	91	4	268	55	255	
5	5	20	347.19	0.55	1.45	1.45	93	4	270	57	258	
6	B-1	25/0	350.554	0.62	1.63	1.63	95	5	261	67	249	
7	2	5	354.14	0.63	1.66	1.66	96	5	247	53	245	
8	3	10	357.76	0.61	1.70	1.70	98	5	243	50	237	
9	4	15	361.42	0.54	1.51	1.51	101	4	247	45	247	
10	5	20	364.98	0.64	1.78	1.78	102	5	252	48	253	
11	C-1	50/0	368.623	0.60	1.67	1.67	103	5	254	63	246	
12	2	5	372.37	0.64	1.78	1.78	103	5	251	54	258	
13	3	10	375.99	0.58	1.62	1.62	103	5	249	53	251	
14	4	15	379.62	0.45	1.25	1.25	103	5	251	54	253	
15	5	20	382.80	0.54	1.51	1.51	102	5	248	56	261	
16	D-1	75/0	386.253	0.62	1.73	1.73	100	5	246	65	272	
17	2	5	389.92	0.53	1.48	1.48	99	5	249	60	271	
18	3	10	393.33	0.63	1.76	1.76	99	5	252	54	267	
19	4	15	397.04	0.65	1.81	1.81	100	5	255	58	257	
20	5	20	400.82	0.64	1.78	1.78	101	5	258	59	260	
21	E-1	100/0	403.900	0.47	1.31	1.31	100	5	262	65	259	
22	2	5	406.96	0.61	1.70	1.70	100	7	256	56	268	
23	3	10	410.62	0.52	1.45	1.45	100	7	252	54	274	
24	4	15	414.03	0.54	1.51	1.51	99	6	255	57	277	
25	5	20	417.48	0.58	1.62	1.62	97	8	259	59	276	
		125/off	420.810									

CHANGE Nom.

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	86.210	0.5630	1.55	98	260

F1010
9/89
p1

ENTROPY

ISOKINETIC TYPE FIELD DATA SHEET

385

COMPANY NAME NCRRRF
RUN NUMBER 2-ØPO-M8-3
ADDRESS West Palm Beach FL
TIME START 1850
SAMPLING LOCATION Unit #2 · ESP Outlet Duct
TIME FINISH 2102
DATE 10-25-88 TEAM LEADER B. Rudd TECHNICIANS —
BAROMETRIC PRESSURE. IN. HG 30.0
STATIC PRESSURE IN. H_2O -5.0
TRAIN LEAK CHECK VACUUM IN. HG 15 8
TRAIN LEAK RATE, CU.FT/MIN 0.003 0.002

EQUIPMENT CHECKS

- ✓ PITOTS, PRETEST
- ✓ PITOTS, POSTTEST
- ✓ M3 SAMPLING SYS/TED BAG
- ✓ THERMOCOUPLE @ 255 PRE
- ✓ THERMOCOUPLE @ 255 POST

IDENTIFICATION NUMBERS

REAGENT BOX 0508 NOZZLE 604 DIAMETER 0.254
METER BOX N.8 T/C READOUT E.69
UMBILICAL U.11 T/C PROBE 9.37
SAMPLE BOX 5 ORSAT PUMP 2
PROBE 9.12 PITOT 12 TEDLAR BAG 15

LEAK CHECK READINGS

B 1 E	
B 2 E	
B 3 E	
B 4 E	
B 5 E	
B 6 E	

FILTER #	TARE
N/A	Untared

DELTA $H_@$ 1.674
METER TEMP 90
EST. %H_2O 22
C FACTOR 0.70
STACK TEMP 260
REF DELTA P 0.82
K-FACTOR 0.022439

FYRITE

C_p 0.84

LINE	SAMPLE POINT	CLOCK TIME MINUTES	DRY GAS METER READINGS CUBIC FEET	PITOT READING IN. H_2O	ORIFICE SETTING IN. H2O IDEAL	ORIFICE SETTING IN. H2O ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMPERATURES FILTER BOX °F	GAS TEMPERATURES IMPINGER EXIT °F	STACK TEMP. °F	LK CHK #
1	A.1	0/0	421.732	0.45	1.01	1.01	83	3	255	67	262	
2	2	5	424.60	0.59	1.32	1.32	86	4	259	57	285	
3	3	10	427.75	0.51	1.14	1.14	88	4	253	54	264	
4	4	15	430.76	0.56	1.26	1.26	89	5	252	55	264	
5	5	20	433.87	0.60	1.35	1.35	90	5	249	58	263	
6	B.1	25/0	437.140	0.55	1.23	1.23	91	5	256	65	258	
7	2	5	440.27	0.54	1.21	1.21	91	5	253	54	264	
8	3	10	443.40	0.51	1.14	1.14	91	5	250	55	263	
9	4	15	446.45	0.50	1.12	1.12	92	5	246	55	261	
10	5	20	449.48	0.58	1.30	1.30	92	5	248	56	262	
11	C.1	50/0	452.715	0.61	1.37	1.37	92	5	243	63	262	
12	2	5	456.03	0.53	1.19	1.19	92	5	253	54	264	
13	3	10	459.15	0.42	0.94	0.94	93	4	258	57	265	
14	4	15	461.94	0.37	0.83	0.83	93	4	262	57	264	
15	5	20	464.55	0.38	0.85	0.85	93	4	260	58	264	
16	D.1	75/0	467.207	0.50	1.12	1.12	92	4	249	66	266	
17	2	5	470.33	0.47	1.05	1.05	92	4	253	62	270	
18	3	10	473.14	0.57	1.28	1.28	92	4	264	58	269	
19	4	15	476.32	0.64	1.44	1.44	93	5	267	59	267	
20	5	20	429.72	0.62	1.39	.39	93	5	261	61	266	
21	E 1	100/0	483.013	0.50	1.12	1.12	93	4	253	66	268	
22	2	5	486.12	0.66	1.48	1.48	93	5	246	53	267	
23	3	10	489.48	0.60	1.35	1.35	93	5	244	56	265	
24	4	15	492.75	0.60	1.35	135	93	5	248	55	265	
25	5	20	496.00	0.59	1.32	1.32	93	4	253	57	264	
		125/off	499.197									

minutes	Vm	$(\sqrt{\Delta p})^2$	ΔH	tm	ts
125	77.465	.5352	1.21	91	264

F1010
9/89
p1

ENTROPY

MOISTURE SAMPLING LABORATORY RESULTS

Plant Name: North County Regional Resource Recovery Facility EEI Ref# 6284

Sampling Location: Unit No. 2 ESP Outlet

Date Received: 10/30 Date Analyzed: 10/30 Reagent Box(es): 0508

Run Number	2-PO-M8-1	2-PO-M8-2	2-PO-M8-3
Run Date	10/25	10/25	10/25

ANALYSIS OF MOISTURE CATCH

Reagent 1 (5% H2O2)			
Final Weight, g.	656.5	660.5	698.0
Tared Weight, g.	572.0	571.0	582.0
	==========	==========	==========
Water Catch,g.	84.5	89.5	116.0
Reagent 2 (80% IPA)			
Final Weight, g.	536.0	597.5	538.0
Tared Weight, g.	308.0	308.0	305.5
	==========	==========	==========
Water Catch,g.	228.0	289.5	232.5
Reagent 3 ( )			
Final Weight, g.			
Tared Weight, g.			
	==========	==========	==========
Water Catch,g.	0.0	0.0	0.0
CONDENSED WATER, g.	312.5	379.0	348.5
Silica Gel:			
Final Weight, g.	444.5	456.0	448.5
Tared Weight, g.	400.0	400.0	400.0
	==========	==========	==========
ADSORBED WATER, g.	44.5	56.0	48.5
TOTAL WATER COLLECTED, g.	357.0	435.0	397.0

SULFURIC ACID (H2SO4) ANALYTICAL RESULTS

EPA REFERENCE METHOD

Company Name: NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY EEI #: 6284

Sampling Location: UNIT NO. 2 ESP OUTLET

Date Analyzed: 11/28

Analyst: PR

Burette Size Used: 10 ml

Analytical Media: 80% IPA

RUN NUMBER	SAMPLE VOLUME mls (V)	ALIQUOT VOLUME mls (A)	ALIQUOT FACTOR (F)	TITRANT VOLUME mls (T1)	TITRANT VOLUME mls (T2)	TITRANT VOLUME mls (Tavg)	MASS H2SO4 mg (MH2SO4)
Reagent Blank	XXXXXX	20	XXXXXX	0.06	0.06	0.060	Tbavg
2-PO-M8-1	550	20	27.5	0.41	0.44	0.425	4.8
2-PO-M8-2	650	20	32.5	0.56	0.57	0.565	7.9
2-PO-M8-3	550	20	27.5	1.1	1.13	1.115	13.9

Where:

Tavg = (T + T) / 2

F = V / A

N = Volume H2SO4 * 0.02N / Volume BaCl2

MSO2 = 49.04 * (Tavg + Tbavg) * N * F

Titration Standardization against 0.02N H2SO4

H2SO4 Volume	BaCl2 Volume	BaCl2 Normality
5	10.25	0.0098
5	10.25	0.0098
5	10.20	0.0098
	Average	0.0098

For Run: 2-PO-M8-1

MH2SO4=49.04 *(0.425 - 0.06) * 0.0098 * 27.5

MH2SO4 = 4.8 mg

NOTE: Results reported to the nearest 0.1 mg. or four significant figures

CUSTODY SHEET FOR REAGENT BOX # 0508

Date of Makeup 10/13 Initials MGY Locked? ✓

Individual Tare of Reagent: 200 gms. of 5% H_2O_2

Individual Tare of Reagent: 84 gms. of 80% IPA

Individual Silica Gel Tare Weight 200 gms.

PLANT NAME NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

SAMPLING LOCATION UNIT #2 ESP OUTLET

Run Number	Date Used	Initials	Locked?	Date Cleanup	% S. Gel Spent	Initials	Locke
2-ESPO-M8-1	10-25-89	SRD	—	10-25-89	70%	RFD	✓
2-ESPO-M8-2	10-25-89	SRD	—	10-25-89	70%	SRD	✓
2-ESPO-M8-3	10-25-89	SRD	—	10-25-89	70	JRW	✓

Received in Lab Date 10/31/89 Initials PR Locked? ✓

Zero & Span Balance Initials PR

Sampling Method: M8

Filter #	Tare Weight (grams)	Used on Test
N/A	N/A	

Remarks:

DOUBLE CHARGE SILICA GEL

APPENDIX B.2.b.7

B. FIELD AND ANALYTICAL DATA

2. Unit No. 2

b. ESP Outlet

7. Total Hydrocarbons as Methane

FIELD DATA AND RESULTS TABULATION

PLANT: North County Resource Recovery Facility, West Palm Beach, Florida
LOCATION: Unit No. 2 ESP Outlet
Method 25A Results
Run # 2-PO-M25A-1
Date: 10/25/89

	TAG	CAL	CAL FACTOR
PRETEST	30.4	30.51	0.996
POSTTEST	30.4	30.72	0.990
		AVG --	0.993

TIME	THC (ppmvw) *	ADJUSTED CONCENTRATION (ppmvw) **
1301	1.21	1.20
1302	1.22	1.21
1303	1.19	1.18
1304	1.17	1.16
1305	1.18	1.17
1306	1.16	1.15
1307	1.27	1.26
1308	1.19	1.18
1309	1.02	1.01
1310	0.98	0.97
1311	1.08	1.07
1312	0.97	0.96
1313	0.73	0.73
1314	0.70	0.70
1315	0.81	0.80
1316	0.90	0.89
1317	0.69	0.69
1318	0.62	0.62
1319	0.59	0.59
1320	0.55	0.55
1321	0.52	0.52
1322	0.49	0.49
1323	0.55	0.55
1324	0.59	0.59
1325	0.54	0.54
1326	0.55	0.55
1327	0.56	0.56
1328	0.53	0.53
1329	0.52	0.52
1330	0.48	0.48
1331	0.45	0.45
1332	0.41	0.41
1333	0.43	0.43
1334	0.41	0.41
1335	0.37	0.37
1336	0.38	0.38
1337	0.46	0.46
1338	0.61	0.61
1339	0.72	0.72
1340	0.59	0.59
1341	0.41	0.41
1342	0.42	0.42
1343	0.35	0.35
1344	0.39	0.39
1345	0.42	0.42
1346	0.43	0.43
1347	0.46	0.46
1348	0.44	0.44
1349	0.54	0.54
1350	0.52	0.52
1351	0.40	0.40
1352	0.32	0.32
1353	0.30	0.30
1354	0.27	0.27
1355	0.30	0.30
1356	0.25	0.25
1357	0.31	0.31
1358	0.22	0.22
1359	0.20	0.20
1400	0.18	0.18
	AVG --	0.594

* As measured
** Adjusted for calibration factor

FIELD DATA AND RESULTS TABULATION

PLANT: North County Resource Recovery Facility, West Palm Beach, Florida
LOCATION: Unit No. 2 ESP Outlet
Method 25A Results
Run # 2-PO-M25A-2
Date: 10/25/89

	TAG	CAL	CAL FACTOR
PRETEST	30.4	30.72	0.990
POSTTEST	30.4	30.5	0.997
		AVG ---	0.9935

TIME	THC (ppmvw) *	ADJUSTED CONCENTRATION (ppmvw) **
1601	0.81	0.81
1602	0.84	0.84
1603	0.91	0.90
1604	0.87	0.86
1605	0.89	0.88
1606	0.85	0.84
1607	0.80	0.80
1608	0.79	0.79
1609	0.79	0.79
1610	0.80	0.80
1611	0.81	0.81
1612	0.82	0.82
1613	1.03	1.02
1614	1.05	1.04
1615	1.02	1.01
1616	1.00	0.99
1617	0.99	0.98
1618	1.00	0.99
1619	1.01	1.00
1620	0.99	0.98
1621	0.94	0.93
1622	0.89	0.88
1623	0.97	0.96
1624	0.97	0.96
1625	0.86	0.85
1626	0.79	0.79
1627	0.76	0.76
1628	0.71	0.71
1629	0.67	0.67
1630	0.69	0.69
1631	0.77	0.77
1632	0.78	0.78
1633	0.71	0.71
1634	0.74	0.74
1635	0.74	0.74
1636	0.78	0.78
1637	1.07	1.06
1638	1.31	1.30
1639	1.15	1.14
1640	0.98	0.97
1641	0.86	0.85
1642	0.87	0.86
1643	0.88	0.87
1644	0.86	0.85
1645	0.87	0.86
1646	1.03	1.02
1647	1.08	1.07
1648	1.07	1.06
1649	0.91	0.90
1650	0.87	0.86
1651	1.05	1.04
1652	1.03	1.02
1653	1.00	0.99
1654	0.95	0.94
1655	0.95	0.94
1656	0.92	0.91
1657	0.84	0.84
1658	0.85	0.84
1659	0.91	0.90
1700	1.00	0.99
	AVG ---	0.882

* As measured
** Adjusted for calibration factor

FIELD DATA AND RESULTS TABULATION

PLANT: North County Resource Recovery Facility, West Palm Beach, Florida
LOCATION: Unit No. 2 ESP Outlet
Method 25A Results
Run # 2-PO-M25A-3
Date: 10/25/89

	TAG	CAL	CAL FACTOR
PRETEST	30.4	30.5	0.997
POSTTEST	30.4	30.31	1.003
		AVG ---	1.000

TIME	THC (ppmvw) *	ADJUSTED CONCENTRATION (ppmvw) **
1921	0.76	0.76
1922	0.74	0.74
1923	0.78	0.78
1924	0.84	0.84
1925	0.82	0.82
1926	0.81	0.81
1927	0.8	0.80
1928	0.77	0.77
1929	0.81	0.81
1930	0.78	0.78
1931	0.78	0.78
1932	0.74	0.74
1933	0.74	0.74
1934	0.77	0.77
1935	0.77	0.77
1936	0.76	0.76
1937	0.76	0.76
1938	0.7	0.70
1939	0.74	0.74
1940	0.77	0.77
1941	0.67	0.67
1942	0.64	0.64
1943	0.59	0.59
1944	0.58	0.58
1945	0.83	0.83
1946	1.76	1.76
1947	2.42	2.42
1948	1.66	1.66
1949	1.24	1.24
1950	0.95	0.95
1951	0.86	0.86
1952	0.82	0.82
1953	0.82	0.82
1954	0.8	0.80
1955	0.74	0.74
1956	0.72	0.72
1957	0.69	0.69
1958	0.69	0.69
1959	0.71	0.71
2000	0.68	0.68
2001	0.68	0.68
2002	0.68	0.68
2003	0.63	0.63
2004	0.61	0.61
2005	0.6	0.60
2006	0.58	0.58
2007	0.58	0.58
2008	0.58	0.58
2009	0.58	0.58
2010	0.58	0.58
2011	0.55	0.55
2012	0.57	0.57
2013	0.51	0.51
2014	0.49	0.49
2015	0.48	0.48
2016	0.46	0.46
2017	0.47	0.47
2018	0.49	0.49
2019	0.52	0.52
2020	0.48	0.48
	AVG ---	0.745

* As measured
** Adjusted for calibration factor

APPENDIX B.2.c

B. FIELD AND ANALYTICAL DATA

2. Unit No. 2

c. Stack, Plume Opacity

394

2-8-MI-1A

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: NC RRE

ADDRESS: 45th ST

CITY: WEST PALM B. | STATE: FL | ZIP: —

PHONE: | SOURCE ID NUMBER:

PROCESS EQUIPMENT: INCIN #2 | OPERATING MODE: CONT

CONTROL EQUIPMENT: ESP | OPERATING MODE: CONT

DESCRIBE EMISSION POINT
START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL: START ≈270' STOP ≈270'

HEIGHT RELATIVE TO OBSERVER: START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER: START ≈1000' STOP ≈1000'

DIRECTION FROM OBSERVER: START N-NW STOP N-NW

DESCRIBE EMISSIONS *WHEN VISIBLE
START CONING* STOP SAME

EMISSION COLOR*: START LT BRN STOP SAME

PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐

IS WATER DROPLET PLUME: ATTACHED ☐ N/A DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND
START SKY STOP SKY

BACKGROUND COLOR: START LT GRY STOP LT GRY

SKY CONDITIONS: START 100% cl STOP 90% cl

WIND SPEED: START 2-5 STOP 3-7

WIND DIRECTION: START NE STOP NE

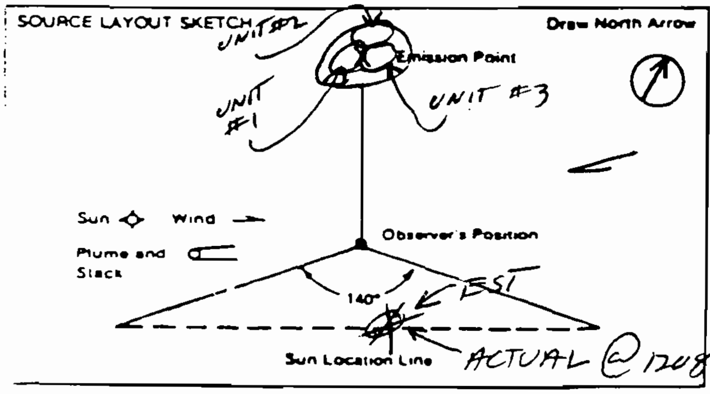
AMBIENT TEMP: START 71°F STOP 76°F

WET BULB TEMP: 69°F

RH, percent: 90%

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS

UNITS #1 + #2 ON-LINE

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

OBSERVATION DATE: 10/24/89 | START TIME: 1152 | STOP TIME: 1252

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	5	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	5	0	0	0	35	0	0	5	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	5	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	5	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	5	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS: MIN 0 MAX 5

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD: —

NUMBER OF READINGS ≥ 10 %: 0 →

MINUTES OPACITY ≥ 10 %: 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B. WINEGAR

OBSERVER'S SIGNATURE: J B. W | DATE: 10/24/89

ORGANIZATION

CERTIFIED BY: ETA | DATE: 9/20/89

VERIFIED BY | DATE

2-8-m9-10

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME: N C R RF

ADDRESS: 45 ~~A~~ ST

CITY: WEST PALM B.

STATE: FL

ZIP: —

PHONE:

SOURCE ID NUMBER: —

PROCESS EQUIPMENT: INCIN #2

OPERATING MODE: CONT

CONTROL EQUIPMENT: ESP

OPERATING MODE: CONT

DESCRIBE EMISSION POINT

START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL: START ≈270' STOP ≈ 270'

HEIGHT RELATIVE TO OBSERVER: START ≈ 270' STOP ≈ 270'

DISTANCE FROM OBSERVER: START ≈1000' STOP ≈ 1000'

DIRECTION FROM OBSERVER: START N-NW STOP N-NW

DESCRIBE EMISSIONS

START NO VE DETECTED STOP ONE PUFF

EMISSION COLOR: START NA STOP LT BRWN

PLUME TYPE: CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT: NO ☒ YES ☐

IS WATER DROPLET PLUME: ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED

START ≈ 20' ABOVE STOP SAME

DESCRIBE BACKGROUND

START SKY STOP SKY

BACKGROUND COLOR: START BL-WH-GR STOP GRY

SKY CONDITIONS: START 80% STOP 90% cl

WIND SPEED: START 3-7 STOP 3-7

WIND DIRECTION: START NE STOP NE

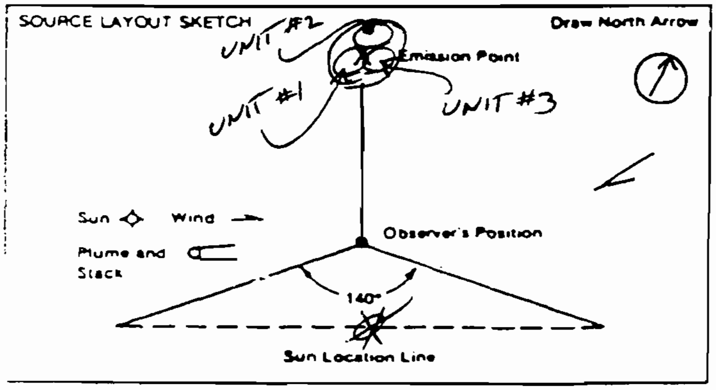
AMBIENT TEMP: START 76°F STOP 76°F

WET BULB TEMP: 72°F

RH, percent: 78%

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS

I HAVE RECEIVED A COPY OF THESE OPACITY OBSERVATIONS

SIGNATURE

TITLE

DATE

OBSERVATION DATE: 10/24/89

START TIME: 1259

STOP TIME: 1359

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	5
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS: MIN 0 MAX 5

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD: —

NUMBER OF READINGS ≥ 10 %: 0 →

MINUTES OPACITY ≥ 10 %: 0 × 0.25 = 0

OBSERVER'S NAME (PRINT): JAMES B WINEGAR

OBSERVER'S SIGNATURE: J B. Winegar

DATE: 10/24/89

ORGANIZATION: —

CERTIFIED BY: ETA

DATE: 9/20/89

VERIFIED BY

DATE

1

VISIBLE EMISSION OBSERVATION FORM 2

2-6-M9-2A

SOURCE NAME NCRRF

ADDRESS 45 ST

CITY WEST PALM B

STATE FL

ZIP —

PHONE

SOURCE ID NUMBER

PROCESS EQUIPMENT INCIN #2

OPERATING MODE CONT

CONTROL EQUIPMENT ESP

OPERATING MODE CONT

DESCRIBE EMISSION POINT

START ≈12' DIAM DUCT ~~STK~~ IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL START ≈270' STOP ≈270'

HEIGHT RELATIVE TO OBSERVER START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER START ≈900' STOP ≈900'

DIRECTION FROM OBSERVER START N STOP N

DESCRIBE EMISSIONS

START PUFFS STOP SAME

EMISSION COLOR START LT BRN STOP LT BRN

PLUME TYPE CONTINUOUS ☒ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT NO ☒ YES ☐

IS WATER DROPLET PLUME ATTACHED ☐ N/A DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED

START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND

START SKY STOP SKY

BACKGROUND COLOR START BL-WH-~~GY~~ STOP SAME

SKY CONDITIONS START 70%cl STOP 70%cl

WIND SPEED START 10-15 STOP 10-15

WIND DIRECTION START NE STOP NE

AMBIENT TEMP START 75°F STOP 76°F

WET BULB TEMP 70°F

RH percent 78%

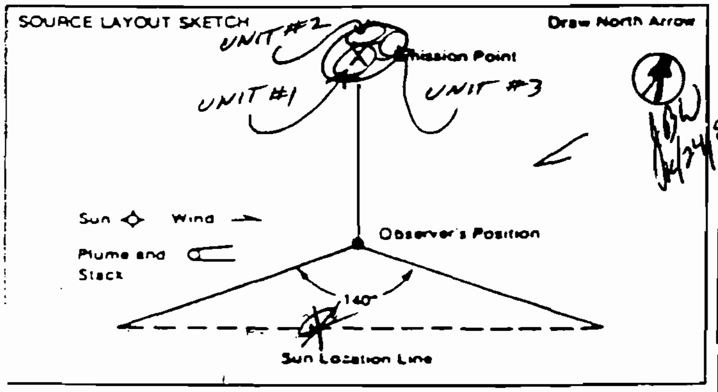
OBSERVATION DATE 10/24/89

START TIME 1446

STOP TIME 1546

SEC / MIN	0	15	30	45	SEC / MIN	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	5
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	5	0	0
7	0	0	0	0	37	0	0	5	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	5	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	5	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	5	0	5	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

SOURCE LAYOUT SKETCH



COMMENTS

RANGE OF OPACITY READINGS MIN 0 MAX 5

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD

NUMBER OF READINGS ≥ 10 % 0

MINUTES OPACITY ≥ 10 % 0 ÷ 0.25 = 0

OBSERVER'S NAME (PRINT) JAMES B. WINEGAR

OBSERVER'S SIGNATURE J B. W

DATE 10/24/89

ORGANIZATION —

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SIGNATURE

TITLE

DATE

CERTIFIED BY ETA

DATE 9/20/89

VERIFIED BY

DATE

0

2-S-M9-23

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME NCRRF

ADDRESS 45th ST

CITY WEST PALM B.
STATE FL
ZIP —

PHONE
SOURCE ID NUMBER

PROCESS EQUIPMENT INCIN #2
OPERATING MODE CONT

CONTROL EQUIPMENT ESP
OPERATING MODE CONT

DESCRIBE EMISSION POINT
START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST

HEIGHT ABOVE GROUND LEVEL
START ≈270' STOP ≈270'

HEIGHT RELATIVE TO OBSERVER
START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER
START ≈900' STOP ≈900'

DIRECTION FROM OBSERVER
START N STOP N

DESCRIBE EMISSIONS
START NO VE DETECTED STOP SAME

EMISSION COLOR
START NA STOP NA

PLUME TYPE CONTINUOUS ☑ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT
NO ☑ YES ☐

IS WATER DROPLET PLUME
ATTACHED ☐ N/A DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED
START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND
START SKY STOP SKY

BACKGROUND COLOR
START BL-WH STOP SAME

SKY CONDITIONS
START 70% cl STOP 50% cl

WIND SPEED
START 10-15 STOP 10-15

WIND DIRECTION
START NE STOP NE

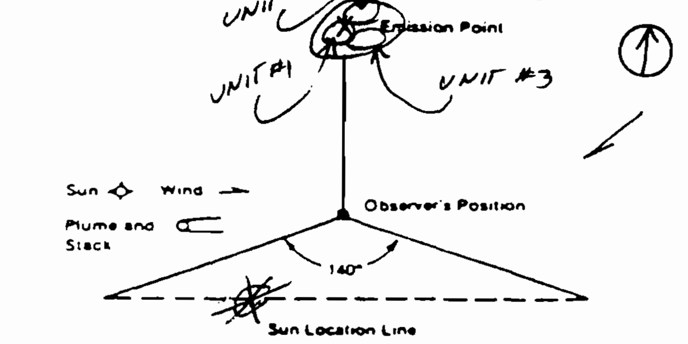
AMBIENT TEMP
START 76°F STOP 78°F

WET BULB TEMP 70°F

RH, percent 74%

SOURCE LAYOUT SKETCH

Draw North Arrow



COMMENTS

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SIGNATURE

TITLE

DATE

OBSERVATION DATE 10/24/89
START TIME 1552
STOP TIME 1652

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

RANGE OF OPACITY READINGS
MIN 0 MAX 0

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD

NUMBER OF READINGS ≥ 10 % 0

MINUTES OPACITY ≥ 10 % 0 = 0.25 = 0

OBSERVER'S NAME (PRINT) JAMES B. WINEGAR

OBSERVER'S SIGNATURE J B. W
DATE 10/24/89

ORGANIZATION

CERTIFIED BY ETA
DATE 9/20/89

VERIFIED BY
DATE

0/

2-8-M9-3A

VISIBLE EMISSION OBSERVATION FORM 2

SOURCE NAME WCRRF

ADDRESS 45 ST ST

CITY WEST PALM B. STATE FL ZIP —

PHONE — SOURCE ID NUMBER —

PROCESS EQUIPMENT INCIN #2 OPERATING MODE CONT

CONTROL EQUIPMENT ESP OPERATING MODE CONT

DESCRIBE EMISSION POINT

START ≈12' DIAM DUCT ~~STOP~~ IN COMMON ST.

HEIGHT ABOVE GROUND LEVEL START ≈270' STOP ≈270'

HEIGHT RELATIVE TO OBSERVER START ≈270' STOP ≈270'

DISTANCE FROM OBSERVER START ≈400' STOP ≈400'

DIRECTION FROM OBSERVER START E STOP E

DESCRIBE EMISSIONS

START NO VE DETECTED STOP SAME

EMISSION COLOR START NA STOP NA

PLUME TYPE CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐

WATER DROPLETS PRESENT NO ☐ YES ☐

IS WATER DROPLET PLUME ATTACHED ☐ NA DETACHED ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED

START ≈20' ABOVE STOP SAME

DESCRIBE BACKGROUND

START SKY STOP SKY

BACKGROUND COLOR START BL-WH-GR STOP GRY

SKY CONDITIONS START 50%cd STOP 50%cd

WIND SPEED START 4-8 STOP 3-5

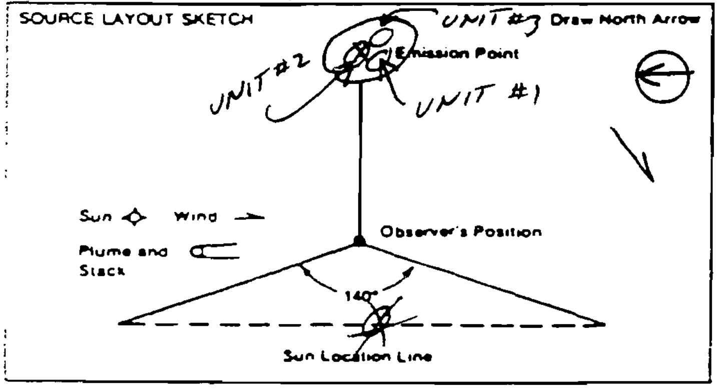
WIND DIRECTION START NE STOP NE

AMBIENT TEMP START 72°F STOP NOT TAKEN

WET BULB TEMP 70°F

RH, percent 90%

SOURCE LAYOUT SKETCH



COMMENTS

UNITS #1 & #2 ON-LINE

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SIGNATURE

TITLE

DATE

OBSERVATION DATE 10/24/89 START TIME 1804 STOP TIME 1846

MIN \ SEC	0	15	30	45	MIN \ SEC	0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	
13	0	0	0	0	43				
14	0	0	0	0	44				
15	0	0	0	0	45				
16	0	0	0	0	46				
17	0	0	0	0	47				
18	0	0	0	0	48				
19	0	0	0	0	49				
20	0	0	0	0	50				
21	0	0	0	0	51				
22	0	0	0	0	52				
23	0	0	0	0	53				
24	0	0	0	0	54				
25	0	0	0	0	55				
26	0	0	0	0	56				
27	0	0	0	0	57				
28	0	0	0	0	58				
29	0	0	0	0	59				
30	0	0	0	0	60				

END DUE TO POOR LIGHT

RANGE OF OPACITY READINGS MIN 0 MAX 0

HIGHEST AVERAGE OPACITY AND AVERAGING PERIOD

NUMBER OF READINGS ≥ 10% 0

MINUTES OPACITY ≥ 10% 0 × 0.25 = 0

OBSERVER'S NAME (PRINT) JAMES B. WINEGAN

OBSERVER'S SIGNATURE J B. Winegan DATE 10/24/89

ORGANIZATION

CERTIFIED BY ETA DATE 9/20/89

VERIFIED BY DATE

APPENDIX C

CALIBRATION DATA

BEST AVAILABLE COPY

Dry Gas Meter Identification: 1017057 Calibration by: WLS

Page 1 of 2

Date: 3-30-89 Barometric Pressure (P_b): 29.56 in. Hg

*Date: 3-31-89 *Barometric Pressure (P_b): 29.34 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

Approx. Flow Rate (Q) cfm	Spirometer Gas Volume (V_s) ft^3	Spirometer Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft^3	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (Θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	2.859	77	2.747	77	.35	10	.2776		1.0399
	2.823	77	2.713	77	.35		.2741		1.0396
	2.796	79	2.685	77	.35		.2705		1.0366
	4.144	79	4.129	77	.59		.4009		0.9984
	4.189	79	4.146	77	.59		.4053		1.0051
	4.262	79	4.134	77	.59		.4123		1.0256
	4.945	79	4.913	77	.77		.4784		1.0009
	5.027	79	4.942	77	.77		.4863		1.0115
	5.055	79	4.926	77	.77		.4890		1.0204
	8.069	79	8.013	77	1.70		.7806		0.9990
	8.078	79	7.959	77	1.70		.7815		1.0069
	8.051	79	7.990	77	1.70		.7789		0.9997
*	10.700	79	10.515	76	2.80		1.0274		1.0049
*	10.665	79	10.578	76	2.80		1.0241		0.9956
*	10.565	79	10.514	76	2.80		1.0145		0.9923

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V_{ds})\ (t_s + 460)\ (P_b + (\ p\ /\ 13.6))}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{(t_s + 460)\ (\Theta)}$$

Dry Gas Meter Identification: 1017057 Calibration by: WLS Page 2 of 2

Date: 3-30-89 Barometric Pressure (P_b): 29.56 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

*Date: 3-31-89 *Barometric Pressure (P_b): 29.34 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer Gas Volume (V_s) ft^3	Spirometer Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft^3	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (Θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
*	12.168	79	12.266	77	3.74	10	1.1684		0.9792
*	12.231	79	12.153	77	3.74		1.1744		0.9934
*	12.186	79	12.219	77	3.74		1.1701		0.9844
	13.461	79	13.469	77	4.60		1.3022		0.9844
	13.661	79	13.666	77	4.60		1.3216		0.9847
	13.461	79	13.535	77	4.60		1.3022		0.9796

YDS = 1.0040

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V_{ds})\ (t_s + 460)\ (P_b + (\ p\ /\ 13.6))}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{(t_s + 460)\ (\Theta)}$$

BEST AVAILABLE COPY

Dry Gas Meter Identification: 1017051

Calibration by: W. L. Sherrill

Date: 10-3-89

Barometric Pressure (P_b): 29.73 in. Hg

PAGE 1 OF 2

ENTROPY ENVIRONMENTALISTS, INC.

*Date: 10-4-89

*Barometric Pressure (P_b): 29.82 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer Gas Volume (V_s) ft³	Spirometer Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft³	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (Θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	2.62	80	2.541	78	-.28	10	.2544		1.0280
	2.55	80	2.533	79	-.28		.2477		1.0055
	2.614	80	2.529	79	-.28		.2539		1.0324
*	4.153		4.188	79	-.60		.4046		.9913
*	4.2987		4.193	79	-.60		.4187		1.0248
*	4.3169		4.186	79	-.60		.4205		1.0309
	4.9826		4.923	80	-.84		.4839		1.0142
	4.973		4.936	80	-.84		.4830		1.0096
	5.045		4.926	80	-.84		.4900		1.0263
	7.960		7.809	80	-1.68		.7731		1.0236
	7.805		7.806	80	-1.68		.7580		1.0040
	7.942		7.818	80	-1.68		.7713		1.0201
*	10.255		10.144	79	-2.80		.9990		1.0161
*	10.264		10.266	79	-2.80		.9998		1.0049
*	10.3826		10.348	79	-2.80		1.0114		1.0084

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V_{ds})\ (t_s + 460)\ (P_b + (\Delta p / 13.6))}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{(t_s + 460)\ (\Theta)}$$

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Dry Gas Meter Identification: 1017657

Calibration by: W.L. SHERRILL

Date: 10-3-89

Barometric Pressure (P_b): 29.73 in. Hg

PAGE 2 OF 2

ENTROPY
ENVIRONMENTALISTS, INC.

*Date: 10-4-89

*Barometric Pressure (P_b): 29.82 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer		Dry Gas Meter		Pressure (Δp) in. H_2O	Time (O) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	Gas Volume (V_s) ft^3	Temp. (t_s) °F	Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F					
*	12.1403	80	11.962	78	-3.72	10	1.1826		1.0205
*	12,031		11.969	79	-3.72		1.1720		1.0126
*	12.0037		11.970	79	-3.72		1.1693		1.0102
	13.588		13.377	80	-4.60		1.3196		1.0275
	13.397		13.318	80	-4.60		1.3011		1.0175
	13.333		13.271	80	-4.60		1.2949		1.0162

$\bar{Y}_{ds}$ = 1.0164

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V\ )\ (t\ + 460)\ (P\ + (\ p\ /\ 13.6))}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{(t\ + 460)\ (\theta)}$$

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Dry Gas Meter Identification: 6838323 Calibration by: WLS Page 1 of 2

Date: 3-30-89 Barometric Pressure (P_b): 29.56 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

*Date: 3-31-89 *Barometric Pressure (P_b): 29.34 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer Gas Volume (V_s) ft³	Spirometer Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft³	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (θ) min.	Flow Rate (Q) cfm	Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	2.859	77	2.757	77	.5	10	.2776		1.0357
	2.823	77	2.726	77	.5		.2741		1.0343
	2.796	79	2.710	77	.5		.2705		1.0266
	4.144	79	4.127	77	.8		.4009		0.9984
	4.189	79	4.133	77	.8		.4053		1.0078
	4.262	79	4.136	77	.8		.4123		1.0246
	5.027	79	4.92	77	1.0		.4863		1.0154
	4.945	79	4.884	77	1.0		.4784		1.0062
	5.055	79	4.909	77	1.0		.4890		1.0234
	8.069	79	7.955	77	2.2		.7806		1.0051
	8.078	79	7.917	77	2.2		.7815		1.011
	8.051	79	7.938	77	2.2		.7789		1.005
*	10.700	79	10.436	76	3.4		1.0274		1.011
*	10.665	79	10.525	76	3.4		1.0241		0.9991
*	10.565	79	10.452	76	3.4		1.0145		0.9967

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V)\ (t + 460)\ (P + (p / 13.6))}$$

$$Q = (17.64) \frac{(P_b)\ (V_s)}{(t + 460)\ (\theta)}$$

Dry Gas Meter Identification: 683323 Calibration by: WLS Page 2 of 2

Date: 3-30-89 Barometric Pressure (P_b): 29.56 in. Hg

ENTROPY ENVIRONMENTALISTS, INC.

*Date: 3-31-89 *Barometric Pressure (P_b): 29.34 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer Gas Volume (V_s) ft³	Spirometer Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft³	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (Θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
*	12.168	79	12.110	77	4.52	10	1.1684		0.9898
*	12.231	79	12.180	77	4.52		1.1744		0.9893
*	12.186	79	12.177	77	4.52		1.1701		0.9859
	13.461	79	13.355	77	5.50		1.3022		0.9906
	13.661	79	13.575	77	5.50		1.3216		0.9891
	13.461	79	13.413	77	5.50		1.3022		0.9864

YDS = 1.0063

$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{}$

$Q = (17.64)\ \frac{(P_b)\ (V_s)}{}$

Dry Gas Meter Identification: 6838323 Calibration by: W.L. Sherrill

Date: 10-3-89 Barometric Pressure (P_b): 29.73 in. Hg

PAGE 1 of 2

ENTROPY ENVIRONMENTALISTS, INC.

*Date: 10-4-89 *Barometric Pressure (P_b): 29.82 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer Gas Volume (V_s) ft^3	Spirometer Temp. (t_s) °F	Dry Gas Meter Gas Volume (V_{ds}) ft^3	Dry Gas Meter Temp. (t_{ds}) °F	Pressure (Δp) in. H_2O	Time (θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	2.62	80	2.572	75	-.48	10	.2544		1.0104
	2.55		2.543	75	-.48		.2477		.9946
	2,614		2.559	75	-.48		.2539		1.0132
*	4.153		4.214	76	-.90		.4046		.9804
*	4.2987		4.204	76	-.90		.4187		1.0172
*	4.3169		4.214	76	-.90		.4205		1.0191
	4.9826		4.943	75	-1.20		.4801		.9937
	5.045		4.945	75	-1.20		.4900		1.0138
	4.973		4.963	75	-1.20		.4830		.9957
	7.96		7.807	75	-2.38		.7731		1.0161
	7.805		7.808	75	-2.38		.7580		.9962
	7.942		7.806	75	-2.38		.7713		1.0140
*	10.255		10.296	76	-3.80		.9990		.9980
*	10.264		10.293	76	-3.80		.9998		.9992
*	10.3826		10.381	76	-3.80		1.0114		1.0021

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V_{ds})\ (t_s + 460)\ (P_b + (p / 13.6))}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{(t_s + 460)\ (\theta)}$$

Dry Gas Meter Identification: 6838323 Calibration by: W.L. SHERRILL

Date: 10-3-89 Barometric Pressure (P_b): 29.73 in. Hg

PAGE 2 OF 2

ENTROPY ENVIRONMENTALISTS, INC.

*Date: 10-4-89 *Barometric Pressure (P_b): 29.82 in. Hg

Approx. Flow Rate (Q) cfm	Spirometer		Dry Gas Meter		Pressure (Δp) in. H_2O	Time (Θ) min.	Flow Rate (Q) cfm	Meter Meter Coeff. (Y_{ds})	Avg. Meter Coeff. ($\bar{Y}_{ds}$)
	Gas Volume (V_s) ft^3	Temp. (t_s) °F	Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F					
*	12.1403	80	12.032	76	-5.20	16	1.1826		1.0145
*	12.031		12.053	76	-5.20		1.1720		1.0036
*	12.0037		12.059	76	-5.20		1.1693		1.0009
	13.588		13.515	75	-6.40		1.3196		1.0121
	13.397		13.472	75	-6.40		1.3011		1.0011
	13.333		13.428	75	-6.40		1.2949		.9996

Yds = 1.0045

$$Y_{ds} = \frac{(V_s)\ (t_{ds} + 460)\ (P_b)}{(V_{ds})\ (t_s + 460)\ (P_b + (\ p\ /\ 13.6))}$$

$$Q = (17.64)\ \frac{(P_b)\ (V_s)}{(t_s + 460)\ (\theta)}$$

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER North County Regional #6248 Resource Recovery Facility **TEAM LEADER** B. Rudd

SAMPLING LOCATION Unit #1 - ESP Outlet Duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10.20.89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10.23.89 REFERENCE THERMOMETER AMBIENT TEMPERATURE 76 °F

		AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS			
Impinger Exit		75	±2°F
Filter Compartment		75	±5.4°F
Dry Gas Meter		76	±5.4°F
Other			
THERMOCOUPLE	9.37	77	±8°F
	9-3	75	

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	VISUAL INSPECTION CHECK
PITOTS	PT.12	✓
	9.13	✓
NOZZLES	604	✓
	505	✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER NCRRRE/#6284 **TEAM LEADER** B. RUDD

SAMPLING LOCATION UNIT # 2 - ESP OUTLET DUCT

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-20-89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-24-89 **REFERENCE THERMOMETER AMBIENT TEMPERATURE** 72 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	72	±2°F
Filter Compartment	75	±5.4°F
Dry Gas Meter	76	±5.4°F
Other		
THERMOCOUPLE		±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	*VISUAL INSPECTION CHECK*
PITOTS	9-13	✓
	9-12	✓
NOZZLES	505	✓
	604	✓

F-1039
8/86

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER NCRRRF / #6284 **TEAM LEADER** B. Rudd

SAMPLING LOCATION Unit # 2 - ESP Outlet Duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10.20.89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10.25.89 **REFERENCE THERMOMETER AMBIENT TEMPERATURE** 75 °F

		AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS			
Impinger Exit		76	±2°F
Filter Compartment		75	±5.4°F
Dry Gas Meter		77	±5.4°F
Other			
THERMOCOUPLE	9.32	76	±8°F
	9.4	78	

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	VISUAL INSPECTION CHECK
PITOTS	9.12	✓
	9.9	✓
NOZZLES	604	✓
	504	✓

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ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER NCRRRF / #6284 TEAM LEADER B. RUDD

SAMPLING LOCATION Unit #1- ESP Outlet Duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10.20.89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10.26.89 REFERENCE THERMOMETER AMBIENT TEMPERATURE 78 °F

		AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS			
Impinger Exit		78	$\pm 2^{\circ}$F
Filter Compartment		80	$\pm 5.4^{\circ}$F
Dry Gas Meter		80	$\pm 5.4^{\circ}$F
Other			
THERMOCOUPLE	9.37	79	$\pm 8^{\circ}$F
	9.4	80	

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

PITOTS	*I.D. #*	*VISUAL INSPECTION CHECK*
	9.9	✓
	9.12	✓
NOZZLES	504	✓
	604	✓

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ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER B+W /   TEAM LEADER Myt

SAMPLING LOCATION UNIT 1 DRY SCRUBBER INLET

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-22-89	29.69	29.7

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-23-89   REFERENCE THERMOMETER AMBIENT TEMPERATURE 90 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	91	±2°F
Filter Compartment	92	±5.4°F
Dry Gas Meter	93	±5.4°F
Other		
THERMOCOUPLE	90	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	VISUAL INSPECTION CHECK
PITOTS	PT-10	✓
NOZZLES	GL 87	✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER NCRRRF / 6284 **TEAM LEADER** MK

SAMPLING LOCATION UNIT 2 DRY SCRUBBER INLET

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-22-89	29.69	29.7

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-25 **REFERENCE THERMOMETER AMBIENT TEMPERATURE** 80 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	82	±2°F
Filter Compartment	81	±5.4°F
Dry Gas Meter	78	±5.4°F
Other		
THERMOCOUPLE	84	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

PITOTS	*I.D. #*	*VISUAL INSPECTION CHECK*
	9-8	✓
	9-3	✓
NOZZLES	506	✓

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ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER B+W / 6284 TEAM LEADER MK

SAMPLING LOCATION UNIT 1 DSI

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-[illegible]-89	29.69	29.7

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-26 REFERENCE THERMOMETER AMBIENT TEMPERATURE 77 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	78	±2°F
Filter Compartment	75	±5.4°F
Dry Gas Meter	76	±5.4°F
Other		
THERMOCOUPLE	80	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	*VISUAL INSPECTION CHECK*
PITOTS		
	9-3	✓
NOZZLES	506	~~0.244~~ ✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER B&W/6284 **TEAM LEADER** MF

SAMPLING LOCATION UNIT 1 DSI

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-22-89	29.69	29.7

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-27 **REFERENCE THERMOMETER AMBIENT TEMPERATURE** 75°F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	76	±2°F
Filter Compartment	77	±5.4°F
Dry Gas Meter	75	±5.4°F
Other		
THERMOCOUPLE	77	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	VISUAL INSPECTION CHECK
PITOTS	9-8	✓
	9-3	✓
NOZZLES	506	✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER nCRRRF/ TEAM LEADER DOH

SAMPLING LOCATION Dry Scrubber Inlet

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-20-89	30.00	30.00

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 20 REFERENCE THERMOMETER AMBIENT TEMPERATURE 75 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	97	±2°F
Filter Compartment	96	±5.4°F
Dry Gas Meter	90	±5.4°F
Other		
THERMOCOUPLE	95	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

PITOTS	*I.D. #*	*VISUAL INSPECTION CHECK*
	970	✓
NOZZLES	506.241	✓

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ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER nCRRRF **TEAM LEADER** DDH

SAMPLING LOCATION Unit no: 2 ESP Outlet Duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-20-89	30.00	30.00

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-20 **REFERENCE THERMOMETER AMBIENT TEMPERATURE** 75 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	80	±2°F
Filter Compartment	80	±5.4°F
Dry Gas Meter	80	±5.4°F
Other Palmes	80	
THERMOCOUPLE	81	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	VISUAL INSPECTION CHECK
PITOTS	9-14	✓
	9-9	✓
NOZZLES	605 .254	✓
	504 .266	✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER North County Regional Resource Recovery Facility 6284 TEAM LEADER LCM

SAMPLING LOCATION Unit 1 ESP out duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-20-89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-22-89 REFERENCE THERMOMETER AMBIENT TEMPERATURE 80 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	80	±2°F
Filter Compartment	80	±5.4°F
Dry Gas Meter	80	±5.4°F
Other		
THERMOCOUPLE	81	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	VISUAL INSPECTION CHECK
PITOTS	9-10	✓
	9-3	✓
NOZZLES	606	✓
	506	✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER NCRRRF 6284 **TEAM LEADER** LCM

SAMPLING LOCATION Unit II ESP Outlet Duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-20-89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-24-89 **REFERENCE THERMOMETER AMBIENT TEMPERATURE** 72 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	71	±2°F
Filter Compartment	72	±5.4°F
Dry Gas Meter	72	±5.4°F
Other		
THERMOCOUPLE	73	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	*VISUAL INSPECTION CHECK*
PITOTS	9-10	✓
	9-3	✓
NOZZLES	606	✓
	506	✓

ENTROPY

SAMPLING EQUIPMENT CALIBRATION CHECKLIST

JOB NAME/NUMBER NCRRRF TEAM LEADER LC m

SAMPLING LOCATION Unit 2 ESP Outlet Duct

BAROMETER CHECK

DATE	ENTROPY IN-HOUSE REFERENCE BAROMETER	FIELD BAROMETER
10-20-89	30.0	30.0

THERMOMETERS AND THERMOCOUPLE CHECK

DATE 10-28-89 REFERENCE THERMOMETER AMBIENT TEMPERATURE 75 °F

	AMBIENT TEMPERATURE °F	MUST BE WITHIN ACCEPTANCE RANGE °F
THERMOMETERS		
Impinger Exit	75	±2°F
Filter Compartment	74	±5.4°F
Dry Gas Meter	75	±5.4°F
Other		
THERMOCOUPLE	74	±8°F

NOTE: Adjust thermometer until acceptable. If thermometer can't be adjusted, use a backup. If no back up, then record the ambient temperature indicated by the unadjusted thermometer.

PITOT AND NOZZLE CHECK

	I.D. #	*VISUAL INSPECTION CHECK*
PITOTS	69-14	✓
	9-13	✓
NOZZLES	605	✓
	505	✓

Meter Box Number: N5	Calibration by: SRD/MBC

Standard Meter Number: 1017057 Standard Meter Gamma: 1.004

Date: 9-14-89 Barometric Pressure (P_b): 29.57 in. Hg

*Date: ______ *Barometric Pressure (P_b): ______ in. Hg

METERBOX CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft^3	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
3.858	76	10	0.5	3.962	98	1.0165	1.839
3.890	75		0.5	3.959	81	.9963	1.856
7.729	76		2.1	7.900	93	1.0082	1.942
7.676	77		2.1	7.879	95	1.0057	1.969
11.877	76		4.8	12.047	89	1.0019	1.894
11.853	75	↓	4.8	11.974	86	1.0023	1.902
					Average	1.0052	1.900

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ON-SITE DRY GAS METER AUDIT

Date 10-23-89

Time 1935

Auditor VMT

Meter Box Identification Number N5

Pretest Gamma (Y) 1.0052 ΔH_a 1.900

Barometric Pressure (P_{bar}) 30.0 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 567.000	Initial 104	0.97 * Y = 0.9750
Final 574.768	Final 111	1.03 * Y = 1.0354

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.768	Tm = 108	10	Y_c = 1.0005

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.768} * \sqrt{\frac{0.0319\ (108 + 460)}{30.0}} = 1.0005$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

F-1040
9/86

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10-24-89

Time 2025

Auditor MH

Meter Box Identification Number N5

Pretest Gamma (Y) 1.0052 ΔH_a 1.90

Barometric Pressure (P_{bar}) 30.2 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 747.000	Initial 90	0.97 * Y = 0.975
Final 754.561	Final 95	1.03 * Y = 1.0354

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.561	Tm = 93	10	Y_c = 1.0108

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.561} * \sqrt{\frac{0.0319\ (93 + 460)}{30.2}} = 1.0108$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

ON-SITE DRY GAS METER AUDIT

Date 10-25-89

Time 0800

Auditor Mf

Meter Box Identification Number N5

Pretest Gamma (Y) 1.0052 ΔH_a 1.90

Barometric Pressure (P_{bar}) 30.0 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 977.700	Initial 99	0.97 * Y = 0.975
Final 985.363	Final 103	1.03 * Y = 1.0354

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.663	Tm = 101	10	Y_c = 1.0079

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.663} * \sqrt{\frac{0.0319\ (101 + 460)}{30.0}} = 1.0079$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

F-1040
9/86

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10-26-89

Time 0800

Auditor MH

Meter Box Identification Number N5

Pretest Gamma (Y) 1.0052 ΔH_a 1.90

Barometric Pressure (P_{bar}) 30.0 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 102.000	Initial 95	0.97 * Y = 0.975
Final 109.572	Final 100	1.03 * Y = 1.0354

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.572	Tm = 98	10	Y_c = 1.0173

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.572} * \sqrt{\frac{0.0319\ (98 + 460)}{30.0}} = 1.0173$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

ON-SITE DRY GAS METER AUDIT

Date 10-27-89

Time 0920

Auditor MK

Meter Box Identification Number N5

Pretest Gamma (Y) 1.0052 ΔH_a 1.90

Barometric Pressure (P_{bar}) 29.8 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 172.300	Initial 87	0.97 * Y = 0.9750
Final 179.803	Final 92	1.03 * Y = 1.0354

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.503	Tm = 90	10	Y_c = 1.0227

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.503} * \sqrt{\frac{0.0319\ (90 + 460)}{29.8}} = 1.0227$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

cmc

Meter Box Number NS

Calibration by: MC

Meter Box Vacuum: 17 (in. Hg)

Job No. 6284

Standard Meter Number: 6838323

Standard Meter Gamma: 1.0045

Date: 11-8-89

Barometric Pressure (P_b) 29.44 (in. Hg)

POST TEST CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft³	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft³	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
6.453	70	10	1.42	6.602	88	1.0116	1.865
6.430	70	10	1.42	6.604	90	1.0114	1.872
6.442	70	10	1.42	6.640	93	1.0132	1.855
					Average	1.0121	1.864

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ΔP (Magnehelic®)	ΔP (Manometer)	% Difference
.24	.235	2
.66	.66	0
1.08	1.08	0

F-1038
7/89

ENTROPY

Meter Box Number: N7

Calibration by: MBC

Standard Meter Number: 6838323

Standard Meter Gamma: 1.0063

Date: 8-31-89

Barometric Pressure (P_b): 29.58 in. Hg

*Date: ____

*Barometric Pressure (P_b): ____ in. Hg

METERBOX CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft^3	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
3.998	76	10	0.5	4.165	84	.9792	1.748
3.988	76	↓	0.5	4.177	86	.9775	1.751
8.057	74	↓	2.1	8.350	85	.9858	1.791
8.036	74	↓	2.1	8.374	88	.9859	1.791
12.061	74	↓	4.8	12.516	92	.9906	1.804
12.078	74	↓	4.8	12.554	93	.9908	1.796
					Average	.9850	1.780

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10-22-89

Time 16:00

Auditor DDH

Meter Box Identification Number N 7

Pretest Gamma (Y) .9850 ΔH_a 1.780

Barometric Pressure (P_{bar}) 30.20 in.Hg

Dry Gas Meter Readings, ft^3		Meter Temperatures, ^oF		Upper and Lower Limits for Audit Gamma
Initial	968.946	Initial	96	0.97 * Y = 0.95545
Final	976.685	Final	96	1.03 * Y = 1.01455

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.739	Tm = 96	10	Y_c = .990249

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\,(Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.739} * \sqrt{\frac{0.0319\,(96 + 460)}{30.}} = .990249$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

ON-SITE DRY GAS METER AUDIT

Date 10-23-89 Meter Box Identification Number N7

Time 19:35 Pretest Gamma (Y) .9850 ΔH_a 1.780

Auditor DDH Barometric Pressure (P_{bar}) 30.10 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 316.780	Initial 100	0.97 * Y = .95545
Final 324.576	Final 100	1.03 * Y = 1.01455

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.796	Tm = 100	10	Y_c = .9881759

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.796} * \sqrt{\frac{0.0319\ (100\ 460)}{30.10}} = .9881759$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

F-1040
9/86

ON-SITE DRY GAS METER AUDIT

Date 10-26-89

Time 0813-0823

Auditor B. Rudd

Meter Box Identification Number N-7

Pretest Gamma (Y) 0.9850 ΔH_a 1.780

Barometric Pressure (P_{bar}) 30.0 in.Hg

Dry Gas Meter Readings, ft³	Meter Temperatures, °F	Upper and Lower Limits for Audit Gamma
Initial 725.100	Initial 84	0.97 * Y = 0.95545
Final 732.850	Final 86	1.03 * Y = 1.01455

Dry Gas Volume Metered, ft³	Average Meter Temperature, °F	Run Time, min.	Calculated Audit Gamma
Vm = 7.750	Tm = 85	10	Y_c = 0.9823

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.750} * \sqrt{\frac{0.0319\ (85 + 460)}{30.0}} = 0.9822709$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

F-1040
9/86

ENTROPY

cmc

Meter Box Number N7

Calibration by: MBC

Meter Box Vacuum: 7 (in. Hg)

Job No. 6284

Standard Meter Number 1017057

Standard Meter Gama: 1.0164

Date: 11-8-89

Barometric Pressure (P_b) 29.44 (in. Hg)

POST TEST CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft³	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft³	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
6.731	72	10	1.48	7.069	89	.9950	1.755
6.686	73	10	1.48	7.114	95	.9910	1.766
6.669	73	10	1.48	1.146	96	.9914	1.772
					Average	.9925	1.764

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ΔP (Magnehelic®)	ΔP (Manometer)	% Difference
.32	.32	0
.58	.58	0
.85	.843	0.8

F-1038
7/89

ENTROPY

Meter Box Number: N8

Calibration by: MBC

Standard Meter Number: 1017057

Standard Meter Gamma: 1.004

Date: 7-5-89

Barometric Pressure (P_b): 29.62 in. Hg

*Date: ______

*Barometric Pressure (P_b): ______ in. Hg

METERBOX CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F	Time (Θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft^3	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
4.371	75	11	0.5	4.584	97	.9955	1.728
4.043	76	10	0.5	4.179	86	.9882	1.709
8.557	76	10	2.1	8.610	77	.9945	1.629
11.076	76	13	2.1	11.111	78	.9994	1.640
12.722	76	10	4.8	12.673	82	1.0072	1.669
12.724	75	10	4.8	12.757	80	.9989	1.668
					Average	.9973	1.674

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \Theta}{Y_{ds} * V_{ds}}\right]^2$$

F-1037
6-88 rev

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10.22.89

Time 1617-1627

Auditor B. Ruan

Meter Box Identification Number N-8

Pretest Gamma (Y) 0.9973 ΔH_a 1.674

Barometric Pressure (P_{bar}) 30.2 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 702.700	Initial 104	0.97 * Y = 0.967381
Final 710.234	Final 106	1.03 * Y = 1.027219

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.534	Tm = 105	10	Y_c = 1.0253933

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.534} * \sqrt{\frac{0.0319\ (105 + 460)}{30.2}} = 1.0253933$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

ON-SITE DRY GAS METER AUDIT

Date 10.23.89

Time 1938 - 1948

Auditor B. Radd

Meter Box Identification Number N.8

Pretest Gamma (Y) 0.9973 ΔH_a 1.674

Barometric Pressure (P_{bar}) 30.1 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, °F	Upper and Lower Limits for Audit Gamma
Initial 964.500	Initial 88	0.97 • Y = 0.967381
Final 972.057	Final 90	1.03 • Y = 1.027219

Dry Gas Volume Metered, ft^3	Average Meter Temperature, °F	Run Time, min.	Calculated Audit Gamma
Vm = 7.557	Tm = 89	10	Y_c = 1.0093664

$$Y_c = \frac{10}{Vm} \cdot \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.557} \cdot \sqrt{\frac{0.0319\ (\underline{89} + 460)}{\underline{30.1}}} = \underline{1.0093664}$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

ON-SITE DRY GAS METER AUDIT

Date 10.24.89

Time 2024 - 2034

Auditor B. Rudd

Meter Box Identification Number N-8

Pretest Gamma (Y) 0.9973 ΔH_a 1.674

Barometric Pressure (P_{bar}) 29.9 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, °F	Upper and Lower Limits for Audit Gamma
Initial 233.000	Initial 84	0.97 • Y = 0.967381
Final 240.563	Final 84	1.03 • Y = 1.027219

Dry Gas Volume Metered, ft^3	Average Meter Temperature, °F	Run Time, min.	Calculated Audit Gamma
Vm = 7.563	Tm = 84	10	Y_c = 1.007

$$Y_c = \frac{10}{Vm} \cdot \sqrt{\frac{0.0319\,(Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.563} \cdot \sqrt{\frac{0.0319\,(84 + 460)}{29.9}} = 1.007345$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

ON-SITE DRY GAS METER AUDIT

Date 10·25·89

Time 2108-2118

Auditor B. Rudd

Meter Box Identification Number N-8

Pretest Gamma (Y) 0.9973 ΔH_a 1.674

Barometric Pressure (P_{bar}) 30.0 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, °F	Upper and Lower Limits for Audit Gamma
Initial 499.800	Initial 91	0.97 * Y = 0.967381
Final 507.402	Final 91	1.03 * Y = 1.027219

Dry Gas Volume Metered, ft^3	Average Meter Temperature, °F	Run Time, min.	Calculated Audit Gamma
Vm = 7.602	Tm = 91	10	Y_c = 1.007

$$Y_c = \frac{10}{V_m} \cdot \sqrt{\frac{0.0319\,(T_m + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.602} \cdot \sqrt{\frac{0.0319\,(\underline{91} + 460)}{\underline{30.0}}} = \underline{1.0068914}$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

Meter Box Number N8

Calibration by: emc

Meter Box Vacuum: 8 (in. Hg)

Job No. 6284

Standard Meter Number: 6838323

Standard Meter Gama: 1.0045

Date: 11-20-89

Barometric Pressure (P_b): 29.55 (in. Hg)

POST TEST CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft³	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft³	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
6.275	72	10	1.25	6.613	92	.9859	1.730
6.305	73	10	1.25	6.642	88	.9773	1.733
6.310	73	10	1.25	6.622	87	.9793	1.733
					Average	.9808	1.732

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ΔP (Magnehelic®)	ΔP (Manometer)	% Difference
.34	.335	1.5
.56	.56	0
.75	.75	0

F-1038
7/89

ENTROPY

Meter Box Number: N10

Calibration by: MBC

Standard Meter Number: 1017057

Standard Meter Gamma: 1.004

Date: 7-5-89

Barometric Pressure (P_b): 29.68 in. Hg

*Date: ____

*Barometric Pressure (P_b): ____ in. Hg

METERBOX CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft^3	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
4.079	75	10	0.5	4.233	83	.9807	1.678
4.081	75	|	0.5	4.266	87	.9808	1.665
7.982	76	|	2.1	8.303	90	.9853	1.824
7.965	|	|	2.1	8.332	93	.9851	1.822
12.087	|	|	4.8	12.593	96	.9879	1.799
12.082	↓	↓	4.8	12.619	98	.9890	1.794
					Average	.9848	1.764

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ON-SITE DRY GAS METER AUDIT

Date 10-22-89

Time 1530

Auditor LCM

Meter Box Identification Number N-10

Pretest Gamma (Y) .9848 ΔH_a 1.764

Barometric Pressure (P_{bar}) 30.2 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 992.200	Initial 101	0.97 * Y = .955256
Final 999.805	Final 104	1.03 * Y = 1.014344

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.665	Tm = 102.5	10	Y_c = 1.01357

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.665} * \sqrt{\frac{0.0319\ (102.5 + 460)}{30.2}} = 1.0135703591$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

F-1040
9/86

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10-23-89

Time 2000

Auditor

Meter Box Identification Number N-10

Pretest Gamma (Y) .9848 ΔH_a 1.764

Barometric Pressure (P_{bar}) 30.1 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 299.100	Initial 96	0.97 * Y = .955256
Final 306.824	Final 100	1.03 * Y = 1.014344

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = ~~306~~ 7.724	Tm = 98	10	Y_c = .99039

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.724} * \sqrt{\frac{0.0319\ (98 + 460)}{30.1}} = .993954958$$

Audit Gamma Within Acceptable Limits? [✓ Yes] No ___

F-1040
9/86

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10-24-89

Time 2030

Auditor LCM

Meter Box Identification Number N-10

Pretest Gamma (Y) .9848 ΔH_a 1.764

Barometric Pressure (P_{bar}) 29.9 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 591.100	Initial 87	0.97 * Y = .955256
Final 598.869	Final 92	1.03 * Y = 1.01344

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.769	Tm = 89.5	10	Y_c = .985549

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.769} * \sqrt{\frac{0.0319\ (89.5 + 460)}{29.9}} = .985549573$$

Audit Gamma Within Acceptable Limits? [✓ Yes] No ___

F-1040
9/86

ENTROPY

ON-SITE DRY GAS METER AUDIT

Date 10-25-89

Time 2100

Auditor LCM

Meter Box Identification Number N 10

Pretest Gamma (Y) .9848 ΔH_a 1.764

Barometric Pressure (P_{bar}) 30.0 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 768.700	Initial 93	0.97 * Y = .955256
Final 776.495	Final 96	1.03 * Y = 1.014344

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.795	Tm = 94.5	10	Y_c = .9850

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.795} * \sqrt{\frac{0.0319\ (94.5 + 460)}{30.0}} = .985075164$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

MC

Meter Box Number N10

Calibration by: MBC/SWS

Meter Box Vacuum: 5 (in. Hg)

Job No. 6284

Standard Meter Number 6838323

Standard Meter Gama: 1.0045

Date: 11-20-89

Barometric Pressure (P_b) 29.55 (in. Hg)

POST TEST CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft³	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft³	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
6.802	71	11	1.2	7.043	91	1.0036	1.736
6.160	71	10	1.2	6.450	92	.9943	1.746
6.148	71	10	1.2	6.454	93	.9935	1.750
					Average	.9971	1.744

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \Theta}{Y_{ds} * V_{ds}}\right]^2$$

ΔP (Magnehelic®)	ΔP (Manometer)	% Difference
.31	.31	0
.56	.56	0
.82	.82	0

F-1038
7/89

ENTROPY

Meter Box Number: N20

Calibration by: MBC

Standard Meter Number: 6838323

Standard Meter Gamma: 1.0063

Date: 8-29-89

Barometric Pressure (P_b): 29.58 in. Hg

*Date: ______

*Barometric Pressure (P_b): ______ in. Hg

METERBOX CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft^3	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft^3	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
4.073	75	10	0.5	4.110	70	.9867	1.723
4.066	↓	10	0.5	4.121	70	.9824	1.729
10.369	↓	13	2.1	10.426	73	.9919	1.876
7.949	↓	10	2.1	8.014	76	.9948	1.878
12.102	↓	10	4.8	12.096	80	1.0042	1.838
12.120	↓	10	4.8	12.135	83	1.0025	1.833
					Average	.9938	1.813

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ON-SITE DRY GAS METER AUDIT

Date 10-25-89

Time 08:00

Auditor DDH

Meter Box Identification Number N20

Pretest Gamma (Y) .9938 ΔH_a 1.813

Barometric Pressure (P_{bar}) 29.90 in.Hg

3.582

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial ~~3.378~~	Initial 80	0.97 * Y = 0.963986
Final 11.161	Final 82	1.03 * Y = 1.023614

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = 7.579	Tm = 81	10	Y_c = 1.0024125

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\,(Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.579} * \sqrt{\frac{0.0319\,(81 + 460)}{29.90}} = 1.0024125$$

Audit Gamma Within Acceptable Limits? Yes [✓] No ___

ON-SITE DRY GAS METER AUDIT

Date 10-26-89

Time 08:00

Auditor DDH

Meter Box Identification Number N20

Pretest Gamma (Y) .9938 ΔH_a 1.813

Barometric Pressure (P_{bar}) 29.90 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, °F	Upper and Lower Limits for Audit Gamma
Initial 146.145	Initial 70	0.97 * Y = .963986
Final ~~70~~ 153.707	Final 74	1.03 * Y = 1.023614

Dry Gas Volume Metered, ft^3	Average Meter Temperature, °F	Run Time, min.	Calculated Audit Gamma
Vm = 7.562	Tm = 72	10	Y_c = .9962742

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.562} * \sqrt{\frac{0.0319\ (72 + 460)}{29.90}} = .9962742$$

Audit Gamma Within Acceptable Limits? [✓ Yes] No ___

ON-SITE DRY GAS METER AUDIT

Date 10-27-89

Time 09:20

Auditor DDH

Meter Box Identification Number N20

Pretest Gamma (Y) .9938 ΔH_a 1.813

Barometric Pressure (P_{bar}) 29.80 in.Hg

Dry Gas Meter Readings, ft^3	Meter Temperatures, ^oF	Upper and Lower Limits for Audit Gamma
Initial 276.050	Initial 84	0.97 * Y = 0.963986
Final 283.520	Final 88	1.03 * Y = 1.023614

Dry Gas Volume Metered, ft^3	Average Meter Temperature, ^oF	Run Time, min.	Calculated Audit Gamma
Vm = ~~283.520~~ 7.47	Tm = 86	10	Y_c = 1.0234413

$$Y_c = \frac{10}{Vm} * \sqrt{\frac{0.0319\ (Tm + 460)}{P_{bar}}}$$

$$Y_c = \frac{10}{7.47} * \sqrt{\frac{0.0319\ (86 + 460)}{29.80}} = 1.0234413$$

Audit Gamma Within Acceptable Limits? Yes ✓ No ___

F-1040
9/86

ENTROPY

cmc

Meter Box Number N20

Calibration by: MBC

Meter Box Vacuum: 13 (in. Hg)

Job No. 6284

Standard Meter Number: 1017057

Standard Meter Gama: 1.0164

Date: 11-8-89

Barometric Pressure (P_b): 29.44 (in Hg)

POST TEST CALIBRATION

Standard Meter			Meter Box Metering System				
Gas Volume (V_{ds}) ft³	Temp. (t_{ds}) °F	Time (θ) min.	Orifice Setting (ΔH) in. H_2O	Gas Volume (V_d) ft³	Temp. (t_d) °F	Coeff. (Y_d)	$\Delta H_@$ in. H_2O
6.375	71	10	1.3	6.470	83	1.0208	1.718
6.372	71	10	1.3	6.572	89	1.0187	1.701
6.308	71	10	1.3	6.570	95	1.0167	1.717
					Average	1.0187	1.712

$$Y_d = \frac{Y_{ds} * V_{ds} * (t_d + 460) * P_b}{V_d * (t_{ds} + 460) * (P_b + \Delta H/13.6)}$$

$$\Delta H_@ = \frac{0.0317 * \Delta H}{P_b * (t_d + 460)} * \left[\frac{(t_{ds} + 460) * \theta}{Y_{ds} * V_{ds}}\right]^2$$

ΔP (Magnehelic®)	ΔP (Manometer)	% Difference
.26	.26	0
~~.26~~ .58	.58	0
.90	.90	0

F-1038
7/89

ENTROPY

NOZZLE NUMBER: S04

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
3-11-87	ST	.236	.236	.237	.235	.236	0.236
3/20/87	SH	.232	.235	.232	.232	.232	0.233
4/21/87	JE	.255	.254	.257	.256	.259	.257
4/15/88	JE	.246	.243	.245	.246	.245	0.245
8/16/88	BKG	,246	,244	.247	,246	,246	,246
10/31/88	BKG	,264	,267	,265	,265	,266	.265
2/13/89	BKG	,265	,266	,265	,267	,265	,266

NOTE: All diameters measured in inches.

