

February 28, 2008

Certified Mail # 7006 0810 0002 6561 3016

Mr. Lee Hoefert
Air Program Administrator
Florida Department of Environmental Protection
Southeast District
400 North Congress Ave., Suite 200
West Palm Beach, FL 33401

RECEIVED

MAR 03 2008

DIVISION OF AIR
RESOURCES MANAGEMENT

Re: Wheelabrator North and South Broward
Stack Test Protocol Submittal

Dear Mr. Hoefert:

Due to the Department's reluctance to allow combining Method 26A with Method 13B for HCl and fluoride compliance testing, Clean Air Engineering has revised the front-half (attached) of the Wheelabrator North and South Broward stack testing protocol submitted to your office on January 28, 2008 to conduct these two test procedures separately.

I, the undersigned, am a responsible official, as defined in Rule 62-210.200, F.A.C., of the Title V source addressed in this submittal. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements and information in this document are true, accurate and complete.

If there are any questions, please contact Chuck Faller of this office at (954) 971-8701 or (954) 581-6606.

Sincerely,



Gary Collette
Plant Manager (North Broward)



Jairaj Gosine
Plant Manager (South Broward)

Cc: USEPA, Region IV, Pesticides and Toxics Management Division, Air & EPCRA Enforcement Branch, Air Enforcement Section (with) CERTIFIED MAIL #7006 0810 0002 6561 2989
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File: 3.7.2 (without)
5.1.3.2 (without)
3.8.2 (without)

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and

Wheelabrator South Broward
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Ft. Lauderdale, FL 33314

PROTOCOL ON COMPLIANCE – 2008

Performed for:
**WHEELABRATOR NORTH AND SOUTH BROWARD
ASH HANDLING SYSTEMS, LIME SILO VENTS,
SDA INLETS, FF OUTLETS AND STACKS
POMPANO BEACH AND FT. LAUDERDALE, FLORIDA**

CleanAir Project No: Protocol
Revision 0: January 22, 2008
Revision 1: February 22, 2008

Submitted by,

A handwritten signature in black ink, appearing to read "Scott A. Brown", written over a horizontal line.

Scott Brown
Project Manager
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PROJECT OVERVIEW

1-1

Wheelabrator North Broward, Inc. operates the North Broward County Resource Recovery Facility located in Pompano Beach, Florida. Wheelabrator South Broward, Inc. operates the South Broward Resource Recovery Facility in Ft. Lauderdale, Florida. Each of the facility's emission levels are regulated by the Florida Department of Environmental Protection, as well as the United States EPA. Wheelabrator North and South Broward, Inc. have contracted Clean Air Engineering to perform test programs at each facility to show compliance with their air permits as well as CFR 40 Subpart Cb. This test protocol provides a summary of the test methods, procedures, process conditions and all other information necessary to insure testing is conducted in full compliance with all requirements under 40 CFR Subpart Cb and applicable sections of each facilities Title V Permits (0112120-009-AV, North Broward and 0112119-009-AV, South Broward).

Most of sampling will be conducted at the spray dryer absorber inlets (SDA Inlets) and the fabric filter outlets (FF Outlet). In addition, opacity determinations will be conducted for the lime silo using Method 9 and ash handling system fugitive emissions using Method 22.

The testing includes the measurement of the following emissions:

- beryllium (Be),
- cadmium (Cd);
- lead (Pb);
- mercury (Hg);
- dioxins and furans (PCDD/PCDF);
- total suspended particulate (TSP);
- hydrogen chloride (HCl);
- total fluoride;
- visual emissions.

All the above pollutants will be measured at the FF Outlets; in addition, hydrogen chloride will be measured at the SDA Inlet in order to obtain system removal efficiencies.

The testing will also include the relative accuracy test audit (RATA) at the FF Outlet continuous emission monitors (CEMs) for the following compounds:

- sulfur dioxide (SO₂);
- nitrogen oxides (NO_x);
- carbon monoxide (CO).