NOZZLE NUMBER: 505

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
12-2-82	ST	.252	.252	.255	.254	.252	0.253
2-2-83	PLO	.256	.257	.257	.258	.257	0.257
3-12-84	MAH	.252	.256	.255	.252	.255	0.254
3-25-85	JDE	.253	.249	.251	.252	.253	0.252"
2-19-86	JE	.258	.255	.267	.254	.256	0.256
9-17-86	BTB	.251	.252	.254	.254	.252	.253"
3-11-87	ST	.253	.252	.254	.256	.254	.254
3/20/87	SH	.249	.251	.251	.250	.248	0.250
4/21/87	JE	.251	.249	.251	.249	.250	.250
4/15/88	J.E.	.254	.252	.250	.254	.252	0.252
6/27/88	JE	.249	.248	.249	.246	.248	.248
8/16/88	BKG	.247	.248	.250	.247	.247	.248
9/22/88	BKG	.261	.260	.260	.259	.260	.260
10/31/88	BKG	.267	.270	.268	.268	.269	.268
2/13/89	BKG	.261	.262	.262	.263	.262	.262
8/21/89	JRW	0.250	0.251	0.250	0.252	0.253	0.251

NOTE: All diameters measured in inches.

NOZZLE NUMBER: 506

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
12-2-82	ST	.254	.251	.250	.252	.251	0.252
2-3-84	PLO	.252	.252	.254	.251	.250	0.252
3-12-84	MAA	.252	.249	.250	.252	.253	0.251
2-15-85	AMt	.247	.250	.246	.250	.249	0.248
3-25-85	JDE	.247	.245	.247	.249	.248	0.247"
2-19-86	JE	.252	.254	.255	.253	.255	0.254
9-17-86	BB	.253	.253	.256	.255	.256	.255"
4/15/88	JE	.239	.238	.241	.242	.239	0.240
6/27/88	JE	.247	.249	.247	.246	.249	.248
8/16/88	BKG	.244	.242	.245	.242	.244	.243
10/31/88	BKG	.262	.260	.259	.260	.261	.260
2/13/89	BKG	.258	.258	.259	.258	.259	.258
5-25-89	MISSING						
8-21-89	JRW	0.239	0.240	0.243	0.241	0.240	0.241

NOTE: All diameters measured in inches.

NOZZLE NUMBER: 604

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
12-2-82	ST	.244	.246	.243	.245	.244	0.244
04-07-83	HEC	0.241	0.244	0.243	0.244	0.245	0.243
01-10-84	PLO	.248	.245	.247	.245	.246	0.246
7-6-84	TTM	.242	.243	.243	.244	.243	0.243
10.24.85	GMC	.250	.252	.250	.251	.252	0.251
2.26.86	BB	.248	.245	.246	.247	.245	0.246
6-18-86	BB	.237	.240	.237	.238	.237	0.238
9-17-86	BB	.248	.250	.247	.250	249	0.249
11-12-86	BB	.250	.249	.251	.250	.250	0.250
1/12/87	J.E.	250	249	249	.248	.250	.249
5-12-87	J.E	.244	.247	.243	.245	—	0.245
7/31/87	JE	.243	.244	.242	.244	.242	0.243
4/12/88	JE	.240	.239	.242	.239	.240	0.240
8-12-88	JC	.238	.241	.241	.242	.242	.241
10/6/88	BKG	.252	.253	.252	.253	.254	.253
2/27/89	BKG	.253	.254	.254	.254	.254	.254
7/17/89	LM	.257	.258	.255	.255	.255	.254

NOTE: All diameters measured in inches.

NOZZLE NUMBER: 605

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
12-2-82	ST	.245	.242	.246	.246	.244	0.245
04-07-83	HEC	0.244	0.244	0.244	0.245	0.244	0.244
01-10-84	PLD	.243	.241	.244	.243	.244	0.243
7-6-84	TTM	.242	.245	.243	.242	.244	0.243
10.24.85	GMC	.250	.251	.251	.252	.252	0.251
2.26.86	BB	.250	.254	.250	.251	. —	0.251
6-18-86	BB	.241	.243	.242	.244	.242	0.242
9-17-86	BB	.250	.248	.248	.247	.250	0.249
11-12-86	BB	.249	.247	.250	.249	.249	0.249
1/12/87	J.E	.245	248	.245	.245	.246	0.246
5-12-87	J.E	.245	.244	.243	.242	—	0.244
7/31/87	J.E	.243	.243	.241	.242	.244	0.243
4/12/88	JE	.237	.236	.239	.237	.236	0.232
8-12-88	JC	.235	.236	.235	.235	.234	.235
10/31/88	BKG	.256	.254	.255	.255	.255	.255
2/27/89	BKG	.256	.255	.255	.253	.255	.255
3/27/89	BKG	.256	.257	.257	.258	.256	.257
7/17/89	LM	.253	.254	.254	.255	.253	.254

NOTE: All diameters measured in inches.

NOZZLE NUMBER: 606

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
12-2-82	ST	.245	.242	.244	.242	.243	0.243
04-07-83	HEC	0.242	0.241	0.243	0.240	0.242	0.242
01-10-84	PLO	.245	.247	.245	.245	.247	0.246
7-6-84	TTM	.246	.243	.244	.246	.244	0.245
9-12-85	AMK	.242	.242	.242	.243	.244	0.243
10.24.85	GMC	.246	.243	.246	.243	.244	0.244
2.26.86	BB	.240	.242	.244	.243	.244	0.243
6-18-86	BB	.239	.238	.240	.237	.237	0.238
9-17-86	BB	.243	.244	.241	.242	.244	0.243
11-12-86	BB	.243	.244	.243	.242	.243	0.243
1/12/87	J.E.	.244	.245	.246	.243	.243	.244
7/31/87	J.E	.240	.240	.241	.240	.240	.240
8-12-88	JC	Missing	—	—	—	—	—
10/31/88	BKG	.264	.266	.266	.265	.267	.266
2/27/89	BKG	.264	.263	.263	.263	.262	.263
7/17/89	LM.	.261	.263	.265	.262	.263	.263

NOTE: All diameters measured in inches.

NOZZLE NUMBER: GL 87

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Average
4-14-89	WLS	.268	.265	.267	.264	.266	.266

NOTE: All diameters measured in inches.

ENTROPY
ENVIRONMENTALISTS, INC.

NOZZLE NUMBER: GL-161

Date	Initials	Dia. 1	Dia. 2	Dia. 3	Dia. 4	Dia. 5	Averag
10-12-9	WLS	.259	.260	.262	.261	.260	.260

NOTE: All diameters measured in inches.

ENTROPY
ENVIRONMENTALISTS, INC.

BEST AVAILABLE COPY

Scott Specialty Gases
PLUMSTEADVILLE, PA. 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

SCOTT SPECIALTY GASES 1/04/89

CERTIFICATE OF ANALYSIS

ENTROPY
9001 GLENWOOD AVE
US 70 W RT 6 BOX 124
RALEIGHT NC 27612-0000
JOHN MAXWELL

PROJECT #: 01-07931
PO #: 0313-JM

CYLINDER #: ALM001884 ANALYTICAL ACCURACY: --1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES)	U/M
CARBON MONOXIDE	80.0	PPM	80.1	PPM
METHANE	80.0	PPM	79.6	PPM
AIR	BALANCE GAS			N/A

NOTES: NBS TRACEABLE

DATE OF ANALYSIS: 12/30/88

ANALYST: ____________________
TOM SASSAMAN

APPROVED BY: Mark S. Sirinides
MARK S. SIRINIDES

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THIS ANALYSIS SHALL BE THE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST

TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS

Scott Specialty Gases

PLUMSTEADVILLE, PA. 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

SCOTT SPECIALTY GASES, INC. 8/30/8

CERTIFICATE OF ANALYSIS

ENTROPY ENVIRONMENTALIST
9001 GLENWOOD AVENUE
US 70 W. RT. 8 BOX 124
RALEIGH NC 27612-0000
ATTN: JOHN MAXWELL

PROJECT #: 01-11707
PO #: 0779-JM

CYLINDER #: IL3655 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS 1 (MOLES) V/M	
CARBON MONOXIDE	50.0	PPM	49.9	PPM
METHANE	50.0	PPM	50.2	PPM
AIR	BALANCE	GAS		N/A

NOTES: GRAVIMETRIC MASTER GAS
NBS TRACEABLE

DATE OF ANALYSIS: 8/28/89

ANALYST: Ted Neeme 4-TES APPROVED BY:
TOM SASSAMAN MARK S. SIRINIDES

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THIS ANALYSIS SHALL BE THE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST

Scott Specialty Gases

PLUMSTEADVILLE, PA. 18949 PHONE: (215) 766-8861 TWX: 510-665-9344

SCOTT SPECIALTY GASES 1/04/89

CERTIFICATE OF ANALYSIS

ENTROPY
9001 GLENWOOD AVE
US 70 W RT 8 BOX 124
RALEIGHT NC 27612-0000
JOHN MAXWELL

PROJECT #: 01-07931
PO #: 0313-JM

CYLINDER #: ALM001695 ANALYTICAL ACCURACY: +-1%

COMPONENT	REQUESTED CONCENTRATION		ANALYSIS (MOLES) V/M	
CARBON MONOXIDE	30.0	PPM	29.0	PPM
METHANE	30.0	PPM	30.4	PPM
AIR	BALANCE GAS			N/A

NOTES: NBS TRACEABLE

DATE OF ANALYSIS: 12/30/88

ANALYST: ______________ APPROVED BY: ______________
TOM SASSAMAN MARK S. SIRINIDES

THE ONLY LIABILITY OF THIS COMPANY FOR GAS WHICH FAILS TO COMPLY WITH THIS ANALYSIS SHALL BE THE REPLACEMENT THEREOF BY THE COMPANY WITHOUT EXTRA COST

TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS

APPENDIX D

FUEL ANALYSIS SUMMARY

This page was intentionally omitted.

RDF Fuel Properties

A representative RDF fuel analysis was determined by averaging the analytical results of ten (10) fuel samples acquired over the five (5) day test period. The individual and 5-day average RDF analyses are presented in the following "as fired" RDF summary.

The 5-day summary RDF heating values averaged 4698 Btu's per pound and the average EPA Fd factor was calculated to be 9439 DSCF/MMBtu. All "fuel based" F-factor calculations used in this report are based on the average 5-day RDF analysis.

Babcock & Wilcox conducted the on-site fuel sampling and was responsible for obtaining the laboratory analytical results. RDF samples were taken from the boiler feed conveyors every one to two hours during the testing. The hourly RDF samples were composited at the end of a test day and then thoroughly mixed with "cone and quartering" techniques. Two smaller RDF test samples weighing approximately three pounds each were then prepared from each days fuel sample. One set of the daily fuel samples (one per day times 5 days) were sent to National Ecology, Inc. (NEI) who prepared the samples for final analysis by Gould/Warner laboratory. The second set of daily fuel samples were retained by B&W and analyzed by B&W's Alliance Research Center (ARC).

NORTH COUNTY REGIONAL RESOURCE RECOVERY FACILITY

EMISSIONS COMPLIANCE TEST

"as fired" RDF FUEL SUMMARY

	SAMPLE ID	EPA-01		EPA-02		EPA-03		EPA-04		EPA-05		5-DAY
	DATE	10/23/89		10/24/89		10/25/89		10/26/89		10/27/89		TEST
PARAMETER	BY	B&W/ARC	NEI/GOULD	B&W/ARC	NEI/GOULD	B&W/ARC	NEI/GOULD	B&W/ARC	NEI/GOULD	B&W/ARC	NEI/GOULD	AVERAGE
MOISTURE	%wt.	31.11	27.54	29.47	30.96	31.39	31.24	33.93	28.41	32.37	34.60	31.10
CARBON	%wt.	26.36	29.05	28.38	29.93	28.49	27.20	24.31	25.84	26.10	24.46	27.01
HYDROGEN	%wt.	3.43	4.00	3.60	2.95	3.74	3.67	3.18	3.51	3.42	3.35	3.49
NITROGEN	%wt.	0.38	0.54	0.39	0.67	0.53	0.61	0.45	0.48	0.31	0.40	0.48
SULFUR	%wt.	0.14	0.33	0.20	0.20	0.13	0.22	0.12	0.19	0.12	0.18	0.18
CHLORINE	%wt.	0.16	0.48	0.22	0.45	0.18	0.40	0.19	0.37	0.14	0.24	0.28
ASH	%wt.	14.03	15.09	15.21	16.60	10.57	19.33	16.04	20.14	15.45	17.40	15.99
OXYGEN	%wt.	24.39	22.97	22.53	18.24	24.97	17.33	21.78	21.06	22.09	19.37	21.57
TOTAL	%wt.	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
HHV	BTU/LB	4596	5291	5062	4601	5021	4903	4249	4379	4454	4419	4698
Fd	DSCF/MMBTU	9080	9205	9153	10508	9135	9630	9151	9774	9504	9248	9439

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APPENDIX E

SPARE BACK-UP RUN DATA

CALCULATION OF AVERAGE SO2 EMISSIONS

RUN: 1-SI-CEM-4 (INLET)
SOURCE: N. Co. Resource Recov DATE: 10/27/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	4.0	4.5	4.3
218.0 ppm SO2	207.1	209.6	208.4
0.00 % Oxygen	0.04	0.04	0.04
12.50 % Oxygen	12.38	12.46	12.42
0.00 % CO2	0.22	0.33	0.28
11.06 % CO2	11.06	11.13	11.10

Uncorrected Data: 128 ppm SO2
5.9 % Oxygen
13.7 % CO2

CORRECTED RESULTS

132.1 ppm SO2
13.6 % CO2
5.9 % Oxygen
0.288 lb SO2/MBtu

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

CALCULATION OF AVERAGE SO2, NOx AND CO EMISSIONS

RUN: 1-PO-CEM-4 (OUTLET)
SOURCE: N. Co. Resource Recov   DATE: 10/27/89

GAS VALUE	INITIAL CAL	FINAL CAL	MEAN CAL
0.0 ppm SO2	1.6	1.9	1.8
49.6 ppm SO2	48.7	49.0	48.9
0.0 ppm NOx	-0.3	-0.5	-0.4
240.0 ppm NOx	237.9	234.6	236.3
0.0 ppm CO	-0.3	0.4	0.1
24.8 ppm CO	23.5	23.7	23.6
0.00 % Oxygen	0.02	0.03	0.03
12.50 % Oxygen	12.37	12.34	12.36
0.00 % CO2	0.12	0.12	0.12
11.06 % CO2	11.23	11.12	11.18

Uncorrected Data:		
	33 ppm SO2	6.2 % Oxygen
	206 ppm NOx	13.3 % CO2
	34 ppm CO	87,598 DSCFM

===

CORRECTED RESULTS

33.2 ppm SO2	13.2 % CO2
209.3 ppm NOx	6.3 % Oxygen
31.1 ppm CO	29.0 lb SO2/hr
0.076 lb SO2/MBtu	131.3 lb NO2/hr
0.346 lb NOx/MBtu	11.9 lb CO/hr
0.031 lb CO/MBtu	

===

Corrected Conc. = $\bar{C}$ma(C - Co)/(Cm - Co)

Where: $\bar{C}$ = mean reference measurement
Co = mean zero calibration response
Cm = mean mid or upscale calibration gas response
Cma = actual mid or upscale calibration gas concentration

NOTE: CO concentrations are corrected for the lost volume of CO2 using a multiplication factor of [1 - (%CO2/100)].

#/MMBtu = (ppm pollutant)(F-Factor)(Conv. Factor)(20.9/20.9-% O2)

Where: SO2 Conv. Factor = 1.660E-07 lb SO2/DSCF - ppm SO2
NOx Conv. Factor = 1.194E-07 lb NO2/DSCF - ppm NOx
CO Conv. Factor = 7.263E-08 lb CO/DSCF - ppm CO
F-Factor = 9439 DSCF/MBTU

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. CO. Resource Recovery

TEST DATE: 3-21-1989

RUN NUMBER: 1-PO-CEM-4 (OUTLET)

SPAN VALUES:
100 ppm SO2
500 ppm NOx
200 ppm CO
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	-0.5	1.6	2.10	1.9	2.40	0.30
SO2 UP-SCALE	49.7	48.7	-1.00	49.0	-0.70	0.30
NOx ZERO GAS	0.0	-0.3	-0.06	-0.5	-0.10	-0.04
NOx UP-SCALE	241.7	237.9	-0.76	234.6	-1.42	-0.66
CO ZERO GAS	N/A	-0.3	N/A	0.4	N/A	0.35
CO UP-SCALE	N/A	23.5	N/A	23.7	N/A	0.10
O2 ZERO GAS	0.02	0.02	0.00	0.03	0.04	0.04
O2 UP-SCALE	12.52	12.37	-0.60	12.34	-0.72	-0.12
CO2 ZERO GAS	0.00	0.12	0.60	0.12	0.60	0.00
CO2 UP-SCALE	11.24	11.23	-0.05	11.12	-0.60	-0.55

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE} - \text{ANALYZER CAL. RESPONSE}}{\text{SPAN}} \times 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE} - \text{INITIAL CAL. RESPONSE}}{\text{SPAN}} \times 100$$

SYSTEM CALIBRATION BIAS AND DRIFT CALCULATIONS

SOURCE: N. Co. Resource Recovery

TEST DATE: 10/27/89

RUN NUMBER: 1-SI-CEM-4 (INLET)

SPAN VALUES:
500 ppm SO2
25 % Oxygen
20 % CO2

		------INITIAL VALUES------		------FINAL VALUES------		
	ANALYZER CAL. RESPONSE	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	SYSTEM CAL. RESPONSE	SYSTEM CAL. BIAS (% OF SPAN)	DRIFT (% OF SPAN)
SO2 ZERO GAS	0.6	4.0	0.68	4.5	0.78	0.10
SO2 UP-SCALE	216.0	207.1	-1.78	209.6	-1.28	0.50
O2 ZERO GAS	0.01	0.04	0.12	0.04	0.12	0.00
O2 UP-SCALE	12.52	12.38	-0.56	12.46	-0.24	0.32
CO2 ZERO GAS	0.00	0.22	1.10	0.33	1.65	0.55
CO2 UP-SCALE	11.01	11.06	0.25	11.13	0.60	0.35

$$\text{SYSTEM CAL. BIAS} = \frac{\text{SYSTEM CAL. RESPONSE - ANALYZER CAL. RESPONSE}}{\text{SPAN}} \text{ X } 100$$

$$\text{DRIFT} = \frac{\text{FINAL SYSTEM CAL. RESPONSE - INITIAL CAL. RESPONSE}}{\text{SPAN}} \text{ X } 100$$

APPENDIX F

SAMPLING AND ANALYTICAL PROCEDURES

METHOD 1—SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas.

1.2 Applicability. This method is applicable to flowing gas streams in ducts, stacks, and flues. The method cannot be used when: (1) flow is cyclonic or swirling (see Section 2.4), (2) a stack is smaller than about 0.30 meter (12 in.) in diameter, or 0.071 m² (113 in.²) cross-sectional area, or (3) the measurement site is less than two stack or duct diameters downstream or less than a half diameter upstream from a flow disturbance.

The requirements of this method must be considered before construction of a new facility from which emissions will be measured: failure to do so may require subsequent alterations to the stack or deviation from the standard procedure. Cases involving variants are subject to approval by the Administrator, U.S. Environmental Protection Agency.

2. *Procedure*

2.1 Selection of Measurement Site. Sampling or velocity measurement is performed at a site located at least eight stack or duct diameters downstream and two diameters upstream from any flow disturbance such as a bend, expansion, or contraction in the stack, or from a visible flame. If necessary, an alternative location may be selected, at a position at least two stack or duct diameters downstream and a half diameter upstream from any flow disturbance. For a rectangular cross section, an equivalent diameter (D_e) shall be calculated from the following equation, to determine the upstream and downstream distances:

$$D_e = \frac{2\,LW}{(L+W)}$$

where L=length and W=width.

An alternative procedure is available for determining the acceptability of a measurement location not meeting the criteria above. This precedure, determination of gas flow angles at the sampling points and comparing the results with acceptability criteria, is described in Section 2.5.

2.2 Determining the Number of Traverse Points.

2.2.1 Particulate Traverses. When the eight- and two-diameter criterion can be met, the minimum number of traverse points shall be: (1) twelve, for circular or rectangular stacks with diameters (or equivalent diameters) greater than 0.61 meter (24 in.); (2) eight, for circular stacks with diameters between 0.30 and 0.61 meter (12-24 in.); (3) nine, for rectangular stacks with equivalent diameters between 0.30 and 0.61 meter (12-24 in.).

When the eight- and two-diameter criterion cannot be met, the minimum number of traverse points is determined from Figure 1-1. Before referring to the figure, however, determine the distances from the chosen measurement site to the nearest upstream and downstream disturbances, and divide each distance by the stack diameter or equivalent diameter, to determine the distance in terms of the number of duct diameters. Then, determine from Figure 1-1 the minimum number of traverse points that corresponds: (1) to the number of duct diameters upstream; and (2) to the number of diameters downstream. Select the higher of the two minimum numbers of traverse points, or a greater value, so that for circular stacks the number is a multiple of 4, and for rectangular stacks, the number is one of those shown in Table 1-1.

TABLE 1-1. CROSS-SECTION LAYOUT FOR RECTANGULAR STACKS

Number of traverse points	Matrix layout
9	3x
12	4x
16	4x
20	5x
25	5x
30	6x
36	6x
42	7x
49	7x

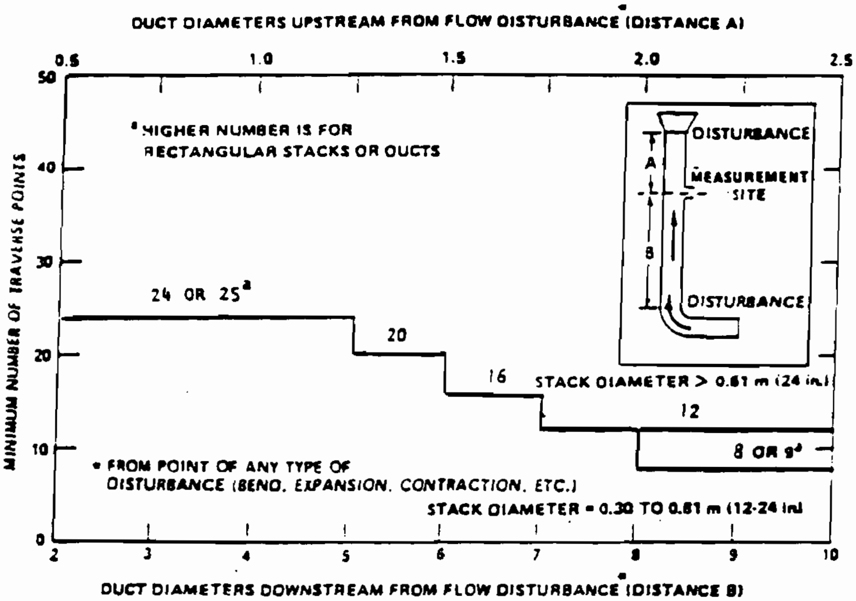

Figure 1-1. Minimum number of traverse points for particulate traverses.

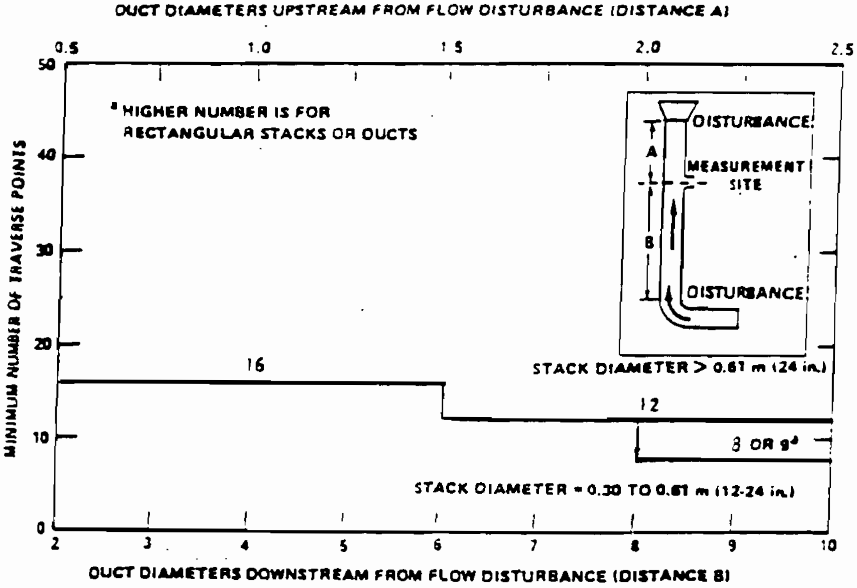

Figure 1-2. Minimum number of traverse points for velocity (nonparticulate) traverses.

2.2.2 Velocity (Non-Particulate) Traverses. When velocity or volumetric flow rate is to be determined (but not particulate matter), the same procedure as that for particulate traverses (Section 2.2.1) is followed, except that Figure 1-2 may be used instead of Figure 1-1.

2.3 Cross-sectional Layout and Location of Traverse Points.

2.3.1 Circular Stacks. Locate the traverse points on two perpendicular diameters according to Table 1-2 and the example shown in Figure 1-3. Any equation (for examples, see Citations 2 and 3 in the Bibliography) that gives the same values as those in Table 1-2 may be used in lieu of Table 1-2.

For particulate traverses, one of the diameters must be in a plane containing the greatest expected concentration variation, e.g., after bends, one diameter shall be in the plane of the bend. This requirement becomes less critical as the distance from the disturbance increases; therefore, other diameter locations may be used, subject to approval of the Administrator.

In addition for stacks having diameters greater than 0.61 m (24 in.) no traverse points shall be located within 2.5 centimeters (1.00 in.) of the stack walls; and for stack diameters equal to or less than 0.61 m (24 in.), no traverse points shall be located within 1.3 cm (0.50 in.) of the stack walls. To meet these criteria, observe the procedures given below.

2.3.1.1 Stacks With Diameters Greater Than 0.61 m (24 in.). When any of the traverse points as located in Section 2.3.1 fall within 2.5 cm (1.00 in.) of the stack walls, relocate them away from the stack walls to: (1) a distance of 2.5 cm (1.00 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger. These relocated traverse points (on each end of a diameter) shall be the "adjusted" traverse points.

Whenever two successive traverse points are combined to form a single adjusted traverse point, treat the adjusted point as two separate traverse points, both in the sampling (or velocity measurement) procedure, and in recording the data.

TRAVERSE POINT	DISTANCE, % of diameter
1	4.4
2	14.6
3	29.6
4	70.4
5	85.4
6	95.6

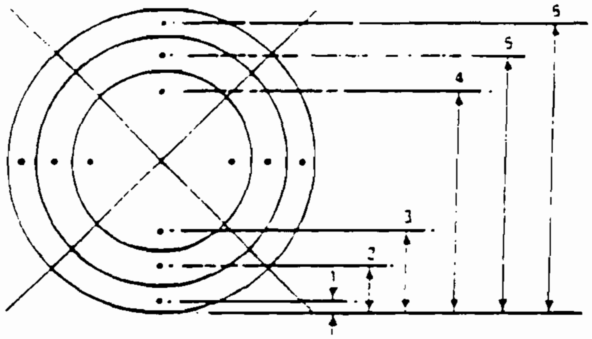

Figure 1-3. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points indicated.

TABLE 1-2. LOCATION OF TRAVERSE POINTS IN CIRCULAR STACKS

(Percent of stack diameter from inside wall to traverse point)

Traverse point number on a diameter	Number of traverse points on a diameter—											
	2	4	6	8	10	12	14	16	18	20	22	24
1	14.6	6.7	4.4	3.2	2.6	2.1	1.8	1.6	1.4	1.3	1.1	1.1
2	85.4	25.0	14.6	10.5	8.2	6.7	5.7	4.9	4.4	3.9	3.5	3.2
3		75.0	29.6	19.4	14.6	11.8	9.9	8.5	7.5	6.7	6.0	5.5
4		93.3	70.4	32.3	22.6	17.7	14.6	12.5	10.9	9.7	8.7	7.9
5			85.4	67.7	34.2	25.0	20.1	16.9	14.6	12.9	11.6	10.5
6			95.6	80.6	65.8	35.6	26.9	22.0	18.8	16.5	14.6	13.2
7				89.5	77.4	64.4	36.6	28.3	23.6	20.4	18.0	16.1
8				96.8	85.4	75.0	63.4	37.5	29.6	25.0	21.8	19.4
9					91.8	82.3	73.1	62.5	38.2	30.6	26.2	23.0
10					97.4	88.2	79.9	71.7	61.8	38.8	31.5	27.2
11						93.3	85.4	78.0	70.4	61.2	39.3	32.3
12						97.9	90.1	83.1	76.4	69.4	60.7	39.8
13							94.3	87.5	81.2	75.0	68.5	60.2
14							98.2	91.5	85.4	79.6	73.8	67.7
15								95.1	89.1	83.5	78.2	72.8
16								98.4	92.5	87.1	82.0	77.0
17									95.6	90.3	85.4	80.6
18									98.6	93.3	88.4	83.9
19										96.1	91.3	86.8
20										98.7	94.0	89.5
21											96.5	92.1
22											98.9	94.5
23												96.8
24												98.9

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2.3.1.2 Stacks With Diameters Equal to or Less Than 0.61 m (24 in.). Follow the procedure in Section 2.3.1.1, noting only that any "adjusted" points should be relocated away from the stack walls to: (1) a distance of 1.3 cm (0.50 in.); or (2) a distance equal to the nozzle inside diameter, whichever is larger.

2.3.2 Rectangular Stacks. Determine the number of traverse points as explained in Sections 2.1 and 2.2 of this method. From Table 1-1, determine the grid configuration. Divide the stack cross-section into as many equal rectangular elemental areas as traverse points, and then locate a traverse point at the centroid of each equal area according to the example in Figure 1-4.

If the tester desires to use more than the minimum number of traverse points, expand the "minimum number of traverse points" matrix (see Table 1-1) by adding the extra traverse points along one or the other or both legs of the matrix; the final matrix need not be balanced. For example, if a 4x3 "minimum number of points" matrix were expanded to 36 points, the final matrix could be 9x4 or 12x3, and would not necessarily have to be 6x6. After constructing the final matrix, divide the stack cross-section into as many equal rectangular, elemental areas as traverse points, and locate a traverse point at the centroid of each equal area.

The situation of traverse points being too close to the stack walls is not expected to arise with rectangular stacks. If this problem should ever arise, the Administrator must be contacted for resolution of the matter.

2.4 Verification of Absence of Cyclonic Flow. In most stationary sources, the direction of stack gas flow is essentially parallel to the stack walls. However, cyclonic flow may exist (1) after such devices as cyclones and inertial demisters following venturi scrubbers, or (2) in stacks having tangential inlets or other duct configurations which tend to induce swirling; in these instances, the presence or absence of cyclonic flow at the sampling location must be determined. The following techniques are acceptable for this determination.

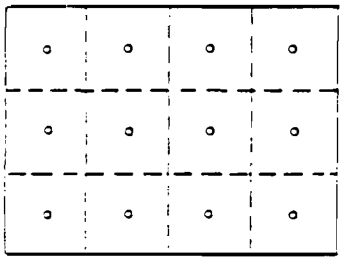

Figure 1-4. Example showing rectangular stack cross section divided into 12 equal areas, with a traverse point at centroid of each area.

Level and zero the manometer. Connect a Type S pitot tube to the manometer. Position the Type S pitot tube at each traverse point, in succession, so that the planes of the face openings of the pitot tube are perpendicular to the stack cross-sectional plane; when the Type S pitot tube is in this position, it is at "0° reference." Note the differential pressure (Δp) reading at each traverse point. If a null (zero) pitot reading is obtained at 0° reference at a given traverse point, an acceptable flow condition exists at that point. If the pitot reading is not zero at 0° reference, rotate the pitot tube (up to ±90° yaw angle), until a null reading is obtained. Carefully determine and record the value of the rotation angle (α) to the nearest degree. After the null technique has been applied at each traverse point, calculate the average of the absolute values of α; assign α values of 0° to those points for which no rotation was required, and include these in the overall average. If the average value of α is greater than 20°, the overall flow condition in the stack is unacceptable and alternative methodology, subject to the approval of the Administrator, must be used to perform accurate sample and velocity traverses.

The alternative procedure described in Section 2.5 may be used to determine the rotation angles in lieu of the procedure described above. The limit of acceptability for the average value of α would remain 20°.

2.5 Alternative Measurement Site Selection Procedure. This alternative applies to sources where measurement locations are less than 2 equivalent stack or duct diameters downstream or less than ½ duct diameter upstream from a flow disturbance. The alternative should be limited to ducts larger than 24 in. in diameter where blockage and wall effects are minimal. A directional flow-sensing probe is used to measure pitch and yaw angles of the gas flow at 40 or more traverse points; the resultant angle is calculated and compared with acceptable criteria for mean and standard deviation.

Note.—Both the pitch and yaw angles are measured from a line passing through the traverse point and parallel to the stack axis. The pitch angle is the angle of the gas flow component in the plane that INCLUDES the traverse line and is parallel to the stack axis. The yaw angle is the angle of the gas flow component in the plane PERPENDICULAR to the traverse line at the traverse point and is measured from the line passing through the traverse point and parallel to the stack axis.

2.5.1 Apparatus.

2.5.1.1 *Directional Probe.* Any directional probe, such as United Sensor Type DA Three-Dimensional Directional Probe, capable of measuring both the pitch and yaw angles of gas flows is acceptable. (Note: Mention of trade name or specific products does not constitute endorsement by the U.S. Environmental Protection Agency.) Assign an identification number to the directional probe, and permanently mark or engrave the number on the body of the probe. The pressure holes of directional probes are susceptible to plugging when used in particulate-laden gas streams. Therefore, a system for cleaning the pressure holes by "back-purging" with pressurized air is required.

2.5.1.2 Differential Pressure Gauges. Inclined manometers, U-tube manometers, o other differential pressure gauges (e.g., magnehelic gauges) that meet the specifications described in Method 2, § 2.2.

Note.—If the differential pressure gauge produces both negative and positive reading then both negative and positive pressure readings shall be calibrated at a minimum of three points as specified in Method 2, § 2.2.

2.5.2 *Traverse Points. Use a minimum of* 40 traverse points for circular ducts and 42 points for rectangular ducts for the gas flow angle determinations. Follow § 2.3 and Table 1-1 or 1-2 for the location and layout of the traverse points. If the measurement location *is determined to be acceptable according to* the criteria in this alternative procedure, use the same traverse point number and location for sampling and velocity measurements.

2.5.3 Measurement Procedure.

2.5.3.1 Prepare the directional probe and *differential pressure gauges as recommende* by the manufacturer. Capillary tubing or surge tanks may be used to dampen pressure fluctuations. It is recommended, but not required, that a pretest leak check be conducted. To perform a leak check, *pressurize or use suction on the impact* opening until a reading of at least 7.6 cm (3 in.) H_2O registers on the differential pressure gauge, then plug the impact opening. The pressure of a leak-free system will remain stable for at least 15 seconds.

2.5.3.2 *Level and zero the manometers.* Since the manometer level and zero may drif because of vibrations and temperature changes, periodically check the level and zero during the traverse.

2.5.3.3 Position the probe at the appropriate locations in the gas stream, and rotate until zero deflection is indicated for th yaw angle pressure gauge. Determine and record the yaw angle. Record the pressure gauge readings for the pitch angle, and determine the pitch angle from the calibratio curve. Repeat this procedure for each traverse point. Complete a "back-purge" of the pressure lines and the impact openings prior to measurements of each traverse point

A post-test check as described in § 2.5.3.1 is required. If the criteria for a leak-free system are not met, repair the equipment, an repeat the flow angle measurements.

2.5.4 Calculate the resultant angle at eac traverse point, the average resultant angle, and the standard deviation using the following equations. Complete the calculations retaining at least one extra significant figure beyond that of the acquired data. Round the values after the final calculations.

2.5.4.1 Calculate the resultant angle at each traverse point:

R_i = arc cosine [(cosine Y_i)(cosine P_i)] Eq. 1–2

Where:

R = Resultant angle at traverse point i, degree.

Y_i = Yaw angle at traverse point i, degree.

P_i = Pitch angle at traverse point i, degree.

2.5.4.2 Calculate the average resultant for the measurements:

$$\bar{R} = \frac{\Sigma R_i}{n} \qquad \text{Eq. 1–3}$$

where:

$\bar{R}$ = Average resultant angle, degree.

n = Total number of traverse points.

2.5.4.3 Calculate the standard deviations:

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} (R_i - \bar{R})^2}{(n-1)}} \qquad \text{Eq. 1–4}$$

Where:

S_d = Standard deviation, degree.

2.5.5 The measurement location is acceptable if $\bar{R} < 20°$ and $S_d \leq 10°$.

2.5.6 Calibration. Use a flow system as described in Sections 4.1.2.1 and 4.1.2.2 of Method 2. In addition, the flow system shall have the capacity to generate two test-section velocities: one between 365 and 730 m/min (1200 and 2400 ft/min) and one between 730 and 1100 m/min (2400 and 3600 [illegible]

2.5.6.1 Cut two entry ports in the test section. The axes through the entry ports shall be perpendicular to each other and intersect in the centroid of the test section. The ports should be elongated slots parallel to the axis of the test section and of sufficient length to allow measurement of pitch angles while maintaining the pitot head position at the test-section centroid. To facilitate alignment of the directional probe during calibration, the test section should be constructed of plexiglass or some other transparent material. All calibration measurements should be made at the same point in the test section, preferably at the centroid of the test-section.

2.5.6.2 To ensure that the gas flow is parallel to the central axis of the test section, follow the procedure in Section 2.4 for cyclonic flow determination to measure the gas flow angles at the centroid of the test section from two test ports located 90° apart. The gas flow angle measured in each port must be ± 2° of 0°. Straightening vanes should be installed, if necessary, to meet this criterion.

2.5.6.3 Pitch Angle Calibration. Perform a calibration traverse according to the manufacturer's recommended protocol in 5° increments for angles from −60° to +60° at one velocity in each of the two ranges specified above. Average the pressure ratio values obtained for each angle in the two flow ranges, and plot a calibration curve with the average values of the pressure ratio (or other suitable measurement factor as recommended by the manufacturer) versus the pitch angle. Draw a smooth line through the data points. Plot also the data values for each traverse point. Determine the differences between the measured data values and the angle from the calibration curve at the same pressure ratio. The difference at each comparison must be within 2° for angles between 0° and 40° and within 3° for angles between 40° and 60°.

2.5.6.4 Yaw Angle Calibration. Mark the three-dimensional probe to allow the determination of the yaw position of the probe. This is usually a line extending the length of the probe and aligned with the impact opening. To determine the accuracy of measurements of the yaw angle, only the zero or null position need be calibrated as follows. Place the directional probe in the test section, and rotate the probe until the zero position is found. With a protractor or other angle measuring device, measure the angle indicated by the yaw angle indicator on the three-demensional probe. This should be within 2° of 0°. Repeat this measurement for any other points along the length of the pitot where yaw angle measurements could be read in order to account for variations in the pitot markings used to indicate pitot head positions.

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METHOD 2—DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

1. *Principle and Applicability*

1.1 Principle. The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube.

1.2 Applicability. This method is applicable for measurement of the average velocity of a gas stream and for quantifying gas flow.

This procedure is not applicable at measurement sites which fail to meet the criteria of Method 1, Section 2.1. Also, the method cannot be used for direct measurement in cyclonic or swirling gas streams; Section 2.4 of Method 1 shows how to determine cyclonic or swirling flow conditions. When unacceptable conditions exist, alternative procedures, subject to the approval of the Administrator, U.S. Environmental Protection Agency, must be employed to make accurate flow rate determinations; examples of such alternative procedures are: (1) to install straightening vanes; (2) to calculate the total volumetric flow rate stoichiometrically, or (3) to move to another measurement site at which the flow is acceptable.

2. *Apparatus*

Specifications for the apparatus are given below. Any other apparatus that has been demonstrated (subject to approval of the Administrator) to be capable of meeting the specifications will be considered acceptable.

2.1 Type S Pitot Tube. The Type S pitot tube (Figure 2-1) shall be made of metal tubing (e.g. stainless steel). It is recommended that the external tubing diameter (dimension D_t Figure 2-2b) be between 0.48 and 0.95 centimeters (3/16 and 3/8 inch). There shall be an equal distance from the base of each leg of the pitot tube to its face-opening plane (dimensions P_A and P_B Figure 2-2b); it is recommended that this distance be between 1.05 and 1.50 times the external tubing diameter. The face openings of the pitot tube shall, preferably, be aligned as shown in Figure 2-2; however, slight misalignments of the openings are permissible (see Figure 2-3).

The Type S pitot tube shall have a known coefficient, determined as outlined in Section 4. An identification number shall be assigned to the pitot tube; this number shall be permanently marked or engraved on the body of the tube.

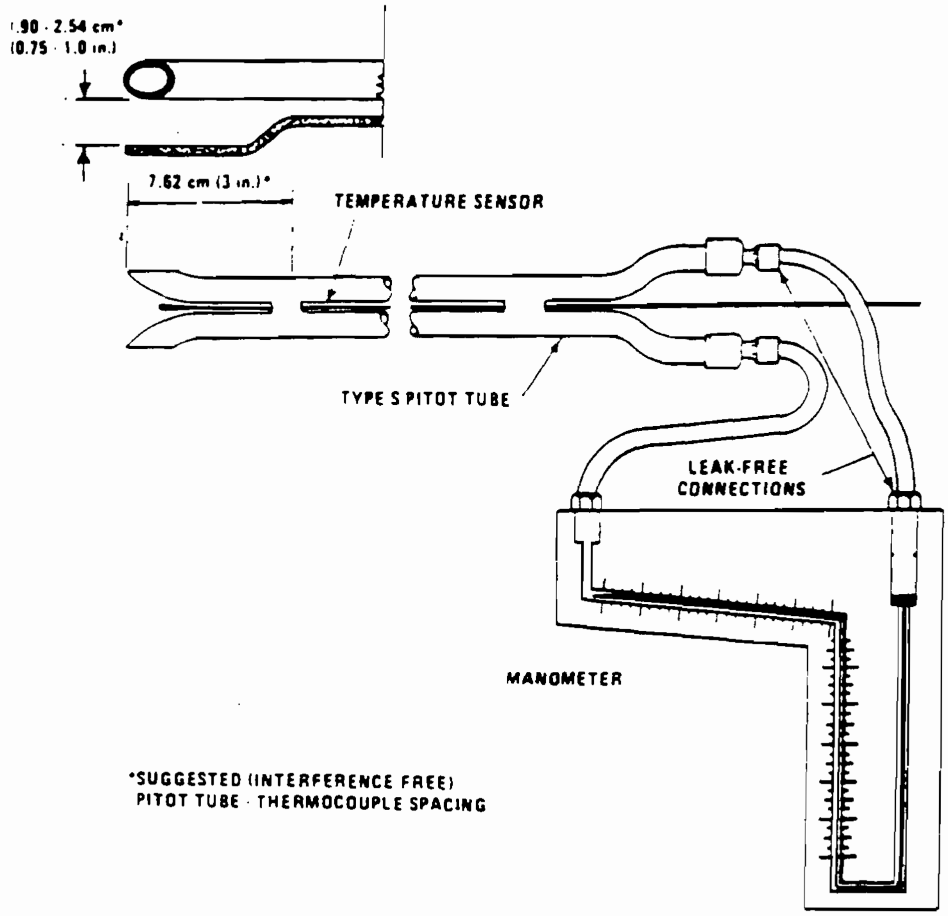


Figure 2-1. Type S pitot tube manometer assembly.

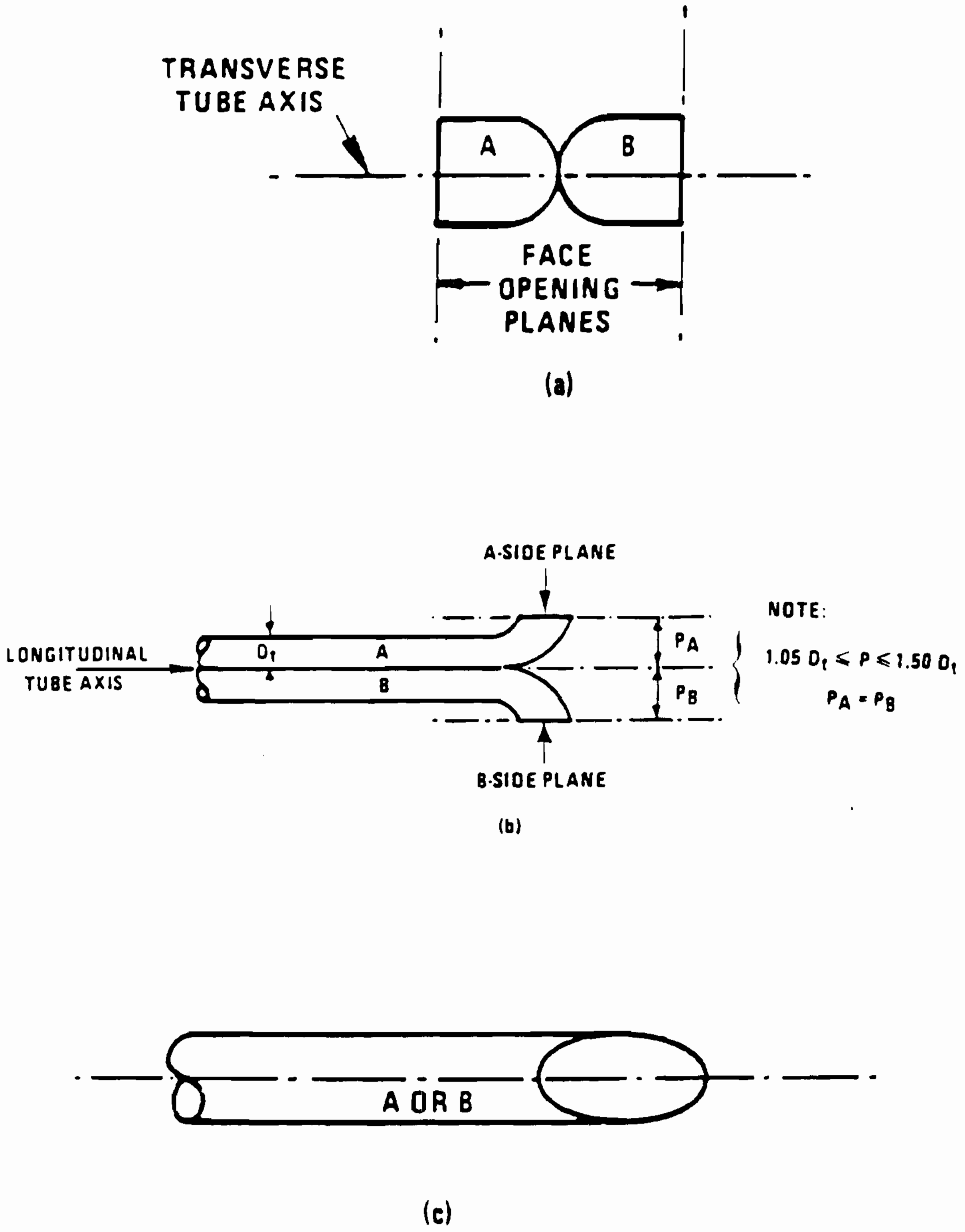


Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

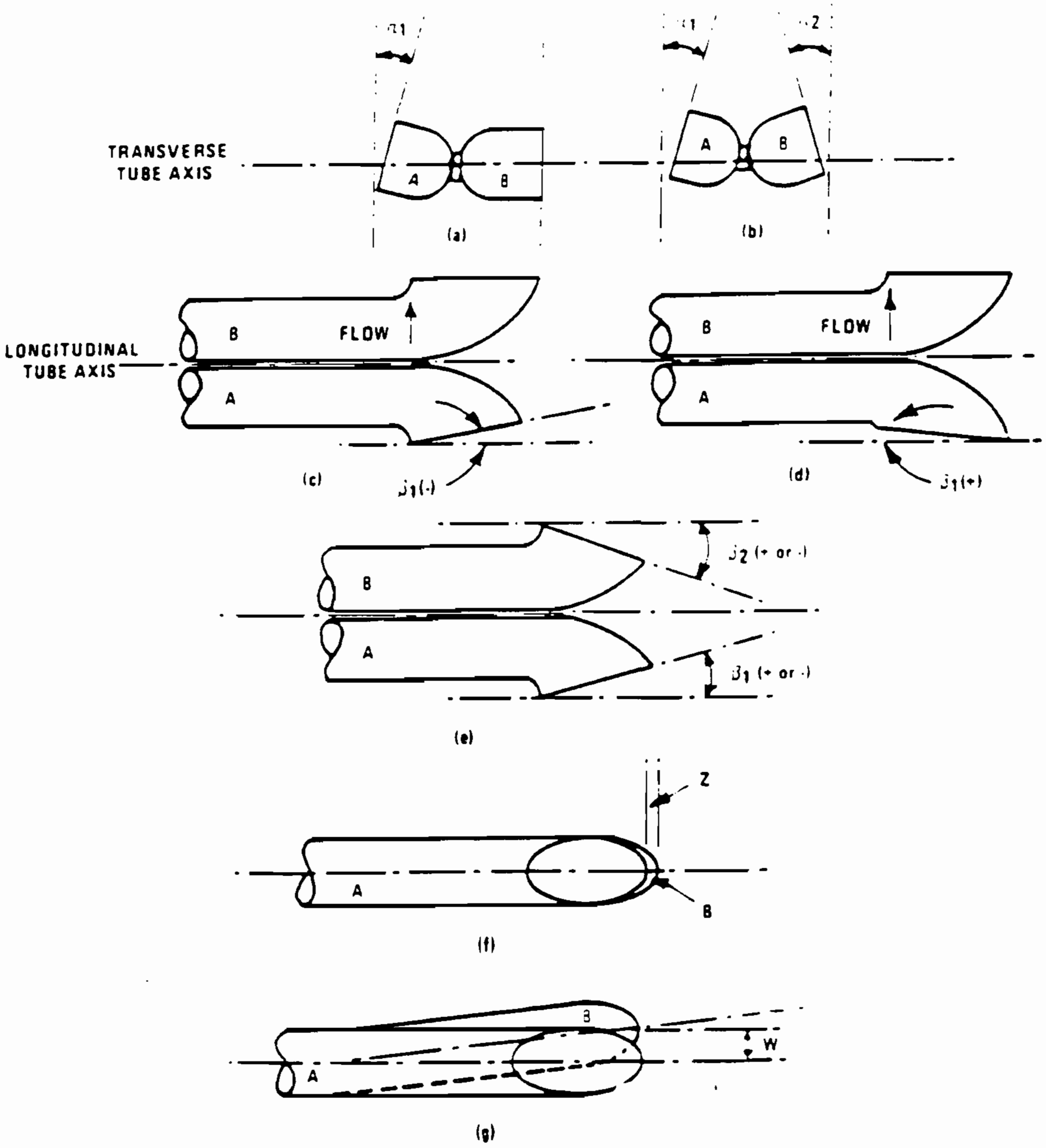


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of Cp(s) so long as $\alpha 1$ and $\alpha 2$ 10°, $\beta 1$ and $\beta 2$ 5°, z 0.32 cm (1/8 in.) and w 0.08 cm (1/32 in.) (citation 11 in Section 6).

A standard pitot tube may be used instead of a Type S, provided that it meets the specifications of Sections 2.7 and 4.2; note, however, that the static and impact pressure holes of standard pitot tubes are susceptible to plugging in particulate-laden gas streams. Therefore, whenever a standard pitot tube is used to perform a traverse, adequate proof must be furnished that the openings of the pitot tube have not plugged up during the traverse period; this can be done by taking a velocity head (Δp) reading at the final traverse point, cleaning out the impact and static holes of the standard pitot tube by "back-purging" with pressurized air, and then taking another Δp reading. If the Δp readings made before and after the air purge are the same ($\pm$5 percent), the traverse is acceptable. Otherwise, reject the run. Note that if Δp at the final traverse point is unsuitably low, another point may be selected. If "back-purging" at regular intervals is part of the procedure, then comparative Δp readings shall be taken, as above, for the last two back purges at which suitably high Δp readings are observed.

2.2 Differential Pressure Gauge. An inclined manometer or equivalent device is used. Most sampling trains are equipped with a 10-in. (water column) inclined-vertical manometer, having 0.01-in. H_2O divisions on the 0-to 1-in. inclined scale, and 0.1-in. H_2O divisions on the 1- to 10-in. vertical scale. This type of manometer (or other gauge of equivalent sensitivity) is satisfactory for the measurement of Δp values as low as 1.3 mm (0.05 in.) H_2O. However, a differential pressure gauge of greater sensitivity shall be used (subject to the approval of the Administrator), if any of the following is found to be true: (1) the arithmetic average of all Δp readings at the traverse points in the stack is less than 1.3 mm (0.05 in.) H_2O; (2) for traverses of 12 or more points, more than 10 percent of the individual Δp readings are below 1.3 mm (0.05 in.) H_2O; (3) for traverses of fewer than 12 points, more than one Δp reading is below 1.3 mm (0.05 in.) H_2O. Citation 18 in Section 6 describes commercially available instrumentation for the measurement of low-range gas velocities.

As an alternative to criteria (1) through (3) above, the following calculation may be performed to determine the necessity of using a more sensitive differential pressure gauge:

$$T=\frac{\sum_{i=1}^{n}\sqrt{\Delta p_i+K}}{\sum_{i=1}^{n}\sqrt{\Delta p_i}}$$

where:

Δp_i = Individual velocity head reading at a traverse point, mm H_2O (in. H_2O).

n = Total number of traverse points.

K = 0.13 mm H_2O when metric units are used and 0.005 in H_2O when English units are used.

If T is greater than 1.05, the velocity head data are unacceptable and a more sensitive differential pressure gauge must be used.

NOTE: If differential pressure gauges other than inclined manometers are used (e.g., magnehelic gauges), their calibration must be checked after each test series. To check the calibration of a differential pressure gauge, compare Δp readings of the gauge with those of a gauge-oil manometer at a minimum of three points, approximately representing the range of Δp values in the stack. If, at each point, the values of Δp as read by the differential pressure gauge and gauge-oil manometer agree to within 5 percent, the differential pressure gauge shall be considered to be in proper calibration. Otherwise, the test series shall either be voided, or procedures to adjust the measured Δp values and final results shall be used subject to the approval of the Administrator.

2.3 Temperature Gauge. A thermocouple, liquid-filled bulb thermometer, bimetallic thermometer, mercury-in-glass thermometer, or other gauge, capable of measuring temperature to within 1.5 percent of the minimum absolute stack temperature shall be used. The temperature gauge shall be attached to the pitot tube such that the sensor tip does not touch any metal; the gauge shall be in an interference-free arrangement with respect to the pitot tube face openings (see Figure 2-1 and also Figure 2-7 in Section 4). Alternate positions may be used if the pitot tube-temperature gauge system is calibrated according to the procedure of Section 4. Provided that a difference of not more than 1 percent in the average velocity measurement is introduced, the temperature gauge need not be attached to the pitot tube; this alternative is subject to the approval of the Administrator.

2.4 Pressure Probe and Gauge. A piezometer tube and mercury- or water-filled U-tube manometer capable of measuring stack pressure to within 2.5 mm (0.1 in.) Hg is used. The static tap of a standard type pitot tube or one leg of a Type S pitot tube with the face opening planes positioned parallel to the gas flow may also be used as the pressure probe.

2.5 Barometer. A mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg) may be used. In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and the sampling point shall be applied at a rate of minus 2.5 mm (0.1 in.) Hg per 30-meter (100 foot) elevation increase or vice-versa for elevation decrease.

2.6 Gas Density Determination Equipment. Method 3 equipment, if needed (see Section 3.6), to determine the stack gas dry molecular weight, and Reference Method 4 or Method 5 equipment for moisture content determination; other methods may be used subject to approval of the Administrator.

2.7 Calibration Pitot Tube. When calibration of the Type S pitot tube is necessary (see Section 4), a standard pitot tube is used as a reference. The standard pitot tube shall, preferably, have a known coefficient, obtained either (1) directly from the National Bureau of Standards, Route 270, Quince Orchard Road, Gaithersburg, Maryland, or (2) by calibration against another standard pitot tube with an NBS-traceable coefficient. Alternatively, a standard pitot tube designed according to the criteria given in 2.7.1 through 2.7.5 below and illustrated in Figure 2-4 (see also Citations 7, 8, and 17 in Section 6) may be used. Pitot tubes designed according to these specifications will have baseline coefficients of about 0.99±0.01.

2.7.1 Hemispherical (shown in Figure 2-4), ellipsoidal, or conical tip.

2.7.2 A minimum of six diameters straight run (based upon D, the external diameter of the tube) between the tip and the static pressure holes.

2.7.3 A minimum of eight diameters straight run between the static pressure holes and the centerline of the external tube, following the 90 degree bend.

2.7.4 Static pressure holes of equal si[illegible] (approximately 0.1 D), equally spaced in [illegible] piezometer ring configuration.

2.7.5 Ninety degree bend, with curved or mitered junction.

2.8 Differential Pressure Gauge for Type S Pitot Tube Calibration. An inclined manometer or equivalent is used. If the single-velocity calibration technique is employed (see Section 4.1.2.3), the calibration differential pressure gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in. H_2O). For multivelocity calibrations, the gauge shall be readable to the nearest 0.13 mm H_2O (0.005 in H_2O) for Δp values between 1.3 and 25 mm H_2O (0.05 and 1.0 in. H_2O), and to the nearest 1.3 mm H_2O (0.05 in. H_2O) for Δp values above 25 mm H_2O (1.0 in. H_2O). A special, more sensitive gauge will be required to read Δp values below 1.3 mm H_2O [0.05 in. H_2O] (see Citation 18 in Section 6).