Coordinating the field portion of the program will be:

- C. Faller - Wheelabrator North and South Broward, Inc.
- S. Brown - Clean Air Engineering

PROJECT OVERVIEW

1-2

Table 1-1.outlines both facility's testing schedule. Operational constraints may cause Wheelabrator North and/or South Broward to modify the corresponding schedule or personnel during each testing week. The above referenced field coordinators may change depending on Clean Air Engineering and plant staffing. Currently the testing is scheduled to take place at North Broward from March 18-20, 2008 and at South Broward from March 24-26, 2008.

The units to be reported are presented in Tables 1-3 and 1-4 on pages 1-6 and 1-7. The emission limits are from Subpart Cb Emission Guidelines and Compliance Times for Large Municipal Waste Combustors That Are Constructed on or Before September 20, 1994, - final rules published December 19, 1995 as modified on August 25, 1997 (for NO_x) and the facilities' Title V Permits.

During all compliance testing the unit being tested will be operated within 10% of the plants maximum steam flow of 192,000 lbs/hr (for South Broward) and 186,000 lbs/hr (for North Broward). The steam flow for each test will be reported in the final compliance report. During each dioxin test run the steam flow and FF inlet temperature will be recorded and averaged by the Bailey Net 90 system to determine the maximum combustor load and particulate control device temperature required by 40 CFR 60.58b.

Other parameters recorded during testing are further outlined in Section 2 on page 2-4. All testing will be done in accordance with 40 CFR 60.58b and F.A.C. 62-297. A final report will be issued within forty days of the last compliance test date.

Table 1-2 on page 1-4 presents the quarterly mercury testing schedule for each facility. This is in accordance with F.A.C. 62-296.416. The semiannual mercury testing shall be staggered so that at least one unit is tested during each calendar quarter at each facility and each unit is tested twice per year.

At North and South Broward only one unit will be tested for PCDD/PCDF per the alternative performance testing schedule in section 60.38b of Subpart Cb. The maximum demonstrated load and FF Inlet temperature limit will be revised only on the one unit tested. Unit 3 will be tested at both facility's during the 2008 test program. Methylene chloride will be omitted in the Method 23 sample recovery per the EPA letter presented in Appendix B.

PROJECT OVERVIEW

1-3

Opacity Performance Tests-As allowed under Title V Conditions B.53(6), B.76 and B.81 (South Broward) and B.54(6), B.77 and B.82 (North Broward), compliance with the opacity standard will be demonstrated using the certified continuous opacity monitor system (COMS) installed on each unit in lieu of conducting EPA Reference Method 9 test as provided under 40 CFR 60.11 (e). For the purpose of determining compliance with the opacity standard during a performance test using COMS data, the minimum total time of COMS data collection will consist of the average of all 6 minute continuous periods within the duration of the Method 5 particulate tests. The COMS data printout will be included in the test report.

CleanAir and Wheelabrator are proposing two adaptations to previous years sampling programs. We propose that Method 5 will be combined with Method 29 for particulate and metals compliance. Previously Method 5 had been combined with Method 26A (HCl). Metals and particulate matter sampling can be combined as referenced in Method 29 Section 1.2 Principle "This method may be used to determine particulate emissions in addition to the metals emissions if the prescribed procedures and precautions are followed". A more detailed description of Method 5/29 procedures is detailed in Section 3, starting on page 3-7 of this Protocol.

HCl will no longer be collected at the FF Outlet locations by combining Method 26A with Method 5. 60-minute Method 26A sample trains at the SDA Inlets and FF Outlets will be utilized to exhibit compliance with each units HCl limit(s). Method 26A will be modified to a single point constant sampling rate at both test locations.