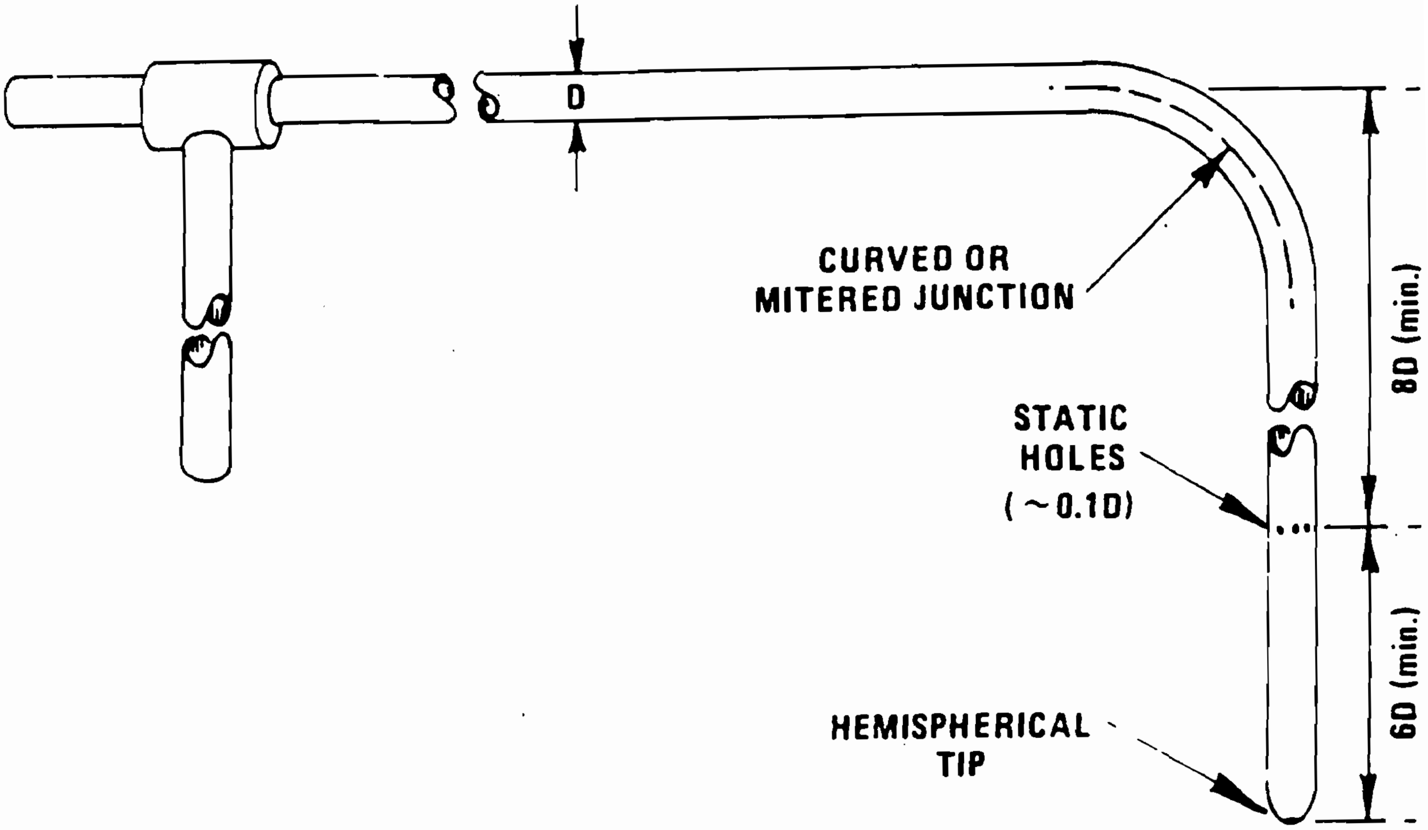


Figure 2-4. Standard pitot tube design specifications.

3. *Procedure*

3.1 Set up the apparatus as shown in Figure 2-1. Capillary tubing or surge tanks installed between the manometer and pitot tube may be used to dampen Δp fluctuations. It is recommended, but not required, that a pretest leak-check be conducted, as follows: (1) blow through the pitot impact opening until at least 7.6 cm (3 in.) H_2O velocity pressure registers on the manometer; then, close off the impact opening. The pressure shall remain stable for at least 15 seconds; (2) do the same for the static pressure side, except using suction to obtain the minimum of 7.6 cm (3 in.) H_2O. Other leak-check procedures, subject to the approval of the Administrator may be used.

3.2 Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse. Record all necessary data as shown in the example data sheet (Figure 2-5).

3.3 Measure the velocity head and temperature at the traverse points specified by Method 1. Ensure that the proper differential pressure gauge is being used for the range of Δp values encountered (see Section 2.2). If it is necessary to change to a more sensitive gauge, do so, and remeasure the Δp and temperature readings at each traverse point. Conduct a post-test leak-check (mandatory), as described in Section 3.1 above, to validate the traverse run.

3.4 Measure the static pressure in the stack. One reading is usually adequate.

3.5 Determine the atmospheric pressure.

PLANT ______________________________

DATE ________________ RUN NO. __________

STACK DIAMETER OR DIMENSIONS, m(in.) __________

BAROMETRIC PRESSURE, mm Hg (in. Hg) __________

CROSS SECTIONAL AREA, m^2(ft^2) __________

OPERATORS __________

PITOT TUBE I.D. NO. __________

AVG. COEFFICIENT, C_p = __________

LAST DATE CALIBRATED __________

SCHEMATIC OF STACK CROSS SECTION

Traverse Pt. No.	Vel. Hd., Δp mm (in.) H_2O	Stack Temperature		P_g mm Hg (in.Hg)	$\sqrt{\Delta p}$
		t_s, °C (°F)	T_s, °K (°R)		
		Average			

Figure 2-5. Velocity traverse data.

3.6 Determine the stack gas dry molecular weight. For combustion processes or processes that emit essentially CO_2, O_2, CO, and N_2, use Method 3. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0. For other processes, other methods, subject to the approval of the Administrator, must be used.

3.7 Obtain the moisture content from Reference Method 4 (or equivalent) or from Method 5.

3.8 Determine the cross-sectional area of the stack or duct at the sampling location. Whenever possible, physically measure the stack dimensions rather than using blueprints.

4. *Calibration*

4.1 Type S Pitot Tube. Before its initial use, carefully examine the Type S pitot tube in top, side, and end views to verify that the face openings of the tube are aligned within the specifications illustrated in Figure 2-2 or 2-3. The pitot tube shall not be used if it fails to meet these alignment specifications.

After verifying the face opening alignment, measure and record the following dimensions of the pitot tube: (a) the external tubing diameter (dimension D_t, Figure 2-2b); and (b) the base-to-opening plane distances (dimensions P_A and P_B, Figure 2-2b). If D_t is between 0.48 and 0.95 cm ($\frac{3}{16}$ and $\frac{3}{8}$ in.) and if P_A and P_B are equal and between 1.05 and 1.50 D_t, there are two possible options: (1) the pitot tube may be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, or (2) a baseline (isolated tube) coefficient value of 0.84 may be assigned to the pitot tube. Note, however, that if the pitot tube is part of an assembly, calibration may still be required, despite knowledge of the baseline coefficient value (see Section 4.1.1).

If D_t, P_A, and P_B are outside the speci limits, the pitot tube must be calibra outlined in 4.1.2 through 4.1.5 below.

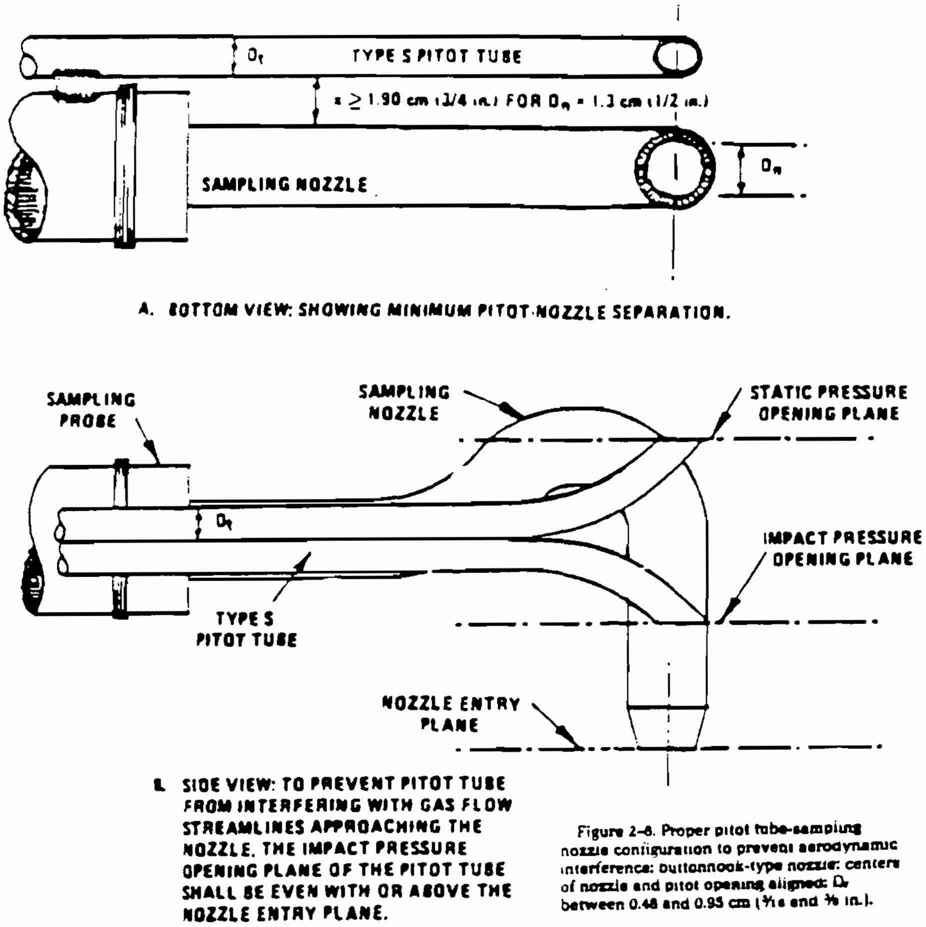


Figure 2-6. Proper pitot tube-sampling nozzle configuration to prevent aerodynamic interference: buttonhook-type nozzle: centers of nozzle and pitot opening aligned: D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.1 Type S Pitot Tube Assemblies. During sample and velocity traverses, the isolated Type S pitot tube is not always used; in many instances, the pitot tube is used in combination with other source-sampling components (thermocouple, sampling probe, nozzle) as part of an "assembly." The presence of other sampling components can sometimes affect the baseline value of the Type S pitot tube coefficient (Citation 9 in Section 6); therefore an assigned (or otherwise known) baseline coefficient value may or may not be valid for a given assembly. The baseline and assembly coefficient values will be identical only when the relative placement of the components in the assembly is such that *aerodynamic interference effects are eliminated*. Figures 2-6 through 2-8 illustrate interference-free component arrangements for Type S pitot tubes having external tubing diameters between *0.48* and *0.95* cm (3/16 and 3/8 in.). Type S pitot tube assemblies that fail to meet any or all of the specifications of Figures 2-6 through 2-8 shall be calibrated according to the procedure outlined in Sections 4.1.2 through 4.1.5 below, and prior to calibration, the values of the intercomponent spacings (pitot-nozzle, pitot-thermocouple, pitot-probe sheath) shall be measured and recorded.

NOTE: Do not use any Type S pitot tube assembly which is constructed such that the impact pressure opening plane of the pitot tube is below the entry plane of the nozzle (see Figure 2-6b).

4.1.2 Calibration Setup. If the Type S pitot tube is to be calibrated, one leg of the tube shall be permanently marked A, and the other, B. Calibration shall be done in a flow system having the following essential design features:

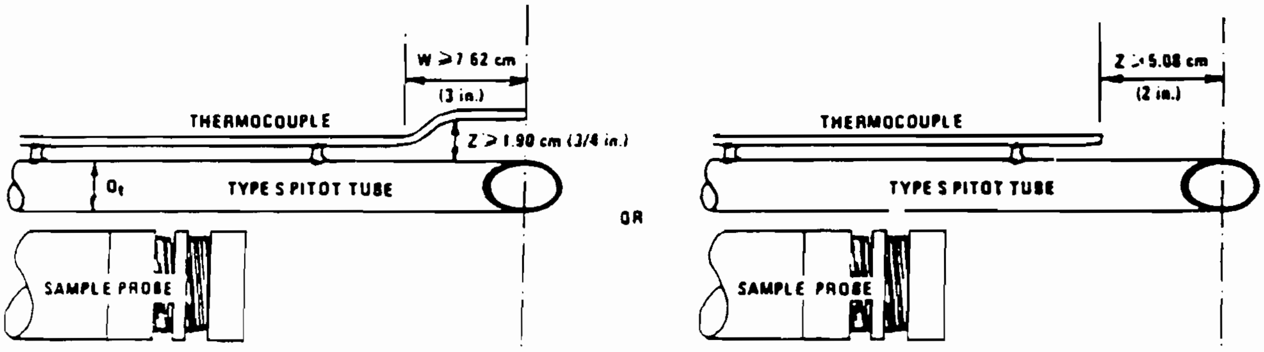


Figure 2-7. Proper thermocouple placement to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

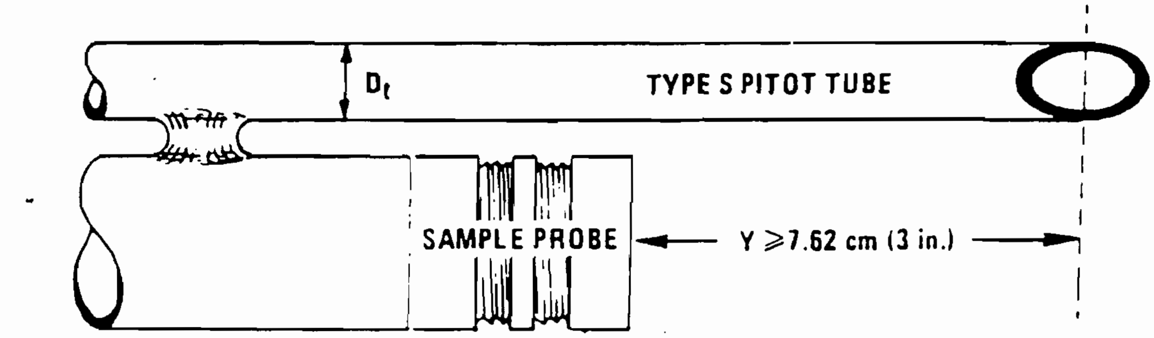


Figure 2-8. Minimum pitot-sample probe separation needed to prevent interference; D_t between 0.48 and 0.95 cm (3/16 and 3/8 in.).

4.1.2.1 The flowing gas stream must be confined to a duct of definite cross-sectional area, either circular or rectangular. For circular cross-sections, the minimum duct diameter shall be 30.5 cm (12 in.); for rectangular cross-sections, the width (shorter side) shall be at least 25.4 cm (10 in.).

4.1.2.2 The cross-sectional area of the calibration duct must be constant over a distance of 10 or more duct diameters. For a rectangular cross-section, use an equivalent diameter, calculated from the following equation, to determine the number of duct diameters:

$$D = \frac{2LW}{(L+W)}$$

Equation 2-1

where:
D_e = Equivalent diameter
L = Length
W = Width

To ensure the presence of stable, fully developed flow patterns at the calibration site, or "test section," the site must be located at least eight diameters downstream and two diameters upstream from the nearest disturbances.

NOTE: The eight- and two-diameter criteria are not absolute; other test section locations may be used (subject to approval of the Administrator), provided that the flow at the test site is stable and demonstrably parallel to the duct axis.

4.1.2.3 The flow system shall have the capacity to generate a test-section velocity around 915 m/min (3,000 ft/min). This velocity must be constant with time to guarantee steady flow during calibration. Note that Type S pitot tube coefficients obtained by single-velocity calibration at 915 m/min (3,000 ft/min) will generally be valid to within ±3 percent for the measurement of velocities above 305 m/min (1,000 ft/min) and to within ±5 to 6 percent for the measurement of velocities between 180 and 305 m/min (600 and 1,000 ft/min). If a more precise correlation between C_p and velocity is desired, the flow system shall have the capacity to generate at least four distinct, time-invariant test-section velocities covering the velocity range from 180 to 1,525 m/min (600 to 5,000 ft/min), and calibration data shall be taken at regular velocity intervals over this range (see Citations 9 and 14 in Section 6 for details).

4.1.2.4 Two entry ports, one each for the standard and Type S pitot tubes, shall be cut in the test section; the standard pitot entry port shall be located slightly downstream of the Type S port, so that the standard and Type S impact openings will lie in the same cross-sectional plane during calibration. To facilitate alignment of the pitot tubes during calibration, it is advisable that the test section be constructed of plexiglas or some other transparent material.

4.1.3 Calibration Procedure. Note that this procedure is a general one and must not be used without first referring to the special considerations presented in Section 4.1.5. Note also that this procedure applies only to single-velocity calibration. To obtain calibration data for the A and B sides of the Type S pitot tube, proceed as follows:

4.1.3.1 Make sure that the manometer is properly filled and that the oil is free from contamination and is of the proper density. Inspect and leak-check all pitot lines; repair or replace if necessary.

PITOT TUBE IDENTIFICATION NUMBER: ______________ DATE: ________

CALIBRATED BY: ______________________

	"A" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1				
2				
3				
		$\bar{C}_p$ (SIDE A)		

	"B" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2-9. Pitot tube calibration data.

4.1.3.2 Level and zero the manometer. Turn on the fan and allow the flow to stabilize. Seal the Type S entry port.

4.1.3.3 Ensure that the manometer is level and zeroed. Position the standard pitot tube at the calibration point (determined as outlined in Section 4.1.5.1), and align the tube so that its tip is pointed directly into the flow. Particular car should be taken in aligning the tube to avoid yaw and pitch angles. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.4 Read Δp_{std} and record its value in a data table similar to the one shown in Figure 2-9. Remove the standard pitot tube from the duct and disconnect it from the manometer. Seal the standard entry port.

4.1.3.5 Connect the Type S pitot tube to the manometer. Open the Type S entry port. Check the manometer level and zero. Insert and align the Type S pitot tube so that its A side impact opening is at the same point as was the standard pitot tube and is pointed directly into the flow. Make sure that the entry port surrounding the tube is properly sealed.

4.1.3.6 Read Δp_s and enter its value in the data table. Remove the Type S pitot tube from the duct and disconnect it from the manometer.

4.1.3.7 Repeat steps 4.1.3.3 through 4.1.3.6 above until three pairs of Δp readings have been obtained.

4.1.3.8 Repeat steps 4.1.3.3 through 4.1.3.7 above for the B side of the Type S pitot tube.

4.1.3.9 Perform calculations, as described in Section 4.1.4 below.

4.1.4 Calculations.

4.1.4.1 For each of the six pairs of Δp readings (i.e., three from side A and three from side B) obtained in Section 4.1.3 above, calculate the value of the Type S pitot tube coefficient as follows:

$$C_{p(s)} = C_{p(std)} \sqrt{\frac{\Delta p_{std}}{\Delta p_s}}$$

Equation 2-2

where:

$C_{p(s)}$ = Type S pitot tube coefficient

$C_{p(std)}$ = Standard pitot tube coefficient; use 0.99 if the coefficient is unknown and the tube is designed according to the criteria of Sections 2.7.1 to 2.7.5 of this method.

Δp_{std} = Velocity head measured by the standard pitot tube. cm H_2O (in. H_2O)

Δp_s = Velocity head measured by the Type S pitot tube. cm H_2O (in H_2O)

4.1.4.2 Calculate $\bar{C}_p$ (side A). the mean A-side coefficient. and $\bar{C}_p$ (side B). the mean B-side coefficient: calculate the difference between these two average values.

4.1.4.3 Calculate the deviation of each of the three A-side values of $\bar{C}_{p(s)}$ from $\bar{C}_p$ (side A). and the deviation of each B-side value of $\bar{C}_{p(s)}$ from $\bar{C}_p$ $\bar{C}_p$ (side B). Use the following equation:

$$\text{Deviation} = C_{p(s)} - \bar{C}_p(\text{A or B})$$

Equation 2-3

4.1.4.4 Calculate σ. the average deviation from the mean. for both the A and B sides of the pitot tube. Use the following equation:

$$\sigma\,(\text{side A or B}) = \frac{\sum_{1}^{3} |C_{p(s)} - \bar{C}_p(A \text{ or } B)|}{3}$$

Equation 2-4

4.1.4.5 Use the Type S pitot tube only if the values of σ (side A) and σ (side B) are less than or equal to 0.01 and if the absolute value of the difference between $\bar{C}_p$ (A) and $\bar{C}_p$ (B) is 0.01 or less.

4.1.5 Special considerations.

4.1.5.1 Selection of calibration point.

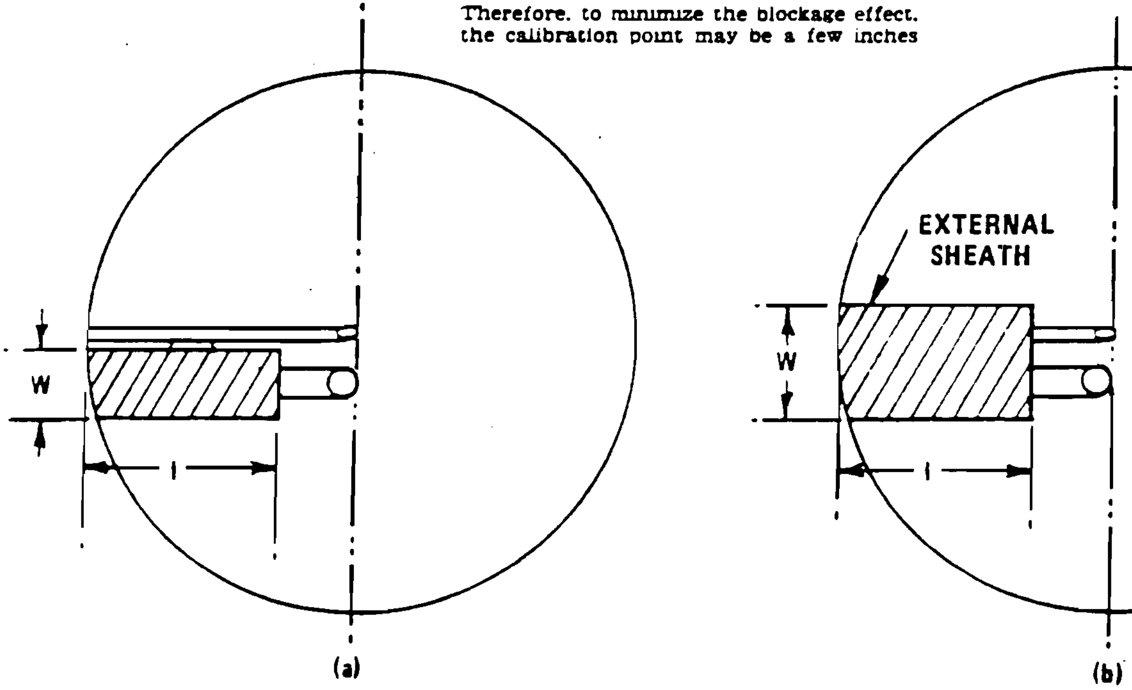
4.1.5.1.1 When an isolated Type S pitot tube is calibrated. select a calibration point at or near the center of the duct. and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The Type S pitot coefficients so obtained. i.e.. $\bar{C}_p$ (side A) and $\bar{C}_p$ (side B). will be valid. so long as either: (1) the isolated pitot tube is used: or (2) the pitot tube is used with other components (nozzle. thermocouple. sample probe) in an arrangement that is free from aerodynamic interference effects (see Figures 2-6 through 2-8).

4.1.5.1.2 For Type S pitot tube-thermocouple combinations (without sample probe). select a calibration point at or near the center of the duct. and follow the procedures outlined in Sections 4.1.3 and 4.1.4 above. The coefficients so obtained will be valid so long as the pitot tube-thermocouple combination is used by itself or with other components in an interference-free arrangement (Figures 2-6. and 2-8).

4.1.5.1.3 For assemblies with sample probes. the calibration point should be located at or near the center of the duct: however. insertion of a probe sheath into a small duct may cause significant cross-sectional area blockage and yield incorrect coefficient values (Citation 9 in Section 6). Therefore. to minimize the blockage effect. the calibration point may be a few inches off-center if necessary. The actual blockage effect will be negligible when the theoretical blockage. as determined by a projected-area model of the probe sheath. is 2 percent or less of the duct cross-sectional area for assemblies without external sheaths (Figure 2-10a). and 3 percent or less for assemblies with external sheaths (Figure 2-10b).

4.1.5.2 For those probe assemblies in which pitot tube-nozzle interference is a factor (i.e.. those in which the pitot-nozzle separation distance fails to meet the specification illustrated in Figure 2-6a). the value of $C_{p(s)}$ depends upon the amount of free-space between the tube and nozzle. and therefore is a function of nozzle size. In these instances. separate calibrations shall be performed with each of the commonly used nozzle sizes in place. Note that the single-velocity calibration technique is acceptable for this purpose. even though the larger nozzle sizes (>0.635 cm or ¼ in.) are not ordinarily used for isokinetic sampling at velocities around 915 m/min (3.000 ft/min). which is the calibration velocity: note also that it is not necessary to draw an isokinetic sample during calibration (see Citation 19 in Section 6).

4.1.5.3 For a probe assembly constructed such that its pitot tube is always used in the same orientation. only one side of the pitot tube need be calibrated (the side which will face the flow). The pitot tube must still meet the alignment specifications of Figure 2-2 or 2-3. however. and must have an average deviation (σ) value of 0.01 or less (see Section 4.1.4.4).



$$\text{ESTIMATED SHEATH BLOCKAGE (\%)} = \left[\frac{l \times W}{\text{DUCT AREA}}\right] \times 100$$

Figure 2-10. Projected-area models for typical pitot tube assemblies.

Figure 2-10. Projected-area models for typical pitot tube assemblies.

4.1.6 Field Use and Recalibration.

4.1.6.1 Field Use.

4.1.6.1.1 When a Type S pitot tube (isolated tube or assembly) is used in the field, the appropriate coefficient value (whether assigned or obtained by calibration) shall be used to perform velocity calculations. For calibrated Type S pitot tubes, the A side coefficient shall be used when the A side of the tube faces the flow, and the B side coefficient shall be used when the B side faces the flow; alternatively, the arithmetic average of the A and B side coefficient values may be used, irrespective of which side faces the flow.

4.1.6.1.2 When a probe assembly is used to sample a small duct (12 to 36 in. in diameter), the probe sheath sometimes blocks a significant part of the duct cross-section, causing a reduction in the effective value of $C_{p(s)}$. Consult Citation 9 in Section 6 for details. Conventional pitot-sampling probe assemblies are not recommended for use in ducts having inside diameters smaller than 12 inches (Citation 16 in Section 6).

4.1.6.2 Recalibration.

4.1.6.2.1 Isolated Pitot Tubes. After each field use, the pitot tube shall be carefully reexamined in top, side, and end views. If the pitot face openings are still aligned within the specifications illustrated in Figure 2-2 or 2-3, it can be assumed that the baseline coefficient of the pitot tube has not changed. If, however, the tube has been damanged to the extent that it no longer meets the specifications of Figure 2-2 or 2-3, the damage shall either be repaired to restore proper alignment of the face openings or the tube shall be discarded.

4.1.6.2.2 Pitot Tube Assemblies. After each field use, check the face opening alignment of the pitot tube, as in Section 4.1.6.2.1; also, remeasure the intercomponent spacings of the assembly. If the intercomponent spacings have not changed and the face opening alignment is acceptable, it can be assumed that the coefficient of the assembly has not changed. If the face opening alignment is no longer within the specifications of Figures 2-2 or 2-3, either repair the damage or replace the pitot tube (calibrating the new assembly, if necessary). If the intercomponent spacings have changed, restore the original spacings or recalibrate the assembly.

4.2 Standard pitot tube (if applicable). If a standard pitot tube is used for the velocity traverse, the tube shall be constructed according to the criteria of Section 2.7 and shall be assigned a baseline coefficient value of 0.99. If the standard pitot tube is used as part of an assembly, the tube shall be in an interference-free arrangement (subject to the approval of the Administrator).

4.3 Temperature Gauges. After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other gauges at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405° C (761° F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference; alternatively, either a reference thermocouple and potentiometer (calibrated by NBS) or thermometric fixed points, e.g., ice bath and boiling water (corrected for barometric pressure) may be used. For temperatures above 405° C (761° F), use an NBS-calibrated reference thermocouple-potentiometer system or an alternate reference, subject to the approval of the Administrator.

If, during calibration, the absolute temperatures measured with the gauge being calibrated and the reference gauge agree within 1.5 percent, the temperature data taken in the field shall be considered valid. Otherwise, the pollutant emission test shall either be considered invalid or adjustments (if appropriate) of the test results shall be made, subject to the approval of the Administrator.

4.4 Barometer. Calibrate the barometer used against a mercury barometer.

5. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

5.1 Nomenclature.

A = Cross-sectional area of stack, m² (ft²).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

$$34.97\ \frac{m}{sec}\left[\frac{(g/g\text{-mole})(mm\ Hg)}{(°K)(mm\ H_2O)}\right]^{1/2}$$

for the metric system and

$$85.49\ \frac{ft}{sec}\left[\frac{(lb/lb\text{-mole})(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$$

for the English system.

M_d = Molecular weight of stack gas, dry basis (see Section 3.6) g/g-mole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$= M_d\,(1 - B_{ws}) + 18.0\ B_{ws}$

Equation 2-5

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

$= P_{bar} + P_g$

Equation 2-6

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dscm/hr (dscf/hr).

t_s = Stack temperature, °C (°F).

T_s = Absolute stack temperature, °K (°R).

$= 273 + t_s$ for metric

Equation 2-7

$= 460 + t_s$ for English

Equation 2-8

T_{std} = Standard absolute temperature, 293 °K (528° R)

v_s = Average stack gas velocity, m/sec (ft/sec).

Δp = Velocity head of stack gas, mm H₂O (in. H₂O).

3,600 = Conversion factor, sec/hr.

18.0 = Molecular weight of water, g/g-mole (lb/lb-mole).

5.2 Average stack gas velocity.

$$v_s = K_p C_p (\sqrt{\Delta p})_{avg} \sqrt{\frac{T_{s(avg)}}{P_s M_s}}$$

Equation 2-9

5.3 Average stack gas dry volumetric flow rate.

$$Q_{sd} = 3{,}600(1 - B_{ws}) v_s A \left(\frac{T_{std}}{T_{s(avg)}}\right) \left(\frac{P_s}{P_{std}}\right)$$

Equation 2-10

"To convert Q_{sd} from dscm/hr (dscf/hr) to dscm/min (dscf/min), divide Q_{sd} by 60."

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METHOD 3—GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from a stack, by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent carbon dioxide (CO_2), percent oxygen (O_2), and, if necessary, percent carbon monoxide (CO). If a dry molecular weight determination is to be made, either an Orsat or a Fyrite[1] analyzer may be used for the analysis; for excess air or emission rate correction factor determination, an Orsat analyzer must be used.

1.2 Applicability. This method is applicable for determining CO_2 and O_2 concentrations, excess air, and dry molecular weight of a sample from a gas stream of a fossil-fuel combustion process. The method may also be applicable to other processes where it has been determined that compounds other than CO_2, O_2, CO, and nitrogen (N_2) are not present in concentrations sufficient to affect the results.

Other methods, as well as modifications to the procedure described herein, are also applicable for some or all of the above determinations. Examples of specific methods and modifications include: (1) a multi-point sampling method using an Orsat analyzer to analyze individual grab samples obtained at each point; (2) a method using CO_2 or O_2 and stoichiometric calculations to determine dry molecular weight and excess air; (3) assigning a value of 30.0 for dry molecular weight, in lieu of actual measurements, for processes burning natural gas, coal, or oil. These methods and modifications may be used, but are subject to the approval of the Administrator, U.S. Environmental Protection Agency.

2. *Apparatus*

As an alternative to the sampling apparatus and systems described herein, other sampling systems (e.g., liquid displacement) may be used provided such systems are capable of obtaining a representative sample and maintaining a constant sampling rate, and are otherwise capable of yielding acceptable results. Use of such systems is subject to the approval of the Administrator.

2.1 Grab Sampling (Figure 3-1).

2.1.1 Probe. The probe should be made of stainless steel or borosilicate glass tubing and should be equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Any other materials inert to O_2, CO_2, CO, and N_2 and resistant to temperature at sampling conditions may be used for the probe; examples of such material are aluminum, copper, quartz glass and Teflon.

2.1.2 Pump. A one-way squeeze bulb, or equivalent, is used to transport the gas sample to the analyzer.

2.2 Integrated Sampling (Figure 3-2).

2.2.1 Probe. A probe such as that described in Section 2.1.1 is suitable.

2.2.2 Condenser. An air-cooled or water-cooled condenser, or other condenser that will not remove O_2, CO_2, CO, and N_2, may be used to remove excess moisture which would interfere with the operation of the pump and flow meter.

2.2.3 Valve. A needle valve is used to adjust sample gas flow rate.

2.2.4 Pump. A leak-free, diaphragm-type pump, or equivalent, is used to transport sample gas to the flexible bag. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.2.5 Rate Meter. The rotameter, or equivalent rate meter, used should be capable of measuring flow rate to within ±2 percent of the selected flow rate. A flow rate range of 500 to 1000 cm^3/min is suggested.

2.2.6 Flexible Bag. Any leak-free plastic (e.g., Tedlar, Mylar, Teflon) or plastic-coated aluminum (e.g., aluminized Mylar) bag, or equivalent, having a capacity consistent with the selected flow rate and time length of the test run, may be used. A capacity in the range of 55 to 90 liters is suggested.

To leak-check the bag, connect it to a water manometer and pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O). Allow to stand for 10 minutes. Any displacement in the water manometer indicates a leak. An alternative leak-check method is to pressurize the bag to 5 to 10 cm H_2O (2 to 4 in. H_2O) and allow to stand overnight. A deflated bag indicates a leak.

2.2.7 Pressure Gauge. A water-filled U-tube manometer, or equivalent, of about 30 cm (12 in.) is used for the flexible bag leak-check.

2.2.8 Vacuum Gauge. A mercury manometer, or equivalent, of at least 760 mm Hg (30 in. Hg) is used for the sampling train leak-check.

2.3 Analysis. For Orsat and Fyrite analyzer maintenance and operation procedures, follow the instructions recommended by the manufacturer, unless otherwise specified herein.

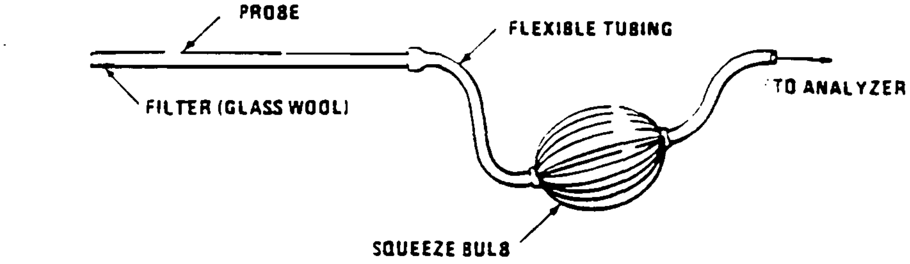

Figure 3-1. Grab-sampling train.

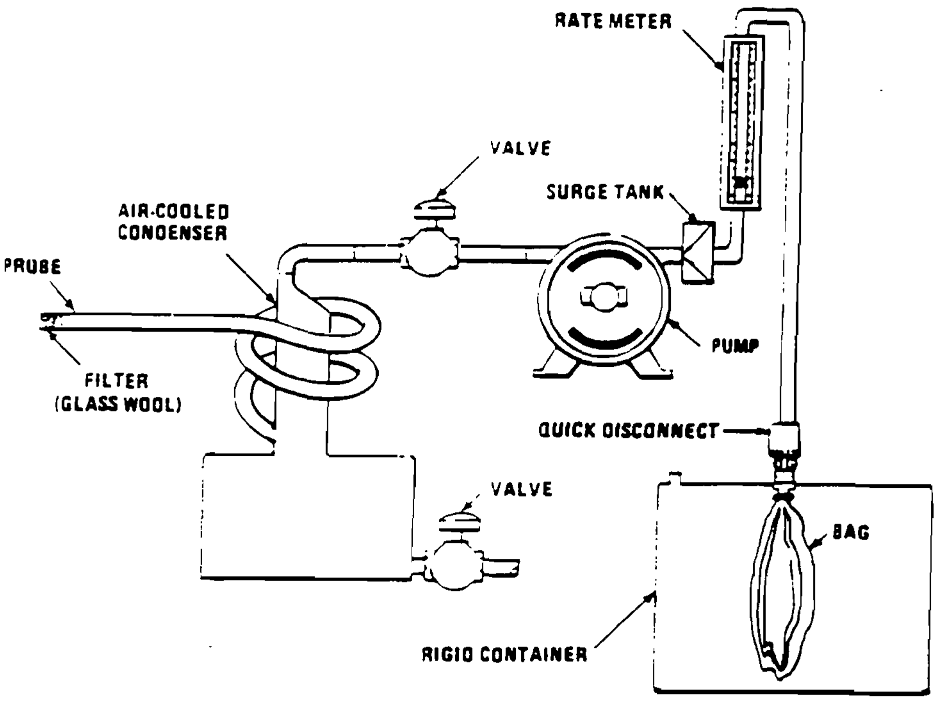

Figure 3-2. Integrated gas-sampling train.

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

2.3.1 Dry Molecular Weight Determination. An Orsat analyzer or Fyrite type combustion gas analyzer may be used.

2.3.2 Emission Rate Correction Factor or Excess Air Determination. An Orsat analyzer must be used. For low CO_2 (less than 4.0 percent) or high O_2 (greater that 15.0 percent) concentrations, the measuring burette of the Orsat must have at least 0.1 percent subdivisions.

3. *Dry Molecular Weight Determination*

Any of the three sampling and analytical procedures described below may be used for determining the dry molecular weight.

3.1 Single-Point, Grab Sampling and Analytical Procedure.

3.1.1 The sampling point in the duct shall either be at the centroid of the cross section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

3.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. If and Orsat analyzer is used, it is recommended that the analyzer be leaked-checked by following the procedure in Section 5; however, the leak-check is optional.

3.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer and immediately analyze it for percent CO_2 and percent O_2. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.1.4 Repeat the sampling, analysis, and calculation procedures, until the dry molecular weights of any three grab samples differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (lb/lb-mole).

3.2 Single-Point, Integrated Sampling and Analytical Procedure.

3.2.1 The sampling point in the duct shall be located as specified in Section 3.1.1.

3.2.2 Leak-check (optional) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (optional) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of at least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum should remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

3.2.3 Sample at a constant rate. The sampling run should be simultaneous with, and for the same total length of time as, the pollutant emission rate determination. Collection of at least 30 liters (1.00 ft^3) of sample gas is recommended; however, smaller volumes may be collected, if desired.

3.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. Within 8 hours after the sample is taken, analyze it for percent CO_2 and percent O_2 using either an Orsat analyzer or a Fyrite-type combustion gas analyzer. If an Orsat analyzer is used, it is recommended that the Orsat leak-check described in Section 5 be performed before this determination; however, the check is optional. Determine the percentage of the gas that is N_2 and CO by subtracting the sum of the percent CO_2 and percent O_2 from 100 percent. Calculate the dry molecular weight as indicated in Section 6.3.

3.2.5 Repeat the analysis and calculation procedures until the individual dry molecular weights for any three analyses differ from their mean by no more than 0.3 g/g-mole (0.3 lb/lb-mole). Average these three molecular weights, and report the results to the nearest 0.1 g/g-mole (0.1 lb/lb-mole).

3.3 Multi-Point, Integrated Sampling and Analytical Procedure.

3.3.1 Unless otherwise specified by the Administrator, a minimum of eight traverse points shall be used for circular stacks having diameters less than 0.61 m (24 in.), a minimum of nine shall be used for rectangular stacks having equivalent diameters less than 0.61 m (24 in.), and a minimum of twelve traverse points shall be used for all other cases. The traverse points shall be located according to Method 1. The use of fewer points is subject to approval of the Administrator.

3.3.2 Follow the procedures outlined in sections 3.2.2 throught 3.2.5, except for the following: traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4. *Emission Rate Correction Factor or Excess Air Determination*

NOTE: A Fyrite-type combustion gas analyzer is not acceptable for excess air or emission rate correction factor determination, unless approved by the Administrator. If both percent CO_2 and percent O_2 are measured, the analytical results of any of the three procedures given below may also be used for calculating the dry molecular weight.

Each of the three procedures below shall be used only when specified in an applicable subpart of the standards. The use of these procedures for other purposes must have specific prior approval of the Administrator.

4.1 Single-Point, Grab Sampling and Analytical Procedure.

4.1.1 The sampling point in the duct shall either be at the centroid of the cross-section or at a point no closer to the walls than 1.00 m (3.3 ft), unless otherwise specified by the Administrator.

4.1.2 Set up the equipment as shown in Figure 3-1, making sure all connections ahead of the analyzer are tight and leak-free. Leak-check the Orsat analyzer according to the procedure described in Section 5. This leak-check is mandatory.

FIGURE 3-3—SAMPLING RATE DATA

Time	Traverse pt.	Q lpm	% dev.*
Average			

*% Dev. $=(Q-Q_{avg})/Q_{avg}\times 100$ (Must be $<|10\%|$)

4.1.3 Place the probe in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Draw a sample into the analyzer. For emission rate correction factor determination, immediately analyze the sample, as outlined in Sections 4.1.4 and 4.1.5, for percent CO_2 or percent O_2. If excess air is desired, proceed as follows: (1) immediately analyze the sample, as in Sections 4.1.4 and 4.1.5, for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; and (3) calculate percent excess air as outlined in Section 6.2.

4.1.4 To insure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three or four) should be made between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.1.5 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before and after the analysis.

NOTE: Since this single-point, grab sampling and analytical procedure in normally conducted in conjunction with a single-point, grab sampling and analytical procedure for a pollutant, only one analysis is ordinarily conducted. Therefore, great care must be taken to obtain a valid sample and analysis. Although in most cases only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Section 4.4 be used to validate the analytical data.

4.2 Single-Point, Integrated Sampling and Analytical Procedure.

4.2.1 The sampling point in the duct shall be located as specified in Section 4.1.1.

4.2.2 Leak-check (mandatory) the flexible bag as in Section 2.2.6. Set up the equipment as shown in Figure 3-2. Just prior to sampling, leak-check (mandatory) the train by placing a vacuum gauge at the condenser inlet, pulling a vacuum of a least 250 mm Hg (10 in. Hg), plugging the outlet at the quick disconnect, and then turning off the pump. The vacuum shall remain stable for at least 0.5 minute. Evacuate the flexible bag. Connect the probe and place it in the stack, with the tip of the probe positioned at the sampling point; purge the sampling line. Next, connect the bag and make sure that all connections are tight and leak free.

4.2.3 Sample at a constant rate, or as specified by the Administrator. The sampling run must be simultaneous with, and for the same total lengh of time as, the pollutant emission rate determination. Collect at least 30 liters (1.00 ft^3) of sample gas. Smaller volumes may be collected, subject to approval of the Administrator.

4.2.4 Obtain one integrated flue gas sample during each pollutant emission rate determination. For emission rate correction factor determination, analyze the sample within 4 hours after it is taken for percent CO_2 or percent O_2 (as outlined in Sections 4.2.5 through 4.2.7). The Orsat analyzer must be leak-check (see Section 5) before the analysis. If excess air is desired, proceed as follows: (1) within 4 hours after the sample is taken, analyze it (as in Sections 4.2.5 through 4.2.7) for percent CO_2, O_2, and CO; (2) determine the percentage of the gas that is N_2 by subtracting the sum of the percent CO_2, percent O_2, and percent CO from 100 percent; (3) calculate percent excess air, as outlined in Section 6.2.

4.2.5 To insure complete absorption of the CO_2, O_2, or if applicable, CO, make repeated passes through each absorbing solution until two consecutive readings are the same. Several passes (three of four) should be make between readings. (If constant readings cannot be obtained after three consecutive readings, replace the absorbing solution.)

4.2.6 Repeat the analysis until the following criteria are met:

4.2.6.1 For percent CO_2, repeat the analytical procedure until the results of any three analyses differ by no more that (a) 0.3 percent by volume when CO_2 is greater than 4.0 percent or (b) 0.2 percent by volume when CO_2 is less than or equal to 4.0 percent. Average the three acceptable values of percent CO_2 and report the results to the nearest 0.1 percent.

4.2.6.2 For percent O_2, repeat the analytical procedure until the results of any three analyses differ by no more than (a) 0.3 percent by volume when O_2 is less than 15.0 percent or (b) 0.2 percent by volume when O_2 is greater than or equal to 15.0 percent. Average the three acceptable values of percent O_2 and report the results to the nearest 0.1 percent.

4.2.6.3 For percent CO, repeat the analytical procedure until the results of any three analyses differ by no more than 0.3 percent. Average the three acceptable values of percent CO and report the results to the nearest 0.1 percent.

4.2.7 After the analysis is completed, leak-check (mandatory) the Orsat analyzer once again, as described in Section 5. For the results of the analysis to be valid, the Orsat analyzer must pass this leak test before an after the analysis.

NOTE: Although in most instances only CO_2 or O_2 is required, it is recommended that both CO_2 and O_2 be measured, and that Section 4.4.1 be used to validate the analytical data.

4.3 Multi-Point, Integrated Sampling and Analytical Procedure.

4.3.1 Both the minimum number of sampling points and the sampling point location shall be as specified in Section 3.3.1 of this method. The use of fewer points than specified is subject to the approval of the Administrator.

4.3.2 Follow the procedures outlined in Sections 4.2.2 through 4.2.7, except for the following: Traverse all sampling points and sample at each point for an equal length of time. Record sampling data as shown in Figure 3-3.

4.4 Quality Control Procedures.

4.4.1 Data Validation When Both CO_2 and O_2 Are Measured. Although in most instances, only CO_2 or O_2 measurement is required, it is recommended that both CO_2 and O_2 be measured to provide a check on the quality of the data. The following quality control procedure is suggested.

NOTE: Since the method for validating the CO_2 and O_2 analyses is based on combustion of organic and fossil fuels and dilution of the gas stream with air, this method does not apply to sources that (1) remove CO_2 or O_2 through processes other than combustion, (2) add O_2 (e.g., oxygen enrichment) and N_2 in proportions different from that of air, (3) add CO_2 (e.g., cement or lime kilns), or (4) have no fuel factor, F_o, values obtainable (e.g., extremely variable waste mixtures). This method validates the measured proportions of CO_2 and O_2 for the fuel type, but the method does not detect sample dilution resulting from leaks during or after sample collection. The method is applicable for samples collected downstream of most lime or limestone flue-gas desulfurization units as the CO_2 added or removed from the gas stream is not significant in relation to the total CO_2 concentration. The CO_2 concentrations from other types of scrubbers using only water or basic slurry can be significantly affected and would render the F_o check minimally useful.

4.4.1.1 Calculate a *fuel factor*, F_o, using the following equation:

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

Eq. 3-3

Where:

$\%O_2$ = Percent O_2 by volume (dry basis).

$\%CO_2$ = Percent CO_2 by volume (dry basis).

20.9 = Percent O_2 by volume in ambient air.

If CO is present in quantities measurable by this method, adjust the O_2 and CO_2 values before performing the calculation for F_o as follows:

$$\%CO_2(adj) = \%CO_2 + \%CO$$

$$\%O_2(adj) = \%O_2 - 0.5\ \%CO$$

Where: %CO = Percent CO by volume (dry basis).

4.4.1.2 Compare the calculated F_o factor with the expected F_o values. The following table may be used in establishing acceptable ranges for the expected F_o if the fuel being burned is known. When fuels are burned in combination, calculate the combined fuel F_d and F_c factors (as defined in Method 19) according to the procedure in Method 19 Section 5.2.3. Then calculate the F_o factor as follows:

$$F_o = \frac{0.209\ F_d}{F_c}$$

Eq. 3-4

Fuel type	F_o range
Coal:	
Anthracite and 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	1.000–1.120
Wood bark	1.003–1.130

Calculated F_o values beyond the acceptable ranges shown in this table should be investigated before accepting the test results. For example, the strength of the solutions in the gas analyzer and the analyzing technique should be checked by sampling and analyzing a known concentration, such as air; the fuel factor should be reviewed and verified. An acceptability range of ±12 percent is appropriate for the F_o factor of mixed fuels with variable fuel ratios. The level of the emission rate relative to the compliance level should be considered in determining if a retest is appropriate, i.e., if the measured emissions are much lower or much greater than the compliance limit, repetition of the test would not significantly change the compliance status of the source and would be unnecessarily time-consuming and costly.

5. *Leak-Check Procedure for Orsat Analyzers*

Moving an Orsat analyzer frequently causes it to leak. Therefore, an Orsat analyzer should be throughly leak-checked on site before the flue gas sample is introduced into it. The procedure for leak-checking an Orsat analyzer is:

5.1.1 Bring the liquid level in each pipette up to the reference mark on the capillary tubing and then close the pipette stopcock.

5.1.2 Raise the leveling bulb sufficiently to bring the confining liquid meniscus onto the graduated portion of the burette and then close the manifold stopcock.

5.1.3 Record the meniscus position.

5.1.4 Observe the menicus in the burette and the liquid level in the pipette for movement over the next 4 minutes.

5.1.5 For the Orsat analyzer to pass the leak-check, two conditions must be met.

5.1.5.1 The liquid level in each pipette must not fall below the bottom of the capillary tubing during this 4-minute interval.

5.1.5.2 The meniscus in the burette must not change by more than 0.2 ml during this 4-minute interval.

5.1.6 If the analyzer fails the leak-check procedure, all rubber connections and stopcocks should be checked until the cause of the leak is identified. Leaking stopcocks must be disassembled, cleaned, and regreased. Leaking rubber connections must be replaced. After the analyzer is reassembled, the leak-check procedure must be repeated.

6. *Calculations*

6.1 Nomenclature.

M_d = Dry molecular weight, g/g-mole (lb/lb-mole).

%EA = Percent excess air.

$\%CO_2$ = Percent CO_2 by volume (dry basis).

$\%O_2$ = Percent O_2 by volume (dry basis).

%CO = Percent CO by volume (dry basis).

$\%N_2$ = Percent N_2 by volume (dry basis).

0.264 = Ratio of O_2 to N_2 in air, v/v.

0.280 = Molecular weight of N_2 or CO, divided by 100.

0.320 = Molecular weight of O_2 divided by 100.

0.440 = Molecular weight of CO_2 divided by 100.

6.2 Percent Excess Air. Calculate the percent excess air (if applicable), by substituting the appropriate values of percent O_2, CO, and N_2 (obtained from Section 4.1.3 or 4.2.4) into Equation 3-1.

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

Equation 3-1

NOTE: The equation above assumes that ambient air is used as the source of O_2 and that the fuel does not contain appreciable amounts of N_2 (as do coke oven or blast furnace gases). For those cases when appreciable amounts of N_2 are present (coal, oil, and natural gas do not contain appreciable amounts of N_2) or when oxygen enrichment is used, alternate methods, subject to approval of the Administrator, are required.

6.3 Dry Molecular Weight. Use Equation 3-2 to calculate the dry molecular weight of the stack gas

$$M_d = 0.440(\%CO_2) + 0.320(\%O_2) + 0.280(\%N_2 + \%CO)$$

Equation 3-2

NOTE: The above equation does not consider argon in air (about 0.9 percent, moleculars weight of 37.7). A negative error of about 0.4 percent is introduced. The tester may opt to include argon in the analysis using procedures subject to approval of the Administrator.

7. *Bibliography*

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Method 3A—Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. *Applicability and Principle.*

1.1 Applicability. This method is applicable to the determination of oxygen (O_2) and carbon dioxide (CO_2) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A sample is continuously extracted from the effluent stream: a portion of the sample stream is conveyed to an instrumental analyzer(s) for determination of O_2 and CO_2 concentration(s). Performance specifications and test procedures are provided to ensure reliable data.

2. *Range and Sensitivity.*

Same as Method 6C, Sections 2.1 and 2.2, except that the span of the monitoring system shall be selected such that the average O_2 or CO_2 concentration is not less than 20 percent of the span.

3. *Definitions.*

3.1 Measurement System. The total equipment required for the determination of the O_2 or CO_2 concentration. The measurement system consists of the same major subsystems as defined in Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, Response Time, and Calibration Curve. Same as Method 6C, Sections 3.2 through 3.8, and 3.10.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. *Measurement System Performance Specifications.*

Same as Method 6C, Sections 4.1 through 4.4.

5. *Apparatus and Reagents.*

5.1 Measurement System. Any measurement system for O_2 or CO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C–1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe. A leak-free probe, of sufficient length to traverse the sample points.

5.1.2 Sample Line. Tubing, to transport the sample gas from the probe to the moisture removal system. A heated sample line is not required for systems that measure the O_2 or CO_2 concentration on a dry basis, or transport dry gases.

5.1.3 Sample Transport Line, Calibration Value Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.3 through 5.1.9, and 5.1.11, except that the requirements to use stainless steel, Teflon, and nonreactive glass filters do not apply.

5.1.4 Gas Analyzer. An analyzer to determine continuously the O_2 or CO_2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer. The requirements for measuring and controlling the analyzer flow rate are not applicable if data are presented that demonstrate the analyzer is insensitive to flow variations over the range encountered during the test.

5.2 Calibration Gases. The calibration gases for CO_2 analyzers shall be CO_2 in N_2 or CO_2 in air. Alternatively, CO_2/SO_2, O_2/SO_2, or $O_2/CO_2/SO_2$ gas mixtures in N_2 may be used. Three calibration gases, as specified Section 5.3.1 through 5.3.3 of Method 6C, shall be used. For O_2 monitors that cannot analyze zero gas, a calibration gas concentration equivalent to less than 10 percent of the span may be used in place of zero gas.

6. *Measurement System Performance Test Procedures.*

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 3 and change the acceptance criteria for agreement among Method 3 results to 5 percent (or 0.2 percent by volume, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the type of gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sampling System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

7. *Emission Test Procedure.*

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 3.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias check. Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as for tests conducted using Method 3 plus twice the system response time. For each run, use only those measurements obtained after twice the response time of the measurement system has elapsed to determine the average effluent concentration.

7.3 Zero and Calibration Drift Test. Follow Section 7.4 of Method 6C.

8. *Quality Control Procedures.*

The following quality control procedures are recommended when the results of this method are used for an emission rate correction factor, or excess air determination. The tester should select one of the following options for validating measurement results:

8.1 If both O_2 and CO_2 are measured using Method 3A, the procedures described in Section 4.4 of Method 3 should be followed to validate the O_2 and CO_2 measurement results.

8.2 If only O_2 is measured using Method 3A, measurements of the sample stream CO_2 concentration should be obtained at the sample by-pass vent discharge using an Orsat or Fyrite analyzer, or equivalent. Duplicate samples should be obtained concurrent with at least one run. Average the duplicate Orsat or Fyrite analysis results for each run. Use the average CO_2 values for comparison with the O_2 measurements in accordance with the procedures described in Section 4.4 of Method 3.

8.3 If only CO_2 is measured using Method 3A, concurrent measurements of the sample stream CO_2 concentration should be obtained using an Orsat or Fyrite analyzer as described in Section 8.2. For each run, differences greater than 0.5 percent between the Method 3A results and the average of the duplicate Fyrite analysis should be investigated.

9. *Emission Calculation.*

For all CO_2 analyzers, and for O_2 analyzers that can be calibrated with zero gas, follow Section 8 of Method 6C, except express all concentrations as percent, rather than ppm.

For O_2 analyzers that use a low-level calibration gas in place of a zero gas, calculate the effluent gas concentration using Equation 3A–1.

$$C_{gas} = \frac{C_{ma} - C_{oa}}{C_m - C_o} (\bar{C} - C_m) + C_{ma}$$

Eq. 3A–1

where:

C_{gas} = Effluent gas concentration, dry basis, percent.

C_{ma} = Actual concentration of the upscale calibration gas, percent.

C_{oa} = Actual concentration of the low-level calibration gas, percent.

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, percent.

C_o = Average of initial and final system calibration bias check responses for the low-level gas, percent.

$\bar{C}$ = Average gas concentration indicated by the gas analyzer, dry basis, percent.

10. *Bibliography.*

Same as bibliography of Method 6C.

METHOD 5—DETERMINATION OF PARTICULATE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature in the range of 120±14° C (248±25° F) or such other temperature as specified by an applicable subpart of the standards or approved by Administrator. U.S. Environmental Protection Agency, for a particular application. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

1.2 Applicability. This method is applicable for the determination of particulate emissions from stationary sources.

2. *Apparatus*

2.1 Sampling Train. A schematic of the sampling train used in this method is shown in Figure 5-1. Complete construction details are given in APTD-0581 (Citation 2 in Bibliography); commercial models of this train are also available. For changes from APTD-0581 and for allowable modifications of the train shown in Figure 5-1, see the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576 (Citation 3 in Bibliography). Since correct usage is important in obtaining valid results, all users should read APTD-0576 and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. The sampling train consists of the following components:

2.1.1 Probe Nozzle. Stainless steel (316) or glass with sharp, tapered leading edge. The angle of taper shall be ≤30° and the taper shall be on the outside to preserve a constant internal diameter. The probe nozzle shall be of the button-hook or elbow design, unless otherwise specified by the Administrator. If made of stainless steel, the nozzle shall be constructed from seamless tubing; other materials of construction may be used, subject to the approval of the Administrator.

A range of nozzle sizes suitable for isokinetic sampling should be available, e.g., 0.32 to 1.27 cm ($\frac{1}{8}$ to $\frac{1}{2}$ in.)—or larger if higher volume sampling trains are used—inside diameter (ID) nozzles in increments of 0.16 cm ($\frac{1}{16}$ in.). Each nozzle shall be calibrated according to the procedures outlined in Section 5.

2.1.2 Probe Liner. Borosilicate or quartz glass tubing with a heating system capable of maintaining a gas temperature at the exit end during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. (The tester may opt to operate the equipment at a temperature lower than that specified.) Since the actual temperature at the outlet of the probe is not usually monitored during sampling, probes constructed according to APTD-0581 and utilizing the calibration curves of APTD-0576 (or calibrated according to the procedure outlined in APTD-0576) will be considered acceptable.

Either borosilicate or quartz glass probe liners may be used for stack temperatures up to about 480° C (900° F); quartz liners shall be used for temperatures between 480 and 900° C (900 and 1,650° F). Both types of liners may be used at higher temperatures than specified for short periods of time, subject to the approval of the Administrator. The softening temperature for borosilicate is 820° C (1,508° F), and for quartz it is 1,500° C (2,732° F).

Whenever practical, every effort should be made to use borosilicate or quartz glass probe liners. Alternatively, metal liners (e.g., 316 stainless steel, Incoloy 825,[1] or other corrosion resistant metals) made of seamless tubing may be used, subject to the approval of the Administrator.

2.1.3 Pitot Tube. Type S, as described in Section 2.1 of Method 2, or other device approved by the Administrator. The pitot tube shall be attached to the probe (as shown in Figure 5-1) to allow constant monitoring of the stack gas velocity. The impact (high pressure) opening plane of the pitot tube shall be even with or above the nozzle entry plane (see Method 2, Figure 2-6b) during sampling. The Type S pitot tube assembly shall have a known coefficient, determined as outlined in Section 4 of Method 2.

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[1] Mention of trade names or specific product does not constitute endorsement by the Environmental Protection Agency.

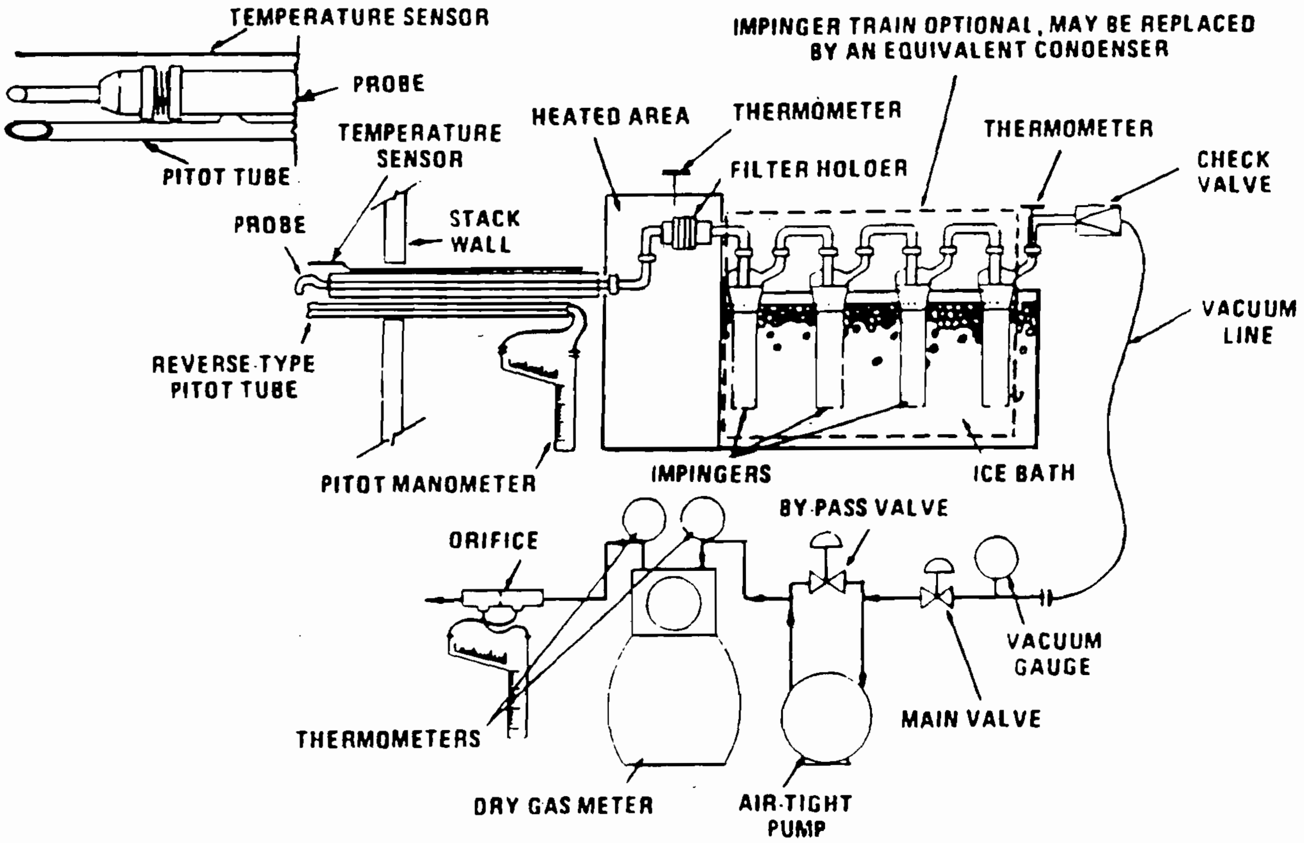

Figure 5-1. Particulate-sampling train.

2.1.4 Differentia Pressure Gauge. Inclined manometer or equivalent device (two), as described in Section 2.2 of Method 2. One manometer shall be used or velocity head (Δp) readings, and the other, for orifice differentia pressure readings.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe (or cyclone, it used).

2.1,6 Filter Heating System. Any heating system capable of maintaining a temperature around the filter holder during sampling of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. Alternatively, the tester may opt to operate the equipment at a temperature lower than that specified. A temperature gauge capable of measuring temperature to within 3° C (5.4° F) shall be installed so that the temperature around the filter holder can be regulated and monitored during sampling. Heating systems other than the one shown in APTD-0581 may be used.

2.1.7 Condenser. The following system shall be used to determine the stack gas moisture content: Four impingers connected in series with leak-free ground glass fittings or any similar leak-free non-contaminating fittings. The first, third, and fourth impingers shall be of the Greenburg-Smith design, modified by replacing the tip with 1.3 cm (½ in.) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. The second impinger shall be of the Greenburg-Smith design with the standard tip. Modifications (e.g., using flexible connections between the impingers, using materials other than glass, or using flexible vacuum lines to connect the filter holder to the condenser) may be used, subject to the approval of the Administrator. The first and second impingers shall contain known quantities of water (Section 4.1.3), the third shall be empty, and the fourth shall contain a known weight of silica gel, or equivalent desiccant. A thermometer, capable of measuring temperture to within 1° C (2° F) shall be placed at the outlet of the fourth impinger for monitoring purposes.

Alternatively, any system that cools the sample gas stream and allows measurement of the water condensed and moisture leaving the condenser, each to within 1 ml or 1 g may be used, subject to the approval of the Administrator. Acceptable means are to measure the condensed water either gravimetrically or volumetrically and to measure the moisture leaving the condenser by: (1) monitoring the temperature and pressure at the exit of the condenser and using Dalton's law of partial pressures: or (2) passing the sample has stream through a tared silica gel (or equivalent desiccant) trap with exit gases kept below 20° C (68° F) and determining the weight gain.

If means other than silica gel are used to determine the amount of moisture leaving the condenser, it is recommended that silica gel (or equivalent) still be used between the condenser system and pump to prevent moisture condensation in the pump and metering devices and to avoid the need to make corrections for moisture in the metered volume.

NOTE: *If a determination of the particulate matter collected in the impingers is desired in addition to moisture content, the impinger system described above shall be used, without modification. Individual States or control agencies requiring this information shall be contacted as to the sample recovery and analysis of the impinger contents.*

2.1.8 Metering System. Vacuum gauge, leak-free pump, thermometers capable of measuring temperature to within 3° C (5.4° F), dry gas meter capable of measuring volume to within 2 percent, and related equipment, as shown in Figure 5-1. Other metering systems capable of maintaining sampling rates within 10 percent of isokinetic and of determining sample volumes to within 2 percent may be used, subject to the approval of the Administrator. When the metering system is used in conjunction with a pitot tube, the system shall enable checks of isokinetic rates.

Sampling trains utilizing metering systems designed for higher flow rates than that decribed in APTD-0581 or APDT-0576 may be used provided that the specifications of this method are met.

2.1.9 Barometer. Mercury aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.10 Gas Density Determination Equipment. Temperature sensor and pressure gauge, as described in Sections 2.3 and 2.4 of Method 2, and gas analyzer, if necessary, as described in Method 3. The temperature sensor shall, preferably, be permanently attached to the pitot tube or sampling probe in a fixed configuration, such that the tip of the sensor extends beyond the leading edge of the probe sheath and does not touch any metal. Alternatively, the sensor may be attached just prior to use in the field. Note, however, that if the temperature sensor is attached in the field, the sensor must be placed in an interference-free arrangement with respect to the Type S pitot tube openings (see Method 2, Figure 2-7). As a second alternative, if a difference of not more than 1 percent in the average velocity measurement is to be introduced, the temperature gauge need not be attached to the probe or pitot tube. (This alternative is subject to the approval of the Administrator.)

2.2 Sample Recovery. The following items are needed.

2.2.1 Probe-Liner and Probe-Nozzle Brushes. Nylon bristle brushes with stainless steel wire handles. The probe brush shall have extensions (at least as long as the probe) of stainless steel, Nylon, Teflon, or similarly inert material. The brushes shall be properly sized and shaped to brush out the probe liner and nozzle.

2.2.2 Wash Bottles—Two. Glass wash bottles are recommended: polyethylene wash bottles may be used at the option of the tester. It is recommended that acetone not be stored in polyethylene bottles for longer than a month.

2.2.3 Glass Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for acetone washes, 500 ml or 1000 ml. Screw cap liners shall either be rubber-backed Teflon or shall be constructed so as to be leak-free and resistant to chemic attack by acetone. (Narrow mouth glass bo tles have been found to be less prone t leakage.) Alternatively, polyethylene bottles may be used.

2.2.4 Petri Dishes. For filter samples, glass or polyethylene, unless otherwise specified by the Administrator.

2.2.5 Graduated Cylinder and/or Balance. To measure condensed water to within 1 ml or 1 g. Graduated cylinders shall have subdivisions no greater than 2 ml. Most laboratory balances are capable of weighing to the nearest 0.5 g or less. Any of these balances is suitable or use here and in Section 2.3.4.

2.2.6 Plastic Storage Containers. Air-tight containers to store silica gel.

2.2.7 Funnel and Rubber Policeman. To aid in transfer of silica gel to container: not

2.2.8 Funnel. Glass or polyethylene, to aid in sample recovery.

2.2 Analysis. For analysis, the following equipment is needed.

2.3.1 Glass Weighing Dishes.

2.3.2 Desiccator.

2.3.3 Analytical Balance. To measure to within 0.1 mg.

2.3.4 Balance. To measure to within 0.5 g.

2.3.5 Beakers. 250 ml.

2.3.6 Hygrometer. To measure the relative humidity of the laboratory environment.

2.3.7 Temperature Gauge. To measure the temperature of the laboratory environment.

3. *Reagents*

3.1 Sampling. The reagents used in sa pling are as follows:

3.1.1 Filters. Glass fiber filters, without organic binder, exhibiting at least 99.95 percent efficiency (<0.05 percent penetration) on 0.3-micron dioctyl phthalate smoke particles. The filter efficiency test shall be conducted in accordance with ASTM standard method D2986-71 (Reapproved 1978) (incorporated by reference—see § 60.17). Test data from the supplier's quality control program are sufficient for this purpose. In sources containing SO_2 or SO_3, the filter material must be of a type that is unreactive to SO_2 or SO_3. Citation 10 in Section 7 Bibliography, may be used to select the appropriate filter.

3.1.2 Silica Gel. Indicating type, 6 to 16 mesh. If previously used, dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively, other types of desiccants (equivalent or better) may be used, subject to the approval of the Administrator.

3.1.3 Water. When analysis of the material caught in the impingers is required, distilled water shall be used. Run blanks prior to field use to eliminate a high blank on test samples.

3.1.4 Crushed Ice.

3.1.5 Stopcock Grease. Acetone-insoluble, heat-stable silicone grease. This is not necessary if screw-on connectors with Teflon sleeves, or similar, are used. Alternatively, other types of stopcock grease may be used, subject to the approval of the Administrator.

3.2 Sample Recovery. Acetone-reagent grade, ≤0.001 percent residue, in glass bottles—is required. Acetone from metal containers generally has a high residue blank and should not be used. Sometimes, suppliers transfer acetone to glass bottles from metal containers; thus, acetone blanks shall be run prior to field use and only acetone with low blank values (≤0.001 percent) shall be used. In no case shall a blank value of greater than 0.001 percent of the weight of acetone used be subtracted from the sample weight.

3.3 Analysis. Two reagents are required for the analysis:

3.3.1 Acetone. Same as 3.2.

3.3.2 Desiccant. Anhydrous calcium sulfate, indicating type. Alternatively, other types of desiccants may be used, subject to the approval of the Administrator.

4. *Procedure*

4.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

4.1.1 Pretest Preparation. It is suggested that sampling equipment be maintained according to the procedures described in APTD-0576.

Weigh several 200 to 300 g portions of silica gel in air-tight containers to the nearest 0.5 g. Record the total weight of the silica gel plus container, on each container. As an alternative, the silica gel need not be preweighed, but may be weighed directly in the impinger or sampling holder just prior to train assembly.

Check filters visually against light for irregularities and flaws or pinhole leaks. Label filters of the proper diameter on the back side near the edge using numbering machine ink. As an alternative, label the shipping containers (glass or plastic petri dishes) and keep the filters in these containers at all times except during sampling and weighing.

Desiccate the filters at 20±5.6° C (68±10° F) and ambient pressure for at least 24 hours and weigh at intervals of at least 6 hours to a constant weight, i.e., 0.5 mg change from previous weighing; record results to the nearest 0.1 mg. During each weighing the filter must not be exposed to the laboratory atmosphere for a period greater than 2 minutes and a relative humidity above 50 percent. Alternatively (unless otherwise specified by the Administrator), the filters may be oven dried at 105° C (220° F) for 2 to 3 hours, desiccated for 2 hours, and weighed. Procedures other than those described, which account for relative humidity effects, may be used, subject to the approval of the Administrator.

4.1.2 Preliminary Determinations. Select the sampling site and the minimum number of sampling points according to Method 1 or as specified by the Administrator. Determine the stack pressure, temperature, and the range of velocity heads using Method 2; it is recommended that a leak-check of the pitot lines (see Method 2, Section 3.1) be performed. Determine the moisture content using Approximation Method 4 or its alternatives for the purpose of making isokinetic sampling rate settings. Determine the stack gas dry molecular weight, as described in Method 2, Section 3.6; if integrated Method 3 sampling is used for molecular weight determination, the integrated bag sample shall be taken simultaneously with, and for the same total length of time as, the particulate sample run.

Select a nozzle size based on the range of velocity heads, such that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates. During the run, do not change the nozzle size. Ensure that the proper differential pressure gauge is chosen for the range of velocity heads encountered (see Section 2.2 of Method 2).

Select a suitable probe liner and probe length such that all traverse points can be sampled. For large stacks, consider sampling from opposite sides of the stack to reduce the length of probes.

Select a total sampling time greater than or equal to the minimum total sampling time specified in the test procedures for the specific industry such that (1) the sampling time per point is not less than 2 min (or some greater time interval as specified by the Administrator), and (2) the sample volume taken (corrected to standard conditions) will exceed the required minimum total gas sample volume. The latter is based on an approximate average sampling rate.

It is recommended that the number of minutes sampled at each point be an integer or an integer plus one-half minute, in order to avoid timekeeping errors. The sampling time at each point shall be the same.

In some circumstances, e.g., batch cycles, it may be necessary to sample for shorter times at the traverse points and to obtain smaller gas sample volumes. In these cases, the Administrator's approval must first be obtained.

4.1.3 Preparation of Collection Train. During preparation and assembly of the sampling train, keep all openings where contamination can occur covered until just prior to assembly or until sampling is about to begin.

Place 100 ml of water in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. More silica gel may be used, but care should be taken to ensure that it is not entrained and carried out from the impinger during sampling. Place the container in a clean place for later use in the sample recovery. Alternatively, the weight of the silica gel plus impinger may be determined to the nearest 0.5 g and recorded.

Using a tweezer or clean disposable surgical gloves, place a labeled (identified) and weighed filter in the filter holder. Be sure that the filter is properly centered and the gasket properly placed so as to prevent the sample gas stream from circumventing the filter. Check the filter for tears after assembly is completed.

When glass liners are used, install the selected nozzle using a Viton A O-ring when stack temperatures are less than 260° C (500° F) and an asbestos string gasket when temperatures are higher. See APTD-0576 for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used. When metal liners are used, install the nozzle as above or by a leak-free direct mechanical connection. Mark the probe with heat resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point.

Set up the train as in Figure 5-1, using (if necessary) a very light coat of silicone grease on all ground glass joints, greasing only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicone grease. Subject to the approval of the Administrator, a glass cyclone may be used between the probe and filter holder when the total particulate catch is expected to exceed 100 mg or when water droplets are present in the stack gas.

Place crushed ice around the impingers.

4.1.4 Leak-Check Procedures.

4.1.4.1 Pretest Leak-Check. A pretest leak-check is recommended, but not required. If the tester opts to conduct the pretest leak-check, the following procedure shall be used.

After the sampling train has been assembled, turn on and set the filter and probe heating systems at the desired operating temperatures. Allow time for the temperatures to stabilize. If a Viton A O-ring or other leak-free connection is used in assembling the probe nozzle to the probe liner, leak-check the train at the sampling site by plugging the nozzle and pulling a 380 mm Hg (15 in. Hg) vacuum.

Note: A lower vacuum may be used, provided that it is not exceeded during the test.

If an asbestos string is used, do not connect the probe to the train during the leak-check. Instead, leak-check the train by first plugging the inlet to the filter holder (cyclone, if applicable) and pulling a 380 mm Hg (15 in. Hg) vacuum (see Note immediately above). Then connect the probe to the train and leak-check at about 25 mm Hg (1 in. Hg) vacuum; alternatively, the probe may be leak-checked with the rest of the sampling train, in one step, at 380 mm Hg (15 in. Hg) vacuum. Leakage rates in excess of 4 percent of the average sampling rate or 0.00057 m^3/min (0.02 cfm), whichever is less, are unacceptable.

The following leak-check instructions for the sampling train described in APTD-0576 and APTD-0581 may be helpful. Start the pump with bypass valve fully open and coarse adjust valve completely closed. Partially open the coarse adjust valve and slowly close the bypass valve until the desired vacuum is reached. Do not reverse direction of bypass value; this will cause water to back up into the filter holder. If the desired vacuum is exceeded, either leak-check at this higher vacuum or end the leak-check as shown below and start over.

When the leak-check is completed, first slowly remove the plug from the inlet to the probe, filter holder, or cyclone (if applicable) and immediately turn off the vacuum pump. This prevents the water in the impingers from being forced backward into the filter holder and silica get from being entrained backward into the third impinger.

4.1.4.2 Leak-Checks During Sample Run. If, during the sampling run, a component (e.g., filter assembly or impinger) change becomes unecessary, a leak-check shall be conducted immediately before the change is made. The leak-check shall be done according to the procedure outlined in Section 4.1.4.1 above, except that it shall be done at a vacuum equal to or greater than the maximum value recorded up to that point in the test. If the leakage rate is found to be no greater than 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction will need to be applied to the total volume of dry gas metered;

If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and plan to correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

Immediately after component changes, leak-checks are optional; if such leak-checks are done, the procedure outlined in Section 4.1.4.1 above shall be used.

4.1.4.3 **Post-test Leak-Check.** A leak-check is mandatory at the conclusion of each sampling run. The leakcheck shall be done in accordance with the procedures outlined in Section 4.1.4.1, except that it shall be conducted at a vacuum equal to or greater than the maximum value reached during the sampling run. If the leakage rate is found to be no greater than 0.00057 m³/min (0.02 cfm) or 4 percent of the average sampling rate (whichever is less), the results are acceptable, and no correction need be applied to the total volume of dry gas metered. If, however, a higher leakage rate is obtained, the tester shall either record the leakage rate and correct the sample volume as shown in Section 6.3 of this method, or shall void the sampling run.

4.1.5 **Particulate Train Operation.** During the sampling run, maintain an isokinetic sampling rate (within 10 percent of true isokinetic unless otherwise specified by the Administrator) and a temperature around the filter of 120±14° C (248±25° F), or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator.

For each run, record the data required on a data sheet such as the one shown in Figure 5-2. Be sure to record the initial dry gas meter reading. Record the dry gas meter readings at the beginning and end of each sampling time increment, when changes in flow rates are made, before and after each leak-check, and when sampling is halted. Take other readings required by Figure 5-2 at least once at each sample point during each time increment and additional readings when significant changes (20 percent variation in velocity head readings) necessitate additional adjustments in flow rate. Level and zero the manometer. Because the manometer level and zero may drift due to vibrations and temperature changes, make periodic checks during the traverse.

Clean the portholes prior to the test run to minimize the chance of sampling deposited material. To begin sampling, remove the nozzle cap, verify that the filter and probe heating systems are up to temperature, and that the pitot tube and probe are properly positioned. Position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Nomographs are available, which aid in the rapid adjustment of the isokinetic sampling rate without excessive computations. These nomographs are designed for use when the Type S pitot tube coefficient is 0.85±0.02, and the stack gas equivalent density (dry molecular weight) is equal to 29±4. APTD-0576 details the procedure for using the nomographs. If C_p and M_d are outside the above stated ranges do not use the nomographs unless appropriate steps (see Citation 7 in Bibliography) are taken to compensate for the deviations.

When the stack is under significant negative pressure (height of impinger stem), take care to close the coarse adjust valve before inserting the probe into the stack to prevent water from backing into the filter holder. If necessary, the pump may be turned on with the coarse adjust valve closed.

When the probe is in position, block off the openings around the probe and porthole to prevent unrepresentative dilution of the gas stream.

Traverse the stack cross-section, as required by Method 1 or as specified by the Administrator, being careful not to bump the probe nozzle into the stack walls when sampling near the walls or when removing or inserting the probe through the portholes; this minimizes the chance of extracting deposited material.

During the test run, make periodic adjustments to keep the temperature around the filter holder at the proper level; add more ice and, if necessary, salt to maintain a temperature of less than 20° C (68° F) at the condenser/silica gel outlet. Also, periodically check the level and zero of the manometer.

If the pressure drop across the filter becomes too high, making isokinetic sampling difficult to maintain, the filter may be replaced in the midst of a sample run. It is recommended that another complete filter assembly be used rather than attempting to change the filter itself. Before a new filter assembly is installed, conduct a leak-check (see Section 4.1.4.2). The total particulate weight shall include the summation of all filter assembly catches.

A single train shall be used for the entire sample run, except in cases where simultaneous sampling is required in two or more separate ducts or at two or more different locations within the same duct, or, in cases where equipment failure necessitates a change of trains. In all other situations, the use of two or more trains will be subject to the approval of the Administrator.

FIGURE 5-2—PARTICULATE FIELD DATA

Plant ....
Location ....
Operator ....
Date ....
Run No ....
Sample box No ....
Meter box No ....
Meter ΔH@ ....
C factor ....
Pitot tube coefficient, Cp ....

SCHEMATIC OF STACK CROSS SECTION

Ambient temperature ....
Barometric pressure ....
Assumed moisture, % ....
Probe length, m (ft.) ....
Nozzle identification No. ....
Average calibrated nozzle diameter, cm (in.) ....
Probe heater setting ....
Leak rate, m³/min, (cfm) ....
Probe liner material ....
Static pressure, mm. Hg (in. Hg) ....
Filter No. ....

Traverse point number	Sampling time	Vacuum	Stack temperature	Velocity head	Pressure differential across orifice meter	Gas sample volume	Gas sample temperature at dry gas meter		Filter holder temperature	Temperature of gas leaving condenser or last impinger
							Inlet	Outlet		
	(θ), min.	mm Hg (in. Hg)	(T_s), °C (° F)	(ΔP_s), mm (in.) H_2O	mm H_2O (in. H_2O)	m³ (ft³)	°C (° F)	° C (° F)	° C (° F)	° C (° F)
Total							Avg.	Avg.		
Average							Avg.			

Note that when two or more trains are used, separate analyses of the front-half and (if applicable) impinger catches from each train shall be performed, unless identical nozzle sizes were used on all trains, in which case, the front-half catches from the individual trains may be combined (as may the impinger catches) and one analysis of front-half catch and one analysis of impinger catch may be performed. Consult with the Administrator for details concerning the calculation of results when two or more trains are used.

At the end of the sample run, turn off the coarse adjust valve, remove the probe and nozzle from the stack, turn off the pump, record the final dry gas meter reading, and conduct a post-test leak-check, as outlined in Section 4.1.4.3. Also, leak-check the pitot lines as described in Method 2, Section 3.1; the lines must pass this leak-check, in order to validate the velocity head data.

4.1.6 Calculation of Percent Isokinetic. Calculate percent isokinetic (see Calculations, Section 6) to determine whether the run was valid or another test run should be made. If there was difficulty in maintaining isokinetic rates due to source conditions, consult with the Administrator for possible variance on the isokinetic rates.

4.2 Sample Recovery. Proper cleanup procedure begins as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool.

When the probe can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it to prevent losing or gaining particulate matter. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing water from the impingers into the filter holder.

Before moving the sample train to the cleanup site, remove the probe from the sample train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the filter inlet where the probe was fastened and cap it. Remove the umbilical cord from the last impinger and cap the impinger. If a flexible line is used between the first impinger or condenser and the filter holder, disconnect the line at the filter holder and let any condensed water or liquid drain into the impingers or condenser. After wiping off the silicone grease, cap off the filter holder outlet and impinger inlet. Either ground-glass stoppers, plastic caps, or serum caps may be used to close these openings.

Transfer the probe and filter-impinger assembly to the cleanup area. This area should be clean and protected from the wind so that the chances of contaminating or losing the sample will be minimized.

Save a portion of the acetone used for cleanup as a blank. Take 200 ml of this acetone directly from the wash bottle being used and place it in a glass sample container labeled "acetone blank."

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

Container No. 1. Carefully remove the filter from the filter holder and place it in its identified petri dish container. Use a pair of tweezers and/or clean disposable surgical gloves to handle the filter. If it is necessary to fold the filter, do so such that the particulate cake is inside the fold. Carefully transfer to the petri dish any particulate matter and/or filter fibers which adhere to the filter holder gasket, by using a dry Nylon bristle brush and/or a sharp-edged blade. Seal the container.

Container No. 2. Taking care to see that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover particulate matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with acetone and placing the wash in a glass container. Distilled water may be used instead of acetone when approved by the Administrator and shall be used when specified by the Administrator; in these cases, save a water blank and follow the Administrator's directions on analysis. Perform the acetone rinses as follows:

Carefully remove the probe nozzle and clean the inside surface by rinsing with acetone from a wash bottle and brushing with a Nylon bristle brush. Brush until the acetone rinse shows no visible particles, after which make a final rinse of the inside surface with acetone.

Brush and rinse the inside parts of the Swagelok fitting with acetone in a similar way until no visible particles remain.

Rinse the probe liner with acetone by tilting and rotating the probe while squirting acetone into its upper end so that all inside surfaces will be wetted with acetone. Let the acetone drain from the lower end into the sample container. A funnel (glass or polyethylene) may be used to aid on transferring liquid washes to the container. Follow the acetone rinse with a probe brush. Hold the probe in an inclined position, squirt acetone into the upper end as the probe brush is being pushed with a twisting action through the probe; hold a sample container underneath the lower end of the probe, and catch any acetone and particulate matter which is brushed from the probe. Run the brush through the probe three times or more until no visible particulate matter is carried out with the acetone or until none remains in the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times since metal probes have small crevices in which particulate matter can be entrapped. Rinse the brush with acetone, and quantitatively collect these washings in the sample container. After the brushing, make a final acetone rinse of the probe as described above.

It is recommended that two people clean the probe to minimize sample losses. Between sampling runs, keep brushes clean and protected from contaminations.

After ensuring that all joints have been wiped clean of silicone grease, clean the inside of the front half of the filter holder by rubbing the surfaces with a Nylon bristle brush and rinsing with acetone. Rinse each surface three times or more if needed to remove visible particulate. Make a final rinse of the brush and filter holder. Carefully rinse out the glass cyclone, also (if applicable). After all acetone washings and particulate matter have been collected in the sample container, tighten the lid on the sample container so that acetone will not leak out when it is shipped to the laboratory. Mark the height of the fluid levcel to determine whether or not leakage occured during transport. Label the container to clearly identify its contents.

Container No. 3. Note the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to its original container and seal. A funnel may make it easier to pour the silica gel without spilling. A rubber policeman may be used as an aid in removing the silica gel from the impinger. it is not necessary to remove the small amount of dust particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, follow the procedure for container No. 3 in Section 4.3.

Impinger Water. Treat the impingers as follows: Make a notation of any color or film in the liquid catch. Measure the liquid which is in the first three impingers to within ±1 ml by using a graduated cylinder or by weighing it to within ±0.5 g by using a balance (if one is available). Record the volume or weight of liquid present. This information is required to calculate the moisture content of the effluent gas.

Discard the liquid after measuring and recording the volume or weight, unless analysis of the impinger catch is required (see Note, Section 2.1.7).

If a different type of condenser is used, measure the amount of moisture condensed either volumetrically or gravimetrically.

Whenever possible, containers should be shipped in such a way that they remain upright at all times.

4.3 Analysis. Record the data required on a sheet such as the one shown in Figure 5-3. Handle each sample container as follows:

FIGURE 5-3—ANALYTICAL DATA

Plant ____________________
Date ____________________
Run No. ____________________
Filter No. ____________________
Amount liquid lost during transport ________
Acetone blank volume, ml ____________
Acetone wash volume, ml ____________
Acetone blank concentration, mg/mg (equation 5-4) ____________
Acetone wash blank, mg (equation 5-5) ________

Container number	Weight of particulate collected, mg		
	Final weight	Tare weight	Weight gain
1 ________			
2 ________			
Total ________			
Less acetone blank ________			
Weight of particulate matter ________			

	Volume of liquid water collected	
	Impinger volume, ml	Silica gel weight, g
Final ________		
Initial ________		
Liquid collected ________		
Total volume collected ________		g* ml

*Convert weight of water to volume by dividing total weight increase by density of water (1 g/ml).

$$\frac{\text{Increase, g}}{(1\ \text{g/ml})} = \text{Volume water, ml}$$

Container No. 1. Leave the contents in the shipping container or transfer the filter and any loose particulate from the sample container to a tared glass weighing dish. Desiccate for 24 hours in a desiccator containing anhydrous calcium sulfate. Weigh to a constant weight and report the results to the nearest 0.1 mg. For purposes of this Section, 4.3, the term "constant weight" means a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

Alternatively, the sample may be oven dried at 105° C (220° F) for 2 to 3 hours, cooled in the desiccator, and weighed to a constant weight, unless otherwise specified by the Administrator. The tester may also opt to oven dry the sample at 105° C (220° F) for 2 to 3 hours, weigh the sample, and use this weight as a final weight.

Container No. 2. Note the level of liquid in the container and confirm on the analysis sheet whether or not leakage occurred during transport. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Measure the liquid in this container either volumetrically to ±1 ml or gravimetrically to ±0.5 g. Transfer the contents to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

Container No. 3. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g using a balance. This step may be conducted in the field.

"Acetone Blank" Container. Measure acetone in this container either volumentrically or gravimetrically. Transfer the acetone to a tared 250-ml beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 mg.

NOTE: At the option of the tester, the contents of Container No. 2 as well as the acetone blank container may be evaporated at temperatures higher than ambient. If evaporation is done at an elevated temperature, the temperature must be below the boiling point of the solvent; also, to prevent "bumping," the evaporation process must be closely supervised, and the contents of the beaker must be swirled occasionally to maintain an even temperature. Use extreme care, as acetone is highly flammable and has a low flash point.

4.4 Quality Control Procedures. The following quality control procedures are suggested to check the volume metering system calibration values at the field test site prior to sample collection. These procedures are optional for the tester.

4.4.1 Meter Orifice Check. Using the calibration data obtained during the calibration procedure described in Section 5.3, determine the $\Delta H_@$ for the metering system orifice. The $\Delta H_@$ is the orifice pressure differential in units of in. H_2O that correlates to 0.75 cfm of air at 528°R and 29.92 in. Hg. The $\Delta H_@$ is calculated as follows:

$$\Delta H_@ = 0.0319\ \Delta H\ \frac{T_m}{P_{bar}}\ \frac{\Theta^2}{Y^2 V_m^2}$$

Eq. 5-9

Where:

ΔH = Average pressure differential across the orifice meter, in. H_2O.

T_m = Absolute average dry gas meter temperature, °R.

P_{bar} = Barometric pressure, in. Hg.

Θ = Total sampling time, min.

Y = Dry gas meter calibration factor, dimensionless.

V_m = Volume of gas sample as measured by dry gas meter, dcf.

0.0319 = (0.0567 in. Hg/°R) x (0.75 cfm)²

Before beginning the field test (a set of three runs usually constitutes a field test), operate the metering system (i.e., pump, volume meter, and orifice) at the $\Delta H_@$ pressure differential for 10 minutes. Record the volume collected, the dry gas meter temperature, and the barometric pressure. Calculate a dry gas meter calibration check value, Y_c, as follows:

$$Y_c = \frac{10}{V_m}\left[\frac{0.0319\ T_m}{P_{bar}}\right]^{1/2}$$

Eq. 5-10

Where:

Y_c = Dry gas meter calibration check value, dimensionless.

10 = 10 minutes of run time.

Compare the Y_c value with the dry gas meter calibration factor Y to determine that:

$0.97Y < Y_c < 1.03Y$

If the Y_c value is not within this range, the volume metering system should be investigated before beginning the test.

4.4.2 Calibration Critical Orifice. A calibrated critical orifice, calibrated against a wet test meter or spirometer and designed to be inserted at the inlet of the sampling meter box, may be used as a quality control check by following the procedure of Section 7.2.

5. *Calibration*

Maintain a laboratory log of all calibrations.

5.1 Probe Nozzle. Probe nozzles shall be calibrated before their initial use in the field. Using a micrometer, measure the inside diameter of the nozzle to the nearest 0.025 mm (0.001 in.). Make three separate measurements using different diameters each time, and obtain the average of the measurements. The difference between the high and low numbers shall not exceed 0.1 mm (0.004 in.). When nozzles become nicked, dented, or corroded, they shall be reshaped, sharpened, and recalibrated before use. Each nozzle shall be permanently and uniquely identified.

5.2 Pitot Tube. The Type S pitot tube assembly shall be calibrated according to the procedure outlined in Section 4 of Method 2.

5.3 Metering System. Before its initial use in the field, the metering system shall be calibrated according to the procedure outlined in APTD-0576. Instead of physically adjusting the dry gas meter dial readings to correspond to the wet test meter readings, calibration factors may be used to mathematically correct the gas meter dial readings to the proper values. Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. for these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.0057 m³/min (0.02 cfm); at the end of the run, take the difference of the measur[illegible] wet test meter and dry gas meter volu[illegible] divide the difference by 10, to get the [illegible] rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

After each field use, the *calibration* of the metering system shall be checked by *performing three calibration runs at a single,* intermediate orifice setting (based on the previous field test). With the vacuum set at the maximum value reached during the test series. To adjust the vacuum, insert a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the calibration factor. If the calibration has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as outlined in APTD-0576.

Alternative procedures, e.g., using the orifice meter coefficients, maybe used, subject to the approval of the Administrator.

NOTE: If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.3.1 Calibration Prior to Use. Before its initial use in the field, the metering system shall be calibrated as follows: Connect the metering system inlet to the outlet of a wet test meter that is accurate to within 1 percent. Refer to Figure 5.5. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev). A spirometer of 400 liters (14 ft³) or more capacity, or equivalent, may be used for thi[illegible] calibration, although a wet test meter is usually more practical. The wet test meter should be periodically calibrated with a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained. Run the metering system pump for about 15 minutes with the orifice manometer indicating a median reading as expected in field use to allow the pump to warm up and to permit the interior surface of the wet test meter to be thoroughly wetted. Then, at each of a minimum of three orifice manometer settings, pass an exact quantity of gas through the wet test meter and note the gas volume indicated by the dry gas meter. Also note the barometric pressure, and the temperatures of the wet test meter, the inlet of the dry gas meter, and the outlet of the dry gas meter. Select the highest and lowest orifice settings to bracket the expected field operating range of the orifice. Use a minimum volume of 0.15 m³ (5 cf) at all orifice settings. Record all the data on a form similar to Figure 5.6, and calculate Y, the dry gas meter calibration factor, and ΔH@, the orifice calibration factor, at each orifice setting as shown on Figure 5.6. Allowable tolerances for individual Y and ΔH@, values are given in Figure 5.6. Use the average of the Y values in the calculations in Section 6.

Before calibrating the metering system, it is suggested that a leak-check be conducted. For metering systems having diaphragm pumps, the normal leak-check procedure will not detect leakages within the pump. For these cases the following leak-check procedure is suggested: make a 10-minute calibration run at 0.00057m³/min (0.02 cfm): at the end of the run, take the difference of the measured wet test meter and dry gas meter volumes: divided the difference by 10, to get the leak rate. The leak rate should not exceed 0.00057 m³/min (0.02 cfm).

5.3.2 Calibration After Use. After each filed use, the calibration of the metering system shall be checked by performing three calibration runs at a single, intermediate orifice setting (based on the previous field test), with the vacuum set at the maximum value reached during the test series. To adjust the vacuum, inset a valve between the wet test meter and the inlet of the metering system. Calculate the average value of the dry gas meter calibration factor. If the value has changed by more than 5 percent, recalibrate the meter over the full range of orifice settings, as previously detailed.

Alternative procedures, e.g., rechecking the orifice meter coefficient may be used, subject to the approval of the Administrator.

5.3.3 Acceptable Variation in Calibration. If the dry gas meter coefficient values obtained before and after a test series differ by more than 5 percent, the test series shall either be voided, or calculations for the test series shall be performed using whichever meter coefficient value (i.e., before or after) gives the lower value of total sample volume.

5.4 Probe Heater Calibration. The probe heating system shall be calibrated before its initial use in the field.

Use a heat source to generate air heated to selected temperatures that approximate those expected to occur in the sources to be sampled. Pass this air through the probe at a typical simple flow rate while measuring the probe inlet and outlet temperatures at various probe heater settings. For each air temperature generated, construct a graph of probe heating system setting versus probe outlet temperature. The procedure outlined in APTD–0576 can also be used. Probes constructed according to APTD–0581 need not be calibrated if the calibration curves in APTD–0576 are used. Also, probes with outlet temperature monitoring capabilities do not require calibration.

5.5 Temperature Gauges. Use the procedure in Section 4.3 of Method 2 to calibrate in-stack temperature gauges. Dial thermometers, such as are used for the dry gas meter and condenser outlet, shall be calibrated against mercury-in-glass thermometers.

5.6 Leak Check of Metering System Shown in Figure 5-1. That portion of the sampling train from the pump to the orifice meter should be leak checked prior to initial use and after each shipment. Leakage after the pump will result in less volume being recorded than is actually sampled. The follow-

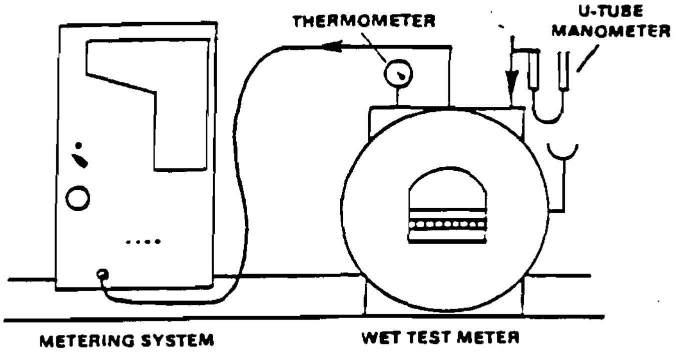

Figure 5.5 Equipment arrangement for metering system calibration.

Date____________________ Metering System Identification:____________________

Barometric pressure, P_b = ______ in. Hg

Orifice manometer setting ΔH in. H_2O	Spirometer (wet meter) gas volume (V_w) ft³	Dry gas meter volume (V_m) ft³	Temperatures				Time (θ) min
			Spirometer (wet meter) (t_w) °F	Dry Gas Meter			
				Inlet (t_i) °F	Outlet (t_o) °F	Average (t_m) °F	

Calculations

	Y	$\Delta H_@$
ΔH in. H_2O	$\dfrac{V_w P_b (t_m + 460)}{V_m\left(P_b + \dfrac{\Delta H}{13.6}\right)(t_w + 460)}$	$\dfrac{0.0317\ \Delta H}{P_b\ (t_o + 460)}\left[\dfrac{(t_w + 460)\ \theta}{V_w}\right]^2$
Average		

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ±0.02 from average.

$\Delta H_@$ = Orifice pressure differential that equates to 0.75 cfm of air @ 68°F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ±0.20 from average.

Figure 5.6. Example data sheet for calibration of metering system (English units).

ing procedure is suggested (see Figure 5-4): Close the main valve on the meter box. Insert a one-hole rubber stopper with rubber tubing atached into the orifice exhaust pipe. Disconnect and vent the low side of the orifice manometer. Close off the low side orifice tap. Pressurize the system to 13 to 18 cm (5 to 7 in.) water column by blowing into the rubber tubing. Pinch off the tubing and observe the manometer for one minute. A loss of pressure on the manometer indicates a leak in the meter box; leaks, if present, must be corrected.

5.7 Barometer. Calibrate against a mercury barometer.

6. *Calculations*

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

6.1 Nomenclature

A_n = Cross-sectional area of nozzle, m² (ft²).

B_{ws} = Water vapor in the gas stream, proportion by volume.

C_a = Acetone blank residue concentration, mg/mg.

c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).

I = Percent of isokinetic sampling.

L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.0057 m³/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.

L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i = 1, 2, 3....n), m³/min (cfm).

L_p = Leakage rate observed during the post-test leak check, m³/min (cfm).

m_n = Total amount of particulate matter collected, mg.

M_w = Molecular weight of water, 18.0 g/g-mole (18.0lb/lb-mole).

m_a = Mass of residue of acteone after evaporation, mg.

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

R = Ideal gas constant, 0.06236 mm Hg-[illegible] °K-g-mole (21.85 in. Hg-ft³/°R-lb-mo[illegible]

T_m = Absolute average dry gas meter tem[illegible]ature (see Figure 5-2), °K (°R).

T_s = Absolute average stack gas temperature (see Figure 5-2), °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of acetone blank, ml.

V_{aw} = Volume of acetone used in wash, ml.

V_{lc} = Total volume of liquid collected in impingers and silica gel (see Figure 5-3), ml.

V_m = Volume of gas sample as measured by dry gas meter, dcm (dscf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).

$V_{w(std)}$ = Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).

v_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).

W_a = Weight of residue in acetone wash, mg.

Y = Dry gas meter calibration factor.

ΔH = Average pressure differential across the orifice meter (see Figure 5-2), mm H_2O (in. H_2O).

ρ_a = Density of acetone, mg/ml (see label on bottle).

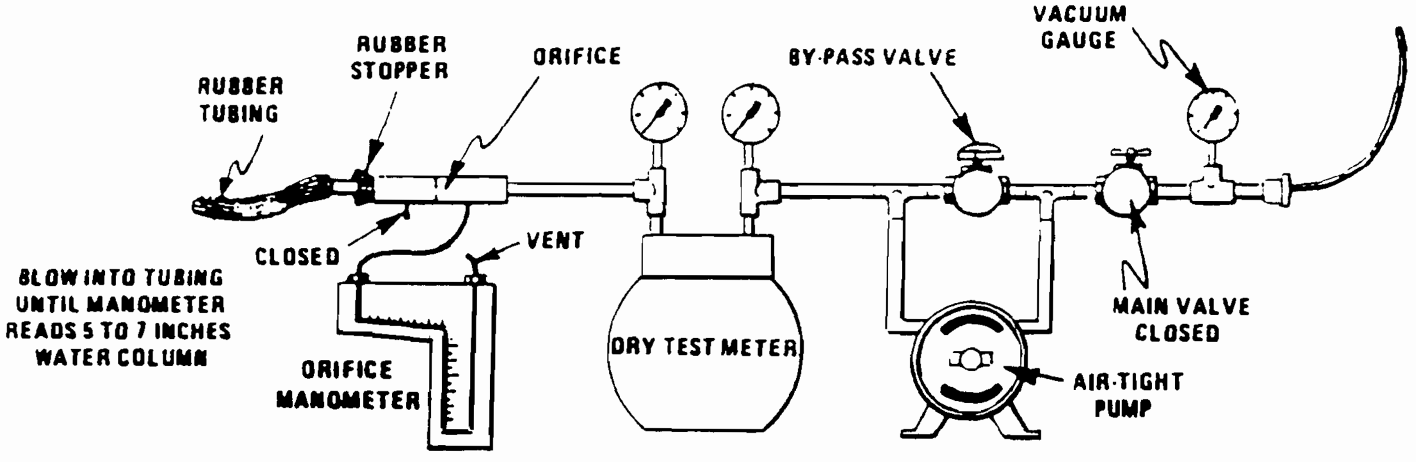

Figure 5-4. Leak check of meter box.

ρ_w = Density of water, 0.9982 g/ml (0.002201 lb/ml).

θ = Total sampling time, min.

θ_1 = Sampling time interval, from the beginning of a run until the first component change, min.

θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.

θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.

13.6 = Specific gravity of mercury.

60 = Sec/min.

100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 5-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C, 760 mm Hg or 68° F, 29.92 in. Hg) by using Equation 5-1.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] = K_1 V_m Y \frac{P_{bar} + (\Delta H/13.6)}{T_m}$$

Equation 5-1

where:

K_1 = 0.3858 °K/mm Hg for metric units
= 17.64 °R/in. Hg for English units

NOTE: Equation 5-1 can be used as written unless the leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 5-1 must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-1 with the expression:

$$V_m - (L_p - L_a)\theta]$$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-1 by the expression:

$$\left[V_m - (L_1 - L_a)\theta_1 - \sum_{i=2}^{n} (L_i - L_a)\theta_i - (L_p - L_a)\theta_p\right]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

6.4 Volume of water vapor.

Equation 5-2

$$V_{w(std)} = V_{lc}\left(\frac{\rho_w}{M_w}\right)\left(\frac{RT_{std}}{P_{std}}\right) = K_2 V_{lc}$$

where:

K_2 = 0.001333 m³/ml for metric units
= 0.04707 ft³/ml for English units.

6.5 Moisture Content.

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

Equation 5-3

NOTE: In saturated or water droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one from the impinger analysis (Equation 5-3), and a second from the assumption of saturated conditions. The lower of the two values of B_w shall be considered correct. The procedure for determining the moisture content based upon assumption of saturated conditions is given in the Note of Section 1.2 of Method 4. For the purposes of this method, the average stack gas temperature from Figure 5-2 may be used to make this determination, provided that the accuracy of the in-stack temperature sensor is ±1° C (2° F).

6.6 Acetone Blank Concentration.

Equation 5-4

$$C_a = \frac{m_a}{V_a \rho_a}$$

6.7 Acetone Wash Blank.

$W_a = C_a V_{aw} \rho_a$ Equation 5-5

6.8 Total Particulate Weight. Determine the total particulate catch from the sum of the weights obtained from containers 1 and 2 less the acetone blank (see Figure 5-3).

NOTE: Refer to Section 4.1.5 to assist in calculation of results involving two or more filter assemblies or two or more sampling trains.

6.9 Particulate Concentration.

$C_s = (0.001\ g/mg)\ (m_n / V_{m(std)})$ Equation 5-6

6.10 Conversion Factors:

From	To	Multiply by
scf	m³	0.02832.
g/ft³	gr/ft³	15.43.
g/ft³	lb/ft³	2.205×10^{-3}.
g/ft³	g/m³	35.31.
g	mg	0.001

6.11 Isokinetic Varition.

6.11.1 Calculation From Raw Data.

$$I = \frac{100\, T_s [K_3 V_{lc} + (V_m Y / T_m)(P_{bar} + \Delta H/13.6)]}{60 \theta_n P_s A_n}$$

Equation 5-7

where:

K_3 = 0.003454 mm Hg − m³/ml − °K for metric units.
= 0.002669 in. Hg − ft³/ml − °R for English units.

6.11.2 Calculation From Intermediate Values.

$$I = \frac{T_s V_{m(std)} P_{std} 100}{T_{std} v_s \theta A_n P_s 60 (1 - B_{ws})} = K_4 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1 - B_{ws})}$$

Equation 5-8

where:

K_4 = 4.320 for metric units
= 0.09450 for English units.

6.12 Acceptable Results. If 90 percent < I < 110 percent, the results are acceptable. If the particulate results are low in comparison to the standard, and I is over 110 percent or less than 90 percent, the Administrator may accept the results. Citation 4 in the bibliography section can be used to make acceptability judgments. If I is judeged to be unacceptable, reject the particulate results and repeat the test.

6.13 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2.

7. *Alternative Procedures*

7.1 Dry Gas Meter as a Calibration Standard. A dry gas meter may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.3, provided that it is calibrated initially and recalibrated periodically as follows:

7.1.1 Standard Dry Gas Meter Calibration.

7.1.1.1 The dry gas meter to be calibrated and used as a secondary reference meter should be of high quality and have an appropriately sized capacity, e.g., 3 liters/rev (0.1 ft³/rev). A spirometer (400 liters or more capacity), or equivalent, may be used for this calibration, although a wet test meter is usually more practical. The wet test meter should have a capacity of 30 liters/rev (1 ft³/rev) and capable of measuring volume to within ±1.0 percent; wet test meters should be checked against a spirometer or a liquid displacement meter to ensure the accuracy of the wet test meter. Spirometers or wet test meters of other sizes may be used, provided that the specified accuracies of the procedure are maintained.

7.1.1.2 Set up the components as shown in Figure 5.7. A spirometer, or equivalent, may be used in place of the wet test meter in the system. Run the pump for at least 5 minutes at a flow rate of about 10 liters/min (0.35 cfm) to condition the interior surface of the wet test meter. The pressure drop indicated by the manometer at the inlet side of the dry gas meter should be minimized [no greater than 100 mm H₂O (4 in. H₂O) at a flow rate of 30 liters/min (1 cfm)]. This can be accomplished by using large diameter tubing connections and straight pipe fittings.

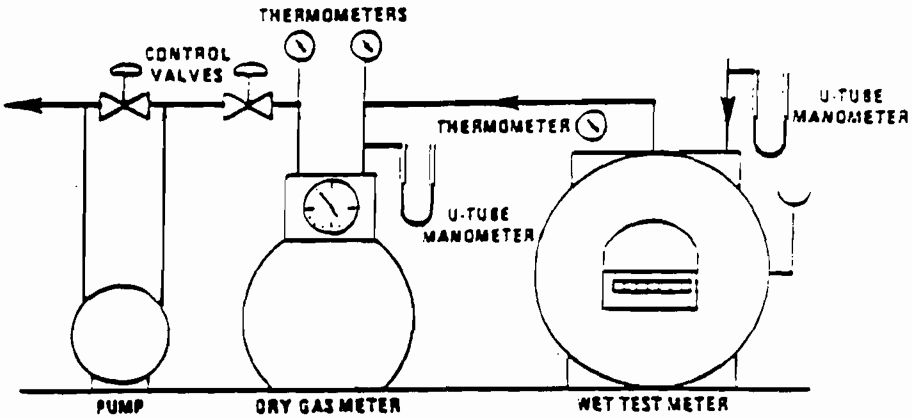

Figure 5.7 . Equipment arrangement for dry-gas meter calibration.

7.1.1.3 Collect the data as shown in the example data sheet (see Figure 5-8). Make triplicate runs at each of the flow rates and at no less than five different flow rates. The range of flow rates should be between 10 and 34 liters/min (0.35 and 1.2 cfm) or over the expected operating range.

DATE:____________________

DRY GAS METER IDENTIFICATION:____________________

BAROMETRIC PRESSURE (P_b):____________________ in. Hg

			TEMPERATURES								
				DRY GAS METER							
APPROXIMATE FLOW RATE ($\bar{Q}$) cfm	SPIROMETER (WET METER) GAS VOLUME (V_s) ft^3	DRY GAS METER VOLUME (V_{dg}) ft^3	SPIROMETER (WET METER) (t_s) °F	INLET (t_i) °F	OUTLET (t_o) °F	AVERAGE ($\bar{t}_d$) °F	DRY GAS METER PRESSURE (Δp) in. H_2O	TIME (Θ) min.	FLOW RATE (Q) cfm	METER COEFFICIENT (Y_{ds})	AVERAGE METER COEFFICIENT ($\bar{Y}_{ds}$)
0.40											
0.60											
0.80											
1.00											
1.20											

$$Q = 17.65 \cdot \frac{V_s}{\Theta} \cdot \frac{P_b}{(t_s + 460)} \qquad Y_{ds} = \frac{V_s}{V_{dg}} \cdot \frac{(\bar{t}_d + 460)}{(t_s + 460)} \cdot \frac{P_b}{(P_b + \frac{\Delta p}{13.6})}$$

Figure 5.8. Example data sheet for calibration of a standard dry gas meter for method 5 sampling equipment (English units).

7.1.1.4 Calculate flow rate, Q, for each run using the wet test meter gas volume, V_w, and the run time, θ. Calculate the dry gas meter coefficient, Y_{ds}, for each run. These calculations are as follows:

$$Q = K_1 \frac{P_{bar}}{t_w + t_{std}} \frac{V_w}{\theta}$$

$$Y_{ds} = \frac{V_w}{V_{ds}} \frac{(t_{ds} + t_{std})}{(t_w + t_{std})} \frac{P_{bar}}{\left(P_{bar} + \frac{\Delta p}{13.6}\right)}$$

Where:

K_1 = 0.3858 for international system of units (SI); 17.64 for English units.

V_w = Wet test meter volume, liters (ft³).

V_{ds} = Dry gas meter volume, liters (ft³).

t_{ds} = Average dry gas meter temperature, °C (°F).

t_{std} = 273° C for SI units; 460° F for English units.

t_w = Average wet test meter temperature, °C (°F).

P_{bar} = Barometric pressure, mm Hg (in. Hg).

Δp = Dry gas meter inlet differential pressure, mm H_2O (in. H_2O).

θ = Run time, min.

7.1.1.5 Compare the three Y_{ds} values at each of the flow rates and determine the maximum and minimum values. The difference between the maximum and minimum values at each flow rate should be no greater than 0.030. Extra sets of triplicate runs may be made in order to complete this requirement. In addition, the meter coefficients should be between 0.95 and 1.05. If these specifications cannot be met in three sets of successive triplicate runs, the meter is not suitable as a calibration standard and should not be used as such. If these specifications are met, average the three Y_{ds} values at each flow rate resulting in five average meter coefficients, $\overline{Y_{ds}}$.

7.1.1.6 Prepare a curve of meter coefficient, $\overline{Y_{ds}}$, versus flow rate, Q, for the dry gas meter. This curve shall be used as a reference when the meter is used to calibrate other dry gas meters and to determine whether recalibration is required.

7.1.2 Standard Dry Gas Meter Recalibration.

7.1.2.1 Recalibrate the standard dry gas meter against a wet test meter or spirometer annually or after every 200 hours of operation, whichever comes first. This requirement is valid provided the standard dry gas meter is kept in a laboratory and, if transported, cared for as any other laboratory instrument. Abuse to the standard meter may cause a change in the calibration and will require more frequent recalibrations.

7.1.2.2 As an alternative to full recalibration, a two-point calibration check may be made. Follow the same procedure and equipment arrangement as for a full recalibration, but run the meter at only two flow rates (suggested rates are 14 and 28 liters/min (0.5 and 1.0 cfm)). Calculate the meter coefficients for these two points, and compare the values with the meter calibration curve. If the two coefficients are within ±1.5 percent of the calibration curve values at the same flow rates, the meter need not be recalibrated until the next date for a recalibration check.

7.2 Critical Orifices As Calibration Standards. Critical orifices may be used as calibration standards in place of the wet test meter specified in Section 5.3, provided that they are selected, calibrated, and used as follows:

7.2.1 Section of Critical Orifices.

7.2.1.1 The procedure that follows describes the use of hypodermic needles or stainless steel needle tubings which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices; i.e., a critical vacuum can be obtained, as described in Section 7.2.2.2.3. Select five critical orifices that are appropriately sized to cover the range of flow rates between 10 and 34 liters/min or the expected operating range. Two of the critical orifices should bracket the expected operating range.

A minimum of three critical orifices will be needed to calibrate a Method 5 dry gas meter (DGM); the other two critical orifices can serve as spares and provide better selection for bracketing the range of operating flow rates. The needle sizes and tubing lengths shown below give the following approximate flow rates:

Gauge/cm	Flow rate (liters/min)	Gauge/cm	Flow rate (liters/min)
12/7.6	32.56	14/2.5	19.54
12/10.2	30.02	14/5.1	17.27
13/2.5	25.77	14/7.6	16.14
13/5.1	23.50	15/3.2	14.16
13/7.6	22.37	15/7.6	11.61
13/10.2	20.67	15/10.2	10.48

7.2.1.2 These needles can be adapted to a Method 5 type sampling train as follows: Insert a serum bottle stopper, 13- by 20-mm sleeve type, into a ½-inch Swagelok quick connect. Insert the needle into the stopper as shown in Figure 5–9.

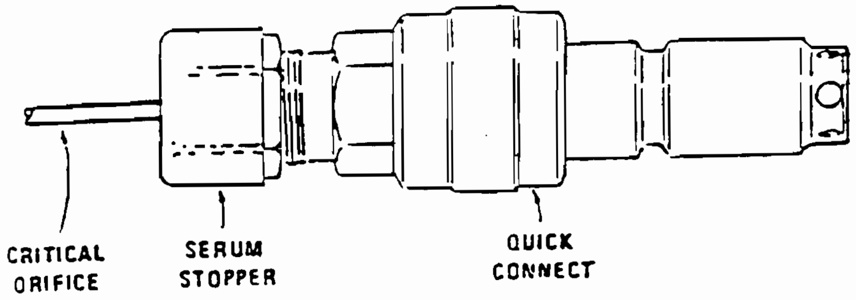

Figure 5-9. Critical orifice adaptation to Method 5 metering system.

7.2.2 Critical Orifice Calibration. The procedure described in this section uses the Method 5 meter box configuration with a DGM as described in Section 2.1.8 to calibrate the critical orifices. Other schemes may be used, subject to the approval of the Administrator.

7.2.2.1 Calibration of Meter Box. The critical orifices must be calibrated in the same configuration as they will be used: i.e., there should be no connections to the inlet of the orifice.

7.2.2.1.1 Before calibrating the meter box, leak check the system as follows: Fully open the coarse adjust valve, and completely close the by-pass valve. Plug the inlet. Then trun on the pump, and determine whether there is any leakage. The leakage rate shall be zero: i.e., no detectable movement of the DGM dial shall be seen for 1 minute.

7.2.2.1.2 Check also for leakages in that portion of the sampling train between the pump and the orifice meter. See Section 5.6 for the procedure: make any corrections, if necessary. If leakage is detected, check for cracked gaskets, loose fittings, worn O-rings, etc., and make the necessary repairs.

7.2.2.1.3 After determining that the meter box is leakless, calibrate the meter box according to the procedure given in Section 5.3. Make sure that the wet test meter meets the requirements stated in Section 7.1.1.1. Check the water level in the wet test meter. Record the DGM calibration factor, Y.

7.2.2.2 Calibration of Critical Orifices. Set up the apparatus as shown in Figure 5-10.

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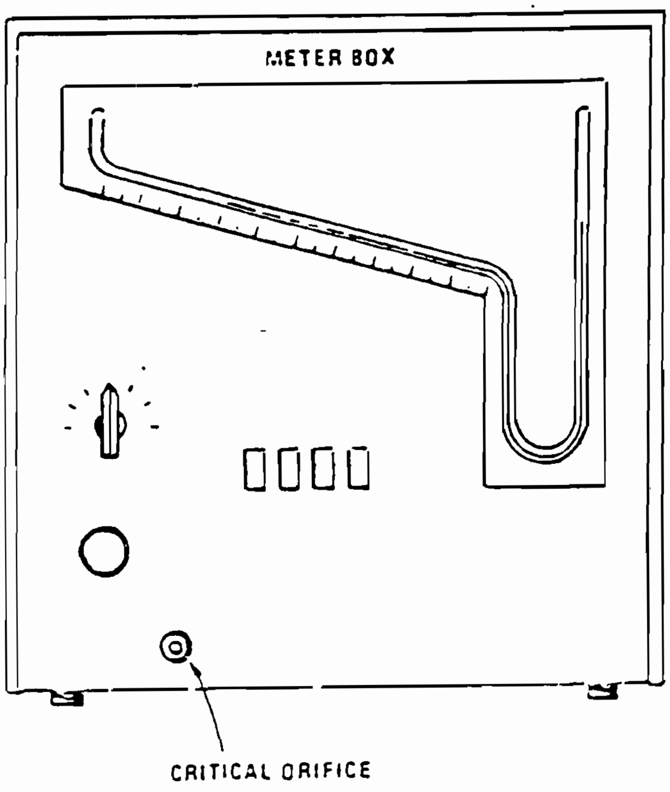

Figure 5-10. Apparatus setup.

7.2.2.2.1 Allow a warm-up time of 15 minutes. This step is important to equilibrate the temperature conditions through the DGM.

7.2.2.2.2 Leak check the system as in Section 7.2.2.1.1. The leakage rate shall be zero.

7.2.2.2.3 Before calibrating the critical orifice, determine its suitability and the appropriate operating vacuum as follows: Turn on the pump, fully open the coarse adjust valve, and adjust the by-pass valve to give a vacuum reading corresponding to about half of atmospheric pressure. Observe the meter box orifice manometer reading, H. Slowly increase the vacuum reading until a stable reading is obtained on the meter box orifice manometer. Record the critical vacuum for each orifice.

Orifices that do not reach a critical value shall not be used.

7.2.2.2.4 Obtain the barometric pressure using a barometer as described in Section 2.1.9. Record the barometric pressure, P_{bar}, in mm Hg (in. Hg).

7.2.2.2.5 Conduct duplicate runs at a vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. The runs shall be at least 5 minutes each. The DGM volume readings shall be in increments of 0.00283 m³ (0.1 ft³) or in increments of complete revolutions of the DGM. As a guideline, the times should not differ by more than 3.0 seconds (this includes allowance for changes in the DGM temperatures) to achieve ± 0.5 percent in K'. Record the information listed in Figure 5–11.

7.2.2.2.6 Calculate K' using Equation 5-9.

K' = Critical orifice coefficient.

T_{amb} = Absolute ambient temperature, °K (°R).

Average the K' values. The individual K' values should not differ by more than ±0.5 percent from the average.

$$K' = \frac{K_1 V_m Y (P_{bar} + \Delta H/13.6) \sqrt{T_{amb}}}{P_{bar} T_m \Theta} \qquad \text{Eq. 5–9}$$

$$\frac{(m^3)(°K)^{1/2}}{(mm.\ Hg)\ (min)} \left[\frac{(ft^3)(°R)^{1/2}}{(in.\ Hg)\ (min)} \right]$$

Sections 7.2.2.2.1 to 7.2.2.2.5. Record the information listed in Figure 5.12.

7.2.3 Using the Critical Orifices as Calibration Standards.

7.2.3.1 Record the barometric pressure.

Date ________ Train ID ________ DGM cal. factor ________ Critical orifice ID ________

Dry gas meter		Run No.	
		1	2
Final reading	m³ (ft³)		
Initial reading	m³ (ft³)		
Difference, V_m	m³ (ft³)		
Inlet/Outlet temperatures:			
Initial	°C (°F)	/	/
Final	°C (°F)	/	/
Avg. Temperature, t_m.	°C (°F)		
Time, Θ	min/sec	/	/
	min		
Orifice man. rdg., ΔH.	mm (in.) H₂O.		
Bar. pressure, P_{bar}	mm (in.) Hg		
Ambient temperature, t_{amb}	°C (°F)		
Pump vacuum	mm (in.) Hg		
K' factor			
Average			

Figure 5–11. Data sheet for determining K' factor.

7.2.3.2 Calibrate the metering system according to the procedure outlined in

7.2.3.3 Calculate the standard volumes of air passed through the DGM and the critical orifices, and calculate the DGM calibration factor, Y, using the equations below:"

$$V_m(std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m} \qquad \text{Eq. 5–10}$$

$$V_{cr}(std) = K' \frac{P_{bar}\Theta}{T_{amb}} \qquad \text{Eq. 5–11}$$

$$Y = \frac{V_{cr(std)}}{V_{m(std)}} \qquad \text{Eq. 5–12}$$

where:

$V_{cr(std)}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions, dsm³ (dscf).

K_1 = 0.3858 °K/mm Hg for metric units = 17.64 °R/in. Hg for English units.

7.2.3.4 Average the DGM calibration values for each of the flow rates. The calibration factor, Y, at each of the flow rates should not differ by more than ±2 percent from the average.

7.2.3.5 To determine the need for recalibrating the critical orifices, compare the DGM Y factors obtained from two adjacent orifices each time a DGM is calibrated; for example, when checking 13/2.5, use orifices 12/10.2 and 13/5.1. If any critical orifice yields a DGM Y factor differing by more than 2 percent from the others, recalibrate the critical orifice according to Section 7.2.2.2.

Date ________ Train ID ________ Critical orifice ID ________ Critical orifice K' facto
____

Dry gas meter		Run No.	
		1	2
Final reading	m³ (ft³)		
Initial reading	m³ (ft³)		
Difference, V_m	m³ (ft³)		
Inlet/outlet temperatures:			
Initial	°C (°F)	/	/
Final	°C (°F)	/	/
Avg. Temperature, t_m.	°C (°F)		
Time, Θ	min/sec	/	/
	min		
Orifice man. rdg., ΔH.	mm (in.) H₂O.		
Bar. pressure, P_{bar}	mm (in.) Hg		
Ambient temperature, t_{amb}	°C (°F)		
Pump vacuum	mm (in.) Hg		
$V_{m(std)}$	m³ (ft³)		
$V_{cr(std)}$	m³ (ft³)		
DGM cal. factor, Y			

Figure 5–12. Data sheet for determining DGM Y factor.

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METHOD 6—DETERMINATION OF SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted from the sampling point in the stack. The sulfuric acid mist (including sulfur trioxide) and the sulfur dioxide are separated. The sulfur dioxide fraction is measured by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the determination of sulfur dioxide emissions from stationary sources. The minimum detectable limit of the method has been determined to be 3.4 milligrams (mg) of SO_2/m^3 (2.12×10^{-7} lb/ft^3). Although no upper limit has been established, tests have shown that concentrations as high as 80.000 mg/m^3 of SO_2 can be collected efficiently in two midget impingers, each containing 15 milliliters of 3 percent hydrogen peroxide, at a rate of 1.0 lpm for 20 minutes. Based on theoretical calculations, the upper concentration limit in a 20-liter sample is about 93.300 mg/m^3.

Possible interferents are free ammonia, water-soluble cations, and fluorides. The cations and fluorides are removed by glass wool filters and an isopropanol bubbler, and hence do not affect the SO_2 analysis. When samples are being taken from a gas stream with high concentrations of very find metallic fumes (such as in inlets to control devices), a high-efficiency glass fiber filter must be used in place of the glass wool plug (i.e., the one in the probe) to remove the cation interferents.

Free ammonia interferes by reacting with SO_2 to form particulate sulfite and by reacting with the indicator. If free ammonia is present (this can be determined by knowledge of the process and noticing white particulate matter in the probe and isopropanol bubbler), alternative methods, subject to the approval of the Administrator, U.S. Environmental Protection Agency, are required.

2. *Apparatus*

2.1 Sampling. The sampling train is shown in Figure 6-1. and component parts are discussed below. The tester has the option of substituting sampling equipment described in Method 8 in place of the midget impinger equipment of Method 6. However, the Method 8 train must be modified to include a heated filter between the probe and isopropanol impinger, and the operation of the sampling train and sample analysis must be at the flow rates and solution volumes defined in Method 8.

The tester also has the option of determining SO_2 simultaneously with particulate matter and moisture determinations by (1) replacing the water in a Method 5 impinger system with 3 percent peroxide solution, or (2) by replacing the Method 5 water impinger system with a Method 8 isopropanol-filter-peroxide system. The analysis for SO_2 must be consistent with the procedure in Method 8.

2.1.1 Probe. Borosilicate glass, or stainless steel (other materials of construction may be used, subject to the approval of the Administrator), approximately 6-mm inside diameter, with a heating system to prevent water condensation and a filter (either in-stack or heated outstack) to remove particulate matter, including sulfuric acid mist. A plug of glass wool is a satisfactory filter.

2.1.2 Bubbler and Impingers. One midget bubbler, with medium-coarse glass frit and borosilicate or quartz glass wool packed in top (see Figure 6-1) to prevent sulfuric acid mist carryover, and three 30-ml midget impingers. The bubbler and midget impingers must be connected in series with leak-free glass connectors. Silicone grease may be used, if necessary, to prevent leakage.

At the option of the tester, a midget impinger may be used in place of the midget bubbler.

Other collection absorbers and flow rates may be used, but are subject to the approval of the Administrator. Also, collection efficiency must be shown to be at least 99 percent for each test run and must be documented in the report. If the efficiency is found to be acceptable after a series of three tests, further documentation is not required. To conduct the efficiency test, an extra absorber must be added and analyzed separately. This extra absorber must not contain more than 1 percent of the total SO_2.

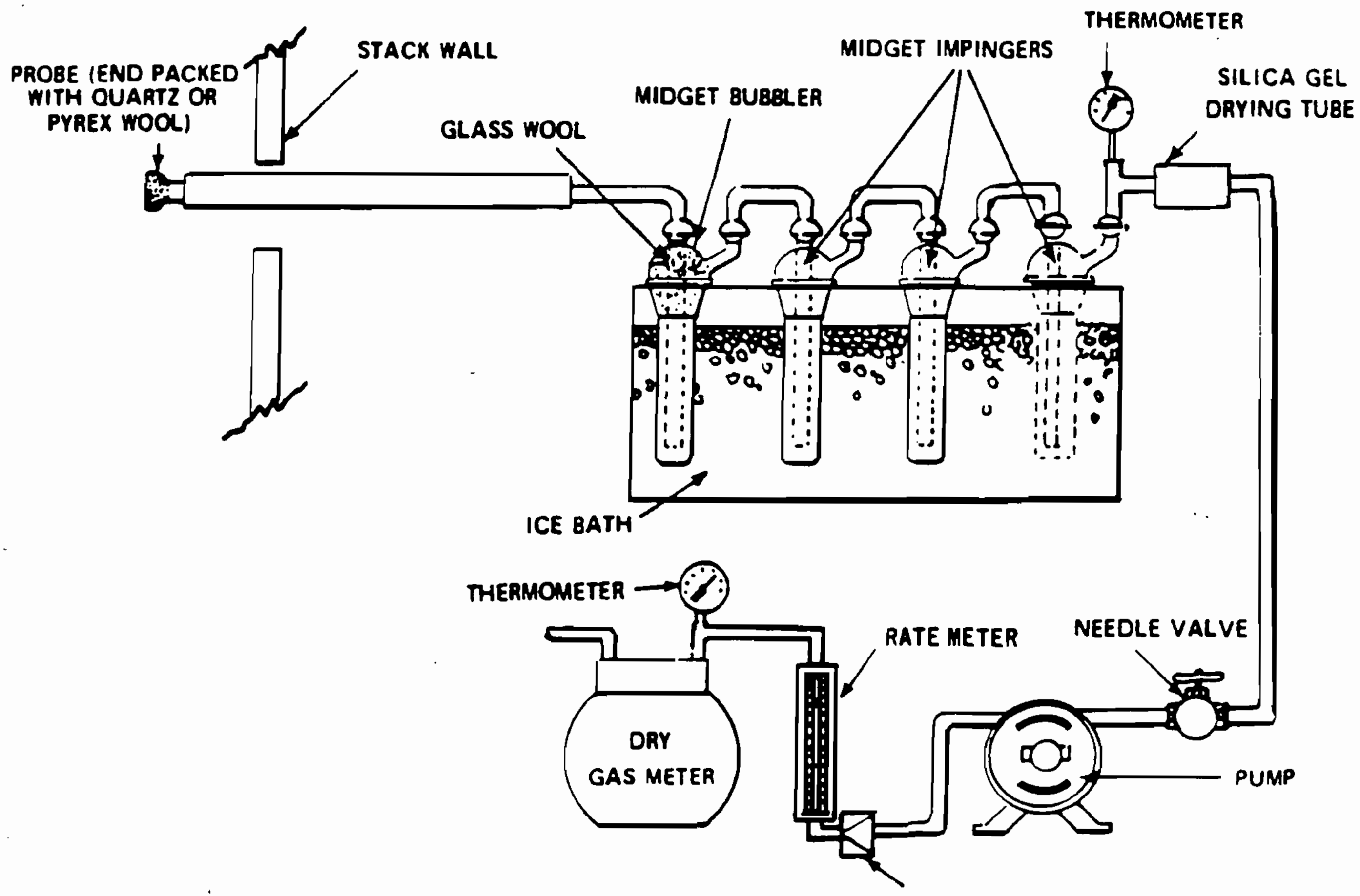

Figure 6-1. SO_2 sampling train.

2.1.3 Glass Wool. Borosilicate or quartz.

2.1.4 Stopcock Grease. Acetone-insoluble. heatstable silicone grease may be used. if necessary.

2.1.5 Temperature Gauge. Dial thermometer. or equivalent. to measure temperature of gas leaving impinger train to within 1° C (2° F.)

2.1.6 Drying Tube. Tube packed with 6- to 16-mesh indicating type silica gel. or equivalent. to dry the gas sample and to protect the meter and pump. If the silica gel has been used previously. dry at 175° C (350° F) for 2 hours. New silica gel may be used as received. Alternatively. other types of decissants (equivalent or better) may be used. subject to approval of the Administrator.

2.1.7 Valve. Needle valve. to regulate sample gas flow rate.

2.1.8 Pump. Leak-free diaphragm pump. or equivalent. to pull gas through the train. Install a small surge tank between the pump and rate meter to eliminate the pulsation effect of the diaphragm pump on the rotameter.