PROJECT OVERVIEW

**Table 1-1:
North and South Broward - Compliance / RATA**

Day	Activity	Location	Test Method	Repli-cates	Sample Time	Minimum Sample Volume
1	Particulate/Metals	FF Outlet 2	5/29	3	125 min.	60 ft ³
	HCl ¹	SDA Inlet 1	Mod. 26A	3	60 min.	30 ft ³
	HCl ¹	FF Outlet 1	Mod. 26A	3	60 min.	30 ft ³
	Particulate/Metals	FF Outlet 3	5/29	3	125 min.	60 ft ³
	PCDD/Fs	FF Outlet 3	23	1	250 min.	120 ft ³
	CEMS (O ₂ , SO ₂ , NO _x , CO)	FF Outlet 2	3A, 6C, 7E, 10	9-12	27 min.	NA
	Opacity ⁴	Lime Silo	9	1 unload	Duration	NA
	Total Fluorides	FF Outlet 1	13B	3	62.5 min.	30 ft ³
2	Particulate/Metals	FF Outlet 1	5/29	3	125 min.	60 ft ³
	HCl ¹	SDA Inlet 3	Mod. 26A	3	60 min.	30 ft ³
	HCl ¹	FF Outlet 3	Mod. 26A	3	60 min.	30 ft ³
	PCDD/Fs	FF Outlet 3	23	2	250 min.	120 ft ³
	Hg ²	FF Outlet 2	29	3	125 min.	60 ft ³
	CEMS (O ₂ , SO ₂ , NO _x , CO)	FF Outlet 1	3A, 6C, 7E, 10	9-12	27 min.	NA
	Total Fluorides	FF Outlet 2	13B	3	62.5 min.	30 ft ³
	3	Hg ²	FF Outlet 1	29	3	125 min.
HCl ¹		SDA Inlet 2	Mod. 26A	3	60 min.	30 ft ³
HCl ¹		FF Outlet 2	Mod. 26A	3	60 min.	30 ft ³
Hg ²		FF Outlet 3	29	3	125 min.	60 ft ³
CEMS (O ₂ , SO ₂ , NO _x , CO)		FF Outlet 3	3A, 6C, 7E, 10	9-12	27 min.	NA
Total Fluorides		FF Outlet 3	13B	3	62.5 min.	30 ft ³
Fugitive Emissions ³		Ash Handling System	22	1	180 min.	NA

¹ EPA Method 26A will be used in a modified format at the FF Outlet and SDA Inlet (single point, constant sampling rate).

² Provisional FF Outlet mercury testing will be analyzed only if necessary.

³ The time period for any fugitive emissions will be determined for the entire ash handling system for a three hour period including times when ash is transferred to the ash storage area and loaded into trucks. To encompass the entire system multiple observation locations will be utilized.

⁴ The opacity of the lime silo will be observed during one loading operation. This observation may be done on a different day or during another week to coordinate with the lime delivery schedule.

PROJECT OVERVIEW

1-5

Table 1-2:
North/South Broward - Quarterly Hg - 2008

Day	Activity	Location	Test Method	Repli-cates	Sample Time	Sample Volume
1	Mercury (Hg)	1, 2 or 3 FF Outlet	29	3	125 min.	60 ft ³ .
2	Mercury (Hg) ¹	1, 2 or 3 FF Outlet	29	3	125 min.	60 ft ³ .
3	Move to other facility Mercury (Hg)	1, 2 or 3 FF Outlet	29	3	125 min.	60 ft ³ .
4	Mercury (Hg) ¹	1, 2 or 3 FF Outlet	29	3	125 min.	60 ft ³ .

¹ Provisional mercury testing will be analyzed only if necessary.

PROJECT OVERVIEW

1-6

**Table 1-3:
Summary of Stack Test Reporting Units**

Source Constituent	Sampling Method	Reporting Units	Limit ¹
<u>FF Outlets</u>			
Particulate	EPA M5	mg/dscm @ 7% O ₂	27
Total Fluoride (as HF)	EPA M13B	lb/10 ⁶ BTU ⁵	0.0040
Total PCDD/PCDFs	EPA M23	ng/dscm @7%O ₂	30
Hydrogen chloride ²	EPA 26A ³	ppmdv @ 7%O ₂ % Reduction	29 ² or >95
Beryllium	EPA M29	mg/dscm @ 7% O ₂	0.001
Cadmium	EPA M29	mg /dscm @ 7%O ₂	0.040
Lead	EPA M29	mg /dscm @ 7%O ₂	0.44
Mercury	EPA M29	µg/dscm @ 7%O ₂	70
<u>Stacks</u>			
Visual Emissions	COMS	percent	10
<u>Ash Handling System</u>			
Fugitive Visual Emissions	EPA M22	percent	5 ⁴
<u>Lime Silo</u>			
Visual Emissions	EPA M9	percent	5

¹ Limits obtained from each facilities Title V Permit (0112119-009 AV/South and 0112120-009 AV/North).

² Hydrogen chloride concentrations will be measured at the SDA Inlet and FF Outlet concurrently. A removal efficiency will be calculated using ppmdv @ 7%O₂ for hydrogen chloride. Limits are the less stringent of the outlet concentration or % reduction.

³ Hydrogen chloride concentrations will be measured with a modified Method 26A sampling train at the SDA inlet. These trains will utilize single point constant rate sampling.

⁴ Visible emissions (5% opacity) no more than 5% of the observation time excluding periods of maintenance or repair.

⁵ The lb/10⁶ BTU calculation will use an Fd value of 9570 (dscf/10⁶BTU) per EPA Method 19.

PROJECT OVERVIEW

**Table 1-4 :
Summary of Relative Accuracy Test Reporting Units**

<u>Location</u> Constituent Units	Sampling Method	Limit ¹
<u>FF Outlet</u>		
Nitrogen Oxides @ 7% O ₂ CEM Relative Accuracy	EPA M7E, PS2	20 percent of RM or 10 percent of Standard
Sulfur Dioxide @ 7% O ₂ CEM Relative Accuracy	EPA 6C, PS2	20 percent of RM or 20 percent of Standard ²
Carbon Monoxide @ 7% O ₂ CEM Relative Accuracy	EPA M10, PS2 and 4A	10 percent of RM or 5 ppm Mean Difference

¹ Limits obtained from 40 Code of Federal Register part 60 Appendix B PS 2, Section 13.2 and 4A, Section 13.2.
² The 29 ppm SO₂ limit is equivalent to 0.069 lb/MMBtu and therefore qualifies for the alternate SO₂ RATA criteria of 20% of the standard (limit).

**Table 1-5 :
Operating Data to be Reported**

<u>Process Condition</u>
Maximum Demonstrated Combustor Load (klbs/hr) ¹
Maximum Particulate Control Device Inlet Temperature (°F) ²

¹ From 40CFR60.58b (i) (8) the maximum demonstrated load during PCDDs/PCDFs testing, highest four hour block average. This will be revised only on the one unit tested.
² From 40CFR60.58b (i) (9) the highest four hour average during PCDDs/PCDFs testing. This will be revised only on the one unit tested.

DESCRIPTION OF INSTALLATION

2-1

The North and South Broward Resource Recovery Facilities each operate three 750 tons per day municipal refuse fired, water wall boiler trains. South Broward is nominally designed to process 750 tons per day and North Broward 747 tons per day. The trains were manufactured by Babcock and Wilcox to produce electricity for sale to a local utility company. Each boiler is equipped a spray dryer absorber (SDA) for acid gas removal, followed by a fabric filter (FF) baghouse for the control of particulate emissions and selective non-catalytic reduction for NO_x control. The control equipment is manufactured by Wheelabrator Air Pollution Control, Inc. Each fabric filter baghouse is followed by an induced draft fan that directs the flue gas to a dedicated flue in a common stack.