2.1.9. Rate Meter. Rotameter. or equivalent. capable of measuring flow rate to within 2 percent of the selected flow rate of about 1000 cc/min.

2.1.10 Volume Meter. Dry gas meter. sufficiently accurate to measure the sample volume within 2 percent. calibrated at the selected flow rate and conditions actually encountered during sampling. and equipped with a temperature gauge (dial thermometer. or equivalent) capable of measuring temperature to within 3° C (5.4° F).

2.1.11 Barometer. Mercury. aneroid. or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases. the barometric reading may be obtained from a nearby national weather service station. in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase or vice versa for elevation decrease.

2.1.12 Vacuum Gauge and Rotameter. At least 760 mm Hg (30 in. Hg) gauge and 0-40 cc/min rotameter. to be used for leak check of the sampling train.

2.2 Sample Recovery.

2.2.1 Wash bottles. Polyethylene or glass. 500 ml. two.

2.2.2 Storage Bottles. Polyethylene. 100 ml. to store impinger samples (one per sample).

2.3 Analysis.

2.3.1 Pipettes. Volumetric type. 5-ml. 20-ml (one per sample). and 25-ml sizes.

2.3.2 Volumetric Flasks. 100-ml size (one per sample) and 1000 ml size.

2.3.3 Burettes. 5- and 50-ml sizes.

2.3.4 Erlenmeyer Flasks. 250 ml-size (one for each sample. blank. and standard).

2.3.5 Dropping Bottle. 125-ml size. to add indicator.

2.3.6 Graduated Cylinder. 100-ml size.

2.3.7 Spectrophotometer. To measure absorbance at 352 nanometers.

3. *Reagents*

Unless otherwise indicated. all reagents must conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society. Where such specifications are not available. use the best available grade.

3.1 *Sampling.*

3.1.1 Water. Deionized distilled to conform to ASTM specification D1193-77. Type 3 (incorporated by reference—see § 60.17). At the option of the analyst. the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.1.2 Isopropanol. 80 percent. Mix 80 ml of isopropanol with 20 ml of deionized. distilled water. Check each lot of isopropanol for peroxide impurities as follows: shake 10 ml of isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of distilled water. After 1 minute. read the absorbance at 352 nanometers on a spectrophotometer. If absorbance exceeds 0.1. reject alcohol for use.

Peroxides may be removed from isopropanol by redistilling or by passage through a column of activated alumina; however. reagent grade isopropanol with suitably low peroxide levels may be obtained from commercial sources. Rejection of contaminated lots may. therefore. be a more efficient procedure.

3.1.3 Hydrogen Peroxide. 3 Percent. Dilute 30 percent hydrogen peroxide 1:9 (v/v) with deionized. distilled water (30 ml is needed per sample). Prepare fresh daily.

3.1.4 Potassium Iodide Solution. 10 Percent. Dissolve 10.0 grams KI in deionized. distilled water and dilute to 100 ml. Prepare when needed.

3.2 Sample Recovery.

3.2.1 Water. Deionized. distilled. as in 3.1.1.

3.2.2 Isopropanol. 80 Percent. Mix 80 ml of isopropanol with 20 ml of deionized. distilled water.

3.3 Analysis.

3.3.1 Water. Deionized. distilled. as in 3.1.1.

3.3.2 Isopropanol. 100 percent.

3.3.3 Thorin Indicator. 1-(o-arsonophenylazo)-2-naphthol-3.6-disulfonic acid. disodium salt. or equivalent. Dissolve 0.20 g in 100 ml of deionized. distilled water.

3.3.4 Barium Perchlorate Solution. 0.0100 N. Dissolve 1.95 g of barium perchlorate trihydrate [$Ba(ClO_4)_2 \cdot 3H_2O$] in 200 ml distilled water and dilute to 1 liter with isopropanol. Alternatively. 1.22 g of [$BaCl_2 \cdot 2H_2O$] may be used instead of the perchlorate. Standardize as in Section 5.5.

3.3.5 Sulfuric Acid Standard. 0.0100 N. Purchase or standardize to ±0.0002 N against 0.0100 N NaOH which has previously been standardized against potassium acid phthalate (primary standard grade).

3.3.6 Quality Assurance Audit Samples. Sulfate samples in glass vials prepared by EPA's Environmental Monitoring Systems Laboratory. Quality Assurance Division. Source Branch. Mail Drop 77A. Research Triangle Park. North Carolina 27711. Each set will consist of two vials having solutions of unknown concentrations. Only whe making compliance determinations. obta[illegible] an audit sample set from the Quality Ass[illegible]ance Management office at each EPA [illegible]gional Office or the responsible enforcement agency. (NOTE: The tester should notify the quality assurance office or the responsible enforcement agency at least 30 days prior to the test date to allow sufficient time for sample delivery.)

4. *Procedure.*

4.1 Sampling.

4.1.1 Preparation of collection train. Measure 15 ml of 80 percent isopropanol into the midget bubbler and 15 ml of 3 percent hydrogen peroxide into each of the first two midget impingers. Leave the final midget impinger dry. Assemble the train as shown in Figure 6-1. Adjust probe heater to a temperature sufficient to prevent water condensation. Place crushed ice and water around the impingers.

4.1.2 Leak-check procedure. A leak check prior to the sampling run is optional; however. a leak check after the sampling run is mandatory. The leak-check procedure is as follows:

Temporarily attach a suitable (e.g., 0-40 cc/min) rotameter to the outlet of the dry gas meter and place a vacuum gauge at or near the probe inlet. Plug the probe inlet. pull a vaccum of at least 250 mm Hg (10 in. Hg). and note the flow rate as indicated by the rotameter. A leakage rate not in excess of 2 percent of the average sampling rate is acceptable.

NOTE: Carefully release the probe inlet plug before turning off the pump.

It is suggested (not mandatory) that [illegible] pump be leak-checked separately. eit[illegible] prior to or after the sampling run. If done prior to the sampling run. the pump leak-check shall precede the leak check of the sampling train described immediately above: if done after the sampling run. the pump leak-check shall follow the train leak-check. To leak check the pump. proceed as follows: Disconnect the drying tube from the probe-impinger assembly. Place a vacuum gauge at the inlet to either the drying tube or the pump. pull a vacuum of 250 mm (10 in.) Hg. plug or pinch off the outlet of the flow meter and then turn off the pump. The vacuum should remain stable for at least 30 seconds.

Other leak-check procedures may be used. subject to the approval of the Adminstrator. U.S. Environmental Protection Agency.

4.1.3 Sample collection. Record the initial dry gas meter reading and barometric pressure. To begin sampling. position the tip of the probe at the sampling point. connect the probe to the bubbler. and start the pump. Adjust the sample flow to a constant rate of approximately 1.0 liter/min as indicated by the rotameter. Maintain this constant rate (±10 percent) during the entire sampling run. Take readings (dry gas meter. tempertures at dry gas meter and at impinger outlet and rate meter) at least every 5 minutes. Add more ice during the run to keep the temperture of the gases leaving the last impinger at 20° C (68° F) or less. At the conclusion of each run, turn off the pump, remove probe from the stack, and record the final readings. Conduct a leak check as in Section 4.1.2 (This leak check is mandatory.) If a leak is found, void the test run, or use procedures acceptable to the Administrator to adjust the sample volume for the leakage. Drain the ice bath, and purge the remaining part of the train by drawing clean ambient air through the system for 15 minutes at the sampling rate.

Clean ambient air can be provided by passing air through a charcoal filter or through an extra midget impinger with 15 ml of 3 percent H_2O_2. The tester may opt to simply use ambient air, without purification.

4.2 Sample Recovery. Disconnect the impingers after purging. Discard the contents of the midget bubbler. Pour the contents of the midget impingers into a leak-free polyethylene bottle for shipment. Rinse the three midget impingers and the connecting tubes with deionized, distilled water, and add the washings to the same storage container. Mark the fluid level. Seal and identify the sample container.

4.3 Sample Analysis. Note level of liquid in container, and confirm whether any sample was lost during shipment; note this on analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

Transfer the contents of the storage container to a 100-ml volumetric flask and dilute to exactly 100 ml with deionized, distilled water. Pipette a 20-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 80 ml of 100 percent isopropanol and two to four drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat and average the titration volumes. Run a blank with each series of samples. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is larger.

NOTE: Protect the 0.0100 N barium perchlorate solution from evaporation at all times.

4.4 Audit Sample Analysis. Concurrently analyze the two audit samples and a set of compliance samples (Section 4.3) in the same manner to evaluate the technique of the analyst and the standards preparation. (NOTE: It is recommended that known quality control samples be analyzed prior to the compliance and audit sample analysis to optimize the system accuracy and precision. One source of these samples is the Source Branch listed in Section 3.3.6.) The same analysts, analytical reagents, and analytical system shall be used both for compliance samples and the EPA audit samples; if this condition is met, auditing of subsequent compliance analyses for the same enforcement agency within 30 days is not required. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies, unless prior arrangements are made with both enforcement agencies.

Calculate the concentrations in mg/dscm using the specified sample volume in the audit instructions. (NOTE: Indication of acceptable results may be obtained immediately by reporting the audit results in mg/dscm and compliance results in total mg SO_2/sample by telephone to the responsible enforcement agency.) Include the results of both audit samples, their identification numbers, and the analyst's name with the results of the compliance determination samples in appropriate reports to the EPA regional office or the appropriate enforcement agency. Include this information with subsequent compliance analyses for the same enforcement agency during the 30-day period.

The concentrations of the audit samples obtained by the analyst shall agree within 5 percent of the actual concentrations. If the 5-percent specification is not met, reanalyze the compliance samples and audit samples, and include initial and reanalysis values in the test report (see NOTE in first paragraph of this section).

Failure to meet the 5-percent specification may require retests until the audit problems are resolved. However, if the audit results do not affect the compliance or noncompliance status of the affected facility, the Administrator may waive the reanalysis requirement, further audits, or retests and accept the results of the compliance test. While steps are being taken to resolve audit analysis problems, the Administrator may also choose to use the data to determine the compliance or noncompliance status of the affected facility.

5. *Calibration*

5.1 Metering System.

5.1.1 Initial Calibration. Before its initial use in the field, first leak check the metering system (drying tube, needle valve, pump, rotameter, and dry gas meter) as follows: place a vacuum gauge at the inlet to the drying tube and pull a vaccum of 250 mm (10 in.) Hg; plug or pinch off the outlet of the flow meter, and then turn off the pump. The vaccum shall remain stable for at least 30 seconds. Carefully release the vaccum gauge before releasing the flow meter end.

Next, remove the drying tube and calibrate the metering system (at the sampling flow rate specified by the method) as follows: connect an appropriately sized wet test meter (e.g., 1 liter per revolution) to the inlet. Make three independent calibration runs, using at least five revolutions of the dry gas meter per run. Calculate the calibration factor, Y (wet test meter calibration volume divided by the dry gas meter volume, both volumes adjusted to the same reference temperature and pressure), for each run, and average the results. If any Y value deviates by more than 2 percent from the average, the metering system is unacceptable for use. Otherwise, use the average as the calibration factor for subsequent test runs.

5.1.2 Post-Test Calibration Check. After each field test series, conduct a calibration check as in Section 5.1.1 above, except for the following variations: (a) the leak check is not to be conducted, (b) three, or more revolutions of the dry gas meter may be used, and (c) only two independent runs need be made. If the calibration factor does not deviate by more than 5 percent from the initial calibration factor (determined in Section 5.1.1), then the dry gas meter volumes obtained during the test series are acceptable. If the calibration factor deviates by more than 5 percent, recalibrate the metering system as in Section 5.1.1, and for the calculations, use the calibration factor (initial or recalibration) that yields the lower gas volume for each test run.

5.2 Thermometers. Calibrate against mercury-in-glass thermometers.

5.3 Rotameter. The rotameter need no be calibrated but should be cleaned an maintained according to the manufactu turer's instruction.

5.4 Barometer. Calibrate against a mer cury barometer.

5.5 Barium Perchlorate Solution. Stand ardize the barium perchlorate solutio against 25 ml of standard sulfuric acid t which 100 ml of 100 percent isopropanol ha been added.

Run duplicate analyses. Calculate the nor mality using the average of a pair of dupli cate analyses where the titrations agre within 1 percent or 0.2 ml, whichever larger.

6. *Calculations*

Carry out calculations, retaining at leas one extra decimal figure beyond that of th acquired data. Round off figures after fina calculation.

6.1 Nomenclature.

C_{SO_2} = Concentration of sulfur dioxide, dr basis corrected to standard condition mg/dscm (lb/dscf).
N = Normality of barium perchlorate titran milliequivalents/ml.
P_{bar} = Barometric pressure at the exit orific of the dry gas meter, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mn Hg (29.92 in. Hg).
T_m = Average dry gas meter absolute temper ature, °K (°R).
T_{std} = Standard absolute temperature, 293° I (528° R).
V_a = Volume of sample aliquot titrated, ml.
V_m = Dry gas volume as measured by the dr gas meter, dcm (dcf).
$V_{m(std)}$ = Dry gas volume measured by the dr gas meter, corrected to standard cond tions, dscm (dscf).
V_{soln} = Total volume of solution in which th sulfur dioxide sample is contained, 10 ml.
V_t = Volume of barium perchlorate titran used for the sample, ml (average or rep licate titrations).
V_{tb} = Volume of barium perchlorate titran used for the blank, ml.
Y = Dry gas meter calibration factor.
32.03 = Equivalent weight of sulfur dioxide.

6.2 Dry sample gas volume, corrected to standard conditions.

$$V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left(\frac{P_{bar}}{P_{std}}\right) = K_1 Y \frac{V_m P_{ba}}{T_m}$$

Equation 6-

where:
K_1 = 0.3858° K/mm Hg for metric units.
= 17.64° R/in. Hg for English units.

6.3 Sulfur dioxide concentration.

$$C_{SO_2} = K_2 \frac{(V_t - V_{tb})\, N \left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 6-2

where:
K_2 = 32.03 mg/meq. for metric units.
= 7.061×10^{-5} lb/meq. for English units.

6.4 Relative Error (RE) for QA Audit Samples, Percent.

$$RE = \frac{C_d - C_a}{C_a \times 100} \qquad \text{Eq. 6-3}$$

Where:

C_d = Determined audit sample concentration, mg/dscm.

C_a = Actual audit sample concentration, mg/dscm.

7. *Alternative Procedures*

7.1 Dry Gas Meter as a Calibration Standard. A dry gas meter may be used as a calibration standard for volume measurements in place of the wet test meter specified in Section 5.1, provided that it is calibrated initially and recalibrated periodically according to the same procedures outlined in Method 5, Section 7.1, with the following exception: (1) the dry gas meter is calibrated against a wet test meter having a capacity of 1 liter/rev or 3 liters/rev and having the capability of measuring volume to within ±1 percent; (2) the dry gas meter is calibrated at 1 liter/min (2 cfh); and (3) the meter box of the Method 6 sampling train is calibrated at the same flow rate.

7.2 Critical Orifices for Volume and Rate Measurements. A critical orifice may be used in place of the dry gas meter specified in Section 2.1.10, provided that it is selected, calibrated, and used as follows:

7.2.1 Preparation of Collection Train. Prepare the sampling train as shown in Figure 6–2. The rotameter and surge tank are optional but are recommended in order to detect changes in the flow rate.

Note.—The critical orifices can be adapted to a Method 6 type sampling train as follows: Insert sleeve type, serum bottle stoppers into two reducing unions. Insert the needle into the stoppers as shown in Figure 6–3.

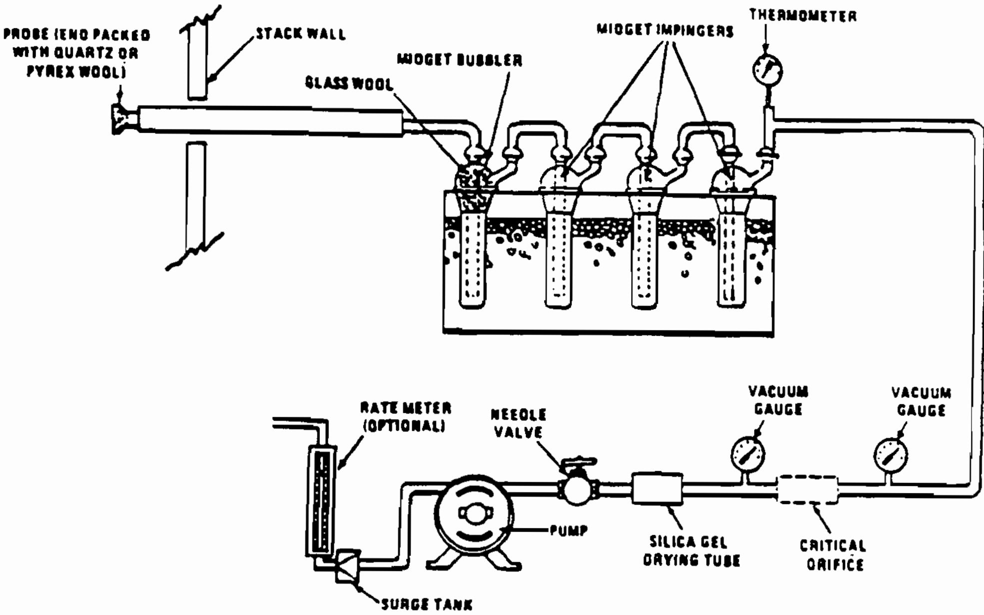

Figure 6-2. SO_2 sampling train using a critical orifice.

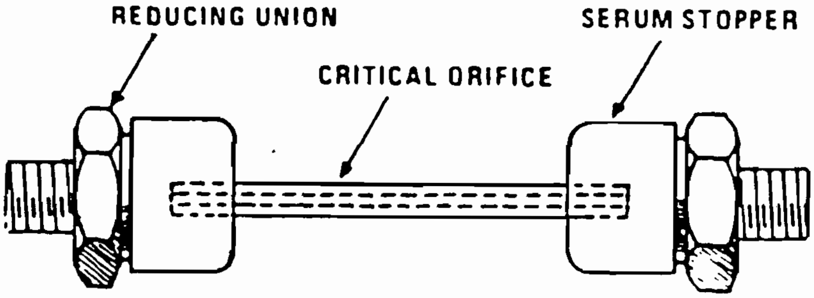

Figure 6-3. Critical orifice adaptation for Method 6 sampling train.

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7.2.2 Selection of Critical Orifices. The procedure that follows describes the use of hypodermic needles and stainless steel needle tubings, which have been found suitable for use as critical orifices. Other materials and critical orifice designs may be used provided the orifices act as true critical orifices, i.e., a critical vacuum can be obtained, as described in this section. Select a critical orifice that is sized to operate at the desired flow rate. The needle sizes and tubing lengths shown below give the following approximate flow rates.

Guage/cm	Flow rate, cc/min	Gauge/cm	Flow rate, cc/min
21/7.6	1100	23/3.8	500
22/2.9	1000	23/5.1	450
22/3.8	900	24/3.2	400

Determine the suitability and the appropriate operating vaccum of the critical orifice as follows: If applicable, temporarily attach a rotameter and surge tank to the outlet of the sampling train. Turn on the pump, and adjust the valve to give a outlet vacuum reading corresponding to about half of the atmospheric pressure. Observe the rotameter reading. Slowly increase the vacuum until a stable reading is obtained on the rotameter. Record the critical vacuum, which is the outlet vacuum when the rotameter first reaches a stable value. Orifices that do not reach a critical value shall not be used.

7.2.3 Field Procedure.

7.2.3.1 Leak-Check Procedure. A leak-check before the sampling run is recommended, but is optional. The leak-check procedure is as follows:

Temporarily attach a suitable (e.g., 0–40 cc/min) rotameter and surge tank, or a soap bubble meter and surge tank to the outlet of the pump. Plug the probe inlet, pull an outlet vacuum of at least 254 mm Hg (10 in. Hg), and note the flow rate as indicated by the rotameter or bubble meter. A leakage rate not in excess of 2 percent of the average sampling rate ($\overline{Q}_{std}$) is acceptable. Carefully release the probe inlet plug before turning off the pump.

7.2.3.2 Moisture Determination. At the sampling location, prior to testing, determine the percent moisture of the ambient air using the wet and dry bulb temperatures or, if appropriate, a relative-humidity meter.

7.2.3.3 Critical Orifice Calibration. Prior to testing, at the sampling location, calibrate the entire sampling train using a 500-cc soap bubble meter which is attached to the inlet of the probe and an outlet vacuum of 25 to 50 mm Hg (1 to 2 in. Hg) above the critical vacuum. Record the information listed in Figure 6-4.

Calculate the standard volume of air measured by the soap bubble meter and the volumetric flow rate, using the equations below:

$$V_{sb(std)} = V_{sb}\left(\frac{T_{std}}{T_{amb}}\right)\left(\frac{P_{bar}}{P_{std}}\right) \qquad \text{Eq. 6-4}$$

$$Q_{std} = \frac{V_{sb(std)}}{\theta} \qquad \text{Eq. 6-5}$$

where:

P_{bar} = Barometric pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{std} = Volumetric flow rate through critical orifice, scm/min (scf/min).

T_{amb} = Ambient absolute temperature of air, °K (°R).

T_{std} = Standard absolute temperature, 273°K (528°R).

V_{sb} = Volume of gas as measured by the soap bubble meter, m^3 (ft^3).

$V_{sb(std)}$ = Volume of gas as measured by the soap bubble meter, corrected to standard conditions, scm (scf).

θ = Time, min.

Date ______________________ Train ID ______________________

Critical orifice size ______________ Critical vacuum ____________

		Pretest	Post-test
Soap bubble meter volume, V_{sb}	cc		
	m^3 (ft^3)		
Time, θ	sec		
	min		
Barometric pressure, P_{bar}	mm Hg (in. Hg)		
Ambient temperature, t_{amb}	°C (°F)		
Inlet vacuum, P_c	mm Hg (in. Hg)		
Outlet vacuum	mm Hg (in. Hg)		
$V_{sb(std)}$	m^3 (ft^3)		
Flow rate, Q_{std}	$\frac{m^3}{min}$ $\left(\frac{ft^3}{min}\right)$		

Figure 6-4. Critical orifice calibration data.

7.2.3.4 *Sampling.* Operate the sampling train for sample collection at the same vacuum used during the calibration run. Start the watch and pump simultaneously. Take readings (temperature, rate meter, inlet vacuum, and outlet vacuum) at least every 5 minutes. At the end of the sampling run, stop the watch and pump simultaneously.

Conduct a post-test calibration run using the calibration procedure outlined in Section 7.2.3.3. If the Q_{std} obtained before and after the test differ by more than 5 pecent, void the test run; if not, calculate the volume of the gas measured with the critical orifice, $V_{m(std)}$, using Equation 6–8 and the average of Q_{std} of both runs, as follows:

$$V_{m(std)} = \overline{Q}_{std}\ \theta_s\ (1-B_{wa}) \left(\frac{P_{bar} + P_{sr}}{P_{bar} + P_c}\right) \qquad \text{Eq. 6-6}$$

where:

$V_{m(std)}$ = Dry gas volume measured with the critical orifice, corrected to standard conditions, dscm (dscf).

$\overline{Q}_{std}$ = Average flow rate of pretest and post-test calibration runs, scm/min (scf/min).

B_{wa} = Water vapor in ambient air, proportion by volume.

θ_s = Sampling time, min.

P_c = Inlet vacuum reading obtained during the calibration run, mm Hg (in. Hg).

P_{sr} = Inlet vacuum reading obtained during the sampling run, mm Hg (in. Hg).

If the percent difference between the molecular weight of the ambient air at staturated conditions and the sample gas is more than ±3 percent, then the molecular weight of the gas sample must be considered in the calculations using the following equation:

$$V_{m(std)} = \bar{\dot{Q}}_{std}\ \theta_s\ (1-B_{wa}) \sqrt{\frac{M_a}{M_s}} \left(\frac{P_{bar} + P_{sr}}{P_{bar} + P_c}\right) \qquad \text{Eq. 6-7}$$

where:

M_a = Molecular weight of the ambient air saturated at impinger temperature. g/g-mole (lb/lb-mole).

M_s = Molecular weight of the sample gas saturated at impinger temperature. g/g-mole (lb/lb-mole).

Note.—A post-test leak-check is not necessary because the post-test calibration run results will indicate whether there is any leakage.

Drain the ice bath. and purge the sampling train using the procedure described in Section 4.1.3.

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Method 6C—Determination of Sulfur Dioxide Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. *Applicability and Principle.*

1.1 *Applicability.* This method is applicable to the determination of sulfur dioxide (SO_2) concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations.

1.2 Principle. A gas sample is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental analyzer for determination of SO_2 gas concentration using an ultraviolet (UV), nondispersive infrared (NDIR), or fluorescence analyzer. Performance specifications and test procedures are provided to ensure reliable data.

2. *Range and Sensitivity.*

2.1 Analytical Range. The analytical range is determined by the instrumental design. For this method, a portion of the analytical range is selected by choosing the span of the monitoring system. The span of the monitoring system shall be selected such that the pollutant gas concentration equivalent to the emission standard is not less than 30 percent of the span. If at any time during a run the measured gas concentration exceeds the span, the run shall be considered invalid.

2.2 Sensitivity. The minimum detectable limit depends on the analytical range, span, and signal-to-noise ratio of the measurement system. For a well designed system, the minimum detectable limit should be less than 2 percent of the span.

3. *Definitions.*

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

3.1.1 Sample Interface. That portion of a system used for one or more of the following: sample acquisition, sample transport, sample conditioning, or protection of the analyzers from the effects of the stack effluent.

3.1.2 Gas Analyzer. That portion of the system that senses the gas to be measured and generates an output proportional to its concentration.

3.1.3 Data Recorder. A strip chart recorder, analog computer, or digital recorder for recording measurement data from the analyzer output.

3.2 Span. The upper limit of the gas concentration measurement range displayed on the data recorder.

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

3.4 Analyzer Calibration Error. The difference between the gas concentration exhibited by the gas analyzer and the known concentration of the calibration gas when the calibration gas is introduced directly to the analyzer.

3.5 Sampling System Bias. The difference between the gas concentrations exhibited by the measurement system when a known concentration gas is introduced at the outlet of the sampling probe and when the same gas is introduced directly to the analyzer.

3.6 Zero Drift. The difference in the measurement system output reading from the initial calibration response at the zero concentration level after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

3.7 Calibration Drift. The difference in the measurement system output reading from the initial calibration response at a mid-range calibration value after a stated period of operation during which no unscheduled maintenance, repair, or adjustment took place.

3.8 Response Time. The amount of time required for the measurement system to display 95 percent of a step change in gas concentration on the data recorder.

3.9 Interference Check. A method for detecting analytical interferences and excessive biases through direct comparison of gas concentrations provided by the measurement system and by a modified Method 6 procedure. For this check, the modified Method 6 samples are acquired at the sample by-pass discharge vent.

3.10 Calibration Curve. A graph or other systematic method of establishing the relationship between the analyzer response and the actual gas concentration introduced to the analyzer.

4. *Measurement System Performance Specifications.*

4.1 Analyzer Calibration Error. Less than ±2 percent of the span for the zero, mid-range, and high-range calibration gases.

4.2 Sampling System Bias. Less than ±5 percent of the span for the zero, and mid- or high-range calibration gases.

4.3 Zero Drift. Less than ±3 percent of the span over the period of each run.

4.4 Calibration Drift. Less than ±3 percent of the span over the period of each run.

4.5 Interference Check. Less than ±7 percent of the modified Method 6 result for each run.

5. *Apparatus and Reagents.*

5.1 Measurement System. Any measurement system for SO_2 that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1. The essential components of the measurement system are described below:

5.1.1 Sample Probe. Glass, stainless steel, or equivalent, of sufficient length to traverse the sample points. The sampling probe shall be heated to prevent condensation.

5.1.2 Sample Line. Heated (sufficient to prevent condensation) stainless steel or Teflon tubing, to transport the sample gas to the moisture removal system.

5.1.3 Sample Transport Lines. Stainless steel or Teflon tubing, to transport the sample from the moisture removal system to the sample pump, sample flow rate control, and sample gas manifold.

5.1.4 Calibration Valve Assembly. A three-way valve assembly, or equivalent, for blocking the sample gas flow and introducing calibration gases to the measurement system at the outlet of the sampling probe when in the calibration mode.

5.1.5 Moisture Removal System. A refrigerator-type condenser or similar device (e.g., permeation dryer), to remove condensate continuously from the sample gas while maintaining minimal contact between the condensate and the sample gas. The moisture removal system is not necessary for analyzers that can measure gas concentrations on a wet basis; for these analyzers, (1) heat the sample line and all interface components up to the inlet of the analyzer sufficiently to prevent condensation, and (2) determine the moisture content and correct the measured gas concentrations to a dry basis using appropriate methods, subject to the approval of the Administrator. The determination of sample moisture content is not necessary for pollutant analyzers that measure concentrations on a wet basis when (1) a wet basis CO_2 analyzer operated according to Method 3A is used to obtain simultaneous measurements, and (2) the pollutant/CO_2 measurements are used to determine emissions in units of the standard.

5.1.6 Particulate Filter. An in-stack or heated (sufficient to prevent water condensation) out-of-stack filter. The filter glass fiber mat. Additional filters at the inlet or outlet of the moisture removal system and inlet of the analyzer may be used to prevent accumulation of particulate material in the measurement system and extend the useful life of the components. All filters shall be fabricated of materials that are nonreactive to the gas being sampled.

5.1.7 Sample Pump. A leak-free pump, to pull the sample gas through the system at a flow rate sufficient to minimize the response time of the measurement system. The pump may be constructed of any material that is nonreactive to the gas being sampled.

5.1.8 Sample Flow Rate Control. A sample flow rate control valve and rotameter, or equivalent, to maintain a constant sampling rate within 10 percent.

(Note.—The tester may elect to install a back-pressure regulator to maintain the sample gas manifold at a constant pressure in order to protect the analyzer(s) from overpressurization, and to minimize the need for flow rate adjustments.)

5.1.9 Sample Gas Manifold. A sample gas manifold, to divert a portion of the sample gas stream to the analyzer, and the remainder to the by-pass discharge vent. The sample gas manifold should also include provisions for introducing calibration gases directly to the analyzer. The manifold may be constructed of any material that is nonreactive to the gas being sampled.

5.1.10 Gas Analyzer. A UV or NDIR absorption or fluorescence analyzer, to determine continuously the SO_2 concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.

(Note.—Housing the analyzer(s) in a clean, thermally-stable, vibration-free environment will minimize drift in the analyzer calibration.)

5.1.11 Data Recorder. A strip chart recorder, analog computer, or digital recorder, for recording measurement data. The data recorder resolution (i.e., readability) shall be 0.5 percent of span. Alternatively, a digital or analog meter having a resolution of 0.5 percent of span may be used to obtain the analyzer responses and the readings may be recorded manually. If this alternative is used, the readings shall be obtained at equally spaced intervals over the duration of the sampling run. For sampling run durations of less than 1 hour, measurements at 1-minute intervals or a minimum of 30 measurements, whichever is less restrictive, shall be obtained. For sampling run durations greater than 1 hour, measurements at 2-minute intervals or a minimum of 96 measurements, whichever is less restrictive, shall be obtained.

5.2 Method 6 Apparatus and Reagents. The apparatus and reagents described in Method 6, and shown by the schematic of the sampling train in Figure 6C–2, to conduct the interference check.

5.3 SO_2 Calibration Gases. The calibration gases for the gas analyzer shall be SO_2 in N_2 or SO_2 in air. Alternatively, SO_2/CO_2, SO_2/O_2, or $SO_2/CO_2/O_2$ gas mixtures in N_2 may be used. For fluorescence-based analyzers, the O_2 and CO_2 concentrations of the calibration gases as introduced to the analyzer shall be within 1 percent (absolute) O_2 and 1 percent (absolute) CO_2 of the O_2 and CO_2 concentrations of the effluent samples as introduced to the analyzer. Alternatively, for fluorescence-based analyzers, use calibration blends of SO_2 in air and the nomographs provided by the vendor to determine the quenching correction factor (the effluent O_2 and CO_2 concentrations must be known). Use three calibration gases as specified below:

5.3.1 High-Range Gas. Concentration equivalent to 80 to 90 percent of the span.

5.3.2 Mid-Range Gas. Concentration equivalent to 50 to 60 percent of the span.

5.3.3 Zero Gas. Concentration of less than 0.25 percent of the span. Purified ambient air may be used for the zero gas by passing air through a charcoal filter, or through one or more impingers containing a solution of 3 percent H_2O_2.

6. *Measurement System Performance Test Procedures.*

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. There are two alternatives for establishing the concentrations of calibration gases. Alternative Number 1 is preferred.

6.1.1 Alternative Number 1—Use of calibration gases that are analyzed following the Environmental Protection Agency Traceability Protocol Number 1 (see Citation 1 in the Bibliography). Obtain a certification from the gas manufacturer that Protocol Number 1 was followed.

6.1.2 Alternative Number 2—Use of calibration gases not prepared according to Protocol Number 1. If this alternative is chosen, obtain gas mixtures with a manufacturer's tolerance not to exceed ±2 percent of the tag value. Within 6 months before the emission test, analyze each of the calibration gases in triplicate using Method 6. Citation 2 in the Bibliography describes procedures and techniques that may be used for this analysis. Record the results on a data sheet (example is shown in Figure 6C–3). Each of the individual SO_2 analytical results for each calibration gas shall be within 5 percent (or 5 ppm, whichever is greater) of the triplicate set average; otherwise, discard the entire set, and repeat the triplicate analyses. If the average of the triplicate analyses is within 5 percent of the calibration gas manufacturer's cylinder tag value, use the tag value; otherwise, conduct at least three additional analyses until the results of six consecutive runs agree with 5 percent (or 5 ppm, whichever is greater) of their average. Then use this average for the cylinder value.

6.2 Measurement System Preparation. Assemble the measurement system by following the manufacturer's written instructions for preparing and preconditioning the gas analyzer and, as applicable, the other system components. Introduce the calibration gases in any sequence, and make all necessary adjustments to calibrate the analyzer and the data recorder. Adjust system components to achieve correct sampling rates.

6.3 Analyzer Calibration Error. Conduct the analyzer calibration error check by introducing calibration gases to the measurement system at any point upstream of the gas analyzer as follows:

6.3.1 After the measurement system has been prepared for use, introduce the zero, mid-range, and high-range gases to the analyzer. During this check, make no adjustments to the system except those necessary to achieve the correct calibration gas flow rate at the analyzer. Record the analyzer responses to each calibration gas on a form similar to Figure 6C–4.

Note.—A calibration curve established prior to the analyzer calibration error check may be used to [illegible]vert the analyzer response to the equivalent gas concentration introduced to the analyzer. However, the same correction procedure shall be used for all effluent and calibration measurements obtained during the test.

6.3.2 The analyzer calibration error check shall be considered invalid if the gas concentration displayed by the analyzer exceeds ±2 percent of the span for any of the calibration gases. If an invalid calibration is exhibited, take corrective action, and repeat the analyzer calibration error check until acceptable performance is achieved.

6.4 Sampling System Bias Check. Perform the sampling system bias check by introducing calibration gases at the calibration valve installed at the outlet of the sampling probe. A zero gas and either the mid-range or high-range gas, whichever most closely approximates the effluent concentrations, shall be used for this check as follows:

6.4.1 Introduce the upscale calibration gas, and record the gas concentration displayed by the analyzer on a form similar to Figure 6C–5. Then introduce zero gas, and record the gas concentration displayed by the analyzer. During the sampling system bias check, operate the system at the normal sampling rate, and make no adjustments to the measurement system other than those necessary to achieve proper calibration gas flow rates at the analyzer. Alternately introduce the zero and upscale gases until a stable response is achieved. The tester shall determine the measurement system response time by observing the times required to achieve a stable response for both the zero and upscale gases. Note the longer of the two times as the response time.

6.4.2 The sampling system bias check shall be considered invalid if the difference between the gas concentrations displayed [illegible] the measurement system for the analyze[illegible] calibration error check and for the sampl[illegible] system bias check exceeds ±5 percent of the span for either the zero or upscale calibration gas. If an invalid calibration is exhibited, take corrective action, and repeat the sampling system bias check until acceptable performance is achieved. If adjustment to the analyzer is required, first repeat the analyzer calibration error check, then repeat the sampling system bias check.

7. *Emission Test Procedure.*

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to Method 6.

7.2 Interference Check Preparation. For each individual analyzer, conduct an interference check for at least three runs during the initial field test on a particular source category. Retain the results, and report them with each test performed on that source category.

If an interference check is being performed, assemble the modified Method 6 train (flow control valve, two midget impingers containing 3 percent H_2O_2, and dry gas meter) as shown in Figure 6C–2. Install the sampling train to obtain a sample at the measurement system sample by-pass discharge vent. Record the initial dry gas meter reading.

7.3 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate as used during the sampling system bias chec[illegible]. Maintain constant rate sampling (i.e., ±[illegible] percent) during the entire run. The samp[illegible] time per run shall be the same as for Method 6 plus twice the system response time. For each run, use only those measurements obtained after twice response time of the measurement system has elapsed, to determine the average effluent concentration. If an interference check is being performed, open the flow control valve on the modified Method 6 train concurrent with the initiation of the sampling period, and adjust the flow to 1 liter per minute (±10 percent).

(Note.—If a pump is not used in the modified Method 6 train, caution should be exercised in adjusting the flow rate since overpressurization of the impingers may cause leakage in the impinger train, resulting in positively biased results).

7.4 Zero and Calibration Drift Tests. Immediately preceding and following each run, or if adjustments are necessary for the measurement system during the run, repeat the sampling system bias check procedure described in Section 6.4 (Make no adjustments to the measurement system until after the drift checks are completed.) Record and analyzer's responses on a form similar to Figure 6C–5.

7.4.1 If either the zero or upscale calibration value exceeds the sampling system bias specification, then the run is considered invalid. Repeat both the analyzer calibration error check procedure (Section 6.3) and the sampling system bias check procedure (Section 6.4) before repeatin[illegible] run.

7.4.2 If both the zero and upscale calibration values are within the sampling system bias specification, then use the average of the initial and final bias check values to calculate the gas concentration for the run. If the zero or upscale calibration drift value exceeds the drift limits, based on the difference between the sampling system bias check responses immediately before and after the run, repeat both the analyzer calibration error check procedure (Section 6.3) and the sampling system bias check procedure (Section 6.4) before conducting additional runs.

7.5 Interference Check (if performed). After completing the run, record the final dry gas meter reading, meter temperature, and barometric pressure. Recover and analyze the contents of the midget impingers, and determine the SO_2 gas concentration using the procedures of Method 6. (It is not necessary to analyze EPA performance audit samples for Method 6.) Determine the average gas concentration exhibited by the analyzer for the run. If the gas concentrations provided by the analyzer and the modified Method 6 differ by more than 7 percent of the modified Method 6 result, the run is invalidated.

8. *Emission Calculation.*

The average gas effluent concentration is determined from the average gas concentration displayed by the gas analyzer, and is adjusted for the zero and upscale sampling system bias checks, as determined in accordance with Section 7.4. The average gas concentration displayed by the analyzer may be determined by integration of the area under the curve for chart recorders, or by averaging all of the effluent measurements. Alternatively, the average may be calculated from measurements recorded at equally spaced intervals over the entire duration of the run. For sampling run durations of less than 1 hour, measurements at 1-minute intervals or a minimum of 30 measurements, whichever is less restrictive, shall be used. For sampling run durations greater than 1 hour, measurements at 2-minute intervals or a minimum of 96 measurements, whichever is less restrictive, shall be used. Calculate the effluent gas concentration using Equation 6C-1.

$$C_{gas} = (\bar{C} - C_o)\,\frac{C_{Ma}}{C_m - C_o}$$

Eq. 6C-1

where:

C_{gas} = Effluent gas concentration, dry basis, ppm.

$\bar{C}$ = Average gas concentration indicated by gas analyzer, dry basis, ppm.

C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm.

C_m = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.

C_{ma} = Actual concentration of the upscale calibration gas, ppm.

9. *Bibliography.*

1. Traceability Protocol for Establishing True Concentrations of Gases Used for Calibrations and Audits of Continuous Source Emission Monitors: Protocol Number 1. U.S. Environmental Protection Agency. Quality Assurance Division. Research Triangle Park, NC. June 1978.

2. Westlin, Peter R. and J. W. Brown. Methods for Collecting and Analyzing Gas Cylinder Samples. Source Evaluation Society Newsletter. *3*(3):5–15. September 1978.

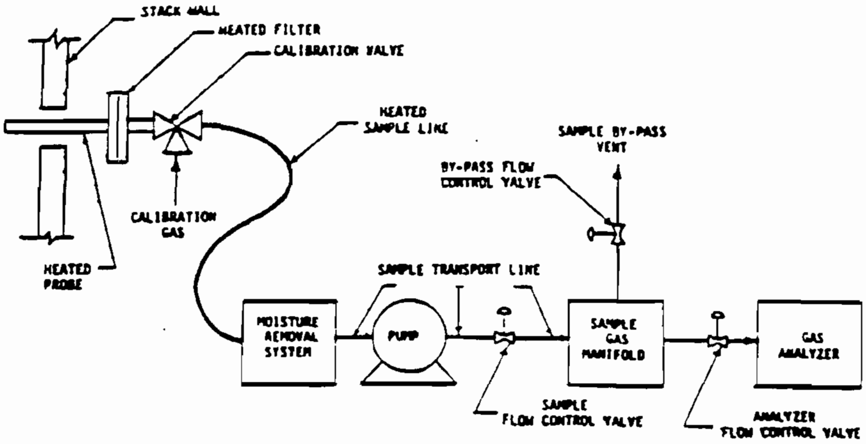

Figure 6C-1. Measurement System Schematic

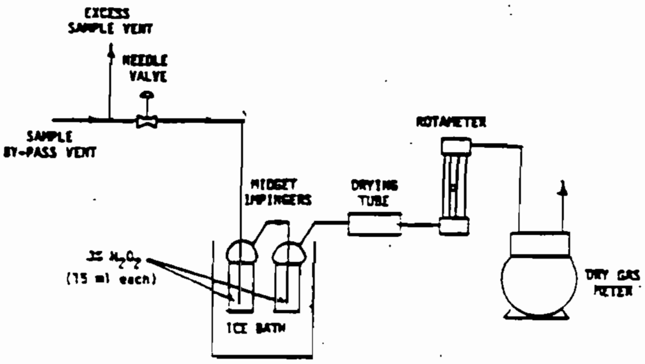

Figure 6C-2. Interference Check Sampling Train

Date ______
Analytic method used ______

FIGURE 6C-3.—ANALYSIS OF CALIBRATION GASES

	Gas concentration (indicate units)		
	Zero [a]	Mid-range [b]	High-range [c]
Sample run:			
1			
2			
3			
Average			
Maximum percent deviation			

[a] Average must be less than 0.25 percent of span.
[b] Average must be 50 to 60 percent of span.
[c] Average must be 80 to 90 percent of span.

Source identification: ______
Test personnel: ______

Date: ______
Analyzer calibration data for sampling runs: ______
Span: ______

FIGURE 6C-4.—ANALYZER CALIBRATION DATA

	Cylinder value	Analyzer calibration response (indicate units)	Absolute difference	Difference (percent of span)
Zero gas				
Mid-range gas				
High-range gas				

Source identification: ______
Test personnel: ______
Date: ______
Run number: ______
Span: ______

			Initial values		Final values (percent of span)	
		Analyzer calibration response	System calibration response	System cal. bias (percent of span)	System cal. bias	Drift
Zero gas						
Upscale gas						

$$\text{System Calibration Bias} = \frac{\text{System Cal. Response} - \text{Analyzer Cal. Response}}{\text{Span}} \times 100$$

$$\text{Drift} = \frac{\text{Final System Cal. Response} - \text{Initial System Cal. Response}}{\text{Span}} \times 100$$

Figure 6C-5. System calibration bias and drift data.

METHOD 7—DETERMINATION OF NITROGEN OXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A grab sample is collected in an evacuated flask containing a dilute sulfuric acid-hydrogen peroxide absorbing solution, and the nitrogen oxides, except nitrous oxide, are measured colorimetrically using the phenoldisulfonic acid (PDS) procedure.

1.2 Applicability. This method is applicable to the measurement of nitrogen oxides emitted from stationary sources. The range of the method has been determined to be 2 to 400 milligrams NO$_x$ (as NO$_2$) per dry standard cubic meter, without having to dilute the sample.

2. *Apparatus*

2.1 Sampling (see Figure 7-1). Other grab sampling systems or equipment, capable of measuring sample volume to within ±2.0 percent and collecting a sufficient sample volume to allow analytical reproducibility to within ±5 percent, will be considered acceptable alternatives, subject to approval of the Administrator, U.S. Environmental Protection Agency. The following equipment is used in sampling:

2.1.1 Probe. Borosilicate glass tubing, sufficiently heated to prevent water condensation and equipped with an in-stack or out-stack filter to remove particulate matter (a plug of glass wool is satisfactory for this purpose). Stainless steel or Teflon[1] tubing may also be used for the probe. Heating is not necessary if the probe remains dry during the purging period.

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

2.1.3 Flask Valve. T-bore stopcock connected to a 24/40 standard taper joint.

2.1.4 Temperature Gauge. Dial-type thermometer, or other temperature gauge, capable of measuring 1° C (2° F) intervals from −5 to 50° C (25 to 125° F).

2.1.5 Vacuum Line. Tubing capable of withstanding a vacuum of 75 mm Hg (3 in. Hg) absolute pressure, with "T" connection and T-bore stopcock.

2.1.6 Vacuum Gauge. U-tube manometer, 1 meter (36 in.), with 1-mm (0.1-in.) divisions, or other gauge capable of measuring pressure to within ±2.5 mm Hg (0.10 in. Hg).

2.1.7 Pump. Capable of evacuating the collection flask to a pressure equal to or less than 75 mm Hg (3 in. Hg) absolute.

2.1.8 Squeeze Bulb. One-way.

2.1.9 Volumetric Pipette. 25 ml.

2.1.10 Stopcock and Ground Joint Grease. A high-vacuum, high-temperature chlorofluorocarbon grease is required. Halocarbon 25-5S has been found to be effective.

2.1.11 Barometer. Mercury, aneroid, or other barometer capable of measuring atmospheric pressure to within 2.5 mm Hg (0.1 in. Hg). In many cases, the barometric reading may be obtained from a nearby national weather service station, in which case the station value (which is the absolute barometric pressure) shall be requested and an adjustment for elevation differences between the weather station and sampling point shall be applied at a rate of minus 2.5 mm Hg (0.1 in. Hg) per 30 m (100 ft) elevation increase, or vice versa for elevation decrease.

2.2 Sample Recovery. The following equipment is required for sample recovery:

2.2.1 Graduated Cylinder. 50 ml with 1-ml divisions.

2.2.2 Storage Containers. Leak-free polyethylene bottles.

2.2.3 Wash Bottle. Polyethylene or glass.

2.2.4 Glass Stirring Rod.

2.2.5 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

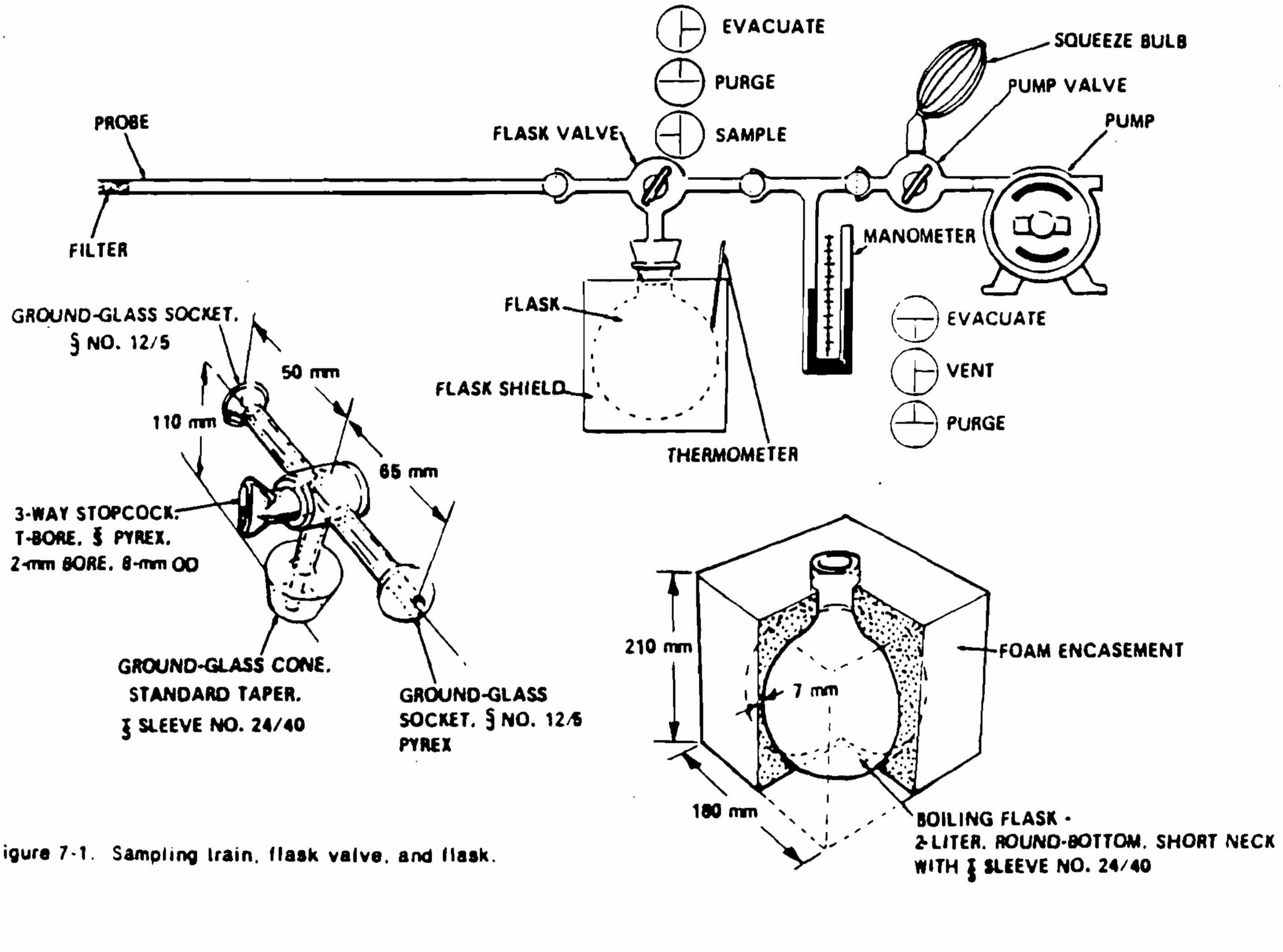

Figure 7-1. Sampling train, flask valve, and flask.

2.3 Analysis. For the analysis, the following equipment is needed:

2.3.1 Volumetric Pipettes. Two 1 ml, two 2 ml, one 3 ml, one 4 ml, two 10 ml, and one 25 ml for each sample and standard.

2.3.2 Porcelain Evaporating Dishes. 175- to 250-ml capacity with lip for pouring, one for each sample and each standard. The Coors No. 45006 (shallow-form, 195 ml) has been found to be satisfactory. Alternatively, polymethyl pentene beakers (Nalge No. 1203, 150 ml), or glass beakers (150 ml) may be used. When glass beakers are used, etching of the beakers may cause solid matter to be present in the analytical step; the solids should be removed by filtration (see Section 4.3).

2.3.3 Steam Bath. Low-temperature ovens or thermostatically controlled hot plates kept below 70° C (160° F) are acceptable alternatives.

2.3.4 Dropping Pipette or Dropper. Three required.

2.3.5 Polyethylene Policeman. One for each sample and each standard.

2.3.6 Graduated Cylinder. 100 ml with 1-ml divisions.

2.3.7 Volumetric Flasks. 50 ml (one for each sample and each standard), 100 ml (one for each sample and each standard, and one for the working standard KNO_3 solution), and 1000 ml (one).

2.3.8 Spectrophotometer. To measure absorbance at 410 nm.

2.3.9 Graduated Pipette. 10 ml with 0.1-ml divisions.

2.3.10 Test Paper for Indicating pH. To cover the pH range of 7 to 14.

2.3.11 Analytical Balance. To measure to within 0.1 mg.

3. *Reagents*

Unless otherwise indicated, it is intended that all reagents conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available; otherwise, use the best available grade.

3.1 Sampling. To prepare the absorbing solution, cautiously add 2.8 ml concentrated H_2SO_4 to 1 liter of deionized, distilled water. Mix well and add 6 ml of 3 percent hydrogen peroxide, freshly prepared from 30 percent hydrogen peroxide solution. The absorbing solution should be used within 1 week of its preparation. Do not expose to extreme heat or direct sunlight.

3.2 Sample Recovery. Two reagents are required for sample recovery:

3.2.1 Sodium Hydroxide (1*N*). Dissolve 40 g NaOH in deionized, distilled water and dilute to 1 liter.

3.2.2 Water. Deionized, distilled to conform to ASTM specification D1193-77, Type 3 (incorporated by reference—see § 60.17). At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.3 Analysis. For the analysis, the following reagents are required:

3.3.1 Fuming Sulfuric Acid. 15 to 18 percent by weight free sulfur trioxide. HANDLE WITH CAUTION.

3.3.2 Phenol. White solid.

3.3.3 Sulfuric Acid. Concentrated, 95 percent minimum assay. HANDLE WITH CAUTION.

3.3.4 Potassium Nitrate. Dried at 105 to 110° C (220 to 230° F) for a minimum of 2 hours just prior to preparation of standard solution.

3.3.5 Standard KNO_3 Solution. Dissolve exactly 2.198 g of dried potassium nitrate (KNO_3) in deionized, distilled water and dilute to 1 liter with deionized, distilled water in a 1,000-ml volumetric flask.

3.3.6 Working Standard KNO_3 Solution. Dilute 10 ml of the standard solution to 100 ml with deionized distilled water. One milliliter of the working standard solution is equivalent to 100 μg nitrogen dioxide (NO_2).

3.3.7 Water. Deionized, distilled as in Section 3.2.2.

3.3.8 Phenoldisulfonic Acid Solution. Dissolve 25 g of pure white phenol in 150 ml concentrated sulfuric acid on a steam bath. Cool, add 75 ml fuming sulfuric acid, and heat at 100° C (212° F) for 2 hours. Store in a dark, stoppered bottle.

3.3.9 Quality Assurance Audit Samples. Nitrate samples in glass vials prepared by EPA's Environmental Monitoring Systems Laboratory, Quality Assurance Division, Source Branch, Mail Drop 77A, Research Triangle Park, North Carolina 27711. Each set will consist of two vials having solutions of unknown concentrations. Only when making compliance determinations, obtain an audit sample set from the quality assurance management office at each EPA regional office or the responsible enforcement agency. (NOTE: The tester should notify the quality assurance office or the responsible enforecement agency at least 30 days prior to the test date to allow sufficient time for sample delivery.)

4. *Procedures*

4.1 Sampling.

4.1.1 Pipette 25 ml of absorbing solution into a sample flask, retaining a sufficient quantity for use in preparing the calibration standards. Insert the flask valve stopper into the flask with the valve in the "purge" position. Assemble the sampling train as shown in Figure 7-1 and place the probe at the sampling point. Make sure that all fittings are tight and leak-free, and that all ground glass joints have been properly greased with a high-vacuum, high-temperature chlorofluorocarbon-based stopcock grease. Turn the flask valve and the pump valve to their "evacuate" positions. Evacuate the flask to 75 mm Hg (3 in. Hg) absolute pressure, or less. Evacuation to a pressure approaching the vapor pressure of water at the existing temperature is desirable. Turn the pump valve to its "vent" position and turn the off the pump. Check for leakage by observing the manometer for any pressure fluctuation. (Any variation greater than 10 mm Hg (0.4 in. Hg) over a period of 1 minute is not acceptable, and the flask is not to be used until the leakage problem is corrected. Pressure in the flask is not to exceed 75 mm Hg (3 in. Hg) absolute at the time sampling is commenced.) Record the volume of the flask and valve (V_f), the flask temperature (T_i), and the barometric pressure. Turn the flask valve counterclockwise to its "purge" position and do the same with the pump valve. Purge the probe and the vacuum tube using the squeeze bulb. If condensation occurs in the probe and the flask valve area, heat the probe and purge until the condensation disappears. Next, turn the pump valve to its "vent" position. Turn the flask valve clockwise to its "evacuate" position and record the difference in the mercury levels in the manometer. The absolute internal pressure in the flask (P_i) is equal to the barometric pressure less the manometer reading. Immediately turn the flask valve to the "sample" position and permit the gas to enter the flask until pressures in the flask and sample line (i.e., duct, stack) are equal. This will usually require about 15 seconds; a longer period indicates a "plug" in the probe, which must be corrected before sampling is continued. After collecting the sample, turn the flask valve to its "purge" position and disconnect the flask from the sampling train. Shake the flask for at least 5 minutes.

4.1.2 If the gas being sampled contains insufficient oxygen for the conversion of NO to NO_2 (e.g., an applicable subpart of the standard may require taking a sample of a calibration gas mixture of NO in N_2), then oxygen shall be introduced into the flask to permit this conversion. Oxygen may be introduced into the flask by one of three methods; (1) Before evacuating the sampling flask, flush with pure cylinder oxygen, then evacuate flask to 75 mm Hg (3 in. Hg) absolute pressure or less; or (2) inject oxygen into the flask after sampling; or (3) terminate sampling with a minimum of 50 mm Hg (2 in. Hg) vacuum remaining in the flask, record this final pressure, and then vent the flask to the atmosphere until the flask pressure is almost equal to atmospheric pressure.

4.2 Sample Recovery. Let the flask set for a minimum of 16 hours and then shake the contents for 2 minutes. Connect the flask to a mercury filled U-tube manometer. Open the valve from the flask to the manometer and record the flask temperature (T_f), the barometric pressure, and the difference between the mercury levels in the manometer. The absolute internal pressure in the flask (P_f) is the barometric pressure less the manometer reading. Transfer the contents of the flask to a leak-free polyethylene bottle. Rinse the flask twice with 5-ml portions of deionized, distilled water and add the rinse water to the bottle. Adjust the pH to between 9 and 12 by adding sodium hydroxide (1 *N*), dropwise (about 25 to 35 drops). Check the pH by dipping a stirring rod into the solution and then touching the rod to the pH test paper. Remove as little material as possible during this step. Mark the height of the liquid level so that the container can be checked for leakage after transport. Label the container to clearly identify its contents. Seal the container for shipping.

4.3 Analysis. Note the level of the liquid in container and confirm whether or not any sample was lost during shipment; note this on the analytical data sheet. If a noticeable amount of leakage has occurred, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results. Immediately prior to analysis, transfer the contents of the shipping container to a 50-ml volumetric flask, and rinse the container twice with 5-ml portions of deionized, distilled water. Add the rinse water to the flask and dilute to the mark with deionized, distilled water; mix thoroughly. Pipette a 25-ml aliquot into the procelain evaporating dish. Return any unused portion of the sample to the polyethylene storage bottle. Evaporate the 25-ml aliquot to dryness on a steam bath and allow to cool. Add 2 ml phenoldisulfonic acid solution to the dried residue and triturate thoroughly with a polyethylene policeman. Make sure the solution contacts all the residue. Add 1 ml deionized, distilled water and four drops of concentrated sulfuric acid. Heat the solution on a steam bath for 3 minutes with occasional stirring. Allow the solution to cool, add 20 ml deionized, distilled water, mix well by stirring, and add concentrated ammonium hydroxide, dropwise, with constant stirring, until the pH is 10 (as determined by pH paper). If the sample contains solids, these must be removed by filtration (centrifugation is an acceptable alternative, subject to the approval of the Administrator), as follows: filter through Whatman No. 41 filter paper into a 100-ml volumetric flask; rinse the evaporating dish with three 5-ml portions of deionized, distilled water; filter these three rinses. Wash the filter with at least three 15-ml portions of deionized, distilled water. Add the filter washings to the contents of the volumetric flask and dilute to the mark with deionized, distilled water. If solids are absent, the solution can be transferred directly to the 100-ml volumetric flask and diluted to the mark with deionized, distilled water. Mix the contents of the flask thoroughly, and measure the absorbance at the optimum wavelength used for the standards (Section 5.2.1), using the blank solution as a zero reference. Dilute the sample and the blank with equal volumes of deionized, distilled water if the absorbance exceeds A_4, the absorbance of the 400 μg NO_2 standard (see Section 5.2.2).

4.4 Audit Sample Analysis. Concurrently analyze the two audit samples and a set of compliance samples (Section 4.3) in the same manner to evaluate the technique of the analyst and the standards preparation. (NOTE: It is recommended that known quality control samples be analyzed prior to the compliance and audit sample analysis to optimize the system accuracy and precision. One source of these samples is the Source Branch listed in Section 3.3.9.) The same analysts, analytical reagents, and analytical system shall be used both for the compliance samples and the EPA audit samples; if this condition is met, auditing of subsequent compliance analyses for the same enforcement agency within 30 days is not required. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies, unless prior arrangements are made with both enforcement agencies.

Calculate the concentrations in mg/dscm using the specified sample volume in the audit instructions. (NOTE: Indication of acceptable results may be obtained immediately by reporting the audit results in mg/dscm and compliance results in total μg NO_2/sample by telephone to the responsible enforcement agency.) Include the results of both audit samples, their identification numbers, and the analyst's name with the results of the compliance determination samples in appropriate reports to the EPA regional office or the appropriate enforcement agency. Include this information with subsequent compliance analyses for the same enforcement agency during the 30-day period.

The concentrations of the audit samples obtained by the analyst shall agree within 10 percent of the actual audit concentrations. If the 10-percent specification is not met, reanalyze the compliance samples and audit samples and include initial and reanalysis values in the test report (see NOTE in the first paragraph of this section).

Failure to meet the 10-percent specification may require retests until the audit problems are resolved. However, if the audit results do not affect the compliance or noncompliance status of the affected facility, the Administrator may waive the reanalysis requirement, further audits, or retests and accept the results of the compliance test. While steps are being taken to resolve audit analysis problems, the Administrator may also choose to use the data to determine the compliance or noncompliance status of the affected facility.

5. *Calibration*

5.1 *Flask Volume*. The volume of the collection flask-flask valve combination must be known prior to sampling. Assemble the flask and flask valve and fill with water, to the stopcock. Measure the volume of water to ±10 ml. Record this volume on the flask.

5.2 Spectrophotometer Calibration.

5.2.1 Optimum Wavelength Determination. Calibrate the wavelength scale of the spectrophotometer every 6 months. The calibration may be accomplished by using an energy source with an intense line emission such as a mercury lamp, or by using a series of glass filters spanning the measuring range of the spectrophotometer. Calibration materials are available commercially and from the National Bureau of Standards. Specific details on the use of such materials should be supplied by the vendor; general information about calibration techniques can be obtained from general reference books on analytical chemistry. The wavelength scale of the spectrophotometer must read correctly within ± 5 nm at all calibration points; otherwise, the specrophotometer shall be repaired and recalibrated. Once the wavelength scale of the spectrophotometer is in proper calibration, use 410 nm as the optimum wavelength for the measurement of the absorbance of the standards and samples.

Alternatively, a scanning procedure may be employed to determine the proper measuring wavelength. If the instrument is a double-beam spectrophotometer, scan the spectrum between 400 and 415 nm using a 200 μg NO_2 standard solution in the sample cell and a blank solution in the reference cell. If a peak does not occur, the spectrophotometer is probably malfunctioning and should be repaired. When a peak is obtained within the 400 to 415 nm range, the wavelength at which this peak occurs shall be the optimum wavelength for the measurement of absorbance of both the standards and the samples. For a single-beam spectrophotometer, follow the scanning procedure described above, except that the blank and standard solutions shall be scanned separately. The optimum wavelength shall be the wavelength at which the maximum difference in absorbance between the standard and the blank occurs.

5.2.2 Determination of Spectrophotometer Calibration Factor K_c. Add 0.0 ml, 2 ml, 4 ml, 6 ml, and 8 ml of the KNO_3 working standard solution (1 ml = 100 μg NO_2) to a series of five 50-ml volumetric flasks. To each flask, add 25 ml of absorbing solution, 10 ml deionized, distilled water, and sodium hydroxide (1 N) dropwise until the pH is between 9 and 12 (about 25 to 35 drops each). Dilute to the mark with deionized, distilled water. Mix thoroughly and pipette a 25-ml aliquot of each solution into a separate porcelain evaporating dish. Beginning with the evaporation step, follow the analysis procedure of Section 4.3 until the solution has been transferred to the 100 ml volumetric flask and diluted to the mark. Measure the absorbance of each solution, at the optimum wavelength, as determined in Section 5.2.1. This calibration procedure must be repeated on each day that samples are analyzed. Calculate the spectrophotometer calibration factor as follows:

$$K_c = 100 \frac{A_1 + 2A_2 + 3A_3 + 4A_4}{A_1^2 + A_2^2 + A_3^2 + A_4^2}$$

Equation 16-1
where:

K_c = Calibration factor, μg
A_1 = Absorbance of the 100-μg NO_2 standard
A_2 = Absorbance of the 200-μg NO_2 standard
A_3 = Absorbance of the 300-μg NO_2 standard
A_4 = Absorbance of the 400-μg NO_2 standard

5.2.3 Spectrophotometer Calibration Quality Control. Multiply the absorbance value obtained for each standard by the K_c factor (least squares slope) to determine the distance each calibration point lies from the theoretical calibration line. These calculated concentration values should not differ from the actual concentrations (i.e., 100, 200, 300, and 400 μg NO_2) by more than 7 percent for three of the four standards.