Figure 2-1 shows a general schematic for the two facilities. The general sampling locations for the Units 1, 2 and 3 SDA Inlets and FF Outlets are shown in Figure 2-2.

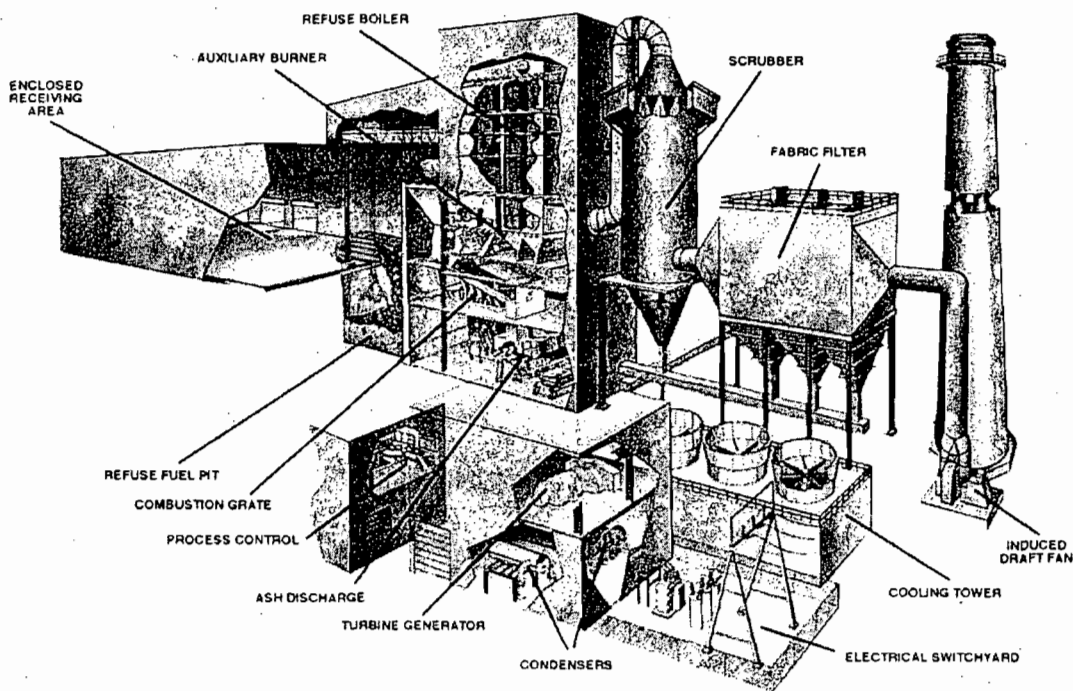


Figure 2-1: General Process Schematic

DESCRIPTION OF INSTALLATION

2-2

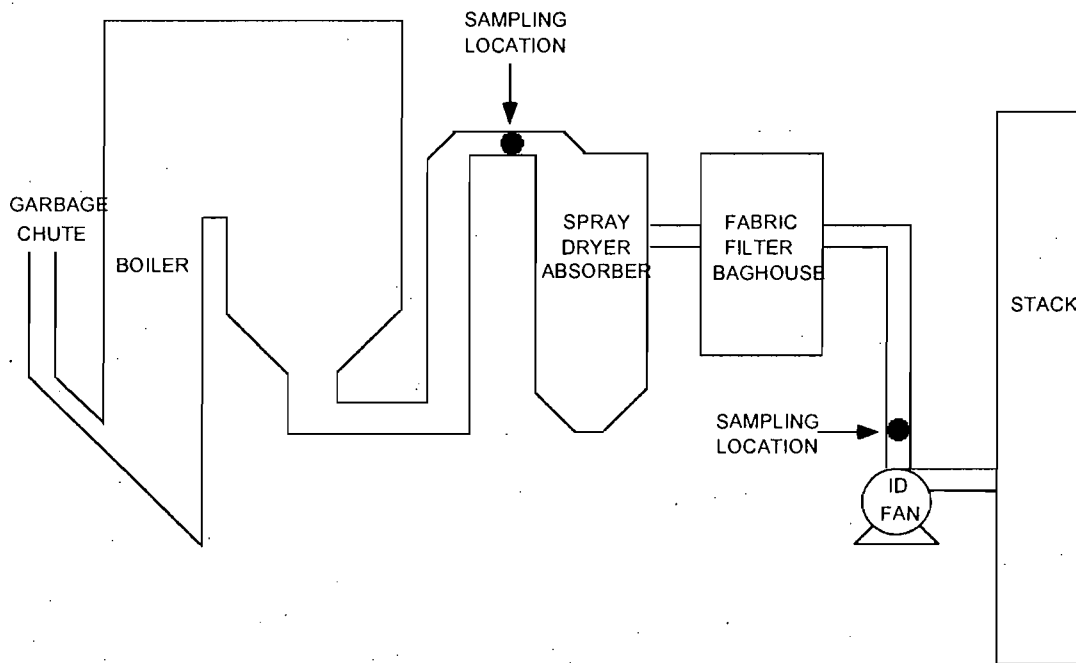


Figure 2-2: Process Schematic

PROCESS OPERATION DURING TESTING

Process information will be collected by plant personnel in conjunction with the testing program. The raw process data collected will be presented in the appendices of the final report. The process information shall consist of the following:

1. Boiler Measurements
 - a) Steam Production, (Klbs/hr)
 - b) Boiler feedwater temperature, (°F)
 - c) Superheater outlet steam temperature, (°F)
 - d) Superheater outlet steam pressure, (psig)
2. Spray Dryer Absorber Measurements
 - a) Total slurry feed, (GPM)
 - b) Dilution water feed, (GPM)
 - c) Inlet flue gas temperature, (°F)
 - d) Slurry concentration (%)
3. Fabric Filter measurements
 - a) Pressure drop, (in. H₂O)
 - b) Outlet flue gas temperature, (°F)
 - c) Fabric Filter Inlet temperature, (°F)
4. SNCR
 - a) Urea flow, (gpm).

DESCRIPTION OF INSTALLATION

2-3

PROCESS OPERATION DURING TESTING (CONT.)

It will be the responsibility of Wheelabrator North and South Broward personnel to serve as test coordinators during the program. The test coordinator will be responsible for:

1. Scheduling the start of all testing
2. Principle contact with the Agency concerning the tests
3. Principle contact with the Clean Air Engineering concerning the tests
4. Assuring that process data is being recorded during the testing
5. Providing copies of any data to the Agency

All tests will be conducted under representative operating conditions in accordance with 40 CFR 60.8 requirements. Operation during periods of boiler and air pollution control system malfunctions or upset conditions will not be considered representative conditions and will be reason for delaying, interrupting, aborting, or invalidating a test run. The following are typical malfunctions or upset conditions that will be reason for delaying, interrupting, or invalidating a test run.

1. Crane outage
2. Fan outage
3. Spray dryer absorber or lime slaker problem
4. Broken or frozen grate block
5. Plugged feed chute
6. Plugged ash expeller
7. Plugged ash conveyor system
8. Turbine trip
9. Hydraulic failure of stoker system
10. Fabric filter malfunction
11. Steam flow not within 10% of steam flow set point
12. Boiler tube leak or rupture
13. Plug or bridge in refuse feed hopper
14. Unusually wet trash

When the malfunction or upset condition has been cleared, testing will resume from that point at which it was stopped. If the malfunction or upset condition results in an extended test delay, then the affected test run(s) may be aborted and a new run(s) conducted when the malfunction has been corrected or process upset cleared. The above list represents the most typical malfunctions or process upsets potentially encountered.

METHODOLOGY

The sampling will follow procedures as detailed in U.S. Environmental Protection Agency (EPA) Methods 1, 2, 3, 3A, 3B, 4, 5, 6C, 7E, 9, 10, 13B, 22, 23, 26A¹ and 29. The following table summarizes the methods and their respective sources.