5.3 Barometer. Calibrate against a mercury barometer.

5.4 Temperature Gauge. Calibrate dial thermometers against mercury-in-glass thermometers.

5.5 Vacuum Gauge. Calibrate mechanical gauges, if used, against a mercury manometer such as that specified in 2.1.6.

5.6 Analytical Balance. Calibrate against standard weights.

6. *Calculations*

Carry out the calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculations.

6.1 Nomenclature.

A = Absorbance of sample.
C = Concentration of NO_x as NO_2, dry basis, corrected to standard conditions, mg/dscm (lb/dscf).
F = Dilution factor (i.e., 25/5, 25/10, etc., required only if sample dilution was needed to reduce the absorbance into the range of calibration).
K_c = Spectrophotometer calibration factor.
m = Mass of NO_x as NO_2 in gas sample, μg.
P_f = Final absolute pressure of flask, mm Hg (in. Hg).
P_i = Initial absolute pressure of flask, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
T_f = Final absolute temperature of flask, °K (°R).
T_i = Initial absolute temperature of flask, °K (°R).
T_{std} = Standard absolute temperature 293° K (528° R)
V_{sc} = Sample volume at standard conditions (dry basis), ml.

V_f = Volume of flask and valve, ml.

V_a = Volume of absorbing soluton, 25 ml.

2 = 50/25, the aliquot factor. (If other than a 25-ml aliquot was used for analysis, the corresponding factor must be substituted).

6.2 Sample volume, dry basis, corrected to standard conditions.

$$V_{sc} = \frac{T_{std}}{P_{std}} (V_f - V_a) \left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

$$= K_1 (V_f - 25 \text{ ml}) \left[\frac{P_f}{T_f} - \frac{P_i}{T_i}\right]$$

Equation 7-2

$$K_1 = 0.3858 \ \frac{°K}{\text{mm Hg}} \text{ for metric units}$$

$$= 17.64 \ \frac{°R}{\text{in. Hg}} \text{ for English units}$$

6.3 Total μg NO_2 Per Sample.

$$m = 2 K_c A F$$

Equation 7-3

NOTE: If other than a 25-ml aliquot is used for analysis, the factor 2 must be replaced by a corresponding factor.

6.4 Sample concentration, dry basis, corrected to standard conditions.

$$C = K_2 \frac{m}{V_{sc}}$$

Equation 7-4

6.5 Relative Error (RE) for QA Audit Samples, Percent.

$$RE = \frac{C_d - C_a}{C_a \times 100} \quad \text{Eq. } 7\text{–}5$$

Where:

C_d = Determined audit sample concentration, mg/dscm.

C_a = Actual audit sample concentration, mg/dscm.

$K_2 = 10^3$ (mg/scm)/(μg/ml) for metric units.
$= 6.242 \times 10^{-5}$ (lb/scf)/(μg/ml) for English units.

To convert from mg/dscm to g/dscm, divide C by 1.000.

7. *Bibliography*

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Method 7E—Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)

1. *Applicability and Principle*

1.1 Applicability. This method is applicable to the determination of nitrogen oxides (NO_x) concentrations in emissions from stationary sources only when specified within the regulations.

1.2 Principle. A gas simple is continuously extracted from a stack, and a portion of the sample is conveyed to an instrumental chemiluminescent analyzer for determination of NO_x concentration. Performance specifications and test procedures are provided to ensure reliable data.

2. *Range and Sensitivity*

Same as Method 6C, Sections 2.1 and 2.2.

3. *Definitions*

3.1 Measurement System. The total equipment required for the determination of NO_x concentration. The measurement system consists of the following major subsystems:

3.1.1 Sample Interface, Gas Analyzer, and Data Recorder. Same as Method 6C, Sections 3.1.1, 3.1.2, and 3.1.3.

3.1.2 NO_2 to NO Converter. A device that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO).

3.2 Span, Calibration Gas, Analyzer Calibration Error, Sampling System Bias, Zero Drift, Calibration Drift, and Response Time. Same as Method 6C, Sections 3.2 through 3.8.

3.3 Interference Response. The output response of the measurement system to a component in the sample gas, other than the gas component being measured.

4. *Measurement System Performance Specifications*

Same as Method 6C, Sections 4.1 through 4.4.

5. *Apparatus and Reagents*

5.1 Measurement System. Any measurement system for NO_x that meets the specifications of this method. A schematic of an acceptable measurement system is shown in Figure 6C-1 of Method 6C. The essential components of the measurement system are described below:

5.1.1 Sample Probe, Sample Line, Calibration Valve Assembly, Moisture Removal System, Particulate Filter, Sample Pump, Sample Flow Rate Control, Sample Gas Manifold, and Data Recorder. Same as Method 6C, Sections 5.1.1 through 5.1.9, and 5.1.11.

5.1.2 NO_2 to NO Converter. That portion of the system that converts the nitrogen dioxide (NO_2) in the sample gas to nitrogen oxide (NO). An NO_2 to NO converter is not necessary if data are presented to demonstrate that the NO_2 portion of the exhaust gas is less than 5 percent of the total NO_x concentration.

5.1.3 NO_x Analyzer. An analyzer based on the principles of chemiluminescence, to determine continuously the NO_x concentration in the sample gas stream. The analyzer shall meet the applicable performance specifications of Section 4. A means of controlling the analyzer flow rate and a device for determining proper sample flow rate (e.g., precision rotameter, pressure gauge downstream of all flow controls, etc.) shall be provided at the analyzer.

5.2 NO_x Calibration Gases. The calibration gases for the NO_x analyzer shall be NO in N_2. Three calibration gases, as specified in Sections 5.3.1 through 5.3.3, of Method 6C, shall be used. Ambient air may be used for the zero gas.

6. *Measurement System Performance Test Procedures*

Perform the following procedures before measurement of emissions (Section 7).

6.1 Calibration Gas Concentration Verification. Follow Section 6.1 of Method 6C, except if calibration gas analysis is required, use Method 7, and change all 5 percent performance values to 10 percent (or 10 ppm, whichever is greater).

6.2 Interference Response. Conduct an interference response test of the analyzer prior to its initial use in the field. Thereafter, recheck the measurement system if changes are made in the instrumentation that could alter the interference response (e.g., changes in the gas detector). Conduct the interference response in accordance with Section 5.4 of Method 20.

6.3 Measurement System Preparation, Analyzer Calibration Error, and Sample System Bias Check. Follow Sections 6.2 through 6.4 of Method 6C.

6.4 NO_2 to NO Conversion Efficiency. Unless data are presented to demonstrate that the NO_2 concentration within the sample stream is not greater than 5 percent of the NO_x concentration, conduct an NO_2 to NO conversion efficiency test in accordance with Section 5.6 of Method 20.

7. *Emission Test Procedure*

7.1 Selection of Sampling Site and Sampling Points. Select a measurement site and sampling points using the same criteria that are applicable to tests performed using Method 7.

7.2 Sample Collection. Position the sampling probe at the first measurement point, and begin sampling at the same rate used during the system calibration drift test Maintain constant rate sampling (i.e., ±10 percent) during the entire run. The sampling time per run shall be the same as the total time required to perform a run using Metho 7, plus twice the system response time. For each run, use only those measurements obtained after twice the response time of th measurement system has elapsed, to determine the average effluent concentratio

7.3 Zero and Calibration Drift Test. Follo Section 7.4 of Method 6C.

8. *Emission Calculation*

Follow Section 8 of Method 6C.

9. *Bibliography*

Same as bibliography of Method 6C.

METHOD 8—DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability*

1.1 Principle. A gas sample is extracted isokinetically from the stack. The sulfuric acid mist (including sulfur trioxide) and the sulfur dioxide are separated, and both fractions are measured separately by the barium-thorin titration method.

1.2 Applicability. This method is applicable for the detemination of sulfuric acid mist (including sulfur trioxide, and in the absence of other particulate matter) and sulfur dioxide emissions from stationary sources. Collaborative tests have shown that the minimum detectable limits of the method are 0.05 milligrams/cubic meter ($0.03 > 10^{-7}$ pounds/cubic foot) for sulfur trioxide and 1.2 mg/m^3 ($0.74\ 10^{-7}$ lb/ft^3) for sulfur dioxide. No upper limits have been established. Based on theoretical calculations for 200 milliters of 3 percent hydrogen peroxide solution, the upper concentration limit for sulfur dioxide in a 1.0 m^3 (35.3 ft^3) gas sample is about 12.500 mg/m^3 (7.7×10^{-4} lb/ft^3). The upper limit can be extended by increasing the quantity of peroxide solution in the impingers.

Possible interfering agents of this method are fluorides, free ammonia, and dimethyl aniline. If any of these interfering agents are present (this can be determined by knowledge of the process), alternative methods, subject to the approval of the Administrator, U. S. E. P.A., are required.

Filterable particulate matter may be determined along with SO_2 and SO_3 (subject to the approval of the Administrator) by inserting a heated glass fiber filter between the probe and isopronanol impinger (see Section 2.1 of method 6.) If this option is chosen, particulate analysis is gravimetric only; H_2SO_4 acid mist is not determined separately.

2. *Apparatus*

2.1 Sampling. A schematic of the sampling train used in this method is shown in Figure 8-1; it is similiar to the Method 5 train except that the filter position is different and the filter holder does not have to be heated. Commercial models of this train are avaiable. For those who desire to build their own, however, complete construction details are described in APTD-0581. Changes from the APTD-0581 document and allowable modifications to Figure 8-1 are discussed in the following subsections.

The operating and maintenance procedures for the sampling train are described in APTD-0576. Since correct usage is important in obtaining valid results, all users should read the APTD-0576 document and adopt the operating and maintenance procedures outlined in it, unless otherwise specified herein. Further details and guidelines on operation and maintenance are given in Method 5 and should be read and followed whenever they are applicable.

2.1.1 Probe Nozzle. Same as Method 5, Section 2.1.1.

2.1.2 Probe Liner. Borosilicate or quartz glass, with a heating system to prevent visible condensation during sampling. Do not use metal probe liners.

2.1.3 Pitot Tube. Same as Method 5, Section 2.1.3.

2.1.4 Differential Pressure Gauge. Same as Method 5, Section 2.1.4.

2.1.5 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other gasket materials, e.g., Teflon or Viton, may be used subject to the approval of the Administrator. The holder design shall provide a positive seal against leakage from the outside or around the filter. The filter holder shall be placed between the first and second impingers. Note: Do not heat the filter holder.

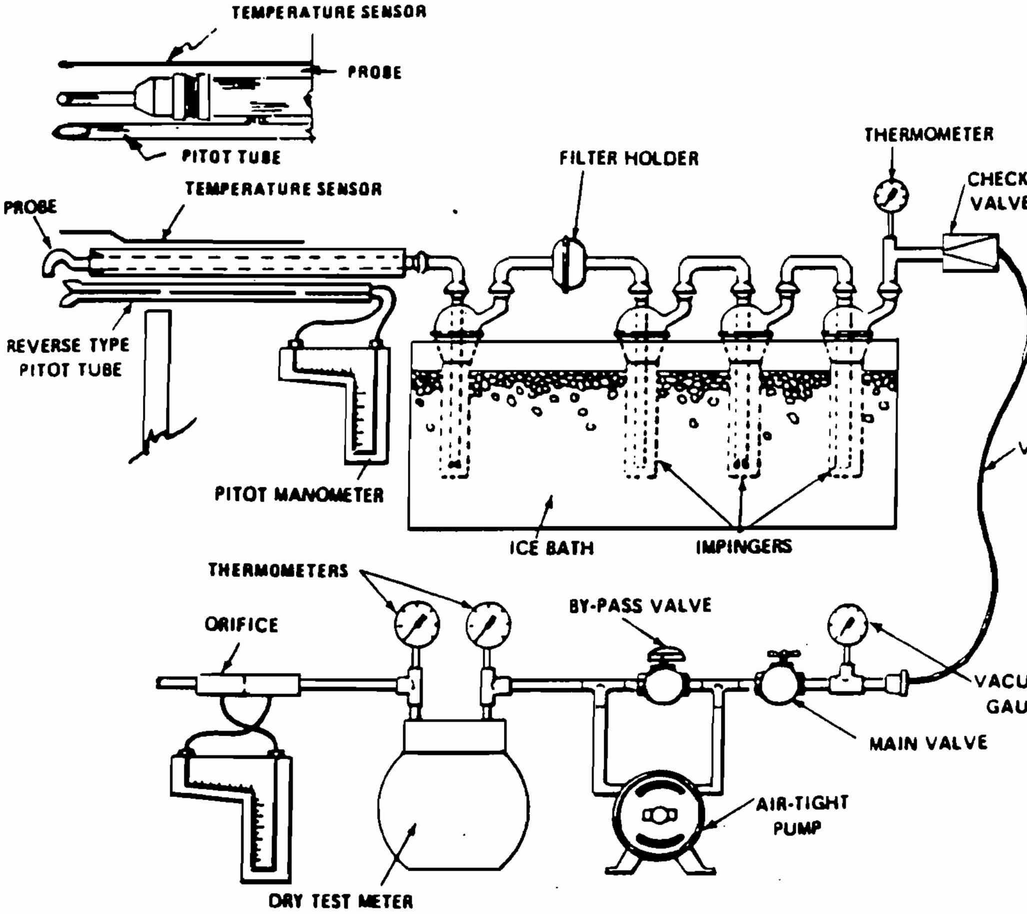

Figure 8-1. Sulfuric acid mist sampling train.

2.1.6 Impingers—Four, as shown in Figure 8-1. The first and third shall be of the Greenburg-Smith design with standard tips. The second and fourth shall be of the Greenburg-Smith design, modified by replacing the insert with an approximately 13 millimeter (0.5 in.) ID glass tube, having an unconstricted tip located 13 mm (0.5 in.) from the bottom of the flask. Similar collection systems, which have been approved by the Administrator, may be used.

2.1.7 Metering System. Same as Method 5, Section 2.1.8.

2.1.8 Barometer. Same as Method 5, Section 2.1.9.

2.1.9 Gas Density Determination Equipment. Same as Method 5, Section 2.1.10.

2.1.10 Temperature Gauge. Thermometer, or equivalent, to measure the temperature of the gas leaving the impinger train to within 1° C (2° F).

2.2 Sample Recovery.

2.2.1 Wash Bottles. Polyethylene or glass, 500 ml. (two).

2.2.2 Graduated Cylinders. 250 ml. 1 liter. (Volumetric flasks may also be used.

2.2.3 Storage Bottles. Leak-free polyethlene bottles, 1000 ml size (two for each sampling run).

2.2.4 Trip Balance. 500-gram capacity, to measure to ±0.5 g (necessary only if a moisture content analysis is to be done).

2.3 Analysis.

2.3.1 Pipettes. Volumetric 25 ml. 100 ml.

2.3.2 Burette. 50 ml.

2.3.3 Erlenmeyer Flask. 250 ml. (one for each sample blank and standard).

2.3.4. Graduated Cylinder. 100 ml.

2.3.5 Trip Balance. 500 g capacity, to measure to ±0.5g.

2.3.6 Dropping Bottle. To add indicator solution, 125-ml size.

3. *Reagents*

Unless otherwise indicated, all reagents are to conform to the specifications established by the Committee on Analytical Reagents of the American Chemical Society, where such specifications are available. Otherwise, use the best available grade.

3.1 Sampling.

3.1.1 Filters. Same as Method 5, Section 3.1.1.

3.1.2 Silica Gel. Same as Method 5, Section 3.1.2.

3.1.3 Water. Deionized, distilled to conform to ASTM specification D1193-77, Type 3 (incorporated by reference—see § 60.17). At the option of the analyst, the $KMnO_4$ test for oxidizable organic matter may be omitted when high concentrations of organic matter are not expected to be present.

3.1.4 Isopropanol, 80 Percent. Mix 800 ml of isopropanol with 200 ml of deionized, distilled water.

Note: Experience has shown that only A.C.S. grade isopropanol is satisfactory. Tests have shown that isopropanol obtained from commerical sources occasionally has peroxide impurities that will cause erroneously high sulfuric acid mist measurement. Use the following test for detecting peroxides in each lot of isopropanol: Shake 10 ml of the isopropanol with 10 ml of freshly prepared 10 percent potassium iodide solution. Prepare a blank by similarly treating 10 ml of distilled water. After 1 minute, read the absorbance on a spectrophotometer at 352 nanometers. If the absorbance exceeds 0.1, the isopropanol shall not be used. Peroxides may be removed from isopropanol by redistilling, or by passage through a column of activated alumina. However, reagent- rade isopropanol with suitably low peroxide levels is readily available from commercial sources; therefore, rejection of contaminated lots may be more efficient than following the peroxide removal procedure.

3.1.5 Hydrogen Peroxide, 3 Percent. Dilute 100 ml of 30 percent hydrogen peroxide to 1 liter with deionized, distilled water. Prepare fresh daily.

3.1.6 Crushed Ice.

3.2 Sample Recovery.

3.2.1 Water. Same as 3.1.3.

3.2.2 Isopropanol, 80 Percent. Same as 3.1.4.

3.3 Analysis.

3.3.1 Water. Same as 3.1.3.

3.3.2 Isopropanol, 100 Percent.

3.3.3 Thorin Indicator. 1-(o-arsonophenylazo) 2-naphthol-3, 6-disulfonic acid, disodium salt, or equivalent. Dissolve 0.20 g in 100 ml of deionized, distilled water.

3.3.4 Barium Perchlorate (0.0100 Normal). Dissolve 1.95 g of barium perchlorate trihydrate ($Ba(ClO_4)_2 \cdot 3H_2O$) in 200 ml deionized, distilled water, and dilute to 1 liter with isopropanol: 1.22 g of barium chloride dihydrate ($BaCl_2 \cdot 2H_2O$) may be used instead of the barium perchlorate. Standardize with sulfuric acid as in Section 5.2. This solution must be protected against evaporation at all times.

3.3.5 Sulfuric Acid Standard (0.0100 N). Purchase or standardize to ±0.0002 N against 0.0100 N NaOH that has previously been standardized against primary standard potassium acid phthalate.

4. *Procedure*

FIGURE 8-2—FIELD DATA

Plant ....

Location ....

Operator ....

Date ....

Run No ....

Sample box No ....

Meter box No ....

Meter ΔH@ ....

C factor ....

Pitot tube coefficient, Cp ....

SCHEMATIC OF STACK CROSS SECTION

Static pressure, mm Hg (in. Hg) ....

Ambient temperature ....

Barometer pressure ....

Assumed moisture, % ....

Probe length, m (ft) ....

Nozzle identification No ....

Average calibrated nozzle diameter, cm (in.) ....

Probed heater setting ....

Leak rate, m³/min, (cfm) ....

Probe liner material ....

Filter No ....

Traverse point number	Sampling time	Vacuum	Stack temperature (T_s)	Velocity head (ΔP)	Pressure differential across orifice meter	Gas sample volume	Gas sample temperature at dry gas meter		Temperature of gas leaving condenser or last impinger
							Inlet	Outlet	
	(θ), min.	mm Hg (in. Hg)	°C (°F)	mm H_2O (in H_2O)	mm H_2O (in H_2O)	m³ (ft³)	°C (°F)	°C (°F)	°C (°F)
Total Average							Avg Avg	Avg	

4.1 Sampling.

4.1.1 Pretest Preparation. Follow the procedure outlined in Method 5, Section 4.1.1; filters should be inspected, but need not be desiccated, weighed, or identified. If the effluent gas can be considered dry, i.e., moisture free, the silica gel need not be weighed.

4.1.2 *Preliminary Determinations.* Follow the procedure outlined in Method 5, Section 4.1.2.

4.1.3 Preparation of Collection Train. Follow the procedure outlined in Method 5, Section 4.1.3 (except for the second paragraph and other obviously inapplicable parts) and use Figure 8-1 instead of Figure 5-1. Replace the second paragraph with: Place 100 ml of 80 percent isopropanol in the first impinger, 100 ml of 3 percent hydrogen peroxide in both the second and third impingers; retain a portion of each reagent for used as a blank solution. Place about 200g of silica gel in the fourth impinger.

NOTE: If moisture content is to be determined by impinger analysis, weigh each of the first three impingers (plus absorbing solution) to the nearest 0.5 g and record these weights. The weight of the silica gel (or silica gel plus container) must also be determined to the nearest 0.5 g and recorded.

4.1.4 Pretest Leak-Check Procedure. Follow the basic procedure outlined in Method 5, Section 4.1.4.1, noting that the probe heater shall be adjusted to the minimum temperature required to prevent condensation, and also that verbage such as, ". . . plugging the inlet to the filter holder . . . ." shall be replaced by, ". . . plugging the inlet to the first impinger . . ." The pretest leak-check is optional.

4.1.5 Train Operation. Follow the basic procedures outlined in Method 5, Section 4.1.5, in conjunction with the following special instructions. Data shall be recorded on a sheet similar to the one in Figure 8-2. The sampling rate shall not exceed 0.030 m³/min (1.0 cfm) during the run. Periodically during the test, observe the connecting line between the probe and first impinger for signs of condensation. If it does occur, adjust the probe heater setting upward to the minimum temperature required to prevent condensation. If component changes become necessary during a run, a leak-check shall be done immediately before each change, according to the procedure outlined in Section 4.1.4.2 of Method 5 (with appropriate modifications, as mentioned in Section 4.1.4 of this method); record all leak rates. If the leakage rate(s) exceed the specified rate, the tester shall either void the run or shall plan to correct the sample volume as outlined in section 6.3 of Method 5. Immediately after component changes, leak-checks are optional. If these leak-checks are done, the procedure outlined in Section 4.1.4.1 of Method 5 (with appropriate modifications) shall be used.

After turning off the pump and recording the final readings at the conclusion of each run, remove the probe from the stack. Conduct a post-test (mandatory) leak-check as in Section 4.1.4.3 of Method 5 (with appropriate modification) and record the leak rate. If the post-test leakage rate exceeds the specified acceptable rate, the tester shall either correct the sample volume, as outlined in Section 6.3 of Method 5, or shall void the run.

Drain the ice bath and, with the probe disconnected, purge the remaining part of the train, by drawing clean ambient air through the system for 15 minutes at the average flow rate used for sampling.

NOTE: Clean ambient air can be provided by passing air through a charcoal filter. At the option of the tester, ambient air (without cleaning) may be used.

4.1.6 Calculation of Percent Isokinetic. Follow the procedure outlined in Method 5, Section 4.1.6.

4.2 Sample Recovery.

4.2.1 Container No. 1. If a moisture content analysis is to be done, weigh the first impinger plus contents to the nearest 0.5 g and record this weight.

Transfer the contents of the first impinger to a 250-ml graduated cylinder. Rinse the probe, first impinger, all connecting glassware before the filter, and the front half of the filter holder with 80 percent isopropanol. Add the rinse solution to the cylinder. Dilute to 250 ml with 80 percent isopropanol. Add the filter to the solution, mix, and transfer to the storage container. Protect the solution against evaporation. Mark the level of liquid on the container and identify the sample container.

4.2.2 Container No. 2. If a moisture content analysis is to be done, weigh the second and third impingers (plus contents) to the nearest 0.5 g and record these weights. Also, weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g.

Transfer the solutions from the second and third impingers to a 1000-ml graduated cylinder. Rinse all connecting glassware (including back half of filter holder) between the filter and silica gel impinger with deionized, distilled water, and add this rinse water to the cylinder. Dilute to a volume of 1000 ml with deionized, distilled water. Transfer the solution to a storage container. Mark the level of liquid on the container. Seal and identify the sample container.

4.3 Analysis.

Note the level of liquid in containers 1 and 2, and confirm whether or not any sample was lost during shipment; note this on the analytical data sheet. If a noticeable amount of leakage has occured, either void the sample or use methods, subject to the approval of the Administrator, to correct the final results.

4.3.1 Container No. 1. Shake the container holding the isopropanol solution and the filter. If the filter breaks up, allow the fragments to settle for and few minutes before removing a sample. Pipette a 100-ml aliquot of this solution into a 250-ml Erlenmeyer flask, add 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat the titration with a second aliquot of sample and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

4.3.2 Container No. 2. Thoroughly mix the solution in the container holding the contents of the second and third impingers. Pipette a 10-ml aliquot of sample into a 250-ml Erlenmeyer flask. Add 40 ml of isopropanol, 2 to 4 drops of thorin indicator, and titrate to a pink endpoint using 0.0100 N barium perchlorate. Repeat the titration with a second aliquot of sample and average the titration values. Replicate titrations must agree within 1 percent or 0.2 ml, whichever is greater.

4.3.3 Blanks. Prepare blanks by adding 2 to 4 drops of thorin indicator to 100 ml of 80 percent isopropanol. Titrate the blanks in the same manner as the samples.

5. *Calibration.*

5.1 Calibrate equipment using the procedures specified in the following sections of Method 5: *Section 5.3* (metering system); Section 5.5 (termperature gauges); Section 5.7 (barometer). Note that the recommended leak-check of the metering system, described in Section 5.6 of Method 5, also applies to this method.

5.2 Standardize the barium perchlorate solution with 25 ml of standard sulfuric acid, to which 100 ml of 100 percent isopropanol has been added.

6. *Calculations*

NOTE: Carry out calculations retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

6.1 Nomenclature.

A_n = Cross-sectional area of nozzle, m² (ft²).

B_{ws} = Water vapor in the gas stream, proportion by volume.

$C_{H_2SO_4}$ = Sulfuric acid (including SO_3) concentration, g/dscm (lb/dscf).

C_{SO_2} = Sulfur dioxide concentration, g/dscm (lb/dscf).

I = Percent of isokinetic sampling.

N = Normality of barium perchlorate titrant, "meq/ml".

P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

T_m = Average absolute dry gas meter temperature (see Figure 8-2), °K (°R).

T_s = Average absolute stack gas temperature (see Figure 8-2), °K (°R).

T_{std} = Standard absolute temperature, 293° K (528° R).

V_a = Volume of sample aliquot titrated, 100 ml for H_2SO_4 and 10 ml for SO_2.

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, dcm (dcf).

$V_{m(std)}$ = Volume of gas sample measured by the dry gas meter corrected to standard conditions, dscm (dscf).

v_s = Average stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from method 8, m/sec (ft/sec).

V_{soln} = Total volume of solution in which the sufuric acid or sulfur dioxide sample is contained, 250 ml or 1,000 ml, respectively.

V_t = Volume of barium perchlorate titrant used for the sample, ml.

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

Y = Dry gas meter calibration factor.

ΔH = Average pressure drop across orifice meter, mm (in.) H_2O.

θ = Total sampling time, min.

13.6 = Specific gravity of mercury.

60 = sec/min.

100 = Conversion to percent.

6.2 Average dry gas meter temperature and average orifice pressure drop. See data sheet (Figure 8-2).

6.3 Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20° C and 760 mm Hg or 68° F and 29.92 in. Hg) by using Equation 8-1.

$$V_{m(std)} = V_mY\left(\frac{T_{std}}{T_m}\right)\frac{P_{bar}+\left(\frac{\Delta H}{13.6}\right)}{P_{std}}$$

$$= K_1V_mY\,\frac{P_{bar}+(\Delta H/13.6)}{T_m}$$

Equation 8-1

where:
K_1 = 0.3858 °K/mm Hg for metric units.
= 17.64 °R/in.. Hg for English units.

NOTE: If the leak rate observed during any mandatory leak-checks exceeds the specified acceptable rate, the tester shall either correct the value of V_m in Equation 8-1 (as described in Section 6.3 of Method 5), or shall invalidate the test run.

6.4 Volume of Water Vapor and Moisture Content. Calculate the volume of water vapor using Equation 5-2 of Method 5: the weight of water collected in the impingers and silica gel can be directly converted to milliliters (the specific gravity of water is 1 g/ml). Calculate the moisture content of the stack gas, using Equation 5-3 of Method 5. The "Note" in Section 6.5 of Method 5 also applies to this method. Note that if the effluent gas stream can be considered dry, the volume of water vapor and moisture content need not be calculated.

6.5 Sulfuric acid mist (including SO_3) concentration.

$$C_{H_2SO_4} = K_2\,\frac{N(V_t-V_{tb})\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 8-2

where:
K_2 = 0.04904 g/milliequivalent for metric units.
= 1.081×10^{-4} lb/meq for English units.

6.6 Sulfur dioxide concentration.

$$C_{SO_2} = K_3\,\frac{N(V_t-V_{tb})\left(\frac{V_{soln}}{V_a}\right)}{V_{m(std)}}$$

Equation 8-3

where:
K_3 = 0.03203 g/meq for metric units.
= 7.061×10^{-5} lb/meq for English units.

6.7 Isokinetic Variation.

6.7.1 Calculation from raw data.

$$V_mY$$

$$I = \frac{100T_s[K_4V_{lc}+(\uparrow/T_m)P_{bar}+\Delta H/13.6)]}{60\theta V_sP_sA_n}$$

Equation 8-4

where:
K_4 = 0.003464 mm Hg-m³/ml-°K for metric units.
= 0.002676 in. Hg-ft³/ml-°R for English units.

6.7.2 Calculation from intermediate values.

$$I = \frac{T_sV_{m(std)}P_{std}\,100}{T_{std}v_s\theta A_nP_s\,60(1-B_{ws})}$$

$$= K_5\,\frac{T_sV_{m(std)}}{P_sv_sA_n\theta(1-B_{ws})}$$

Equation 8-5

where:
K_5 = 4.320 for metric units.
= 0.09450 for English units

6.8 Acceptable Results. If 90 percent < I < 110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may opt to accept the results. Use Citation 4 in the Bibliography of Method 5 to make judgments. Otherwise, reject the results and repeat the test.

6.9 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and the equations in Sections 5.2 and 5.3 of Method 2.

7. *Bibliography*

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METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere: these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume: angle of the observer with respect to the sun: point of observation of attached and detached steam plume: and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. *Principle and applicability.*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedures.* The observer qualified in accordance with paragraph 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g. roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g. stub stacks on baghouses).

2.2 Field records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation* and the date on a field data sheet (Figure 9-1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached steam plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached steam plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.3.3 Fugitive emissions. The guidelines for positioning of the observer in relation to the stack found in paragraph 2.1 can be applied to determination of visible opacity from fugitive emission sources. That is, the observer should have a clear view of the source and the potential emissions with the sun or other light source at his back. A position at least 15 feet from the source, but permitting a clear, unobstructed view of the source, is recommended. To the extent feasible, the line of sight should be approximately perpendicular to the flow of potential fugitive emissions, and also, to the longer axis to the potential fugitive emissions. Readings of opacity should be made for the point(s) of highest opacity within the visible fugitive emission. The highest opacity usually occurs immediately above or immediately downwind of the source, so observers should concentrate on the area(s) close to the source.

2.4 Recording observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9-2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum

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[1] For a set, positive error = average opacity determined by observers' 25 observations—average opacity determined from transmissometer's 25 recordings.

* Section 2.2 by adding the words "a sketch of the observer's position relative to the source," between the words "affiliation," and "and" to read ". . . affiliation, a sketch of the observer's position relative to the source, and . . ."

by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. *Record the average opacity on a* record sheet. (See Figure 9-1 for an example.)

3. *Qualifications and testing.*

3.1 Certification requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in paragraph 3.2. Smoke generators used pursuant to paragraph 3.2 shall be equipped with a smoke meter which meets the requirements of paragraph 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke generator specifications. Any smoke generator used for the purposes of paragraph 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9-1. The smoke meter shall be calibrated as prescribed in paragraph 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9-1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9-1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—reference 4.3).
c. Angle of view	15° maximum total angle.
d. Angle of projection	15° maximum total angle.
e. Calibration error	±3% opacity, maximum.
f. Zero and span drift±1% opacity, 30 minutes.	
g. Response time	5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke meter evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral response of photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

FIGURE 9-1

RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE___of___

COMPANY____________________

LOCATION____________________

TEST NUMBER____________________

DATE____________________

TYPE FACILITY____________________

CONTROL DEVICE____________________

HOURS OF OBSERVATION____________________

OBSERVER____________________

OBSERVER CERTIFICATION DATE____________________

OBSERVER AFFILIATION____________________

POINT OF EMISSIONS____________________

HEIGHT OF DISCHARGE POINT____________________

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

FIGURE 9-2—OBSERVATION RECORD

Page —— of ——

Company ______
Location ______
Test Number ______
Date ______

Observer ______
Type facility ______
Point of emissions ______

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							
	21							
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							

FIGURE 9-2—OBSERVATION RECORD—(CONTINUED)

Page —— of ——

Company ______
Location ______
Test Number ______
Date ______

Observer ______
Type facility ______
Point of emissions ______

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	30							
	31							
	32							
	33							
	34							
	35							
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	59							

3.3.2.3 Angle of view. Check construction geometry to ensure that the total angle of view of the smoke plume, as seen by the photocell, does not exceed 15°. The total angle of view may be calculated from: $\Phi=2\tan^{-1}d/2L$, where θ=total angle of view; d=the sum of the photocell diameter+the diameter of the limiting aperture; and L=the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta=2\tan^{-1}d/2L$, where θ= total angle of projection; d= the sum of the length of the lamp filament + the diameter of the limiting aperture; and L= the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibrated within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and span drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response time. Determine the response time by producing the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *References.*

4.1 Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

4.2 Weisburd, Melvin I., Field Operations and Enforcement Manual for Air, U.S. Environmental Protection Agency, Research Triangle Park, N.C., APTD-1100, August 1972, pp. 4.1-4.36.

4.3 Condon, E.U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., N.Y., N.Y., 1958, Table 3.1, p. 6-52.

ALTERNATE METHOD 1—DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES REMOTELY BY LIDAR

This alternate method provides the quantitative determination of the opacity of an emissions plume remotely by a mobile lidar system (laser radar; Light Detection and Ranging). The method includes procedures for the calibration of the lidar and procedures to be used in the field for the lidar determination of plume opacity. The lidar is used to measure plume opacity during either day or nighttime hours because it contains its own pulsed light source or transmitter. The operation of the lidar is not dependent upon ambient lighting conditions (light, dark, sunny or cloudy).

The lidar mechanism or technique is applicable to measuring plume opacity at numerous wavelengths of laser radiation. However, the performance evaluation and calibration test results given in support of this method apply only to a lidar that employs a ruby (red light) laser [Reference 5.1].

1. Principle and Applicability

1.1 Principle. The opacity of visible emissions from stationary sources (stacks, roof vents, etc.) is measured remotely by a mobile lidar (laser radar).

1.2 Applicability. This method is applicable for the remote measurement of the opacity of visible emissions from stationary sources during both nighttime and daylight conditions, pursuant to 40 CFR § 60.11(b). It is also applicable for the calibration and performance verification of the mobile lidar for the measurement of the opacity of emissions. A performance/design specification for a basic lidar system is also incorporated into this method.

1.3 Definitions.

Azimuth angle: The angle in the horizontal plane that designates where the laser beam is pointed. It is measured from an arbitrary fixed reference line in that plane.

Backscatter: The scattering of laser light in a direction opposite to that of the incident laser beam due to reflection from particulates along the beam's atmospheric path which may include a smoke plume.

Backscatter signal: The general term for the lidar return signal which results from laser light being backscattered by atmospheric and smoke plume particulates.

Convergence distance: The distance from the lidar to the point of overlap of the lidar receiver's field-of-view and the laser beam.

Elevation angle: The angle of inclination of the laser beam referenced to the horizontal plane.

Far region: The region of the atmosphere's path along the lidar line-of-sight beyond or behind the plume being measured.

Lidar: Acronym for Light Detection and Ranging.

Lidar range: The range or distance from the lidar to a point of interest along the lidar line-of-sight.

Near region: The region of the atmospheric path along the lidar line-of-sight between the lidar's convergence distance and the plume being measured.

Opacity: One minus the optical transmittance of a smoke plume, screen target, etc.

Pick interval: The time or range intervals in the lidar backscatter signal whose minimum average amplitude is used to calculate opacity. Two pick intervals are required, one in the near region and one in the far region.

Plume: The plume being measured by lidar.

Plume signal: The backscatter signal resulting from the laser light pulse passing through a plume.

$1/R^2$ correction: The correction made for the systematic decrease in lidar backscatter signal amplitude with range.

Reference signal: The backscatter signal resulting from the laser light pulse passing through ambient air.

Sample interval: The time period between successive samples for a digital signal or between successive measurements for an analog signal.

Signal spike: An abrupt, momentary increase and decrease in signal amplitude.

Source: The source being tested by lidar.

Time reference: The time (t_o) when the laser pulse emerges from the laser, used as the reference in all lidar time or range measurements.

2. Procedures.

The mobile lidar calibrated in accordance with Paragraph 3 of this method shall use the following procedures for remotely measuring the opacity of stationary source emissions:

2.1 Lidar Position. The lidar shall be positioned at a distance from the plume sufficient to provide an unobstructed view of the source emissions. The plume must be at a range of at least 50 meters or three consecutive pick intervals (whichever is greater) from the lidar's transmitter/receiver convergence distance along the line-of-sight. The maximum effective opacity measurement distance of the lidar is a function of local atmospheric conditions, laser beam diameter, and plume diameter. The test position of the lidar shall be selected so that the diameter of the laser beam at the measurement point within the plume shall be no larger than three-fourths the plume diameter. The beam diameter is calculated by Equation (AM1-1):

$$D(\text{lidar}) = A + R\phi < 0.75\ D(\text{Plume}) \quad \text{(AM1-1)}$$

where:

D(Plume) = diameter of the plume (cm).
ϕ = laser beam divergence measured in radians
R = range from the lidar to the source (cm)
D(Lidar) = diameter of the laser beam at range R (cm).
A = diameter of the laser beam or pulse where it leaves the laser.

The lidar range, R, is obtained by aiming and firing the laser at the emissions source structure immediately below the outlet. The range value is then determined from the backscatter signal which consists of a signal spike (return from source structure) and the atmospheric backscatter signal [Reference 5.1]. This backscatter signal should be recorded.

When there is more than one source of emissions in the immediate vicinity of the plume, the lidar shall be positioned so that the laser beam passes through only a single plume, free from any interference of the other plumes for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume along the line-of-sight (determined from the backscatter signals). The lidar shall initially be positioned so that its line-of-sight is approximately perpendicular to the plume.

When measuring the opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks, etc.), the lidar shall be placed in a position so that its line-of-sight is approximately perpendicular to the longer (major) axis of the outlet.

2.2 Lidar Operational Restrictions. The lidar receiver shall not be aimed within an angle of ± 15° (cone angle) of the sun.

This method shall not be used to make opacity measurements if thunderstorms, snowstorms, hail storms, high wind, high-ambient dust levels, fog or other atmospheric conditions cause the reference signals to consistently exceed the limits specified in Section 2.3.

2.3 Reference Signal Requirements. Once placed in its proper position for opacity measurement, the laser is aimed and fired with the line-of-sight near the outlet height and rotated horizontally to a position clear of the source structure and the associated plume. The backscatter signal obtained from this position is called the ambient-air or reference signal. The lidar operator shall inspect this signal [Section V of Reference 5.1] to: (1) determine if the lidar line-of-sight is free from interference from other plumes and from physical obstructions such as cables, power lines, etc., for a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, and (2) obtain a qualitative measure of the homogeneity of the ambient air by noting any signal spikes.

Should there be any signal spikes on the reference signal within a minimum of 50 meters or three consecutive pick intervals (whichever is greater) in each region before and beyond the plume, the laser shall be fired three more times and the operator shall inspect the reference signals on the display. If the spike(s) remains, the azimuth angle shall be changed and the above procedures conducted again. If the spike(s) disappears in all three reference signals, the lidar line-of-sight is acceptable if there is shot-to-shot consistency and there is no interference from other plumes.

Shot-to-shot consistency of a series of reference signals over a period of twenty seconds is verified in either of two ways. (1) The lidar operator shall observe the reference signal amplitudes. For shot-to-shot consistency the ratio of R_f to R_n [amplitudes of the near and far region pick intervals (Section 2.6.1)] shall vary by not more than ± 6% between shots; or (2) the lidar operator shall accept any one of the reference signals and treat the other two as plume signals; then the opacity for each of the subsequent reference signals is calculated (Equation AM1-2). For shot-to-shot consistency, the opacity values shall be within ± 3% of 0% opacity and the associated S_o values less than or equal to 8% (full scale) [Section 2.6].

If a set of reference signals fails to meet the requirements of this section, then all plume signals [Section 2.4] from the last set of acceptable reference signals to the failed set shall be discarded.

2.3.1 Initial and Final Reference Signals. Three reference signals shall be obtained within a 90-second time period prior to any data run. A final set of three reference signals shall be obtained within three (3) minutes after the completion of the same data run.

2.3.2 Temporal Criterion for Additional Reference Signals. An additional set of reference signals shall be obtained during a data run if there is a change in wind direction or plume drift of 30° or more from the direction that was prevalent when the last set of reference signals was obtained. An additional set of reference signals shall also be obtained if there is an increase in value of S_{In} (near region standard deviation, Equation AM1-5) or S_{If} (far region standard deviation, Equation AM1-6) that is greater than 6% (full scale) over the respective values calculated from the immediately previous plume signal, and this increase in value remains for 30 seconds or longer.An additional set of reference signals shall also be obtained if there is a change in amplitude in either the near or the far region of the plume signal, that is greater than 6% of the near signal amplitude and this change in amplitude remains for 30 seconds or more.

2.4 Plume Signal Requirements. Once properly aimed, the lidar is placed in operation with the nominal pulse or firing rate of six pulses/minute (1 pulse/10 seconds). The lidar operator shall observe the plume backscatter signals to determine the need for additional reference signals as required by Section 2.3.2. The plume signals are recorded from lidar start to stop and are called a data run. The length of a data run is determined by operator discretion. Short-term stops of the lidar to record additional reference signals do not constitute the end of a data run if plume signals are resumed within 90 seconds after the reference signals have been recorded, and the total stop or interrupt time does not exceed 3 minutes.

2.4.1 Non-hydrated Plumes. The laser shall be aimed at the region of the plume which displays the greatest opacity. The lidar operator must visually verify that the laser is aimed clearly above the source exit structure.

2.4.2 Hydrated Plumes. The lidar will be used to measure the opacity of hydrated or so-called steam plumes. As listed in the reference method, there are two types, i.e., attached and detached steam plumes.

2.4.2.1 Attached Steam Plumes. When condensed water vapor is present within a plume, lidar opacity measurements shall be made at a point within the residual plume where the condensed water vapor is no longer visible. The laser shall be aimed into the most dense region (region of highest opacity) of the residual plume.

During daylight hours the lidar operator locates the most dense portion of the residual plume visually. During nighttime hours a high-intensity spotlight, night vision scope, or low light level TV, etc., can be used as an aid to locate the residual plume. If visual determination is ineffective, the lidar may be used to locate the most dense region of the residual plume by repeatedly measuring opacity, along the longitudinal axis or center of the plume from the emissions outlet to a point just beyond the steam plume. The lidar operator should also observe color differences and plume reflectivity to ensure that the lidar is aimed completely within the residual plume. If the operator does not obtain a clear indication of the location of the residual plume, this method shall not be used.

Once the region of highest opacity of the residual plume has been located, aiming adjustments shall be made to the laser line-of-sight to correct for the following: movement to the region of highest opacity out of the lidar line-of-sight (away from the laser beam) for more than 15 seconds, expansion of the steam plume (air temperature lowers and/or relative humidity increases) so that it just begins to encroach on the field-of-view of the lidar's optical telescope receiver, or a decrease in the size of the steam plume (air temperature higher and/or relative humidity decreases) so that regions within the residual plume whose opacity is higher than the one being monitored, are present.

2.4.2.2 Detached Steam Plumes. When the water vapor in a hydrated plume condenses and becomes visible at a finite distance from the stack or source emissions outlet, the opacity of the emissions shall be measured in the region of the plume clearly above the emissions outlet and below condensation of the water vapor.

During daylight hours the lidar operators can visually determine if the steam plume is detached from the stack outlet. During nighttime hours a high-intensity spotlight, night vision scope, low light level TV, etc., can be used as an aid in determining if the steam plume is detached. If visual determination is ineffective, the lidar may be used to determine if the steam plume is detached by repeatedly measuring plume opacity from the outlet to the steam plume along the plume's longitudinal axis or center line. The lidar operator should also observe color differences and plume reflectivity to detect a detached plume. If the operator does not obtain a clear indication of the location of the detached plume, this method shall not be used to make opacity measurements between the outlet and the detached plume.

Once the determination of a detached steam plume has been confirmed, the laser shall be aimed into the region of highest opacity in the plume between the outlet and the formation of the steam plume. Aiming adjustments shall be made to the lidar's

LIDAR LOG CONTROL NUMBER TABULATION

Log Book Number-________

(Assign a CONTROL NUMBER to each individual source under test)

CONTROL NUMBER	DATE ASSIGNED	PROJECT	CITY, STATE

continued on next page

LIDAR LOG CONTROL NUMBER TABULATION (cont'd)

(Assign a CONTROL NUMBER to each individual source under test)

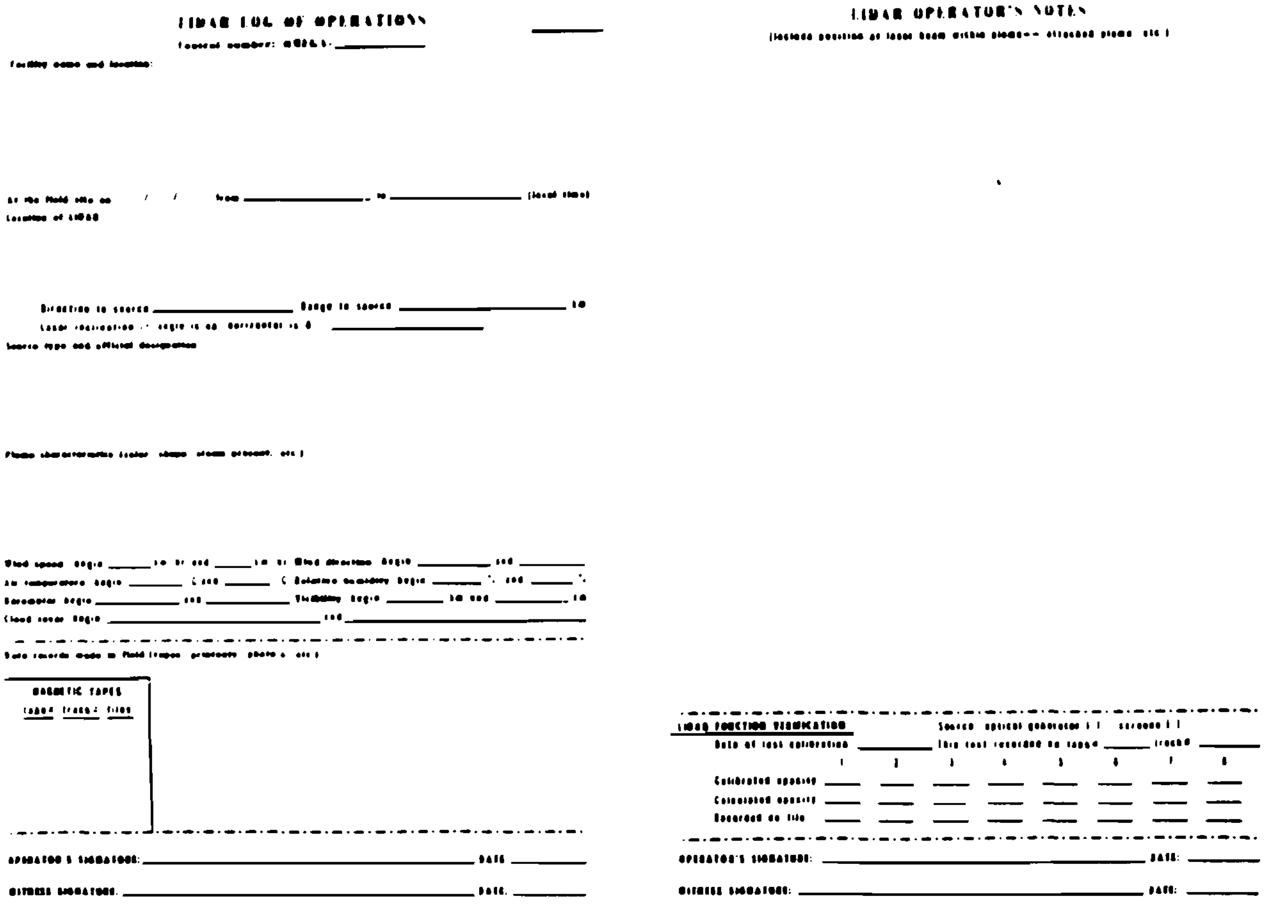
CONTROL NUMBER	DATE ASSIGNED	PROJECT	CITY, STATE

Next Log Book Number-________

Figure AM1-1 Lidar Log Control Number Tabulation line-of-sight within the plume to correct for changes in the location of the most dense region of the plume due to changes in wind direction and speed or if the detached steam plume moves closer to the source outlet encroaching on the most dense region of the plume. If the detached steam plume should move too close to the source outlet for the lidar to make interference-free opacity measurements, this method shall not be used.

2.5 Field Records. In addition to the recording recommendations listed in other sections of this method the following records should be maintained. Each plume measured should be uniquely identified. The name of the facility, type of facility, emission source type, geographic location of the lidar with respect to the plume, and plume characteristics should be recorded. The date of the test, the time period that a source was monitored, the time (to the nearest second) of each opacity measurement, and the sample interval should also be recorded. The wind speed, wind direction, air temperature, relative humidity, visibility (measured at the lidar's position), and cloud cover should be recorded at the beginning and end of each time period for a given source. A small sketch depicting the location of the laser beam within the plume should be recorded.

If a detached or attached steam plume is present at the emissions source, this fact should be recorded. Figures AM1-I and AM1-II are examples of logbook forms that may be used to record this type of data. Magnetic tape or paper tape may also be used to record data.



LIDAR LOG OF OPERATIONS

LIDAR OPERATOR'S NOTES

Figure AM1-II Lidar Log Of Operations

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2.6 Opacity Calculation and Data Analysis. Referring to the reference signal and plume signal in Figure AM1-III, the measured opacity (O_p) in percent for each lidar measurement is calculated using Equation AM1-2. ($O_p = 1 - T_p$; T_p is the plume transmittance.)

$$O_p = (100\%) \left[1 - \left(\frac{I_f}{R_f} \frac{R_n}{I_n} \right)^{\frac{1}{2}} \right]$$

(AM1-2)

where:

I_n = near-region pick interval signal amplitude, plume signal, $1/R^2$ corrected.

I_f = far-region pick interval signal amplitude, plume signal, $1/R^2$ corrected.

R_n = near-region pick interval signal amplitude, reference signal, $1/R^2$ corrected, and

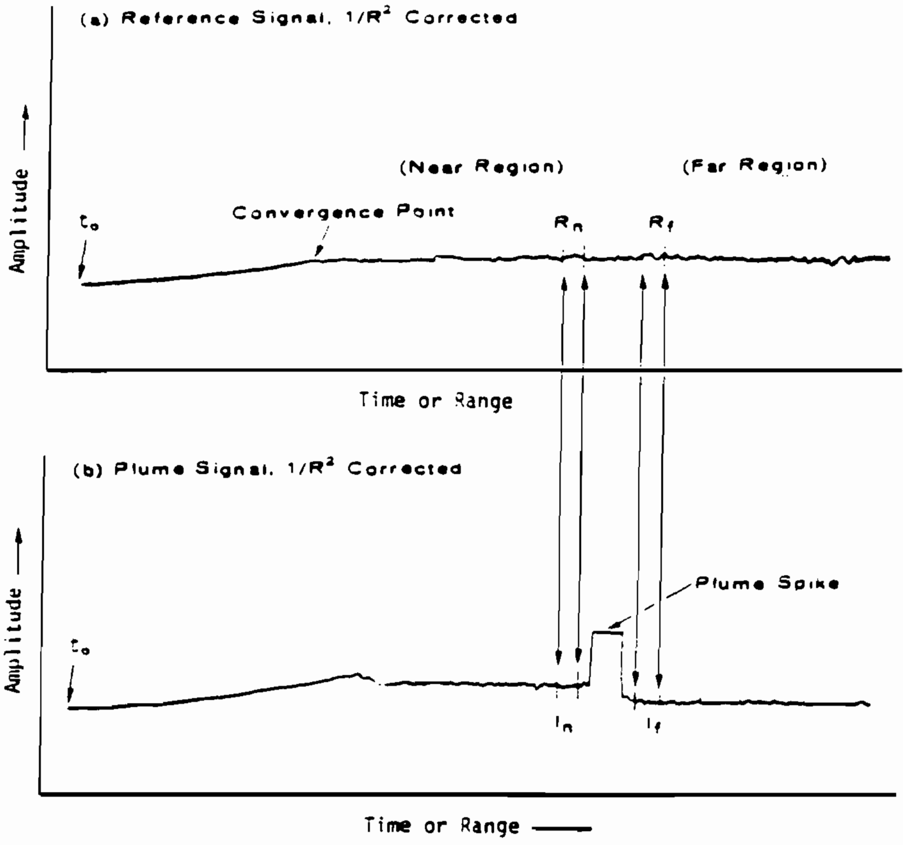
R_f = far-region pick interval signal amplitude, reference signal, $1/R^2$ corrected.

The $1/R^2$ correction to the plume and reference signal amplitudes is made by multiplying the amplitude for each successive sample interval from the time reference, by the square of the lidar time (or range) associated with that sample interval [Reference 5.1].

The first step in selecting the pick intervals for Equation AM1-2 is to divide the plume signal amplitude by the reference signal amplitude at the same respective ranges to obtain a "normalized" signal. The pick intervals selected using this normalized signal, are a minimum of 15 m (100 nanoseconds) in length and consist of at least 5 contiguous sample intervals. In addition, the following criteria, listed in order of importance, govern pick interval selection. (1) The intervals shall be in a region of the normalized signal where the reference signal meets the requirements of Section 2.3 and is everywhere greater than zero. (2) The intervals (near and far) with the minimum average amplitude are chosen. (3) If more than one interval with the same minimum average amplitude is found, the interval closest to the plume is chosen. (4) The standard deviation, S_o, for the calculated opacity shall be 8% or less. (S_o is calculated by Equation AM1-7).

If S_o is greater than 8%, then the far pick interval shall be changed to the next interval of minimal average amplitude. If S_o is still greater than 8%, then this procedure is repeated for the far pick interval. This procedure may be repeated once again for the near pick interval, but if S_o remains greater than 8%, the plume signal shall be discarded.

The reference signal pick intervals, R_n and R_f, must be chosen over the same time interval as the plume signal pick intervals, I_n and I_f, respectively [Figure AM1-III]. Other methods of selecting pick intervals may be used if they give equivalent results. Field-oriented examples of pick interval selection are available in Reference 5.1.



(a) Reference signal, $1/R^2$-corrected. This reference signal is for plume signal (b). R_n, R_f are chosen to coincide with I_n, I_f.

(b) Plume signal, $1/R^2$-corrected. The plume spike and the decrease in the backscatter signal amplitude in the far region are due to the opacity of the plume. I_n, I_f are chosen as indicated in Section 2.6.

Figure AM1-III. Plots of Lidar Backscatter Signals

The average amplitudes for each of the pick intervals, I_n, I_f, R_n, R_f, shall be calculated by averaging the respective individual amplitudes of the sample intervals from the plume signal and the associated reference signal each corrected for $1/R^2$. The amplitude of I_n shall be calculated according to Equation (AM-3).

$$I_n = \frac{1}{m} \sum_{i=1}^{m} I_{ni} \quad , \qquad \text{(AM1-3)}$$

where:

I_{ni} = the amplitude of the ith sample inter (near-region).

Σ = sum of the individual amplitudes for sample intervals.

m = number of sample intervals in the p interval, and

I_n = average amplitude of the near-reg pick interval.

Similarly, the amplitudes for I_f, R_n, and are calculated with the three expressions Equation (AM1-4).

$$I_f = \frac{1}{m} \sum_{i=1}^{m} I_{fi} \ , \quad R_n = \frac{1}{m} \sum_{i=1}^{m} R_{ni} \ , \quad R_f = \frac{1}{m} \sum_{i=1}^{m} R_{fi} \ . \qquad \text{(AM1-4)}$$

The standard deviation, S_{In}, of the set of amplitudes for the near-region pick interval, I_n, shall be calculated using Equation (AM1-5).

$$S_{In} = \left[\sum_{i=1}^{m} \frac{(I_{ni} - I_n)^2}{(m-1)} \right]^{½} . \qquad \text{(AM1-5)}$$

Similarly, the standard deviations S_{If}, S_{Rn}, and S_{Rf} are calculated with the three expressions in Equation (AM1-6).

$$S_{If} = \left[\sum_{i=1}^{m} \frac{(I_{fi} - I_f)^2}{(m-1)} \right]^{½} ,$$

$$S_{Rn} = \left[\sum_{i=1}^{m} \frac{(R_{ni} - R_n)^2}{(m-1)} \right]^{½} ,$$

$$S_{Rf} = \left[\sum_{i=1}^{m} \frac{(R_{fi} - R_f)^2}{(m-1)} \right]^{½} . \qquad \text{(AM1-6)}$$

The standard deviation S_o for each associated opacity value, O_p, shall be calculated using Equation (AMI-7).

$$S_o = \frac{(100\%)}{2} \left(\frac{I_f}{R_f} \frac{R_n}{I_n} \right)^{½} \left[\frac{S_{In}{}^2}{I_n{}^2} + \frac{S_{If}{}^2}{I_f{}^2} + \frac{S_{Rn}{}^2}{R_n{}^2} + \frac{S_{Rf}{}^2}{R_f{}^2} \right]^{½} \qquad \text{(AM1-7)}$$

The calculated values of I_n, I_f, R_n, R_f, S_{In}, S_{If}, S_{Rn}, S_{Rf}, O_p and S_o should be recorded. Any plume signal with an S_o greater than 8% shall be discarded.

2.6.1 Azimuth Angle Correction. If the azimuth angle correction to opacity specified in this section is performed, then the elevation angle correction specified in Section 2.6.2 shall not be performed. When opacity is measured in the residual region of an attached steam plume, and the lidar line-of-sight is not perpendicular to the plume, it may be necessary to correct the opacity measured by the lidar to obtain the opacity that would be measured on a path perpendicular to the plume. The following method, or any other method which produces equivalent results, shall be used to determine the need for a correction, to calculate the correction, and to document the point within the plume at which the opacity was measured.

Figure AM1-IV(b) shows the geometry of the opacity correction. L' is the path through the plume along which the opacity measurement is made. P' is the path perpendicular to the plume at the same point. The angle ϵ is the angle between L' and the plume center line. The angle $(\pi/2-\epsilon)$, is the angle between the L' and P'. The measured opacity, O_p, measured along the path L' shall be corrected to obtain the corrected opacity, O_{pc}, for the path P', using Equation (AM1-8).

$$O_{pc} = (100\%) \left[1 - (1 - 0.01\, O_p)^{\mathrm{Cos}\ (\pi/2-\varepsilon)} \right]$$

$$= (100\%) \left[1 - (1 - 0.01\, O_p)^{\mathrm{Sin}\ \varepsilon} \right] \qquad \text{(AM1-8)}$$

The correction in Equation (AM1-8) shall be performed if the inequality in Equation (AM1-9) is true.

$$\varepsilon \geq \sin^{-1}\left[\frac{\ln(101 - O_p)}{\ln(100 - O_p)}\right] \qquad \text{(AM1-9)}$$

Figure AM1-IV(a) shows the geometry used to calculate ε and the position in the plume at which the lidar measurement is made. This analysis assumes that for a given lidar measurement, the range from the lidar to the plume, the elevation angle of the lidar from the horizontal plane, and the azimuth angle of the lidar from an arbitrary fixed reference in the horizontal plane can all be obtained directly.

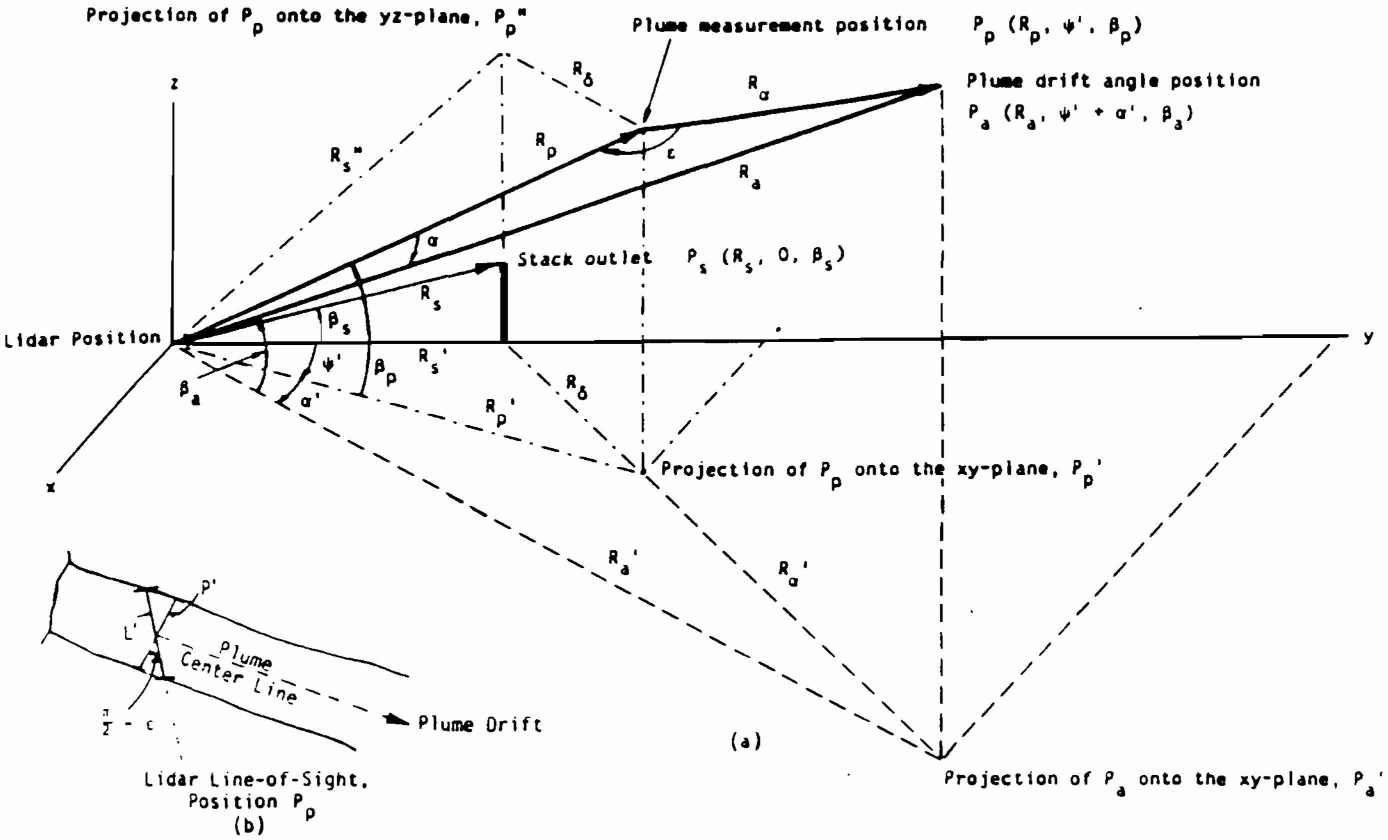


Figure AMI - IV. Correction in Opacity for Drift of the Residual Region of an Attached Steam Plume.

R_s = range from lidar to source*
β_s = elevation angle of R_s*
R_p = range from lidar to plume at the opacity measurement point*
β_p = elevation angle of R_p*
R_a = range from lidar to plume at some arbitrary point, P_a, so the drift angle of the plume can be determined*
β_a = elevation angle of R_a*
α = angle between R_p and R_a
R'_s = projection of R_s in the horizontal plane
R'_p = projection of R_p in the horizontal plane
R'_a = projection of R_a in the horizontal plane
ψ' = angle between R'_s and R'_p*
α' = angle between R'_p and R'_a*
R_δ = distance from the source to the opacity measurement point projected in the horizontal plane
$R\theta$ = distance from opacity measurement point P_p to the point in the plume P_a.

$$O_{pc} = 1 - (1 - O_p)^{\cos(\pi/2-\varepsilon)} = 1 - (1 - O_p)^{\sin\varepsilon} \qquad \text{(AMI-8)}$$

The correction angle ε shall be determined using Equation AM1-10.

where:

$\alpha = \cos^{-1}(\cos\beta_p \cos\beta_s \cos\alpha' + \sin\beta_p \sin\beta_s)$.

and

$R\theta = (R_s^2 + R_p^2 - 2\, R_s R_p \cos\alpha)^{1/2}$

R_δ, the distance from the source to the opacity measurement point projected in the horizontal plane, shall be determined using Equation AM1-11.

$$R_\delta = (R'^2_s + R'^2_p - 2R'_sR'_p\cos\psi')^{\frac{1}{2}} , \qquad \text{(AM1-11)}$$

where:

$R'_s = R_s \cos\beta_s$, and

$R'_p = R_p \cos\beta_p$.

In the special case where the plume centerline at the opacity measurement point is horizontal, parallel to the ground, Equation AM1-12 may be used to determine ε instead of Equation AM1-10.

$$\varepsilon = \cos^{-1}\left[\frac{R_p{}^2 + R_\delta{}^2 - R''^2_s}{2\, R_p\, R_\delta}\right] \qquad \text{(AM1-12)}$$

where:

$R''_s = (R'^2_s + R_p^2 \sin^2\beta_p)^{1/2}$.

If the angle ε is such that ε< 30° or ε > 150°, the azimuth angle correction shall not be performed and the associated opacity value shall be discarded.

2.6.2 Elevation Angle Correction. An individual lidar-measured opacity, O_p, shall be corrected for elevation angle if the laser elevation or inclination angle, β_p [Figure AM1-V], is greater than or equal to the value calculated in Equation AM1-13.

$$\beta_p \geq \cos^{-1}\left[\frac{\ln(101 - O_p)}{\ln(100 - O_p)}\right] \qquad \text{(AM1-13)}$$

The measured opacity, O_p, along the lidar path L is adjusted to obtain the corrected opacity, O_{pc}, for the actual plume (horizontal) path, P, by using Equation (AM1-14).

$$O_{pc} = (100\%)\left[1 - (1 - 0.01\, O_p)^{\cos\beta_p}\right], \qquad \text{(AM1-14)}$$

where:

β_p = lidar elevation or inclination angle,

O_p = measured opacity along path L, and

O_{pc} = corrected opacity for the actual plume thickness P.

The values for β_p, O_p and O_{pc} should be recorded.

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*Obtained directly from lidar. These values should be recorded.

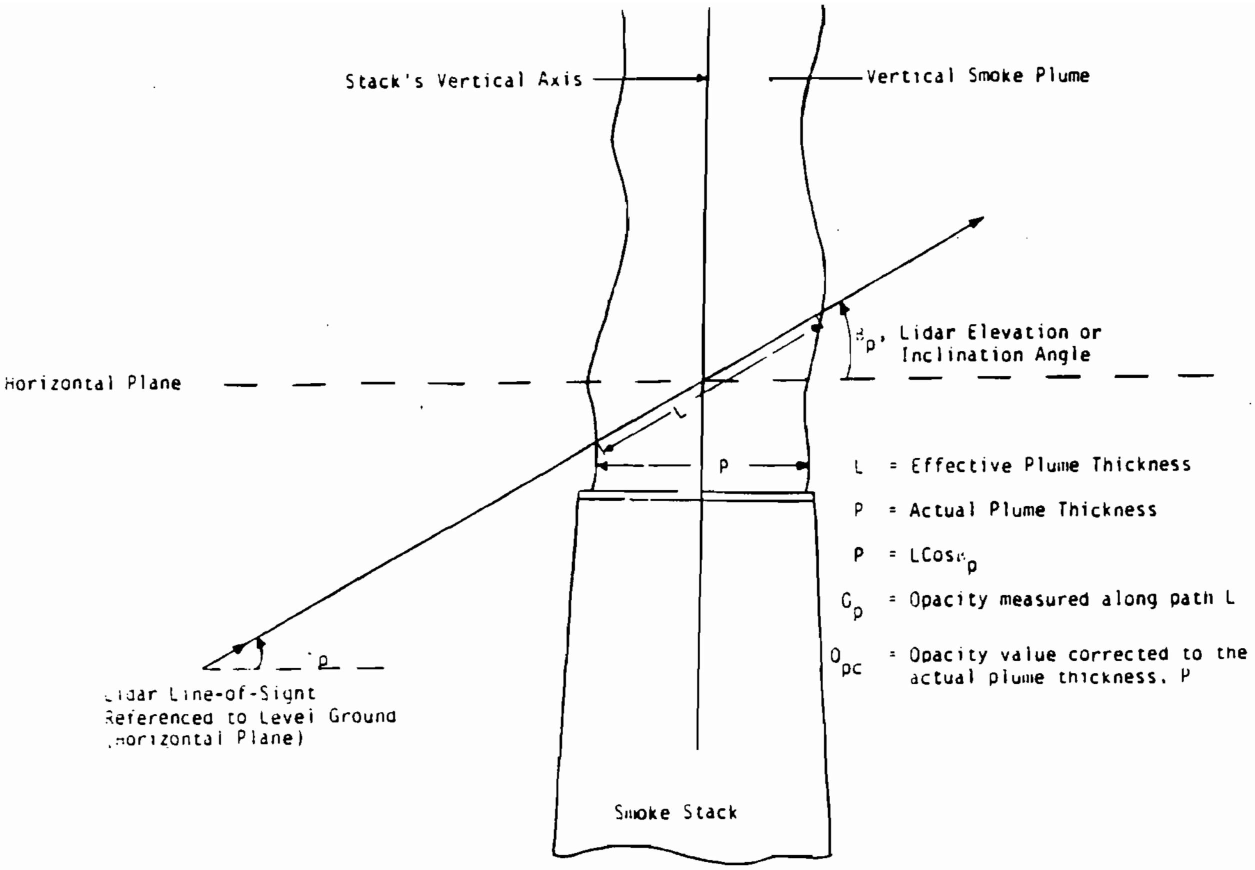


Figure AM1-V. Elevation Angle Correction for Vertical Plumes.

2.6.3 Determination of Actual Plume Opacity. Actual opacity of the plume shall be determined by Equation AM1-15.

$$O_{pa} = O_{pc} - [2 S_o + 5\%]. \qquad (AM1-15)$$

2.6.4 Calculation of Average Actual Plume Opacity. The average of the actual plume opacity, $\bar{O}_{pa}$ shall be calculated as the average of the consecutive individual actual opacity values, O_{pa} by Equation AM1-16.

$$\bar{O}_{pa} = \frac{1}{n} \sum_{k=1}^{n} (O_{pa})_k \ , \qquad (AM1-16)$$

where:

$(O_{pa})_k$ = the kth actual opacity value in an averaging interval containing n opacity values; k is a summing index.

Σ = the sum of the individual actual opacity values.

n = the number of individual actual opacity values contained in the averaging interval.

$\bar{O}_{pa}$ = average actual opacity calculated over the averaging interval.

3. Lidar Performance Verification. The lidar shall be subjected to two types of performance verifications that shall be peformed in the field. The annual calibration, conducted at least once a year, shall be used to directly verify operation and performance of the entire lidar system. The routine verification, conducted for each emission source measured, shall be used to insure proper performance of the optical receiver and associated electronics.

3.1 Annual Calibration Procedures. Either a plume from a smoke generator or screen targets shall be used to conduct this calibration.

If the screen target method is selected, five screens shall be fabricated by placing an opaque mesh material over a narrow frame (wood, metal extrusion, etc.). The screen shall have a surface area of at least one square meter. The screen material should be chosen for precise optical opacities of about 10, 20, 40, 60, and 80%. Opacity of each target shall be optically determined and should be recorded. If a smoke generator plume is selected, it shall meet the requirements of Section 3.3 of Reference Method 9. This calibration shall be performed in the field during calm (as practical) atmospheric conditions. The lidar shall be positioned in accordance with Section 2.1.

The screen targets must be placed perpendicular to and coincident with the lidar line-of-sight at sufficient height above the ground (suggest about 30 ft) to avoid ground-level dust contamination. Reference signals shall be obtained just prior to conducting the calibration test.

The lidar shall be aimed through the center of the plume within 1 stack diameter of the exit, or through the geometric center of the screen target selected. The lidar shall be set in operation for a 6-minute data run at a nominal pulse rate of 1 pulse every 10 seconds. Each backscatter return signal and each respective opacity value obtained from the smoke generator transmissometer, shall be obtained in temporal coincidence. The data shall be analyzed and reduced in accordance with Section 2.6 of this method. This calibration shall be performed for 0% (clean air), and at least five other opacities (nominally 10, 20, 40, 60, and 80%).

The average of the lidar opacity values obtained during a 6-minute calibration run shall be calculated and should be recorded. Also the average of the opacity values obtained from the smoke generator transmissometer for the same 6-minute run shall be calculated and should be recorded.

Alternate calibration procedures that do not meet the above requirements but produce equivalent results may be used.

3.2 Routine Verification Procedures. Either one of two techniques shall be used to conduct this verification. It shall be performed at least once every 4 hours for each emission source measured. The following parameters shall be directly verified.

1) The opacity value of 0% plus a minimum of 5 (nominally 10, 20, 40, 60, and 80%) opacity values shall be verified through the PMT detector and data processing electronics.

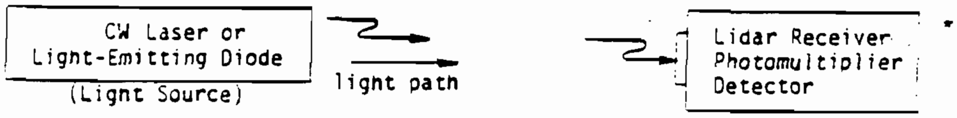
2) The zero-signal level (receiver signal with no optical signal from the source present) shall be inspected to insure that no spurious noise is present in the signal. With the entire lidar receiver and analog/digital electronics turned on and adjusted for normal operating performance, the following procedures shall be used for Techniques 1 and 2, respectively.

3.2.1 Procedure for Technique 1. This test shall be performed with no ambient or stray light reaching the PMT detector. The narrow band filter (694.3 nanometers peak) shall be removed from its position in front of the PMT detector. Neutral density filters of nominal opacities of 10, 20, 40, 60, and 80% shall be used. The recommended test configuration is depicted in Figure AM1-VI.

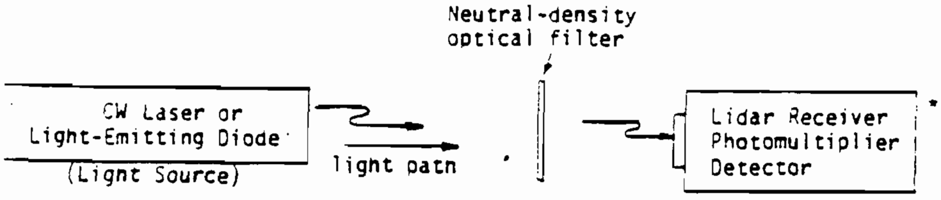
The zero-signal level shall be measured and should be recorded, as indicated in Figure AM1-VI(a). This simulated clear-air or 0% opacity value shall be tested in using the selected light source depicted in Figure AM1-VI(b).

The light source either shall be a continuous wave (CW) laser with the beam mechanically chopped or a light emitting diode controlled with a pulse generator (rectangular pulse). (A laser beam may have to be attenuated so as not to saturate the PMT detector). This signal level shall be measured and should be recorded. The opacity value is calculated by taking two pick intervals (Section 2.6) about 1 microsecond apart in time and using Equation (AM1-2) setting the ratio $R_n/R_f = 1$. This calculated value should be recorded.

(a) Zero-Signal Level Test



(b) Clear-Air or 0% Opacity Test



(c) Optical Filter Test (simulated opacity values)

*Tests shall be performed with no ambient or stray light reaching the detector.

Figure AM1-VI. Test Configuration for Technique 1.

The simulated clear-air signal level is also employed in the optical test using the neutral density filters. Using the test configuration in Figure AM1-VI(c), each neutral density filter shall be separately placed into the light path from the light source to the PMT detector. The signal level shall be measured and should be recorded. The opacity value for each filter is calculated by taking the signal level for that respective filter (I_f), dividing it by the 0% opacity signal level (I_o) and performing the remainder of the calculation by Equation (AM1-2) with $R_n/R_f = 1$. The calculated opacity value for each filter should be recorded.

The neutral density filters used for Technique 1 shall be calibrated for actual opacity with accuracy of ±2% or better. This calibration shall be done monthly while the filters are in use and the calibrated values should be recorded.

3.2.2 Procedure for Technique 2. An optical generator (built-in calibration mechanism) that contains a light-emitting diode (red light for a lidar containing a ruby laser) is used. By injecting an optical signal into the lidar receiver immediately ahead of the PMT detector, a backscatter signal is simulated. With the entire lidar receiver electronics turned on and adjusted for normal operating performance, the optical generator is turned on and the simulation signal (corrected for $1/R^2$) is selected with no plume spike signal and with the opacity value equal to 0%. This simulated clear-air atmospheric return signal is displayed on the system's video display. The lidar operator then makes any fine adjustments th

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may be necessary to maintain the system's normal operating range.

The opacity values of 0% and the other five values are selected one at a time in any order. The simulated return signal data should be recorded. The opacity value shall be calculated. This measurement/calculation shall be performed at least three times for each selected opacity value. While the order is not important, each of the opacity values from the optical generator shall be verified. The calibrated optical generator opacity value for each selection should be recorded.

The optical generator used for Technique 2 shall be calibrated for actual opacity with an accuracy of ±1% or better. This calibration shall be done monthly while the generator is in use and calibrated value should be recorded.

Alternate verification procedures that do not meet the above requirements but produce equivalent results may be used.

3.3 Deviation. The permissible error for the annual calibration and routine verification are:

3.3.1 Annual Calibration Deviation.

3.3.1.1 Smoke Generator. If the lidar-measured average opacity for each data run is not within ±5% (full scale) of the respective smoke generator's average opacity over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.1.2 Screens. If the lidar-measured average opacity for each data run is not within ±3% (full scale) of the laboratory-determined opacity for each respective simulation screen target over the range of 0% through 80%, then the lidar shall be considered out of calibration.

3.3.2 Routine Verification Error. If the lidar-measured average opacity for each neutral density filter (Technique 1) or optical generator selection (Technique 2) is not within ±3% (full scale) of the respective laboratory calibration value then the lidar shall be considered non-operational.

4. Performance/Design Specification for Basic Lidar System.

4.1 Lidar Design Specification. The essential components of the basic lidar system are a pulsed laser (transmitter), optical receiver, detector, signal processor, recorder, and an aiming device that is used in aiming the lidar transmitter and receiver. Figure AM1-VII shows a functional block diagram of a basic lidar system.

4.2 Performance Evaluation Tests. The owner of a lidar system shall subject such a lidar system to the performance verification tests described in Section 3, prior to first use of this method. The annual calibration shall be performed for three separate, complete runs and the results of each should be recorded. The requirements of Section 3.3.1 must be fulfilled for each of the three runs.

Once the conditions of the annual calibration are fulfilled the lidar shall be subjected to the routine verification for three separate complete runs. The requirements of Section 3.3.2 must be fulfilled for each of the three runs and the results should be recorded. The Administrator may request that the results of the performance evaluation be submitted for review.

5. References.

5.1 The Use of Lidar for Emissions Source Opacity Determination. U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA-330/1-79-003-R. Arthur W. Dybdahl, current edition [NTIS No. PB81-246662].

5.2 Field Evaluation of Mobile Lidar for the Measurement of Smoke Plume Opacity. U.S. Environmental Protection Agency, National Enforcement Investigations Center, Denver, CO. EPA/NEIC-TS-128, February 1976.

5.3 Remote Measurement of Smoke Plume Transmittance Using Lidar. C. S. Cook, G. W. Bethke, W. D. Conner (EPA/RTP). Applied Optics 11, pg 1742, August 1972.

5.4 Lidar Studies of Stack Plumes Rural and Urban Environments. EPA-6 4-73-002. October 1973.

5.5 American National Standard for Safe Use of Lasers ANSI Z 136.1-176 March 1976.

5.6 U.S. Army Technical Manual MED 279, Control of Hazards to Hea from Laser Radiation. February 1969.

5.7 Laser Institute of America La Safety Manual. 4th Edition.

5.8 U.S. Department of Health, Edu tion and Welfare. Regulations for the ministration and Enforcement of the Ra ation Control for Health and Safety Act 1968. January 1976.

5.9 Laser Safety Handbook. Alex Malle Leon Chabot. Van Nostrand Reinhold C 1978.

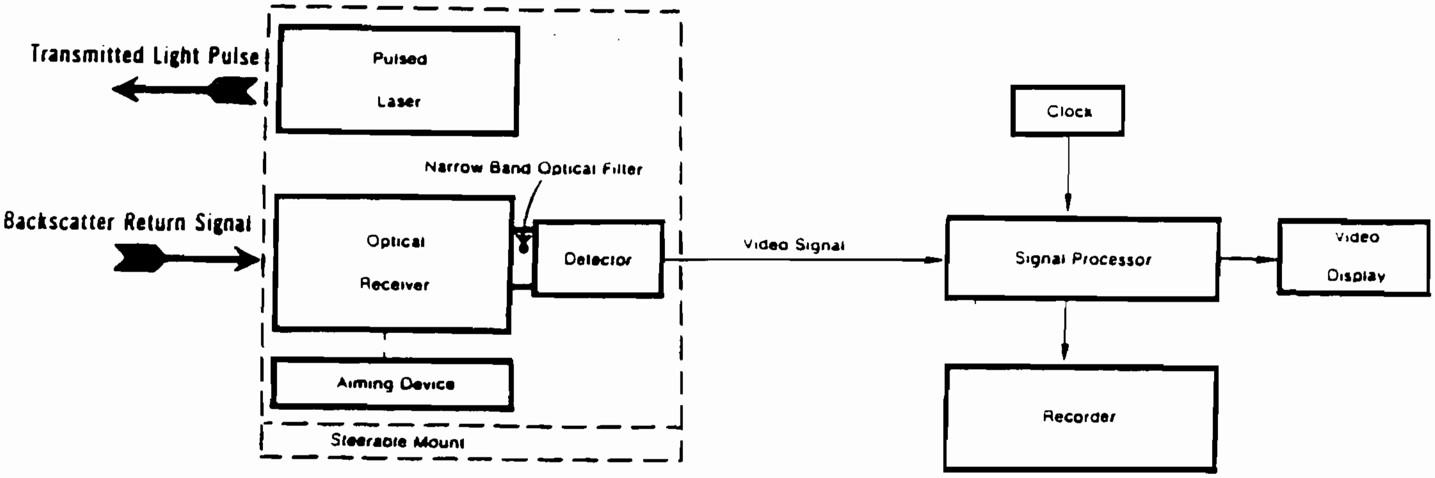

Figure AM1-VII. Functional Block Diagram of a Basic Lidar System

METHOD 10—DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

1. *Principle and Applicability.*

1.1 *Principle.* An integrated or continuous gas sample is extracted from a sampling point and analyzed for carbon monoxide (CO) content using a Luft-type nondispersive infrared analyzer (NDIR) or equivalent.

1.2 *Applicability.* This method is applicable for the determination of carbon monoxide emissions from stationary sources only when specified by the test procedures for determining compliance with new source performance standards. The test procedure will indicate whether a continuous or an integrated sample is to be used.

2. *Range and sensitivity.*

2.1 *Range.* 0 to 1,000 ppm.

2.2 *Sensitivity.* Minimum detectable concentration is 20 ppm for a 0 to 1,000 ppm span.

3. *Interferences.* Any substance having a strong absorption of infrared energy will interfere to some extent. For example, discrimination ratios for water (H_2O) and carbon dioxide (CO_2) are 3.5 percent H_2O per 7 ppm CO and 10 percent CO_2 per 10 ppm CO, respectively, for devices measuring in the 1,500 to 3,000 ppm range. For devices measuring in the 0 to 100 ppm range, interference ratios can be as high as 3.5 percent H_2O per 25 ppm CO and 10 percent CO_2 per 50 ppm CO. The use of silica gel and ascarite traps will alleviate the major interference problems. The measured gas volume must be corrected if these traps are used.

4. *Precision and accuracy.*

4.1 *Precision.* The precision of most NDIR analyzers is approximately ±2 percent of span.

4.2 *Accuracy.* The accuracy of most NDIR analyzers is approximately ±5 percent of span after calibration.

5. *Apparatus.*

5.1 *Continuous sample* (Figure 10-1).

5.1.1 *Probe.* Stainless steel or sheathed Pyrex[1] glass, equipped with a filter to remove particulate matter.

5.1.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2 *Integrated sample* (Figure 10-2).

5.2.1 *Probe.* Stainless steel or sheathed Pyrex glass, equipped with a filter to remove particulate matter.

5.2.2 *Air-cooled condenser or equivalent.* To remove any excess moisture.

5.2.3 *Valve.* Needle valve, or equivalent, to to adjust flow rate.

5.2.4 *Pump.* Leak-free diaphragm type, or equivalent, to transport gas.

5.2.5 *Rate meter.* Rotameter, or equivalent, to measure a flow range from 0 to 1.0 liter per min. (0.035 cfm).

5.2.6 *Flexible bag.* Tedlar, or equivalent, with a capacity of 60 to 90 liters (2 to 3 ft^3). Leak-test the bag in the laboratory before using by evacuating bag with a pump fol-

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[1] Mention of trade names or specific products does not constitute endorsement by the Environmental Protection Agency.

lowed by a dry gas meter. When evacuation is complete, there should be no flow through the meter.

5.2.7 *Pitot tube.* Type S, or equivalent, attached to the probe so that the sampling rate can be regulated proportional to the stack gas velocity when velocity is varying with the time or a sample traverse is conducted.

5.3 *Analysis* (Figure 10-3).

5.3.1 *Carbon monoxide analyzer.* Nondispersive infrared spectrometer, or equivalent. This instrument should be demonstrated, preferably by the manufacturer, to meet or exceed manufacturer's specifications and those described in this method.

5.3.2 *Drying tube.* To contain approximately 200 g of silica gel.

5.3.3 *Calibration gas.* Refer to paragraph 6.1.

5.3.4 *Filter.* As recommended by NDIR manufacturer.

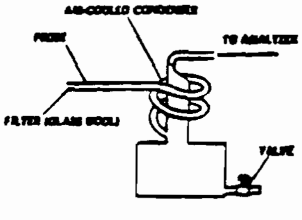

Figure 10-1. Continuous sampling train.

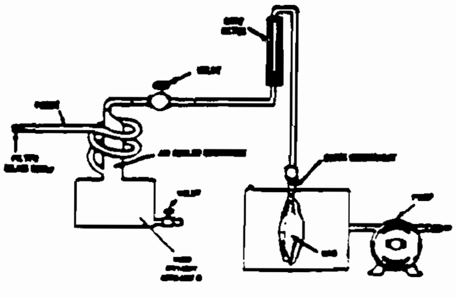

Figure 10-2. Integrated gas-sampling train.

5.3.5 CO_2 *removal tube.* To contain approximately 500 g of ascarite.

5.3.6 *Ice water bath.* For ascarite and silica gel tubes.

5.3.7 *Valve.* Needle valve, or equivalent, to adjust flow rate.

5.3.8 *Rate meter.* Rotameter or equivalent to measure gas flow rate of 0 to 1.0 liter per min. (0.035 cfm) through NDIR.

5.3.9 *Recorder (optional).* To provide permanent record of NDIR readings.

6. *Reagents.*

6.1 *Calibration gases.* Known concentration of CO in nitrogen (N_2) for instrument span, prepurified grade of N_2 for zero, and two additional concentrations corresponding approximately to 60 percent and 30 percent span. The span concentration shall not exceed 1.5 times the applicable source performance standard. The calibration gases shall be certified by the manufacturer to be within ±2 percent of the specified concentration.

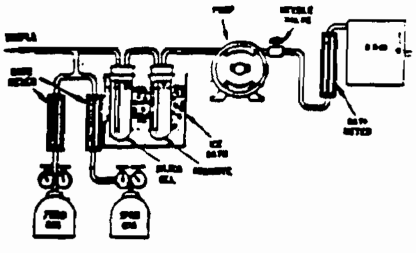

Figure 10-3. Analytical equipment.

6.2 *Silica gel.* Indicating type, 6 to 16 mesh, dried at 175° C (347° F) for 2 hours.

6.3 *Ascarite.* Commercially available.

7. *Procedure.*

7.1 *Sampling.*

7.1.1 *Continuous sampling.* Set up the equipment as shown in Figure 10-1 making sure all connections are leak free. Place the probe in the stack at a sampling point and purge the sampling line. Connect the analyzer and begin drawing sample into the analyzer. Allow 5 minutes for the system to stabilize, then record the analyzer reading as required by the test procedure. (See ¶ 7.2 and 8). CO_2 content of the gas may be determined by using the Method 3 integrated sample procedure (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.1.2 *Integrated sampling.* Evacuate the flexible bag. Set up the equipment as shown in Figure 10-2 with the bag disconnected. Place the probe in the stack and purge the sampling line. Connect the bag, making sure that all connections are leak free. Sample at a rate proportional to the stack velocity. CO_2 content of the gas may be determined by using the Method 3 integrated sample procedures (36 FR 24886), or by weighing the ascarite CO_2 removal tube and computing CO_2 concentration from the gas volume sampled and the weight gain of the tube.

7.2 *CO Analysis.* Assemble the apparatus as shown in Figure 10-3, calibrate the instrument, and perform other required operations as described in paragraph 8. Purge analyzer with N_2 prior to introduction of each sample. Direct the sample stream through the instrument for the test period, recording the readings. Check the zero and span again after the test to assure that any drift or malfunction is detected. Record the sample data on Table 10-1.

8. *Calibration.* Assemble the apparatus according to Figure 10-3. Generally an instrument requires a warm-up period before stability is obtained. Follow the manufacturer's instructions for specific procedure. Allow a minimum time of 1 hour for warm-up. During this time check the sample conditioning apparatus, i.e., filter, condenser, drying tube, and CO_2 removal tube, to ensure that each component is in good operating condition. Zero and calibrate the instrument according to the manufacturer's procedures using, respectively, nitrogen and the calibration gases.

TABLE 10-1—FIELD DATA

Comments

Location ____________

Test ____________

Date ____________

Operator ____________

Clock time	Rotameter setting, liters per minute (cubic feet per minute)

9. *Calculation—Concentration of carbon monoxide.* Calculate the concentration of carbon monoxide in the stack using equation 10-1.

$$C_{CO\ stack}=C_{CO\ NDIR}(1-F_{CO_2})$$

where:

$C_{CO\ stack}$=concentration of CO in stack, ppm by volume (dry basis).

$C_{CO\ NDIR}$=concentration of CO measured by NDIR analyzer, ppm by volume (dry basis).

F_{CO_2}=volume fraction of CO_2 in sample, i.e., percent CO_2 from Orsat analysis divided by 100.

10. *Bibliography.*

10.1 McElroy, Frank. The Intertech NDIR-CO Analyzer. Presented at 11th Methods Conference on Air Pollution, University of California, Berkeley, Calif., Apr 1, 1970.

10.2 Jacobs, M. B., et al., Continuou[illegible]termination of Carbon Monoxid[illegible] Hydrocarbons in Air by a Modified Infrared Analyzer. J. Air Pollution Control Association. 9(2): 110-114. August 1959.

10.3 MSA LIRA Infrared Gas and Liquid Analyzer Instruction Book, Mine Safety Appliances Co., Technical Products Division, Pittsburgh, Pa.

10.4 Models 215A, 315A, and 415A Infrared Analyzers, Beckman Instruments, Inc., Beckman Instructions 1635-B, Fullerton, Calif., October 1967.

10.5 Continuous CO Monitoring System, Model A5611, Intertech Corp., Princeton, N.J.

10.6 UNOR Infrared Gas Analyzers, Bendix Corp., Ronceverte, West Virginia.

ADDENDA—A. PERFORMANCE SPECIFICATIONS FOR NDIR CARBON MONOXIDE ANALYZERS.

Range (minimum)	0-1000 ppm.
Output (minimum)	0-10mv.
Minimum detectable sensitivity.	20 ppm.
Rise time, 90 percent (maximum).	30 seconds.
Fall time, 90 percent (maximum).	30 seconds.
Zero drift (maximum)	10% in 8 hours.
Span drift (maximum)	10% in 8 hours.
Precision (minimum)	±2% of full scale.
Noise (maximum)	±1% of full scale.
Linearity (maximum deviation)	2% of full scale.
Interference rejection ratio	CO_2—1000 to 1, H_2O—500 to 1.

B. *Definitions of Performance Specifications.*

Range—The minimum and maximum measurement limits.

Output—Electrical signal which is proportional to the measurement; intended for connection to readout or data processing devices. Usually expressed as millivolts or milliamps full scale at a given impedance.

Full scale—The maximum measuring limit for a given range.

Minimum detectable sensitivity—The smallest amount of input concentration that can be detected as the concentration approaches zero.

Accuracy—The degree of agreement between a measured value and the true value; usually expressed as ± percent of full scale.

Time to 90 percent response—The time interval from a step change in the input concentration at the instrument inlet to a reading of 90 percent of the ultimate recorded concentration.

Rise Time (90 percent)—The interval between initial response time and time to 90 percent response after a step increase in the inlet concentration.

Fall Time (90 percent)—The interval between initial response time and time to 90 percent response after a step decrease in the inlet concentration.

Zero Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is zero; usually expressed as percent full scale.

Span Drift—The change in instrument output over a stated time period, usually 24 hours, of unadjusted continuous operation when the input concentration is a stated upscale value; usually expressed as percent full scale.

Precision—The degree of agreement between repeated measurements of the same concentration, expressed as the average deviation of the single results from the mean.

Noise—Spontaneous deviations from a mean output not caused by input concentration changes.

Linearity—The maximum deviation between an actual instrument reading and the reading predicted by a straight line drawn between upper and lower calibration points.

Method 12—Determination of Inorganic Lead Emissions From Stationary Sources

1. *Applicability and Principle.*

1.1 Applicability. This method applies to the determination of inorganic lead (Pb) emissions from specified stationary sources only.

1.2 Principle. Particulate and gaseous Pb emissions are withdrawn isokinetically from the source and collected on a filter and in dilute nitric acid. The collected samples are digested in acid solution and analyzed by atomic absorption spectrometry using an air acetylene flame.

2. *Range, Sensitivity, Precision, and Interferences.*

2.1 Range. For a minimum analytical accuracy of ±10 percent, the lower limit of the range is 100 μg. The upper limit can be considerably extended by dilution.

2.2 Analytical Sensitivity. Typical sensitivities for a 1-percent change in absorption (0.0044 absorbance units) are 0.2 and 0.5 μg Pb/ml for the 217.0 and 283.3 nm lines, respectively.

2.3 Precision. The within-laboratory precision, as measured by the coefficient of variation ranges from 0.2 to 9.5 percent relative to a run-mean concentration. These values were based on tests conducted at a gray iron foundry, a lead storage battery manufacturing plant, a secondary lead smelter, and a lead recovery furnace of an alkyl lead manufacturing plant. The concentrations encountered during these tests ranged from 0.61 to 123.3 mg Pb/m^3.

2.4 Interferences. Sample matrix effects may interfere with the analysis for Pb by flame atomic absorption. If this interference is suspected, the analyst may confirm the presence of these matrix effects and frequently eliminate the interference by using the Method of Standard Additions.

High concentrations of copper may interfere with the analysis of Pb at 217.0 nm. This interference can be avoided by analyzing the samples at 283.3 nm.

3. *Apparatus.*

3.1 Sampling Train. A schematic of the sampling train is shown in Figure 12-1; it is similar to the Method 5 train. The sampling train consists of the following components:

3.1.1 Probe Nozzle, Probe Liner, Pitot Tube, Differential Pressure Gauge, Filter Holder, Filter Heating System, Metering System, Barometer, and Gas Density Determination Equipment. Same as Method 5, Sections 2.1.1 to 2.1.6 and 2.1.8 to 2.1.10, respectively.

3.1.2 Impingers. Four impingers connected in series with leak-free ground glass fittings or any similar leak-free noncontaminating fittings. For the first, third, and fourth impingers, use the Greenburg-Smith design, modified by replacing the tip with a 1.3 cm (½ in.) ID glass tube extending to about 1.3 cm (½ in.) from the bottom of the flask. For the second impinger, use the Greenburg-Smith design with the standard tip. Place a thermometer, capable of measuring temperature to within 1°C (2°F) at the outlet of the fourth impinger for monitoring purposes.

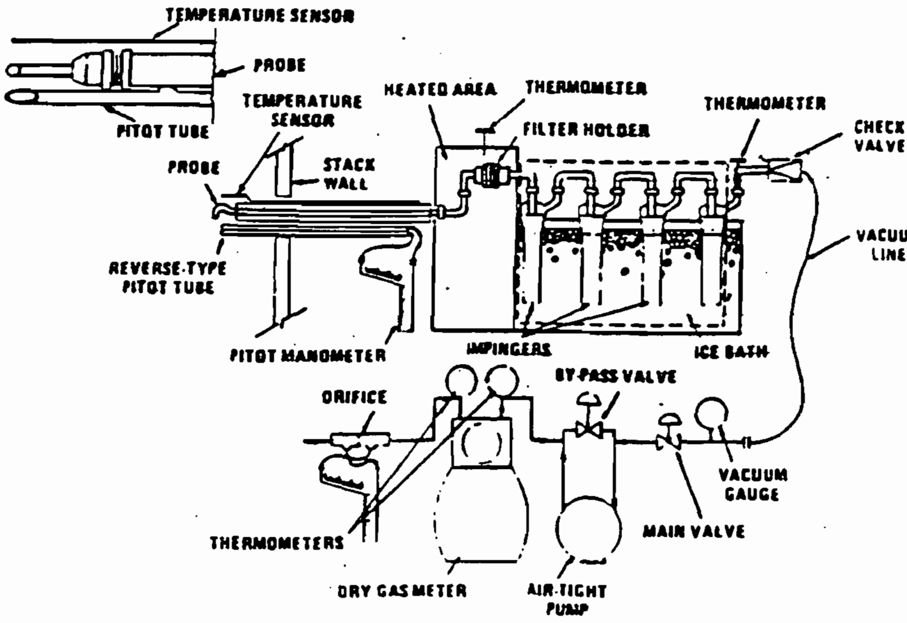

Figure 12-1. Inorganic lead sampling train.

3.2 Sample Recovery. The following items are needed:

3.2.1 Probe-Liner and Probe-Nozzle Brushes, Petri Dishes, Plastic Storage Containers, and Funnel and Rubber Policeman. Same as Method 5, Sections 2.2.1, 2.2.4, 2.2.6, and 2.2.7, respectively.

3.2.2 Wash Bottles. Glass (2).

3.2.3 Sample Storage Containers. Chemically resistant, borosilicate glass bottles, for 0.1 nitric acid (HNO_3) impinger and probe solutions and washes, 1000-ml. Use screw-cap liners that are either rubber-backed Teflon* or leak-free and resistant to chemical attack by 0.1 N HNO_3. (Narrow mouth glass bottles have been found to be less prone to leakage.)

3.2.4 Graduated Cylinder and/or Balance. To measure condensed water to within 2 ml or 1 g. Use a graduated cylinder that has a minimum capacity of 500 ml, and subdivisions no greater than 5 ml. (Most laboratory balances are capable of weighing to the nearest 0.5 g or less.)

3.2.5 Funnel. Glass, to aid in sample recovery.

3.3 Analysis. The following equipment is needed:

3.3.1 Atomic Absorption Spectrophotometer. With lead hollow cathode lamp and burner for air/acetylene flame.

3.3.2 Hot Plate.

3.3.3 Erlenmeyer Flasks. 125-ml, 24/4

3.3.4 Membrane Filters. Millip SCWPO 4700 or equivalent.

3.3.5 Filtration Apparatus. Millip vacuum filtration unit, or equivalent, use with the above membrane filter.

3.3.6 Volumetric Flasks. 100-ml, 250- and 1000-ml.

4. *Reagents.*

4.1 Sampling. The reagents used in sa pling are as follows:

4.1.1 Filter. Gelman Spectro Gra Reeve Angel 934 AH, MSA 1106 BH, all w lot assay for Pb, or other high-purity gl fiber filters, without organic binder, exhit ing at least 99.95 percent efficiency (<0 percent penetration) on 0.3 micron dioc phthalate smoke particles. Conduct t filter efficiency test using ASTM Stand Method D2986-71 (incorporated by ref ence—see § 60.17) or use test data from t supplier's quality control program.

4.1.2 Silica Gel, Crushed Ice, and St cock Grease. Same as Method 5, Secti 3.1.2, 3.1.4, and 3.1.5, respectively.

4.1.3 Water. Deionized distilled, to c form to ASTM Specification D1193-77 (corporated by reference—see § 60.17), Ty 3. If high concentrations of organic matt

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*Mention of trade names or specific pr ucts does not constitute endorsement by t U.S. Environmental Protection Agency.

are not expected to be present, the analyst may delete the potassium permanganate test for oxidizable organic matter.

4.1.4 Nitric Acid, 0.1 N. Dilute 6.5 ml of concentrated HNO_3 to 1 liter with deionized distilled water. (It may be desirable to run blanks before field use to eliminate a high blank on test samples.)

4.2 Pretest Preparation. 6 N HNO_3 is needed. Dilute 390 ml of concentrated HNO_3 to 1 liter with deionized distilled water.

4.3 Sample Recovery. 0.1 N HNO_3 (same as 4.1.4 above) is needed for sample recovery.

4.4 Analysis. The following reagents are needed for analysis (use ACS reagent grade chemicals or equivalent, unless otherwise specified):

4.4.1 Water. Same as 4.1.3 above.

4.4.2 Nitric Acid. Concentrated.

4.4.3 Nitric Acid. 50 percent (V/V). Dilute 500 ml of concentrated HNO_3 to 1 liter with deionized distilled water.

4.4.4 Stock Lead Standard Solution. 1000 μg Pb/ml. Dissolve 0.1598 g of lead nitrate $[Pb(NO_3)_2]$ in about 60 ml of deionized distilled water, add 2 ml concentrated HNO_3, and dilute to 100 ml with deionized distilled water.

4.4.5 Working Lead Standards. Pipet 0.0, 1.0, 2.0, 3.0, 4.0, and 5.0 ml of the stock lead standard solution (4.4.4) into 250-ml volumetric flasks. Add 5 ml of concentrated HNO_3 to each flask and dilute to volume with deionized distilled water. These working standards contain 0.0, 4.0, 8.0, 12.0, 16.0, and 20.0 μg Pb/ml, respectively. Prepare, as needed, additional standards at other concentrations in a similar manner.

4.4.6 Air. Suitable quality for atomic absorption analysis.

4.4.7 Acetylene. Suitable quality for atomic absorption analysis.

4.4.8 *Hydrogen Peroxide*. 3 percent (V/V). Dilute 10 ml of 30 percent H_2O_2 to 100 ml with deionized distilled water.

5. *Procedure.*

5.1 Sampling. The complexity of this method is such that, in order to obtain reliable results, testers should be trained and experienced with the test procedures.

5.1.1 Pretest Preparation. Follow the same general procedure given in Method 5, Section 4.1.1, except the filter need not be weighed.

5.1.2 Preliminary Determinations. Follow the same general procedure given in Method 5, Section 4.1.2.

5.1.3 Preparation of Collection Train. Follow the same general procedure given in Method 5, Section 4.1.3, except place 100 ml of 0.1 HNO_3 in each of the first two impingers, leave the third impinger empty, and transfer approximately 200 to 300 g of preweighed silica gel from its container to the fourth impinger. Set up the train as shown in Figure 12-1.

5.1.4 Leak-Check Procedures. Follow the general leak-check procedures given in Method 5, Sections 4.1.4.1 (Pretest Leak-Check), 4.1.4.2 (Leak-Checks During the Sample Run), and 4.1.4.3 (Post-Test Leak-Check).

5.1.5 Sampling Train Operation. Follow the same general procedure given in Method 5, Section 4.1.5. For each run, record the data required on a data sheet such as the one shown in EPA Method 5, Figure 5-2.

5.1.6 Calculation of Percent Isokinetic. Same as Method 5, Section 4.1.6.

5.2 *Sample Recovery*. Begin proper cleanup procedure as soon as the probe is removed from the stack at the end of the sampling period.

Allow the probe to cool. When it can be safely handled, wipe off all external particulate matter near the tip of the probe nozzle and place a cap over it. Do not cap off the probe tip tightly while the sampling train is cooling down as this would create a vacuum in the filter holder, thus drawing liquid from the impingers into the filter.

Before moving the sampling train to the cleanup site, remove the probe from the sapling train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the glassware inlet where the probe was fastened and cap the inlet. Remove the umbilical cord from the last impinger and cap the impinger. The tester may use ground-glass stoppers, plastic caps, or serum caps to close these openings.

Transfer the probe and filter-impinger assembly to a cleanup area, which is clean and protected from the wind so that the chances of contaminating or losing the sample are minimized.

Inspect the train prior to and during disassembly and note any abnormal conditions. Treat the samples as follows:

5.2.1 *Container No. 1* (Filter). Carefully remove the filter from the filter holder and place it in its identified petri dish container. If it is necessary to fold the filter, do so such that the sample-exposed side is inside the fold. Carefully transfer to the petri dish any visible sample matter and/or filter fibers that adhere to the filter holder gasket by using a dry Nylon bristle brush and/or a sharp-edged blade. Seal the container.

5.2.2 *Container No. 2* (Probe). Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover sample matter or any condensate from the probe nozzle, probe fitting, probe liner, and front half of the filter holder by washing these components with 0.1 N HNO_3 and placing the wash into a glass sample storage container. Measure and record (to the nearest 2-ml) the total amount of 0.1 N HNO_3 used for each rinse. Perform the 0.1 N HNO^3 rinses as follows:

Carefully remove the probe nozzle and rinse the inside surfaces with 0.1 N HNO^3 from a wash bottle while brushing with a stainless steel, Nylon-bristle brush. Brush until the 0.1 N HNO_3 rinse shows no visible particles, then make a final rinse of the inside surface.

Brush and rinse with 0.1 N HNO_3 the inside parts of the Swagelok fitting in a similar way until no visible particles remain.

Rinse the probe liner with 0.1 N HNO_3. While rotating the probe so that all inside surfaces will be rinsed with 0.1 N HNO_3, tilt the probe and squirt 0.1 N HNO_3 into its upper end. Let the 0.1 N HNO_3 drain from the lower end into the sample container. The tester may use a glass funnel to aid in transferring liquid washes to the container. Follow the rinse with a probe brush. Hold the probe in an inclined position, squirt 0.1 N HNO_3 into the upper end of the probe as the probe brush is being pushed with a twisting action through the probe; hold the sample container underneath the lower end of the probe and catch any 0.1 N HNO_3 and sample matter that is brushed from the probe. Run the brush through the probe three times or more until no visible sample matter is carried out with the 0.1 N HNO_3 and none remains on the probe liner on visual inspection. With stainless steel or other metal probes, run the brush through in the above prescribed manner at least six times, since metal probes have small crevices in which sample matter can be entrapped. Rinse the brush with 0.1 N HNO_3 and quantitatively collect these washings in the sample container. After the brushing make a final rinse of the probe as described above.

It is recommended that two people clean the probe to minimize loss of sample. Between sampling runs, keep brushes clean and protected from contamination.

After insuring that all joints are wiped clean of silicone grease, brush and rinse with 0.1 N HNO_3 the inside of the front half of the filter holder. Brush and rinse each suface three times or more, if needed, to remove visible sample matter. Make a final rinse of the brush and filter holder. After all 0.1 N HNO_3 washings and sample matter are collected in the sample container, tighten the lid on the sample container so that the fluid will not leak out when it is shipped to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to clearly identify its contents.

5.2.3 *Container No. 3* (Silica Gel). Check the color of the indicating silica gel to determine if it has been completely spent and make a notation of its condition. Transfer the silica gel from the fourth impinger to the original container and seal. The tester may use a funnel to pour the silica gel and a rubber policeman to remove the silica from the impinger. It is not necessary remove the small amount of particles tha may adhere to the walls and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, the tester may follow procedure for Container No. 3 under Section 5.4 (Analysis).

5.2.4 *Container No. 4* (Impingers). Due to the large quantity of liquid involved, the tester may place the impinger solutions in several containers. Clean each of the first three impingers and connecting glassware in the following manner:

1. Wipe the impinger ball joints free of silicone grease and cap the joints.
2. Rotate and agitate each impinger, so that the impinger contents might serve as a rinse solution.
3. Transfer the contents of the impingers to a 500-ml graduated cylinder. Remove the outlet ball joint cap and drain the contents through this opening. Do not separate the impinger parts (inner and outer tubes) while transferring their contents to the cylinder. Measure the liquid volume to within ±2 ml. Alternatively, determine the weight of the liquid to within ±0.5 g. Record in the log the volume or weight of the liquid present, along with a notation of any color or film observed in the impinger catch. The liquid volume or weight is needed, along with the silica gel data, to calculate the stack gas moisture content (see Method 5, Figure 5-3).
4. Transfer the contents to Container No. 4.

5. Note: In steps 5 and 6 below. measure and record the total amount of 0.1 N HNO_3 used for rinsing. Pour approximately 30 ml of 0.1 N HNO_3 into each of the first three impingers and agitate the impingers. Drain the 0.1 N HNO_3 through the outlet arm of each impinger into Container No. 4. Repeat this operation a second time; inspect the impingers for any abnormal conditions.

6. Wipe the ball joints of the glassware connecting the impingers free of silicone grease and rinse each piece of glassware twice with 0.1 N HNO_3; transfer this rinse into Container No. 4. (*Do not rinse or brush the glass-fritted filter support.*) Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to clearly identify its contents.

5.2.5 Blanks. Save 200 ml of the 0.1 N HNO_3 used for sampling and cleanup as a blank. Take the solution directly from the bottle being used and place into a glass sample container labeled "0.1 N HNO_3 blank."

5.3 Sample Preparation.

5.3.1 *Container No. 1* (Filter). Cut the filter into strips and transfer the strips and all loose particulate matter into a 125-ml Erlenmeyer flask. Rinse the petri dish with 10 ml of 50 percent HNO_3 to insure a quantitative transfer and add to the flask. (Note: If the total volume required in Section 5.3.3 is expected to exceed 80 ml. use a 250-ml Erlenmeyer flask in place of the 125-ml flask.)

5.3.2 *Containers No. 2 and No. 4* (Probe and Impingers). (Check the liquid level in Containers No. 2 and/or No. 4 and confirm as to whether or not leakage occurred during transport; note observation on the analysis sheet. If a noticeable amount of leakage had occurred. either void the sample or take steps. subject to the approval of the Administrator. to adjust the final results.) Combine the contents of Containers No. 2 and No. 4 and take to dryness on a hot plate.

5.3.3 Sample Extraction for lead. Based on the approximate stack gas particulate concentration and the total volume of stack gas sampled. estimate the total weight of particulate sample collected. Then transfer the residue from Containers No. 2 and No. 4 to the 125-ml Erlenmeyer flask that contains the filter using rubber policeman and 10 ml of 50 percent HNO_3 for every 100 mg of sample collected in the train or a minimum of 30 ml of 50 percent HNO_3 whichever is larger.

Place the Erlenmeyer flask on a hot plate and heat with periodic stirring for 30 min at a temperature just below boiling. If the sample volume falls below 15 ml. add more 50 percent HNO_3. Add 10 ml of 3 percent H_2O_2 and continue heating for 10 min. Add 50 ml of hot (80°C) deionized distilled water and heat for 20 min. Remove the flask from the hot plate and allow to cool. Filter the sample through a Millipore membrane filter or equivalent and transfer the filtrate to a 250-ml volumetric flask. Dilute to volume with deionized distilled water.

5.3.4 Filter Blank. Determine a filter blank using two filters from each lot of filters used in the sampling train. Cut each filter into strips and place each filter in a separate 125-ml Erlenmeyer flask. Add 15 ml of 50 percent HNO_3 and treat as described in Section 5.3.3 using 10 ml of 3 percent H_2O_2 and 50 ml of hot. deionized distilled water. Filter and dilute to a toal volume of 100 ml using deionized distilled water.

5.3.5 0.1 N HNO_3 Blank. Take the entire 200 ml of 0.1 N HNO_3 to dryness on a steam bath. add 15 ml of 50 percent HNO_3, and treat as described in Section 5.3.3 using 10 ml of 3 percent H_2O_2 and 50 ml of hot. deionized distilled water. Dilute to a total volume of 100 ml using deionized distilled water.

5.4 Analysis.

5.4.1 Lead Determination. Calibrate the spectrophotometer as described in Section 6.2 and determine the absorbance for each source sample. the filter blank. and 0.1 N HNO_3 blank. Analyze each sample three times in this manner. Make appropriate dilutions. as required. to bring all sample Pb concentrations into the linear absorbance range of the spectrophotometer.

If the Pb concentration of a sample is at the low end of the calibration curve and high accuracy is required. the sample can be taken to dryness on a hot plate and the residue dissolved in the appropriate volume of water to bring it into the optimum range of the calibration curve.

5.4.2 Mandatory Check for Matrix Effects on the Lead Results. The analysis for Pb by atomic absorption is sensitive to the chemical compositon and to the physical properties (viscosity. pH) of the sample (matrix effects). Since the Pb procedure described here will be applied to many different sources. many sample matrices will be encountered. Thus. check (mandatory) at least one sample from each source using the Method of Additions to ascertain that the chemical composition and physical properties of the sample did not cause erroneous analytical results.

Three acceptable "Method of Additions" procedures are described in the General Procedure Section of the Perkin Elmer Corporation Manual (see Citation 9.1). If the results of the Method of Additions procedure on the source sample do not agree within 5 percent of the value obtained by the conventional atomic absorption analysis. then the tester must reanalyze all samples from the source using the Method of Additions procedure.

5.4.3 *Container No. 3* (Silica Gel). The tester may conduct this step in the field. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g; record this weight.

6. *Calibration.*

Maintain a laboratory log of all calibrations.

6.1 Sampling Train Calibration. Calibrate the sampling train components according to the indicated sections of Method 5: Probe Nozzle (Section 5.1); Pitot Tube (Section 5.2); Metering System (Section 5.3); Probe Heater (Section 5.4); Temperature Gauges (Section 5.5); Leak-Check of the Metering System (Section 5.6); and Barometer (Section 5.7).

6.2 Spectrophotometer. Measure the absorbance of the standard solutions using the instrument settings recommended by the spectrophotometer manufacturer. Repeat until good agreement (±3 percent) is obtained between two consecutive readings.

Plot the absorbance (y-axis) versus concentration in µg Pb/ml (x-axis). Draw or compute a straight line through the linear portion of the curve. Do not force the calibration curve through zero. but if the curve does not pass through the origin or at least lie closer to the origin than ±0.003 absorbance units. check for incorrectly prepared standards and for curvature in the calibration curve.

To determine stability of the calibrat curve. run a blank and a standard a every five samples and recalibrate. as ne sary.

7. *Calculations.*

7.1 Dry Gas Volume. Using the data f this test. calculate $V_{m(std)}$ the total vol of dry gas metered corrected to stand conditions (20°C and 760 mm Hg). by u Equation 5-1 of Method 5. If necess adjust $V_{m(std)}$ for leakages as outlined in S tion 6.3 of Method 5. See the field d sheet for the average dry gas meter tem ature and average orifice pressure drop.

7.2 Volume of Water Vapor and Moist Content. Using data obtained in this and Equations 5-2 and 5-3 of Method 5. culate the volume of water vapor $V_{w(std)}$ the moisture content B_{ws} of the stack ga

7.3 Total Lead in Source Sample. each source sample correct the average sorbance for the contribution of the f blank and the 0.1 N HNO_3 blank. Use calibration curve and this corrected ab bance to determine the µg Pb concentra in the sample aspirated into the spectrop tometer. Calculate the total Pb content (in µg) in the original source sample; corr for all the dilutions that were made to br the Pb concentration of the sample into linear range of the spectrophotometer.

7.4 Lead Concentration. Calculate stack gas Pb concentration C_{Pb} in mg/d as follows:

$$C_{Pb} = K \frac{C'_{Pb}}{V_{m(std)}}$$

Where:

K=0.001 mg/µg for metric units.

=2.205 lb/µg for English units.

7.5 Isokinetic Variation and Accepta Results. Same as Method 5. Sections 6 and 6.12. respectively. To calculate v_s, average stack gas velocity. use Equation of Method 2 and the data from this f test.

8. *Alternative Test Methods for Inorga Lead.*

8.1 Simultaneous Determination of P ticulate and Lead Emissions. The tester m use Method 5 to simultaneously determ Pb provided that (1) he uses acetone remove particulate from the probe a inside of the filter holder as specified Method 5. (2) he uses 0.1 N HNO_3 in the pingers. (3) he uses a glass fiber filter wit low Pb background. and (4) he treats a analyzes the entire train contents. includ the impingers. for Pb as described in S tion 5 of this method.

8.2 Filter Location. The tester may us filter between the third and fourth imp er provided that he includes the filter in analysis for Pb.

8.3 In-stack Filter. The tester may use in-stack filter provided that (1) he uses glass-lined probe and at least two imping each containing 100 ml of 0.1 N HNO_3, af the in-stack filter and (2) he recovers a analyzes the probe and impinger conte for Pb. Recover sample from the nozzle w acetone if a particulate analysis is to made.

9. *Bibliography*

9.1 Perkin Elmer Corporation. Analytical Methods for Atomic Absorption Spectrophotometry. Norwalk, Connecticut. September 1976.

9.2 American Society for Testing and Materials. Annual Book of ASTM Standards. Part 31: Water, Atmospheric Analysis. Philadelphia, Pa. 1974. p. 40–42.

9.3 Klein, R. and C. Hach. Standard Additions—Uses and Limitations in Spectrophotometric Analysis. *Amer. Lab.* 9:21-27. 1977.

9.4 Mitchell, W.J. and M.R. Midgett. Determining Inorganic and Alkyl Lead Emissions from Stationary Sources. U.S. Environmental Protection Agency. Emission Monitoring and Support Laboratory. Research Triangle Park, N.C. (Presented at National APCA Meeting, Houston, June 26, 1978).

9.5 Same as Method 5, Citations 2 to 5 and 7 of Section 7.

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1. By revising Section 5.4.2 to read as follows:

5.4.2 Check for Matrix Effects on the Lead Results. Since the analysis for Pb by atomic absorption is sensitive to the chemical composition and to the physical properties (viscosity, pH) of the sample (matrix effects), the analyst shall check at least one sample from each source using the method of additions as follows:

Add or spike an equal volume of standard solution to an aliquot of the sample solution, then measure the absorbance of the resulting solution and the absorbance of an aliquot of unspiked sample.

Next, calculate the Pb concentration C_a in μg/ml of the sample solution by using the following equation:

$$C_a = C_s \frac{A_a}{A_t - A_a} \qquad \text{Eq. 12-1}$$

Where:

C_s = Pb concentration of the standard solution, μg/ml.

A_a = Absorbance of the sample solution.

A_t = Absorbance of the spiked sample solution.

Volume corrections will not be required if the solutions as analyzed have been made to the same final volume. Therefore, C_a and C_s represent lead concentration before dilutions.

Method of additions procedures described on pages 9–4 and 9–5 of the section entitled "General Information" of the Perkin Elmer Corporation Atomic Absorption Spectrophotometry Manual, Number 303–0152 (see Section 9.1) may also be used. In any event, if the results of the method of additions procedure used on the source sample do not agree to within 5 percent of the value obtained by the routine atomic absorption analysis, then reanalyze all samples from the source using a method of additions procedure.

2. By correcting the symbol "$V_{m(std)}$" to "$V_{w(std)}$" in Section 7.2, line 3.

3. By adding "Eq. 12–2" to the right of the equation in Section 7.4.

4. By inserting "$\times 10^{-9}$" immediately after the number "2.205" in the last line of Section 7.4

METHOD 13B—DETERMINATION OF TOTAL FLUORIDE EMISSIONS FROM STATIONARY SOURCES—SPECIFIC ION ELECTRODE METHOD

1. Applicability and Principle

1.1 Applicability. This method applies to the determination of fluoride (F) emissions from stationary sources as specified in the regulations. It does not measure fluorocarbons, such as freons.

1.2 Principle. Gaseous and particulate F are withdrawn isokinetically from the source and collected in water and on a filter. The total F is then determined by the specific ion electrode method.

2. Range and Sensitivity

The range of this method is 0.02 to 2,000 μg F/ml; however, measurements of less than 0.1 μg F/ml require extra care. Sensitivity has not been determined.

3. Interferences

Grease on sample-exposed surfaces may cause low F results because of adsorption.

4. Precision and Accuracy

4.1 Precision. The following estimates are based on a collaborative test done at a primary aluminum smelter. In the test, six laboratories each sampled the stack simultaneously using two sampling trains for a of 12 samples per sampling run. Fluo- oncentrations encountered during the ranged from 0.1 to 1.4 mg F/m^3. The within-laboratory and between-laboratory standard deviations, which include sampling and analysis errors, are 0.037 mg F/m^3 with 60 degrees of freedom and 0.056 mg F/m^3 with five degrees of freedom, respectively.

4.2 Accuracy. The collaborative test did not find any bias in the analytical method.

5. Apparatus

5.1 Sampling Train and Sample Recovery. Same as Method 13A, Sections 5.1 and 5.2, respectively.

5.2 Analysis. The following items are needed:

5.2.1 Distillation Apparatus, Bunsen Burner, Electric Muffle Furnace, Crucibles, Beakers, Volumetric Flasks, Erlenmeyer Flasks or Plastic Bottles, Constant Temperature Bath, and Balance. Same as Method 13A, Sections 5.3.1 to 5.3.9, respectively, except include also 100-ml polyethylene beakers.

5.2.2 Fluoride Ion Activity Sensing Electrode.

5.2.3 Reference Electrode. Single junction, sleeve type.

5.2.4 Electrometer. A pH meter with millivolt-scale capable of ±0.1-mv resolution, or a specific ion meter made specifically for specific ion use.

5.2.5 Magnetic Stirrer and TFE[1] Fluorocarbon-Coated Stirring Bars.

6. Reagents

6.1 Sampling and Sample Recovery. as Method 13A, Sections 6.1 and 6.2, tively.

Analysis. Use ACS reagent grade chemicals (or equivalent), unless otherwise specified. The reagents needed for analysis are as follows:

6.2.1 Calcium Oxide (CaO). Certified grade containing 0.005 percent F or less.

6.2.2 Phenolphthalein Indicator. Dissolve 0.1 g of phenolphthalein in a mixture of 50 ml of 90 percent ethanol and 50 ml deionized distilled water.

6.2.3 Sodium Hydroxide (NaOH). Pellets.

6.2.4 Sulfuric Acid (H_2SO_4), Concentrated.

6.2.5 Filters. Whatman No. 541, or equivalent.

6.2.6 Water. From same container as 6.1.2 of Method 13A.

6.2.7 Sodium Hydroxide, 5 M. Dissolve 20 g of NaOH in 100 ml of deionized distilled water.

6.2.8 Sulfuric Acid, 25 percent (V/V). Mix 1 part of concentrated H_2SO_4 with 3 parts of deionized distilled water.

6.2.9 Total Ionic Strength Adjustment Buffer (TISAB). Place approximately 500 ml of deionized distilled water in a 1-liter beaker. Add 57 ml of glacial acetic acid, 58 g of sodium chloride, and 4 g of cyclohexylene dinitrilo tetraacetic acid. Stir to dissolve. Place the beaker in a water bath to cool it. Slowly add 5 M NaOH to the solution, measuring the pH continuously with a calibrated pH/reference electrode pair, until the pH is 5.3. Cool to room temperature. Pour into a 1-liter volumetric flask, and dilute to volume with deionized distilled water. Commercially prepared TISAB may be substituted for the above.

6.2.10 Fluoride Standard Solution, 0.1 M. Oven dry some sodium fluoride (NaF) for a minimum of 2 hours at 110°C, and store in a desiccator. Then add 4.2 g of NaF to a 1-liter volumetric flask, and add enough deionized distilled water to dissolve. Dilute to volume with deionized distilled water.

7. Procedure

7.1 Sampling, Sample Recovery, and Sample Preparation and Distillation. Same as Method 13A, Sections 7.1, 7.2, and 7.3, respectively, except the notes concerning chloride and sulfate interferences are not applicable.

7.2 Analysis.

7.2.1 Containers No. 1 and No. 2. Distill suitable aliquots from Containers No. 1 and No. 2. Dilute the distillate in the volumetric flasks to exactly 250 ml with deionized distilled water and mix thoroughly. Pipet a 25-ml aliquot from each of the distillate and separate beakers. Add an equal volume of TISAB, and mix. The sample should be at the same temperature as the calibration standards when measurements are made. If ambient laboratory temperature fluctuates more than ±2°C from the temperature at which the calibration standards were measured, condition samples and standards in a constant-temperature bath before measurement. Stir the sample with a magnetic stirrer during measurement to minimize electrode response time. If the stirrer generates enough heat to change solution temperature, place a piece of temperature insulating material such as cork, between the stirrer and the beaker. Hold dilute samples (below 10^{-4} M fluoride ion content) in polyethylene beakers during measurement.

Insert the fluoride and reference electrodes into the solution. When a steady millivolt reading is obtained, record it. This may take several minutes. Determine concentration from the calibration curve. Between electrode measurements, rinse the electrode with deionized distilled water.

7.2.2 Container No. 3 (Silica Gel). Same as Method 13A, Section 7.4.2.

8. Calibration

Maintain a laboratory log of all calibrations.

8.1 Sampling Train. Same as Method 13A.

8.2 Fluoride Electrode. Prepare fluoride standardizing solutions by serial dilution of the 0.1 M fluoride standard solution. Pipet 10 ml of 0.1 M fluoride standard solution into a 100-ml volumetric flask, and make up to the mark with deionized distilled water for a 10^{-2} M standard solution. Use 10 ml of 10^{-2} M solution to make a 10^{-3} M solution in the same manner. Repeat the dilution procedure and make 10^{-4} and 10^{-5} solutions.

Pipet 50 ml of each standard into a separate beaker. Add 50 ml of TISAB to each beaker. Place the electrode in the most dilute standard solution. When a steady millivolt reading is obtained, plot the value on the linear axis of semilog graph paper versus concentration on the log axis. Plot the nominal value for concentration of the standard on the log axis, e.g., when 50 ml of 10^{-2} M standard is diluted with 50 ml of TISAB, the concentration is still designated "10^{-2} M."

Between measurements soak the fluoride sensing electrode in deionized distilled water for 30 seconds, and then remove and blot dry. Analyze the standards going from dilute to concentrated standards. A straight-line calibration curve will be obtained, with nominal concentrations of 10^{-4}, 10^{-3}, 10^{-2}, and 10^{-1} fluoride molarity on the log axis plotted versus electrode potential (in mv) on the linear scale. Some electrodes may be slightly nonlinear between 10^{-5} and 10^{-4} M. If this occurs, use additional standards between these two concentrations.

Calibrate the fluoride electrode daily, and check it hourly. Prepare fresh fluoride standardizing solutions daily (10^{-2} M or less). Store fluoride standardizing solutions in polyethylene or polypropylene containers.

NOTE: Certain specific ion meters have been designed specifically for fluoride electrode use and give a direct readout of fluoride ion concentration. These meters may be used in lieu of calibration curves for fluoride measurements over narrow concentration ranges. Calibrate the meter according to the manufacturer's instructions.)

9. Calculations

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after final calculation.

9.1 Nomenclature. Same as Method 13A, Section 9.1. In addition:

M = F concentration from calibration curve, molarity.

9.2 Average Dry Gas Meter Temperature and Average Orifice Pressure Drop, Dry Gas Volume, Volume of Water Vapor and Moisture Content, Fluoride Concentration in Stack Gas, and Isokinetic Variation and Acceptable Results. Same as Method 13A, Section 9.2 to 9.4, 9.5.2, and 9.6, respectively.

9.3 Fluoride in Sample. Calculate the amount of F in the sample using the following:

$$F_t = K \frac{V_t}{A_t} V_d \; M \qquad \text{Equation 13B-1}$$

Where:

K = 19 mg/millimole

10. References

1. Same as Method 13A, Citations 1 and 2 of Section 10.

2. MacLeod, Kathryn E. and Howard L. Crist. Comparison of the SPADNS—Zirconium Lake and Specific Ion Electrode Methods of Fluoride Determination in Stack Emission Samples. Analytical Chemistry. *45*:1272-1273. 1973.

METHOD 19—DETERMINATION OF SULFUR DIOXIDE REMOVAL EFFICIENCY AND PARTICULATE, SULFUR DIOXIDE AND NITROGEN OXIDES EMISSION RATES FROM ELECTRIC UTILITY STEAM GENERATORS

1. Principle and applicability

1.1 *Principle.*

1.1.1 Fuel samples from before and after fuel pretreatment systems are collected and analyzed for sulfur and heat content, and the percent sulfur dioxide (ng/Joule, lb/million Btu) reduction is calculated on a dry basis. (Optional Procedure.)

1.1.2 Sulfur dioxide and oxygen or carbon dioxide concentration data obtained from sampling emissions upstream and downstream of sulfur dioxide control devices are used to calculate sulfur dioxide removal efficiencies. (Minimum Requirement.) As an alternative to sulfur dioxide monitoring upstream of sulfur dioxide control devices, fuel samples may be collected in an as-fired condition and analyzed for sulfur and heat content. (Optional Procedure.)

1.1.3 An overall sulfur dioxide emission reduction efficiency is calculated from the efficiency of fuel pretreatment systems and the efficiency of sulfur dioxide control devices.

1.1.4 Particulate, sulfur dioxide, nitrogen oxides, and oxygen or carbon dioxide concentration data obtained from sampling emissions downstream from sulfur dioxide control devices are used along with F factors to calculate particulate, sulfur dioxide, and nitrogen oxides emission rates. F factors are values relating combustion gas volume to the heat content of fuels.

1.2 *Applicability.* This method is applicable for determining sulfur removal efficiencies of fuel pretreatment and sulfur dioxide control devices and the overall reduction of potential sulfur dioxide emissions from electric utility steam generators. This method is also applicable for the determination of particulate, sulfur dioxide, and nitrogen oxides emission rates.

2. Determination of Sulfur Dioxide Removal Efficiency of Fuel Pretreatment Systems

2.1 *Solid Fossil Fuel.*

2.1.1 *Sample Increment Collection.* Use ASTM D2234-76 (incorporated by reference—see § 60.17), Type I, Conditions A, B, or C, and systematic spacing. Determine the number and weight of increments required per gross sample representing each coal lot according to Table 2 or paragraph 7.1.5.2 of ASTM D2234-76. Collect one gross sample for each new coal lot and one gross sample for each product coal lot.

2.1.2 *ASTM Lot Size.* For the purpose of Section 2.1.1, the product coal lot size is defined as the weight of product coal produced from one type of raw coal. The raw coal lot size is the weight of raw coal used to produce one product coal lot. Typically, the lot size is the weight of coal processed in a 1-day (24 hours) period. If more than one type of coal is treated and produced in 1 day, then gross samples must be collected and analyzed for each type of coal. A coal lot size equaling the 90-day quarterly fuel quantity for a specific power plant may be used if representative sampling can be conducted for the raw coal and product coal.

NOTE: Alternate definitions of fuel lot sizes may be specified subject to prior approval of the Administrator.

2.1.3 *Gross Sample Analysis.* Determine the percent sulfur content (% S) and gross calorific value (GCV) of the solid fuel on a dry basis for each gross sample. Use ASTM D2013-72 (incorporated by reference—see § 60.17) for sample preparation, ASTM D3177-75 (incorporated by reference—see § 60.17) for sulfur analysis, and ASTM D3173-73 (incorporated by reference—see § 60.17) for moisture analysis. Use ASTM D2015-77 (incorporated by reference—see § 60.17) for gross calorific value determination.

2.2 *Liquid Fossil Fuel.*

2.2.1 *Sample Collection.* Use ASTM D270-65 (Reapproved 1975) (incorporated by reference—see § 60.17) following the practices outlined for continuous sampling for each gross sample representing each fuel lot.

2.2.2 *Lot Size.* For the purposes of Section 2.2.1, the weight of product fuel from one pretreatment facility and intended as one shipment (ship load, barge load, etc.) is defined as one product fuel lot. The weight of each crude liquid fuel type used to produce one product fuel lot is defined as one inlet fuel lot.

NOTE: Alternate definitions of fuel lot sizes may be specified subject to prior approval of the Administrator.

NOTE: For the purposes of this method, raw or inlet fuel (coal or oil) is defined as the fuel delivered to the desulfurization pretreatment facility or to the steam generating plant. For pretreated oil the input oil to the oil desulfurization process (e.g. hydrotreatment emitted) is sampled.

2.2.3 *Sample Analysis.* Determine the percent sulfur content (% S) and gross calorific value (GCV). Use ASTM D240-76 (incorporated by reference—see § 60.17) for the sample analysis. This value can be assumed to be on a dry basis.

2.3 *Calculation of Sulfur Dioxide Removal Efficiency Due to Fuel Pretreatment.* Calculate the percent sulfur dioxide reduction due to fuel pretreatment using the following equation:

$$\%R_f = 100\left[1 - \frac{\%S_o/GCV_o}{\%S_i/GCV_i}\right]$$

Where:

$\%R_f$=Sulfur dioxide removal efficiency due pretreatment: percent.

$\%S_o$=Sulfur content of the product fuel lot on a dry basis: weight percent.

$\%S_i$=Sulfur content of the inlet fuel lot on a dry basis: weight percent.

GCV_o=Gross calorific value for the outlet fuel lot on a dry basis: kJ/kg (Btu/lb).

GCV_i=Gross calorific value for the inlet fuel lot on a dry basis: kJ/kg (Btu/lb).

NOTE: If more than one fuel type is used to produce the product fuel, use the following equation to calculate the sulfur contents per unit of heat content of the total fuel lot, %S/GCV:

$$\%S/GCV = \sum_{k=1}^{n} Y_k(\%S_k/GCV_k)$$

Where:

Y_k=The fraction of total mass input derived from each type, k, of fuel.

$\%S_k$=Sulfur content of each fuel type, k, on a dry basis: weight percent.

GCV_k=Gross calorific value for each fuel type, k, on a dry basis: kJ/kg (Btu/lb).

n=The number of different types of fuels.

3. Determination of Sulfur Removal Efficiency of the Sulfur Dioxide Control Device

3.1 *Sampling.* Determine SO_2 emission rates at the inlet and outlet of the sulfur dioxide control system according to methods specified in the applicable subpart of the regulations and the procedures specified in Section 5. The inlet sulfur dioxide emission rate may be determined through fuel analysis (Optional, see Section 3.3.)

3.2. *Calculation.* Calculate the percent removal efficiency using the following equation:

$$\%R_{g(m)} = 100 \times \left(1.0 - \frac{E_{SO_2o}}{E_{SO_2i}}\right)$$

Where:

$\%R_g$=Sulfur dioxide removal efficiency of the sulfur dioxide control system using inlet and outlet monitoring data: percent.

E_{SO_2o}=Sulfur dioxide emission rate from the inlet of the sulfur dioxide control system: ng/J (lb/million Btu).

E_{SO_2i}=Sulfur dioxide emission rate to the outlet of the sulfur dioxide control system: ng/J (lb/million Btu).

3.3 *As-fired Fuel Analysis (Optional Procedure).* If the owner or operator of an electric utility steam generator chooses to determine the sulfur dioxide imput rate at the inlet to the sulfur dioxide control device through an as-fired fuel analysis in lieu of data from a sulfur dioxide control system inlet gas monitor, fuel samples must be collected in accordance with applicable paragraph in Section 2. The sampling can be conducted upstream of any fuel processing, e.g., plant coal pulverization. For the purposes of this section, a fuel lot size is defined as the weight of fuel consumed in 1 day (24 hours) and is directly related to the exhaust gas monitoring data at the outlet of the sulfur dioxide control system.

3.3.1 *Fuel Analysis.* Fuel samples must be analyzed for sulfur content and gross calorific value. The ASTM procedures for determining sulfur content are defined in the applicable paragraphs of Section 2.

3.3.2 *Calculation of Sulfur Dioxide Input Rate.* The sulfur dioxide imput rate determined from fuel analysis is calculated by:

$$I_s = \frac{2.0(\%S_f)}{GCV} \times 10^7 \text{ for S. I. units}$$

$$I_s = \frac{2.0(\%S_f)}{GCV} \times 10^4 \text{ for English units}$$

Where:

I_s=Sulfur dioxide input rate from as-fired fuel analysis, ng/J (lb/million Btu).

$\%S_f$=Sulfur content of as-fired fuel, on a dry basis: weight percent.

GCV=Gross calorific value for as-fired fuel, on a dry basis: kJ/kg (Btu/lb).

3.3.3 *Calculation of Sulfur Dioxide Emission Reduction Using As-fired Fuel Analysis.* The sulfur dioxide emission reduction efficiency is calculated using the sulfur imput rate from paragraph 3.3.2 and the sulfur dioxide emission rate, E_{SO_2}, determined in the applicable paragraph of Section 5.3. The equation for sulfur dioxide emission reduction efficiency is:

$$\%R_{g(f)} = 100 \times (1.0 - \frac{E_{SO_2}}{I_s})$$

Where:

$\%R_{g(f)}$ = Sulfur dioxide removal efficiency of the sulfur dioxide control system using as-fired fuel analysis data; percent.

E_{SO_2} = Sulfur dioxide emission rate from sulfur dioxide control system; ng/J (lb/million Btu).

I_s = Sulfur dioxide input rate from as-fired fuel analysis; ng/J (lb/million Btu).

4. *Calculation of Overall Reduction in Potential Sulfur Dioxide Emission*

4.1 The overall percent sulfur dioxide reduction calculation uses the sulfur dioxide concentration at the inlet to the sulfur dioxide control device as the base value. Any sulfur reduction realized through fuel cleaning is introduced into the equation as an average percent reduction, $\%R_f$.

4.2 Calculate the overall percent sulfur reduction as:

$$\%R_o = 100[1.0 - (1.0 - \frac{\%R_f}{100})(1.0 - \frac{\%R_g}{100})]$$

Where:

$\%R_o$ = Overall sulfur dioxide reduction; percent.

$\%R_f$ = Sulfur dioxide removal efficiency of fuel pretreatment from Section 2; percent. Refer to applicable subpart for definition of applicable averaging period.

$\%R_g$ = Sulfur dioxide removal efficiency of sulfur dioxide control device either O_2 or CO_2 - based calculation or calculated from fuel analysis and emission data, from Section 3; percent. Refer to applicable subpart for definition of applicable averaging period.

5. *Calculation of Particulate, Sulfur Dioxide, and Nitrogen Oxides Emission Rates*

5.1 *Sampling.* Use the outlet SO_2 and O_2 or CO_2 concentrations data obtained in Section 3.1. Determine the particulate, NO_x, and O_2 or CO_2 concentrations according to methods specified in an applicable subpart of the regulations.

5.2 *Determination of an F Factor.* Select an average F factor (Section 5.2.1) or calculate an applicable F factor (Section 5.2.2.). If combined fuels are fired, the selected or calculated F factors are prorated using the procedures in Section 5.2.3. F factors are ratios of the gas volume released during combustion of a fuel divided by the heat content of the fuel. A dry F factor (F_d) is the ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted; a wet F factor (F_w) is the ratio of the volume of wet flue gases generated to the calorific value of the fuel combusted; and the carbon F factor (F_c) is the ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted. When pollutant and oxygen concentrations have been determined in Section 5.1, wet or dry F factors are used. (F_w) factors and associated emission calculation procedures are not applicable and may not be used after wet scrubbers; (F_c) or (F_d) factors and associated emission calculation procedures are used after wet scrubbers.) When pollutant and carbon dioxide concentrations have been determined in Section 5.1, F_c factors are used.

5.2.1 *Average F Factors.* Table 1 shows average F_d, F_w, and F_c factors (scm/J, scf/million Btu) determined for commonly used fuels. For fuels not listed in Table 1, the F factors are calculated according to the procedures outlined in Section 5.2.2 of this section.

5.2.2 *Calculating an F Factor.* If the fuel burned is not listed in Table 1 or if the owner or operator chooses to determine an F factor rather than use the tabulated data, F factors are calculated using the equations below. The sampling and analysis procedures followed in obtaining data for these calculations are subject to the approval of the Administrator, and the Administrator should be consulted prior to data collection.

For SI units:

$$F_w = \frac{10605.57(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O) + 0.21 (\%H_2O)^{1}_{w}}{GCV_w}$$

$$F_c = \frac{10600.321(\%C)}{GCV}$$

Where:

F_d, F_w, and F_c have the units of scm/J, or scf/million Btu; %H, %C, %S, %N, %O, and $\%H_2O$ are the concentrations by weight (expressed in percent) of hydrogen, carbon, sulfure, nitrogen, oxygen, and water from an ultimate analysis of the fuel; and GCV is the gross calorific value of the fuel in kJ/kg or Btu/lb and consistent with the ultimate analysis. Follows ASTM D2015-77 (incorporated by reference—see § 60.17) for solid fuels, D240-76 (incorporated by reference—see § 60.17) for liquid fuels, and D1826-77 (incorporated by reference—see § 60.17) for gaseous fuels as applicable in determining GCV.

5.2.3 *Combined Fuel Firing F Factor.* For affected facilities firing combinations of fossil fuels or fossil fuels and wood residue, the F_d, F_w, or F_c factors determined by Sections 5.2.1 or 5.2.2 of this section shall be prorated in accordance with applicable formula as follows:

$$F_d = \sum_{k=1}^{n} x_k F_{dk} \quad \text{or}$$

$$F_w = \sum_{k=1}^{n} x_k F_{wk} \quad \text{or}$$

$$F_c = \sum_{k=1}^{n} x_k F_{ck}$$

Where:

x_k=The fraction of total heat input derived from each type of fuel, K.

n=The number of fuels being burned in combination.

5.3 *Calculation of Emission Rate.* Select from the following paragraphs the applicable calculation procedure and calculate the particulate, SO_2, and NO_x emission rate. The values in the equations are defined as:

E=Pollutant emission rate, ng/J (lb/million Btu).

C=Pollutant concentration, ng/scm (lb/scf).

NOTE: It is necessary in some cases to convert measured concentration units to other units for these calculations.

Use the following table for such conversions:

CONVERSION FACTORS FOR CONCENTRATION

From—	To—	Multiply by—
g/scm	ng/scm	10^9
mg/scm	ng/scm	10^6
lb/scf	ng/scm	1.602×10^{13}
ppm(SO_2)	ng/scm	2.660×10^6
ppm(NO_x)	ng/scm	1.912×10^6
ppm/(SO_2)	lb/scf	1.660×10^{-7}
ppm/(NO_x)	lb/scf	1.194×10^{-7}

5.3.1 *Oxygen-Based F Factor Procedure.*

5.3.1.1 *Dry Basis.* When both percent oxygen ($\%O_{2d}$) and the pollutant concentration (C_d) are measured in the flue gas on a dry basis, the following equation is applicable:

$$E = C_d F_d \left[\frac{20.9}{20.9 - \%O_{2d}}\right]$$

$$F_d = \frac{[227.0 (\%H)+95.7 (\%C)+35.4 (\%S)+8.6 (\%N)-28.5 (\%O)]}{10 \cdot GCV}$$

$$F_w = \frac{[347.4 (\%H)+95.7 (\%C)+35.4 (\%S)+8.6 (\%N)-28.5 (\%O)+13.0 (\%H_2O)]}{10 \cdot GCV_w}$$

$$F_c = \frac{[20.0 (\%C)]}{10 \cdot GCV}$$

$$F_d = \frac{10^6[3.64 (\%H)+1.53 (\%C)+0.57 (\%S)+0.14 (\%N)-0.46 (\%O)]}{GCV}$$

For English units:

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[1] The $\%H_2O$ term may be omitted if %H and %O include the unavailable hydrogen and oxygen in the form of H_2O.

5.3.1.2 *Wet Basis.* When both the percent oxygen ($\%O_{2w}$) and the pollutant concentration (C_w) are measured in the flue gas on a wet basis, the following equations are applicable:

Note: F_w factors are not applicable after wet scrubbers.

$$(a) \quad E = C_w F_w \left[\frac{20.9}{20.9(1 - B_{wa}) - \%O_{2w}}\right]$$

Where:

B_{wa} = Proportion by volume of water vapor in the ambient air.

In lieu of actual measurement, B_{wa} may be estimated as follows:

Note: The following estimating factors are selected to assure that any negative error introduced in the term:

$$\left(\frac{20.9}{20.9(1 - B_{wa}) - \%O_{2w}}\right)$$

will not be larger than −1.5 percent. However, positive errors, or over-estimation of emissions, of as much as 5 percent may be introduced depending upon the geographic location of the facility and the associated range of ambient moisture.

(i) B_{wa} = 0.027. This factor may be used as a constant value at any location.

(ii) B_{wa} = Highest monthly average of B_{wa} which occurred within a calendar year at the nearest Weather Service Station.

(iii) B_{wa} = Highest daily average of B_{wa} which occurred within a calendar month at the nearest Weather Service Station, calculated from the data for the past 3 years. This factor shall be calculated for each month and may be used as an estimating factor for the respective calendar month.

$$(b) \quad E = C_w F_d \left[\frac{20.9}{20.9(1 - B_{ws}) - \%O_{2w}}\right]$$

Where:

B_{ws} = Proportion by volume of water vapor in the stack gas.

5.3.1.3 *Dry/Wet Basis.* When the pollutant concentration (C_w) is measured on a wet basis and the oxygen concentration ($\%O_{2d}$) or measured on a dry basis, the following equation is applicable:

$$E = \left[\frac{C_w F_d}{(1 - B_{ws})}\right] \left[\frac{20.9}{20.9 - \%O_{2w}}\right]$$

When the pollutant concentration (C_d) is measured on a dry basis and the oxygen concentration ($\%O_{2w}$) is measured on a wet basis, the following equation is applicable:

$$E = C_d F_d \frac{20.9}{20.9 - \left(\frac{\%O_{2w}}{1 - B_{ws}}\right)}$$

5.3.2 *Carbon Dioxide-Based F Factor Procedure.*

5.3.2.1 *Dry Basis.* When both the percent carbon dioxide ($\%CO_{2d}$) and the pollutant concentration (C_d) are measured in the flue gas on a dry basis, the following equation is applicable:

$$E = C_d F_c \left(\frac{100}{\%CO_{2d}}\right)$$

5.3.2.2 *Wet Basis.* When both the percent carbon dioxide ($\%CO_{2w}$) and the pollutant concentration (C_w) are measured on a wet basis, the following equation is applicable:

$$E = C_w F_c \left(\frac{100}{\%CO_{2w}}\right)$$

5.3.2.3 *Dry/Wet Basis.* When the pollutant concentration (C_w) is measured on a wet basis and the percent carbon dioxide ($\%CO_{2d}$) is measured on a dry basis, the following equation is applicable:

$$E = \left[\frac{C_w F_c}{(1 - B_{ws})}\right] \left[\frac{100}{\%CO_{2d}}\right]$$

When the pollutant concentration (C_d) is measured on a dry basis and the precent carbon dioxide ($\%CO_{2w}$) is measured on a wet basis, the following equation is applicable:

$$E = C_d (1 - B_{ws}) F_c \left(\frac{100}{\%CO_{2w}}\right)$$

5.4 *Calculation of Emission Rate from Combined Cycle-Gas Turbine Systems.* For gas turbine-steam generator combined cycle systems, the emissions from supplemental fuel fired to the steam generator or the percentage reduction in potential (SO_2) emissions cannot be determined directly. Using measurements from the gas turbine exhaust (performance test, subpart GG) and the combined exhaust gases from the stear generator, calculate the emission rates f these two points following the appropri paragraphs in Section 5.3.

Note: F_w factors shall not be used to determine emission rates from gas turbines because of the injection of steam nor to calculate emission rates after wet scrubbers; F_d or F_c factor and associated calculation procedures are used to combine effluent emissions according to the procedure in Paragraph 5.2.3.

The emission rate from the steam generator is calculated as:

$$E_{sg} = \frac{E_{cc} - X_{gt} E_{gt}}{X_{sg}}$$

Where:

E_{sg} = Pollutant emission rate from steam generator effluent, ng/J (lb/million Btu).

E_{cc} = Pollutant emission rate in combined cycle effluent; ng/J (lb/million Btu).

E_{gt} = Pollutant emission rate from gas turbine effluent; ng/J (lb/million Btu).

X_{sg} = Fraction of total heat input from supplemental fuel fired to the steam generator.

X_{gt} = Fraction of total heat input from gas turbine exhaust gases.

Note: The total heat input to the steam generator is the sum of the heat input from supplemental fuel fired to the steam generator and the heat input to the steam generator from the exhaust gases from the gas turbine.

5.5 *Effect of Wet Scrubber Exhaus Direct-Fired Reheat Fuel Burning.* Some wet scrubber systems require that the temperature of the exhaust gas be raised above the moisture dew-point prior to the gas entering the stack. One method used to accomplish this is directfiring of an auxiliary burner into the exhaust gas. The heat required for such burners is from 1 to 2 percent of total heat input of the steam generating plant. The effect of this fuel burning on the exhaust gas components will be less than ±1.0 percent and will have a similar effect on emission rate calculations. Because of this small effect, a determination of effluent gas constituents from direct-fired reheat burners for correction of stack gas concentrations is not necessary.

TABLE 19-1—F FACTORS FOR VARIOUS FUELS [1]

Fuel type	F_d		F_w		F_c	
	dscm/J	dscf/10⁶ Btu	wscm/J	wscf J 10⁶ Btu	scm/J	scf/10⁶ Btu
Coal:						
Anthracite [2]	2.71×10^{-7}	(10100)	2.83×10^{-7}	(10540)	0.530×10^{-7}	(1970)
Bituminous [2]	2.63×10^{-7}	(9780)	2.86×10^{-7}	(10640)	0.484×10^{-7}	(1800)
Lignite	2.65×10^{-7}	(9860)	3.21×10^{-7}	(11950)	0.513×10^{-7}	(1910)
Oil [3]	2.47×10^{-7}	(9190)	2.77×10^{-7}	(10320)	0.383×10^{-7}	(1420)
Gas:						
Natural	2.43×10^{-7}	(8710)	2.85×10^{-7}	(10610)	0.287×10^{-7}	(1040)
Propane	2.34×10^{-7}	(8710)	2.74×10^{-7}	(10200)	0.321×10^{-7}	(1190)
Butane	2.34×10^{-7}	(8710)	2.79×10^{-7}	(10390)	0.337×10^{-7}	(1250)
Wood	2.48×10^{-7}	(9240)			0.492×10^{-7}	(1830)
Wood Bark	2.58×10^{-7}	(9600)			0.516×10^{-7}	(1920)

[1] Determined at standard conditions: 20° C (68° F) and 760 mm Hg (29.92 in. Hg).

[2] As classified according to ASTM D 388-66.

[3] Crude, residual, or distillate.

6. *Calculation of Confidence Limits for Inlet and Outlet Monitoring Data*

6.1 *Mean Emission Rates.* Calculate the mean emission rates using hourly averages in ng/J (lb/million Btu) for SO_2 and NO_x outlet data and, if applicable, SO_2 inlet data using the following equations:

$$E_o = \frac{\Sigma x_o}{n_o}$$

$$E_i = \frac{\Sigma x_i}{n_i}$$

Where:

E_o = Mean outlet emission rate; ng/J (lb/million Btu).

E_i = Mean inlet emission rate; ng/J (lb/million Btu).

x_o = Hourly average outlet emission rate; ng/J (lb/million Btu).

x_i = Hourly average in let emission rate; ng/J (lb/million Btu).

n_o = Number of outlet hourly averages available for the reporting period.

n_i = Number of inlet hourly averages available for reporting period.

6.2 *Standard Deviation of Hourly Emission Rates.* Calculate the standard deviation of the available outlet hourly average emission rates for SO_2 and NO_x and, if applicable, the available inlet hourly average emission rates for SO_2 using the following equations:

$$s_o = \left(\sqrt{\frac{1}{n_o} - \frac{1}{720}}\right)\left(\sqrt{\frac{\Sigma(E_o - x_o)^2}{n_o - 1}}\right)$$

$$s_i = \left(\sqrt{\frac{1}{n_i} - \frac{1}{720}}\right)\left(\sqrt{\frac{\Sigma(E_i - x_i)^2}{n_i - 1}}\right)$$

Where:

s_o = Standard deviation of the average outlet hourly average emission rates for the reporting period: ng/J (lb/million Btu).

s_i = Standard deviation of the average inlet hourly average emission rates for the reporting period: ng/J (lb/million Btu).

6.3 *Confidence Limits.* Calculate the lower confidence limit for the mean outlet emission rates for SO_2 and NO_x and, if applicable, the upper confidence limit for the mean inlet emission rate for SO_2 using the following equations:

$E_o^* = E_o - t_{0.95} s_o$

$E_i^* = E_i + t_{0.95} s_i$

Where:

E_o^* = The lower confidence limit for the mean outlet emission rates; ng/J (lb/million Btu).

E_i^* = The upper confidence limit for the mean inlet emission rate; ng/J (lb/million Btu).

$t_{0.95}$ = Values shown below for the indicated number of available data points (n):

VALUES FOR $T_{0.95}$

n	$t_{0.95}$
2	6.31
3	2.42
4	2.35
5	2.13
6	2.02
7	1.94
8	1.89
9	1.86
10	1.83
11	1.81
12-16	1.77
17-21	1.73
22-26	1.71
27-31	1.70
32-51	1.68
52-91	1.67
92-151	1.66
152 or more	1.65

The values of this table are corrected for n-1 degrees of freedom. Use n equal to the number of hourly average data points.

7. Calculation to Demonstrate Compliance When Available Monitoring Data Are Less Than the Required Minimum

7.1 *Determine Potential Combustion Concentration (PCC) for SO_2.*

7.1.1 When the removal efficiency due to fuel pretreatment (% R_f) is included in the overall reduction in potential sulfur dioxide emissions (% R_o) and the "as-fired" fuel analysis is not used, the potential combustion concentration (PCC) is determined as follows:

$$PCC = E_i^* + 2\left(\frac{\% S_f}{GCV_f} - \frac{\% S_o}{GCV_o}\right) 10^7;\ ng/J$$

$$PCC = E_i^* + 2\left(\frac{\% S_f}{GCV_f} - \frac{\% S_o}{GCV_o}\right) 10^4;\ lb/million\ Btu.$$

Where:

$\left(\frac{\% S_f}{GCV_f} - \frac{\% S_o}{GCV_o}\right)$ = Potential emissions removed by the pretreatment process, using the fuel parameters defined in section 2.3; ng/J (lb/million Btu).

7.1.2 When the "as-fired" fuel analysis is used and the removal efficiency due to fuel pretreatment (% R_f) is not included in the overall reduction in potential sulfur dioxide emissions (% R_o), the potential combustion concentration (PCC) is determined as follows:

PCC = I_s

Where:

I_s = The sulfur dioxide input rate as defined in section 3.3

7.1.3 When the "as-fired" fuel analysis is used and the removal efficiency due to fuel pretreatment (% R_f) is included in the overall reduction (% R_o), the potential combustion concentration (PCC) is determined as follows:

$$PCC = I_s + 2\left(\frac{\% S_f}{GCV_f} - \frac{\% S_o}{GCV_o}\right) 10^7;\ ng/J$$

$$PCC = I_s + 2\left(\frac{\% S_f}{GCV_f} - \frac{\% S_o}{GCV_o}\right) 10^4;\ lb/million\ Btu.$$

7.1.4 When inlet monitoring data are used and the removal efficiency due to fuel pretreatment (% R_f) is not included in the overall reduction in potential sulfur dioxide emissions (% R_o), the potential combustion concentration (PCC) is determined as follows:

PCC = E_i^*

Where:

E_i^* = The upper confidence limit of the mean inlet emission rate, as determined in section 6.3.

7.2 *Determine Allowable Emission Rates (E_{std}).*

7.2.1 *NO_x.* Use the allowable emission rates for NO_x as directly defined by the applicable standard in terms of ng/J (lb/million Btu).

7.2.2 *SO_2.* Use the potential combustion concentration (PCC) for SO_2 as determined in section 7.1, to determine the applicable emission standard. If the applicable standard is an allowable emission rate in ng/J (lb/million Btu), the allowable emission rate is used as E_{std}. If the applicable standard is an allowable percent emission, calculate the allowable emission rate (E_{std}) using the following equation:

E_{std} = % PCC/100

Where:

% PCC = Allowable percent emission as defined by the applicable standard; percent.

7.3 *Calculate E_o^*/E_{std}.* To determine compliance for the reporting period calculate the ratio:

E_o^*/E_{std}

Where:

E_o^* = The lower confidence limit for the mean outlet emission rates, as defined in section 6.3; ng/J (lb/million Btu).

E_{std} = Allowable emission rate as defined in section 7.2; ng/J (lb/million Btu).

If E_o^*/E_{std} is equal to or less than 1.0, the facility is in compliance; if E_o^*/E_{std} is greater than 1.0, the facility is not in compliance for the reporting period.

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 midlevel 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:

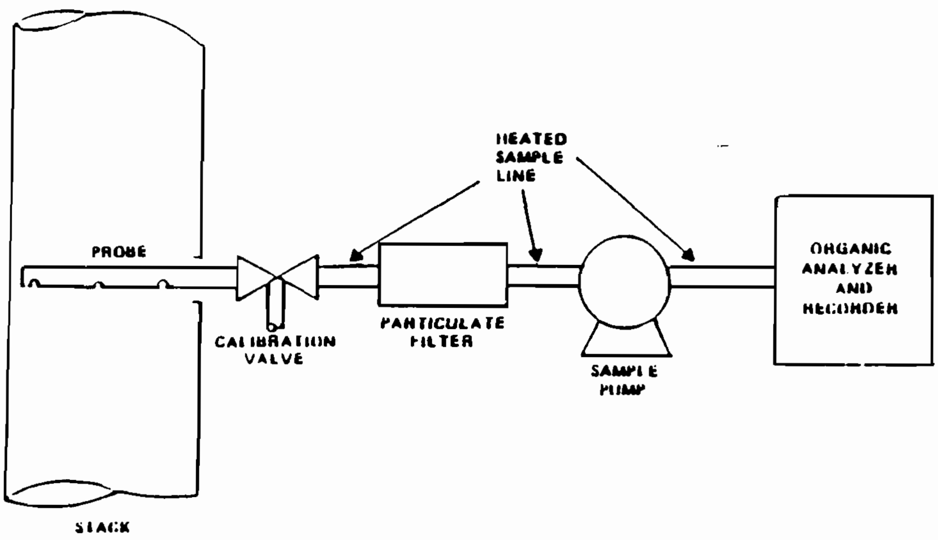

Figure 25A-1. Organic Concentration Measurement System.

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 analyzers. 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 ±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.

4.1 Fuel. A 40 percent H_2/60 percent He or 40 percent H_2/60 percent N_2 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 ±3 percent of the span value.

5.2 Calibration Drift. Less than ±3 percent of span value.

METHOD 101A—DETERMINATION OF PARTICULATE AND GASEOUS MERCURY EMISSIONS FROM SEWAGE SLUDGE INCINERATORS

INTRODUCTION

This method is similar to Method 101. except acidic potassium permangante solution is used instead of acidic iodine monochloride for collection.

1. *Applicability and Principle*—1.1 *Applicability.* This method applies to the determination of particulate and gaseous mercury (Hg) emissions from sewage sludge incinerators and other sources as specified in the regulations.

1.2 *Principle.* Particulate and gaseous Hg emissions are withdrawn isokinetically from the source and collected in acidic potassium permanganate ($KMnO_4$) solution. The Hg collected (in the mercuric form) is reduced to elemental Hg, which is then aerated from the solution into an optical cell and measured by atomic absorption spectrophotometry.

2. *Range and Sensitivity*—2.1 *Range.* After initial dilution, the range of this method is 20 to 800 ng Hg/ml. The upper limit can be extended by further dilution of the sample.

2.2 *Sensitivity.* The sensitivity of the method depends on the recorder/spectrophotometer combination selected.

3. *Interfering Agents*—3.1 *Sampling.* Excessive oxidizable organic matter in the stack gas prematurely depletes the $KMnO_4$ solution and thereby prevents further collection of Hg.

3.2 *Analysis.* Condensation of water vapor on the optical cell windows causes a positive interference.

4. *Precision*—Based on eight paired-train tests, the within-laboratory standard deviation was estimated to be 4.8 µg Hg/ml in the concentration range of 50 to 130 µg Hg/m^3.

5. *Apparatus*—5.1 *Sampling Train and Sample Recovery.* Same as Method 101, Sections 5.1 and 5.2, respectively, except for the following variations:

5.1.1 *Probe Liner.* Same as Method 101, Section 5.1.2, except that if a filter is used ahead of the impingers, the tester must use the probe heating system to minimize the condensation of gaseous Hg.

5.1.2 *Filter Holder (Optional).* Borosilicate glass with a rigid stainless-steel wire-screen filter support (do not use glass frit supports) and a silicone rubber of Teflon gasket, designed to provide a positive seal against leakage from outside or around the filter. The filter holder must be equipped with a filter heating system capable of maintaining a temperature around the filter holder of 120 ± 15° C (248 ± 25° F) during sampling to minimize both water and gaseous Hg condensation. The tester may use a filter in cases where the stream contains large quantities of particulate matter.

5.2 *Analysis.* The apparatus needed for analysis is the same as Method 101, Sections 5.3 and 5.4, except as follows:

5.2.1 *Volumetric Pipets.* Class A; 1-, 2-, 3-, 4-, 5-, 10-, and 20-ml.

5.2.2 *Graduated Cylinder.* 25-ml.

5.2.3 *Steam Bath.*

6. *Reagents—Use ACS reagent-grade chemicals or equivalent, unless otherwise specified.*

6.1 *Sampling and Recovery.* The reagents used in sampling and recovery are as follows:

6.1.1 *Water.* Deionized distilled, meeting ASTM Specifications for Type I Reagent Water—ASTM Test Method D1193-77 (incorporated by reference—see § 61.18). If high concentrations of organic matter are not expected to be present, the analyst may eliminate the $KMnO_4$ test for oxidizable organic matter. Use this water in all dilutions and solution preparations.

6.1.2 *Nitric Acid (HNO_3), 50 Percent (V/V).* Mix equal volumes of concentrated HNO_3 and deionized distilled water, being careful to slowly add the acid to the water.

6.1.3 *Silica Gel.* Indicating type, 6- to 16-mesh. If previously used, dry at 175° C (350° F) for 2 hr. The tester may use new silica gel as received.

6.1.4 *Filter (Optional).* Glass fiber filter, without organic binder, exhibiting at least 99.95 percent efficiency on 0.3 µm dioctyl phthalate smoke particles. The tester may use the filter in cases where the gas stream contains large quantities of particulate matter, but he should analyze blank filters for Hg content.

6.1.5 *Sulfuric Acid (H_2SO_4), 10 Percent (V/V).* Add and mix 100 ml of concentrated H_2SO_4 with 900 ml of deionized distilled water.

6.1.6 *Absorbing Solution, 4 Percent $KMnO_4$ (W/V).* Prepare fresh daily. Dissolve 40 g of $KMnO_4$ in sufficient 10 percent H_2SO_4 to make 1 liter. Prepare and store in glass bottles to prevent degradation.

6.2 *Analysis.* The reagents needed for analysis are listed below:

6.2.1 *Tin (II) Solution.* Prepare fresh daily and keep sealed when not being used. Competely dissolve 20 g of tin (II) chloride [or 25 g of tin (II) sulfate] crystals (Baker Analyzed reagent grade or any other brand that will give a clear solution) in 25 ml of concentrated HCl. Dilute to 250 ml with deionized distilled water. Do not substitute HNO_3, H_2SO_4, or other strong acids for the HCl.

6.2.2 *Sodium Chloride—Hydroxylamine Solution.* Dissolve 12 g of sodium chloride and 12 g of hydroxylamine sulfate (or 12 g of hydroxylamine hydrochloride) in deionized distilled water and dilute to 100 ml.

6.2.3 *Hydrochloric Acid (HCl), 8 N.* Dilute 67 ml of concentrated HNO_3 to 100 ml with deionzed distilled water (slowly add the HCl to the water).

6.2.4 *Nitric Acid, 15 Percent (V/V).* Dilute 15 ml of concentrated HNO_3 to 100 ml with deionized distilled water.

6.2.5 *Mercury Stock Solution, 1 mg Hg/mL.* Prepare and store all mercury standard solutions in borosilicate glass containers. Completely dissolve 0.1354 g of mercury (II) chloride in 75 ml of deionized distilled water. Add 100 ml of concentrated HNO_3, and adjust the volume to exactly 100 ml with deionized distilled water. Mix thoroughly. This solution is stable for at least 1 month.

6.2.6 *Intermediate Mercury Standard Solution, 10 µg Hg/mL.* Prepare fresh weekly. Pipet 5.0 ml of the mercury stock solution (Section 6.2.5) into a 500-ml volumetric flask and add 20 ml of 15 percent HNO_3 solution. Adjust the volume to exactly 500 ml with deionized distilled water. Thoroughly mix the solution.

6.2.7 *Working Mercury Standard Sol tion, 200 ng Hg/mL.* Prepare fresh dail Pipet 5.0 ml from the "Intermediate Merc ry Standard Solution" (Section 6.2.6) into 250-ml volumetric flask. Add 5 ml of 4 pe cent $KMnO_4$ absorbing solution and 5 ml 15 percent HNO_3. Adjust the volume to ex actly 250 ml with deionized distilled wate Mix thoroughly.

6.2.8 *Potassium Permanganate, 5 Percen (W/V).* Dissolve 5 g of $KMnO_4$ in deionize distilled water and dilute to 100 ml.

6.2.9 *Filter.* Whatman No. 40 or equiv lent.

7. *Procedure*—7.1 *Sampling.* The sam pling procedure is the same as Method 10 except for changes due to the use of KMnC instead of ICl absorbing solution and th possible use of a filter. These changes are follows:

7.1.1 *Preliminary Determinations.* Th preliminary determinations are the same those given in Method 101, Section 7.1. except for the absorbing solution depletio sign. In this method, high oxidizable organic content may make it impossible to sampl for the desired minimum time. This prob lem is indicated by the complete bleachin of the purple color of the $KMnO_4$ solutio In these cases, the tester may divide th sample run into two or more subruns t insure that the absorbing solution woul not be depleted. In cases where an excess o water condensation is encountered, collec two runs to make one sample.

7.1.2 *Preparation of Sampling Train* The preparation of the sampling train is th same as that given in Method 101, Sectio 7.1.3, except for the cleaning of the glassware [probe, filter holder (if used), impingers, and connectors] and the chargin of the first three impingers. In this method clean all the glass components by rinsin with 50 percent HNO_3, tap water, 8 N HC tap water, and finally deionized distille water. Then place 50 ml of 4 percen $KMnO_4$ in the first impinger and 100 ml i each of the second and third impingers.

If a filter is used, use a pair of tweezers t place the filter in the filter holder. Be sur to center the filter and place the gasket i proper position to prevent the sample ga stream from by-passing the filter. Check th filter for tears after assembly is completed Be sure also to set the filter heating system at the desired operating temperature afte the sampling train has been assembled.

7.1.3 *Sampling Train Operation.* In addition to the procedure given in Method 101 Section 7.1.5, maintain a temperatur around the filter (if applicable) of 120°±14 C (248°±25° F).

7.2 *Sample Recovery.* Begin proper cleanup procedure as soon as the probe is removed from the stack at the end of the sampling period. Allow the probe to cool. Whe it can be safely handled, wipe off any external particulate matter near the tip of the probe nozzle and place a cap over it. Do no cap off the probe tip tightly while the sampling train is cooling because the resultan vacuum would draw liquid out from the impingers.

Before moving the sample train to the cleanup site, remove the probe from the train, wipe off the silicone grease, and ca the open outlet of the probe. Be careful no to lose any condensate that might be present. Wipe off the silicone grease from the impinger. Use either ground-glass stoppers, plastic caps, or serum caps to close these openings.

Transfer the probe, impinger assembly, and (if applicable) filter assembly to a cleanup area that is clean, protected from the wind, and free of Hg contamination. The ambient air in laboratories located in the immediate vicinity of Hg-using facilities is not normally free of Hg contamination.

Inspect the train before and during assembly, and note any abnormal conditions. Treat the sample as follows:

7.2.1 *Container No. 1* (Impinger, Probe, and Filter Holder). Use a graduated cylinder; measure the liquid in the first three impingers to within ±1 ml. Record the volume of liquid present (e.g., see Figure 5-3 of Method 5 in Part 60 of 40 CFR). This information is needed to calculate the moisture content of the effluent gas. (Use only graduated cylinder and glass storage bottles that have been precleaned as in Section 7.1.2.) Place the contents of the first three impingers into a 1000-ml glass sample bottle.

(NOTE: If a filter is used, remove the filter from its holder, as outlined under "Container No. 3" below.)

Taking care that dust on the outside of the probe or other exterior surfaces does not get into the sample, quantitatively recover the Hg (and any condensate) from the probe nozzle, probe fitting, probe liner and front half of the filter holder (if applicable) as follows: Rinse these components with a total of 250 to 400 ml of fresh 4 percent $KMnO_4$ solution; add all washings to the 1000-ml glass sample bottle; remove any residual brown deposits on the glassware using the minimum amount of 8 N HCl required; and add this HCl rinse to this sample container.

After all washings have been collected in the sample container, tighten the lid on the container to prevent leakage during shipment to the laboratory. Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to clearly identify its contents.

7.2.2. *Container No. 2* (Silica Gel). Note the color of the indicating silica gel to determine whether it has been completely spent and make a notation of its condition. Transfer the silica gel from its impinger to its original container and seal. The tester may use as aids a funnel to pour the silica gel and a rubber policeman to remove the silica gel from the impinger. It is not necessary to remove the small amount of particles that may adhere to the impinger wall and are difficult to remove. Since the gain in weight is to be used for moisture calculations, do not use any water or other liquids to transfer the silica gel. If a balance is available in the field, weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g; record this weight.

7.2.3 *Container No. 3* (Filter). If a filter was used, carefully remove it from the filter holder, place it in a 100-ml glass sample bottle, and add 20 to 40 ml of 4 percent $KMnO_4$. If it is necessary to fold the filter, be sure that the particulate cake is inside the fold. Carefully transfer to the 150-ml sample bottle any particulate matter and filter fibers that adhere to the filter holder gasket by using a dry Nylon bristle brush and a sharp-edged blade. Seal the container. Label the container to clearly identify its contents. Mark the height of the fluid level to determine whether leakage occurs during transport.

7.2.4 *Container No. 4* (Filter Blank). If a filter was used, treat an unused filter from the same filter lot used for sampling in the same manner as Container No. 3.

7.2.5 *Container No. 5* (Absorbing Solution Blank). For a blank, place 500 ml of 4 percent $KMnO_4$ absorbing solution in a 1000-ml sample bottle. Seal the container.

7.3 *Sample Preparation.* Check liquid level in each container to see if liquid was lost during transport. If a noticeable amount of leakage occurred, either void the sample or use methods subject to the approval of the Administrator to account for the losses. Then follow the procedures below.

7.3.1 *Containers No. 3 and No. 4* (Filter and Filter Blank). If a filter was used, place the contents, including the filter, of Containers No. 3 and No. 4 in separate 250-ml beakers and heat the beakers on a steam bath until most of the liquid has evaporated. Do not take to dryness. Add 20 ml of concentrated HNO_3 to the beakers, cover them with a glass, and heat on a hot plate at 70° C for 2 hours. Remove from the hot plate and filter the solution through Whatman No. 40 filter paper. Save the filtrate for Hg analysis. Discard the filter.

7.3.2 *Container No. 1* (Impingers, Probe, and Filter Holder). Filter the contents of Container No. 1 through Whatman 40 filter paper to remove the brown MnO_2 precipitate. Wash the filter with 50 ml of 4 percent $KMnO_4$ absorbing solution and add this wash to the filtrate. Discard the filter. Combine the filtrates from Containers No. 1 and No. 3 (if applicable), and dilute to a known volume with deionized distilled water. Mix thoroughly.

7.3.3 *Container No. 5* (Absorbing Solution Blank). Treat this container as described in Section 7.3.2. Combine this filtrate with the filtrate with Container No. 4 and dilute to a known volume with deionized distilled water. Mix thoroughly.

7.4 *Analysis.* Calibrate the spectrophotometer and recorder and prepare the calibration curve as described in Sections 8.1 to 8.4. Then repeat the procedure used to establish the calibration curve with appropriately sized aliquots (1 to 10 ml) of the samples (from Sections 7.3.2 and 7.3.3) until two consecutive peak heights agree within ±3 percent of their average value. If the 10-ml sample is below the detectable limit, use a larger aliquot (up to 20 ml), but decrease the volume of water added to the aeration cell accordingly to prevent the solution volume from exceeding the capacity of the aeration bottle. If the peak maximum of a 1.0-ml aliquot is off scale, further dilute the original sample to bring the Hg concentration into the calibration range of the spectrophotometer. If the Hg content of the absorbing solution and filter blank is below the working range of the analytical method, use zero for the blank.

Run a blank and standard at least after every five samples to check the spectrophotometer calibration; recalibrate as necessary.

It is also recommended that at least one sample from each stack test be checked by the Method of Standard Additions to confirm that matrix effects have not interfered in the analysis.

8. *Calibration and Standards*—The calibration and standards are the same as Method 101, Section 8, except for the following variations:

8.1 *Optical Cell Heating System Calibration.* Same as method 101, Section 8.2, except use a 25-ml graduated cylinder to add 25 ml of deionized distilled water to the bottle section of the aeration cell.

8.2 *Spectrophotometer and Recorder Calibration.* The mercury response may be measured by either peak height or peak area. (NOTE: the temperature of the solution affects the rate at which elemental Hg is released from a solution and, consequently, it affects the shape of the absorption curve (area) and the point of maximum absorbance (peak height). To obtain reproducible results, all solutions must be brought to room temperature before use.) Set the spectrophotometer wave length at 253.7 nm and make certain the optical cell is at the minimum temperature that will prevent water condensation.

Then set the recorder scale as follows: Using a 25-ml graduated cylinder, add 25 ml of deionized distilled water to the aeration cell bottle and pipet 5.0 ml of the working mercury standard solution into the aeration cell. (NOTE: Always add the Hg-containing solution to the aeration cell after the 25 ml of deionized distilled water.) Place a Teflon-coated stirring bar in the bottle. Add 5 ml of the 4 percent $KMnO_4$ absorbing solution followed by 5 ml of 15 percent HNO_3 and 5 ml of 5 percent $KMnO_4$ to the aeration bottle and mix well. Now, attach the bottle section to the bubbler section of the aeration cell and make certain that (1) the aeration cell exit arm stopcock (Figure 101-3 of Method 101) is closed (so that Hg will not prematurely enter the optical cell when the reducing agent is being added) and (2) there is no flow through the bubbler. Add 5 ml of sodium chloride hydroxylamine in 1-ml increments until the solution is colorless. Now add 5 ml of tin (II) solution to the aeration bottle through the side arm. Stir the solution for 15 seconds, turn on the recorder, open the aeration cell exit arm stopcock, and immediately initiate aeration with continued stirring. Determine the maximum absorbance of the standard and set this value to read 90 percent of the recorder full scale.

9. *Calculations*—9.1 *Dry Gas Volume, Volume of Water Vapor and Moisture Content, Stack Gas Velocity, Isokinetic Variation and Acceptable Results, and Determination of Compliance.* Same as Method 101, Sections 9.1, 9.2, 9.3, 9.6, and 9.7, respectively, except use data obtained from this test.

9.2 *Total Mercury.* For each source sample, correct the average maximum absorbance of the two consecutive samples whose peak heights agreed within ±3 percent of their average for the contribution of the field blank. Then calculate the total Hg content in μg in each sample. Correct for any dilutions made to bring the sample into the working range of the spectrophotometer.

9.3 *Mercury Emission Rate.* Calculate the Hg emission rate R in g/day for continuous operations using Equation 101A-1. For cyclic operations, use only the time per day each stack is in operation. The total Hg emission rate from a source will be the summation of results from all stacks.

$$R = K \frac{m_{Hg} v_s A_s (86,400 \times 10^{-6})}{[V_{m(std)} + V_{w(std)}](T_s/P_s)}$$

Eq. 101A-1

Where:

m_{Hg} = Total Hg content in each sample, μg.
v_s = Average stack gas velocity, m/sec (fps).
A_s = Stack cross-sectional area, m^2 (ft^2).
86,400 = Conversion factor, sec/day.
10^{-6} = Conversion factor, g/μg.
$V_{m(std)}$ = Dry gas sample volume at standard conditions, corrected for leakage (if any), m^3 (ft^3).

$V_{w(std)}$ = Volume of water vapor at standard conditions, m^3 (ft^3).

T_s = Absolute average stack gas temperature, °K (°R).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

K = 0.3858 °K/mm Hg for metric units.
= 17.64 °R/in. Hg for English units.

10. *Bibliography*. 1. Same as Method 101, Section 10.

2. Mitchell, W. J., M. R. Midgett, J. C. Suggs, and D. Albrinck.

Test Methods to Determine the Mercury Emissions from Sludge Incineration Plants. U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. Publication No. EPA-600/4-79-058. September 1979.

METHOD 104—REFERENCE METHOD FOR DETERMINATION OF BERYLLIUM EMISSIONS FROM STATIONARY SOURCES

1. *Applicability and Principle.*

1.1 Applicability. This method is applicable for the determination of beryllium (Be) emissions in ducts or stacks at stationary sources. Unless otherwise specified, this method is not intended to apply to gas streams other than those emitted directly to the atmosphere without further processing.

1.2 Principle. Be emissions are isokinetically sampled from the source, and the collected sample is digested in an acid solution and analyzed by atomic absorption spectrophotometry.

2. *Apparatus.*

2.1 Sampling Train. The sampling train is identical to the Method 5 train as shown in Figure 5-1 (mention of Method 5 refers to 40 CFR Part 60). The sampling train consists of the following components:

2.1.1 Probe Nozzle, Pitot Tube, Differential Pressure Gauge, Metering System, Barometer, and Gas Density Determination Equipment. Same as Method 5, Sections 2.1.1, 2.1.3, 2.1.4, 2.1.8, 2.1.9, and 2.1.10, respectively.

2.1.2 Probe Liner. Borosilicate or quartz glass tubing. The tester may use a heating system capable of maintaining a gas temperature of 120±14°C (248±25°F) at the probe exit during sampling to prevent water condensation. *Note:* Do not use metal probe liners.

2.1.3 Filter Holder. Borosilicate glass, with a glass frit filter support and a silicone rubber gasket. Other materials of construction (e.g., stainless steel, Teflon, Viton) may be used, subject to the approval of the Administrator. (*Note:* Mention of trade names of specific products does not constitute endorsement by the Environmental Protection Agency.) The holder design shall provide a positive seal against leakage from the outside or around the filter. The holder shall be attached immediately at the outlet of the probe. A heating system capable of maintaining the filter at a minimum temperature in the range of the stack temperature may be used to prevent condensation from occurring.

2.1.4 Impingers. Four Greenburg-Smith impingers connected in series with leak-free ground glass fittings or any similar leak-free noncontaminating fittings. For the first, third, and fourth impingers, the tester may use impingers that are modified by replacing the tip with a 13-mm-ID (0.5-in.) glass tube extending to 13 mm (0.5 in.) from the bottom of the flask.

2.2 Sample Recovery. The following items are needed:

2.2.1 Probe Cleaning Rod. At least as long as probe.

2.2.2 Glass Sample Bottles. Leakless, with Teflon-lined caps, 500-ml.

2.2.3 Graduated Cylinder. 250-ml.

2.2.4 Funnel and Rubber Policeman. To aid in transfer of silica gel to container; not necessary if silica gel is weighed in the field.

2.2.5 Funnel. Glass, to aid in sample recovery.

2.2.6 Plastic Jar. Approximately 300-ml.

2.3 Analysis. The following equipment is needed:

2.3.1 Atomic Absorption Spectrophotometer. Perkin-Elmer 303, or equivalent, with nitrous oxide/acetylene burner.

2.3.2 Hot Plate.

2.3.3 Perchloric Acid Fume Hood.

3. *Reagents.*

Use ACS reagent-grade chemicals or equivalent, unless otherwise specified.

3.1 Sampling and Recovery. The reagents used in sampling and recovery are as follows:

3.1.1 Filter. Millipore AA, or equivalent. It is suggested that a Whatman 41 filter or equivalent be placed immediately against the back side of the Millipore filter as a guard against breaking the Millipore filter. To be equivalent, other filters shall exhibit at least 99.95 percent efficiency (0.05 percent penetration) on 0.3 micron dioctyl phthalate smoke particles. The filter efficiency tests shall be conducted in accordance with ASTM Standard Method D 2986-71 (reapproved 1978) (incorporated by reference—see § 61.18). Test data from the supplier's quality control program are sufficient for this purpose.

3.1.2 Water. Deionized distilled, meeting ASTM Specifications for Type 3 Reagent Water—ASTM Test Method D 1193-77 (incorporated by reference—see § 61.18). If high concentrations of organic matter are not expected to be present, the analyst may eliminate the $KMnO_4$ test for oxidizable organic matter.

3.1.3 Silica Gel. Indicating type, 6- to 16-mesh. If previously used, dry at 175°C (350°F) for 2 hours. The tester may use new silica gel as received.

3.1.4 Acetone.

3.1.5 Wash Acid, 50 Percent (V/V) Hydrochloric Acid (HCl).

Mix equal volumes of concentrated HCl and water, being careful to add the acid slowly to the water.

3.2 Sample Preparation and Analysis. The reagents needed are listed below:

3.2.1 Water. Same as Section 3.1.2.

3.2.2. Perchloric Acid ($HClO_4$). Concentrated (70 percent).

3.2.3 Nitric Acid (HNO_3). Concentrated.

3.2.4 Beryllium Powder. Minimum purity 98 percent.

3.2.5 Sulfuric Acid (H_2SO_4) Solution, 12 N. Dilute 33 ml of concentrated H_2SO_4 to 1 liter with water.

3.2.6 Hydrochloric Acid Solution, 25 percent HCl (V/V).

3.2.7 Standard Beryllium Solution, 1 μg Be/ml. Dissolve 10 mg of Be in 80 ml of 12N H_2SO_4 solution, and dilute to 1000 ml with water. Dilute a 10-ml aliquot to 100 ml with 25 percent HCl solution to give a concentration of 1 μg/ml. Prepare this dilute stock solution fresh daily. Equivalent strength Be stock solutions may be prepared from Be salts such as $BeCl_2$ and $Be(NO_3)_2$ (98 percent minimum purity).

4. *Procedure.*

4.1 Sampling. Because of the complexity of this method testers should be trained and experienced with the test procedures to assure reliable results. As Be is hazardous, testers should take precautions to minimize exposure. The amount of Be that is collected is generally small, therefore, it is necessary to exercise particular care to prevent contamination or loss of sample.

4.1.1 Pretest Preparation. Follow the general procedure given in Method 5, Section 4.1.1, Omit the directions of filters, except check them visually against light for irregularities and flaws such as pinholes.

4.1.2 Preliminary Determinations. Follow the general procedure given in Method 5, Section 4.1.2, except as follows: Select a nozzle size based on the range of velocity heads to assure that it is not necessary to change the nozzle size in order to maintain isokinetic sampling rates below 28 liters/min (1.0 cfm).

Obtain samples over a period or periods of time that accurately determine the maximum emissions that occur in a 24-hour period. In the case of cyclic operations, perform sufficient sample runs for the accurate determination of the emissions that occur over the duration of the cycle. A minimum sample time of 2 hours per run is recommended.

4.1.3 Prior to assembly, clean all glassware (probe, impingers, and connectors) by first soaking in wash acid for 2 hours, followed by rinsing with water. Place 100 ml of water in each of the first two impingers, and leave the third impinger empty. Save a portion of the water for a blank analysis. Place approximately 200 g of preweighted silica gel in the fourth impinger. The tester may use more silica gel, but should be careful to ensure that it is not entrained and carried out from the impinger during sampling. Place the silica gel container in a clean place for later use in the sample recovery. As an alternative, determine and record the weight of the silica gel plus impinger to the nearest 0.5 g.

Install the selected nozzel using a Viton A O-ring when stack temperatures are less the 260°C (500°F). Use a fiberglass string gasket if temperatures are higher. See APTD-0576 (Citation 9 in Section 10 of Method 101) for details. Other connecting systems using either 316 stainless steel or Teflon ferrules may be used.

If condensation in the probe or filter is a problem, probe and filter heaters will be required. Adjust the heaters to provide a temperature at or above the stack temperature. However, membrane filters such as the Millipore AA are limited to about 225°F. If the stack gas is in excess of about 200°F, consideration should be given to an alternate procedure such as moving the filter holder downstream of the first impinger to insure that the filter does not exceed its temperature limit. Mark the probe with heat-resistant tape or by some other method to denote the proper distance into the stack or duct for each sampling point. Assemble the train as shown in Figure 5-1 of Method 5, using (if necessary) a very light coat of silicone grease on all ground glass joints. Grease only the outer portion (see APTD-0576) to avoid possibility of contamination by the silicon grease. *Note:* An empty impinger may be inserted between the third impinger and the silica gel to remove excess moisture from the sample stream.

After the sampling train has been assembled, turn on and set the probe, if applicable, at the desired operating temperature. Allow time for the temperatures to stabilize. Place crushed ice around the impingers.

4.1.4. *Leak-Check Procedures.* Follow the leak-check procedures outlined in Method 5, Sections 4.1.4.1 (Pretest Leak Check), 4.1.4.2 (Leak Checks During Sample Run), and 4.1.4.3 (Post-Test Leak Check).

4.1.5 Beryllium Train Operation. Follow the general procedure given in Method 5, Section 4.1.5. For each run, record the data required on a data sheet such as the one shown in Figure 5-2 of Method 5.

4.1.6 Calculation of Percent Isokinetic. Same as Method 5, Section 4.1.6.

4.2 Sample Recovery. Begin proper cleanup procedure as soon as the probe is removed from the stack at the end of the sampling period.

Allow the probe to cool. When it can be safely handled, wipe off any external particulate matter near the tip of the probe nozzle, and place a cap over it. Do not cap off the probe tip tightly while the sampling train is cooling. Capping would create a vacuum and draw liquid out from the impingers.

Before moving the sampling train to the cleanup site, remove the probe from the train, wipe off the silicone grease, and cap the open outlet of the probe. Be careful not to lose any condensate that might be present. Wipe off the silicone grease from the impinger. Use either ground-glass stoppers, plastic caps, or serum caps to close these openings.

Transfer the probe and impinger assembly to a cleanup area that is clean, protected from the wind, and free of Be contamination.

Inspect the train before and during this assembly, and note any abnormal conditions. Treat the sample as follows:

Disconnect the probe from the impinger train. Remove the filter and any loose particulate matter from the filter holder, and place in a sample bottle. Place the contents (measured to ±1 ml) of the first three impingers into another sample bottle. Rinse the probe and all glassware between it and the back half of the third impinger with water and acetone, and add this to the latter sample bottle. Clean the probe with a brush or a long slender rod and cotton balls. Use acetone while cleaning. Add these to the sample bottle. Retain a sample of the water and acetone as a blank. The total amount of water and acetone used should be measured for accurate blank correction. Place the silica gel in the plastic jar. Seal and secure all sample containers for shipment. If an additional test is desired, the glassware can be carefully double rinsed with water and reassembled. However, if the glassware is out of use more than 2 days, repeat the initial acid wash procedure.

4.3 *Analysis.*

4.3.1 Apparatus Preparation. Before use, clean all glassware according to the procedure of Section 4.1.3. Adjust the instrument settings according to the instrument manual, using an absorption wavelength of 234.8 nm.

4.3.2 Sample Preparation. The digestion of Be samples is accomplished in part in concentrated $HClO_4$. *Caution:* The analyst must insure that the sample is heated to light brown fumes after the initial HNO_3 addition; otherwise, dangerous perchlorates may result from the subsequent $HClO_4$ digestion. $HClO_4$ should be used only under a hood.

4.3.2.1 Filter Preparation. Transfer the filter and any loose particulate matter from the sample container to a 150-ml beaker. Add 35 ml concentrated HNO_3. Heat on a hotplate until light brown fumes are evident to destroy all organic matter. Cool to room temperature, and add 5 ml concentrated H_2SO_4 and 5 ml concentrated $HClO_4$. Then proceed with step 4.3.2.4.

4.3.2.2 Water Preparation. Place a portion of the water and acetone sample into a 150-ml beaker, and put on a hotplate. Add portions of the remainder as evaporation proceeds and evaporate to dryness. Cool the residue, and add 35 ml concentrated HNO_3. Heat on a hotplate until light brown fumes are evident to destroy any organic matter. Cool to room temperature, and add 5 ml concentrated H_2SO_4 and 5 ml concentrated $HClO_4$. Then proceed with step 4.3.2.4.

4.3.2.3 Silica Gel Preparation Analyses. Weigh the spent silica gel, and report to the nearest gram.

4.3.2.4 Final Sample Preparation. Samples from 4.3.2.1 and 4.3.2.2 may be combined here for ease of analysis. Replace on a hotplate, and evaporate to dryness in a $HClO_4$ hood. Cool and dissolve the residue in 10.0 ml of 25 percent V/V HCl. Samples are now ready for the atomic absorption unit. It is necessary for the Be concentration of the sample to be within the calibration range of the unit. If necessary, perform further dilution of sample with 25 percent V/V HCl to bring the sample within the calibration range.

4.3.3 Beryllium Determination. Analyze the samples prepared in 4.3.2 at 234.8 nm using a nitrous oxide/acetylene flame. Aluminum, silicon and other elements can interfere with this method if present in large quantities. Standard methods are available, however, that may be used to effectively eliminate these interferences (see Citation 2 in Section 8).

5. *Calibration.*

5.1 Sampling Train. Calibrate the sampling train components according to the procedures outlined in the following sections of Method 5: Section 5.1 (Probe Nozzle), Section 5.2 (Pitot Tube), Section 5.3 (Metering System), Section 5.4 (Probe Heater), Section 5.5 (Temperature Gauges), Section 5.7 (Barometer). Note that the leak check described in Section 5.6 of Method 5 applies to this method.

6. *Calculations.*

6.1 Dry Gas Volume. Using the data from each sample run, calculate the dry gas sample volume at standard conditions $V_{m(std)}$ (corrected for leakage, if necessary) as outlined in Section 6.3 of Method 5.

6.2 Volume of Water Vapor in Sample and Moisture Content of Stack Gas. Using the data obtained from each sample run, calculate the volume of water vapor $V_{w(std)}$ in the sample, and the moisture content B_{ws} of the stack gas. Use Equations 5-2 and 5-3 of Method 5.

6.3 Stack Gas Velocity. Using the data from each sample run and Equation 2-9 of Method 2, calculate the average stack gas velocity $v_{s(avg)}$.

6.4 Beryllium Emission Rate. Calculate the Be emission rate R in g/day for each stack using Equation 104-1. For cyclic operations, use only the time per day each stack is in operation. The total Be emission rate from a source will be the summation of results from all stacks.

Eq. 104-1

$$R = K \frac{W_t v_{s(avg)} A_s (86.400 \times 10^{-6})}{[V_{m(std)} + V_{w(std)}](T_s/P_s)}$$

Where:

W_t = Total weight of Be collected, μg.

A_s = Stack cross-sectional area, M^2 (ft^2).

86.400 = Conversion factor, sec/day.

10^{-6} = Conversion factor, g/μg.

T_s = Absolute average stack gas temperature, °K (°R).

P_s = Absolute stack gas pressure, mm Hg (in. Hg).

K = 0.3858 °K/mm Hg for metric units.

= 17.64 °R/in. Hg for English units.

6.5 Isokinetic Variation and Acceptable Results. Same as Method 5, Sections 6.11 and 6.12, respectively.

7. *Determination of Compliance.* Each performance test consists of three sample runs of the applicable test method. For the purpose of determining compliance with an applicable national emission standard, use the average of the results of all sample runs.

8. *Bibliography.*

In addition to Citations 1-3 and 5-15 of Section 10 of Method 101, the following citations may be helpful:

1. Amos, M.D., and J. B. Willis. Use of High-Temperature Pre-Mixed Flames in Atomic Absorption Spectroscopy. Spectrochim. Acta. *22*:1325. 1966.

2. Fleet, B., K. V. Liberty, and T. S. West. A Study of Some Matrix Effects in the Determination of Beryllium by Atomic Absorption Spectroscopy in the Nitrous Oxide-Acetylene Flame. Talanta *17*:203. 1970.

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Stack Sampling Technical Information
A Collection of Monographs and Papers

Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
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A GUIDELINE FOR EVALUATING COMPLIANCE TEST RESULTS

(Isokinetic Sampling Rate Criterion)

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Introduction

The sampling rate used in extracting a particulate matter sample is important because anisokinetic conditions can cause sample concentrations to be positively or negatively biased due to the inertial effects of the particulate matter. Hence, the calculation of percent isokinetic (I) is a useful tool for validating particulate test results. Section 6.12 of the recently revised Method 5[1] states, "If 90 percent $\leq$ I $\leq$ 110 percent, the results are acceptable. If the results are low in comparison to the standard and I is beyond the acceptable range, or, if I is less than 90 percent, the Administrator may opt to accept the results."

This guideline provides a more detailed procedure on how to use percent isokinetic to accept or reject test results when the sampling rate is beyond the acceptable range. The basic approach of the procedure is to account for the inertial effects of particulate matter and to make a maximum adjustment on the measured particulate matter concentration.[2] Then, after comparison with the emission standard, the measured particulate matter concentration is categorized (1) as clearly meeting or exceeding the emission standard or (2) as being in a "gray area" zone. In the former category, the test report is accepted; in the latter, a retest should be done because of anisokinetic sampling conditions.

Procedure

1. Check or calculate the percent isokinetic (I) and the particulate

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matter concentration (c_s) according to the procedure outlined in Method 5. Note that c_s must be calculated using the volume of effluent gas actually sampled (in units of dry standard cubic feet, corrected for leakage). Calculate the emission rate (E), i.e. convert c_s to the units of the standard. For the purposes of this guideline, it is assumed that all inputs for calculating E are correct and other specifications of Method 5 are met.

2. Compare E to the standard. Then accept or reject c_s using the criteria outlined below. (A summary is given in Table I):

a. Case 1 - I is between 90 and 110 percent. The concentration c_s must be considered acceptable. A variation of ± 10 percent from 100 percent isokinetic is permitted by Method 5.

b. Case 2 - I is less than 90 percent.

(1) If E meets the standard, c_s should be accepted, since c_s can either be correct (if all particulate matter are less than about 5 micrometers in diameter) or it can be biased high (if larger than 5 micrometer particulate matter is present) relative to the true concentration; one has the assurance that c_s is yielding an E which is definitely below the standard.

(2) If E is above the standard, multiply c_s by the factor (I/100) and recalculate E. If, on the one hand, this adjusted E is still higher than the standard, the adjusted c_s should be accepted; a maximum adjustment which accounts for the inertial effects of particulate matter has been made and E still exceeds the standard. On the other hand, if the

adjusted E is lower than the standard, a retest should be done.

c. Case 3 - I is greater than 110 percent.

(1) If E exceeds the standard, c_s should be accepted, since c_s can either be equal to the true concentration or biased low relative to it; one has the assurance that E is definintely over the standard.

(2) If E is below the standard, multiply c_s by the factor (I/100) and recalculate E. If, on the one hand, this adjusted E is still lower than the standard, the adjusted c_s should be accepted; a maximum adjustment which accounts for the inertial effects of particulate matter has been made and E still meets the standard. On the other hand, if the adjusted E exceeds the standard, a retest should be done.

Table I. Summary of Procedure

Case	I	Category	Decision
1	90 - 110		Accept
2	< 90	E $\leq$ Em. Std.	Accept
		c_s(I/100)→ E_{adj} > Em. Std.	Accept
		c_s(I/100)→ E_{adj} $\leq$ Em. Std.	Retest
3	> 110	E > Em. Std.	Accept
		c_s(I/100)→ E_{adj} $\leq$ Em. Std.	Accept
		c_s(I/100)→ E_{adj} > Em. Std.	Retest

Summary

A procedure for accepting or rejecting particulate matter test results based on percent isokinetic has been outlined. It provides a mechanism for accepting all data except where anisokinetic sampling might affect the validity of the test results. This procedure is one of several useful tools for evaluating testing results.

References

1. Method 5 - Determination of Particulate Emissions from Stationary Sources. Federal Register. 42(160):41776-41782, August 18, 1977.

2. Smith, W. S., R. T. Shigehara, and W. F. Todd. A Method for Interpreting Stack Sampling Data. Stack Sampling News. 1(2):8-17, August 1973.