**Table 3-1:
Summary of Sampling Procedures**

Title 40 CFR Part 60 Appendix A	
Method 1	"Sample and Velocity Traverses for Stationary Sources"
Method 2	"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"
Method 3	"Gas Analysis for the Determination of Dry Molecular Weight"
Method 3A	"Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
Method 3B	"Gas Analysis for the Determination of Emission Rate Correction Factor or Excess Air"
Method 4	"Determination of Moisture Content in Stack Gases"
Method 5	"Determination of Particulate Emissions from Stationary Sources"
Method 6C	"Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
Method 7E	"Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)"
Method 9	"Visual Determination of the Opacity of Emissions from Stationary Sources"
Method 10	"Determination of Carbon Monoxide Emissions from Stationary Sources"
Method 13B	"Determination of Total Fluoride Emissions from Stationary Sources (Specific Ion Electrode Method)"
Method 22	"Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares"
Method 23	"Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans from Stationary Sources"
Method 26A ¹	"Determination of Hydrogen Chloride Emissions from Stationary Sources"
Method 29	"Determination of Metals Emissions from Stationary Sources"
Title 40 CFR Part 60 Appendix B	
PS 2	"Specifications and Test Procedures for SO ₂ and NO _x Continuous Emission Monitoring Systems in Stationary Sources"
PS 3	"Specifications and Test Procedures for O ₂ and CO ₂ Continuous Emission Monitoring Systems in Stationary Sources"
PS 4A	"Specifications and Test Procedures for Carbon Monoxide Continuous Emission Monitoring Systems in Stationary Sources"

¹ Method 26A will be modified using single point constant sampling rate at the outlet and inlet test locations.

These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR).

These sampling, recovery and analytical procedures are summarized on pages 3-2 through 3-22.

The sampling nozzles and continuous emission monitors will be calibrated on site. All other equipment will be calibrated at the Clean Air Engineering laboratory prior to shipment to the job site. A post-test calibration will be performed on the meter boxes at the conclusion of testing to verify that calibration was maintained throughout the test program. Sample calibration sheets can be found in Appendix Section B.

METHODOLOGY

3-2

SAMPLING POINT DETERMINATION - EPA METHOD 1

Sampling point locations will be determined according to EPA Method 1.

Table 3-2 outlines the sampling point configurations. Figures 3-1 and 3-2 illustrate the sampling points and orientation of sampling ports for each of the locations that will be tested in the program.

**Table 3-2:
Sampling Points**

<u>Location</u> Constituent	<u>Method</u>	<u>Run</u> <u>No.</u>	<u>Points</u> <u>per Port</u>	<u>Minutes</u> <u>per Point</u>	<u>Total</u> <u>Minutes</u>	<u>Figure</u>
<u>SDA Inlets</u>						
HCl ²	mod. 26A	1-3	1	1	60	60 3-1
<u>FF Outlets</u>						
CEM	3A, 6C, 7E, 10	1-9 ¹	1	3	10	27 3-2
Fluoride	13B	1-3	5	5	2.5	62.5 3-3
HCl ²	mod. 26A	1-3	1	1	60	60 NA
PCDD/Fs	23	1-3	5	5	10	250 3-3
Particulate/Beryllium	5/29	1-3	5	5	5	125 3-3
Cadmium, Lead, Mercury						
Mercury ³	29	4-6	5	5	5	125 3-3

¹ Continuous emissions monitoring relative accuracy testing for O₂, SO₂, NO_x and CO will consist of at least 9 runs.
² Hydrogen chloride testing will utilize a modification of EPA Method 26A (single point constant sampling rate) at the outlet and inlet sampling locations.
³ Provisional mercury testing will be analyzed only if necessary.

METHODOLOGY

SAMPLING POINT DETERMINATION (CONTINUED)

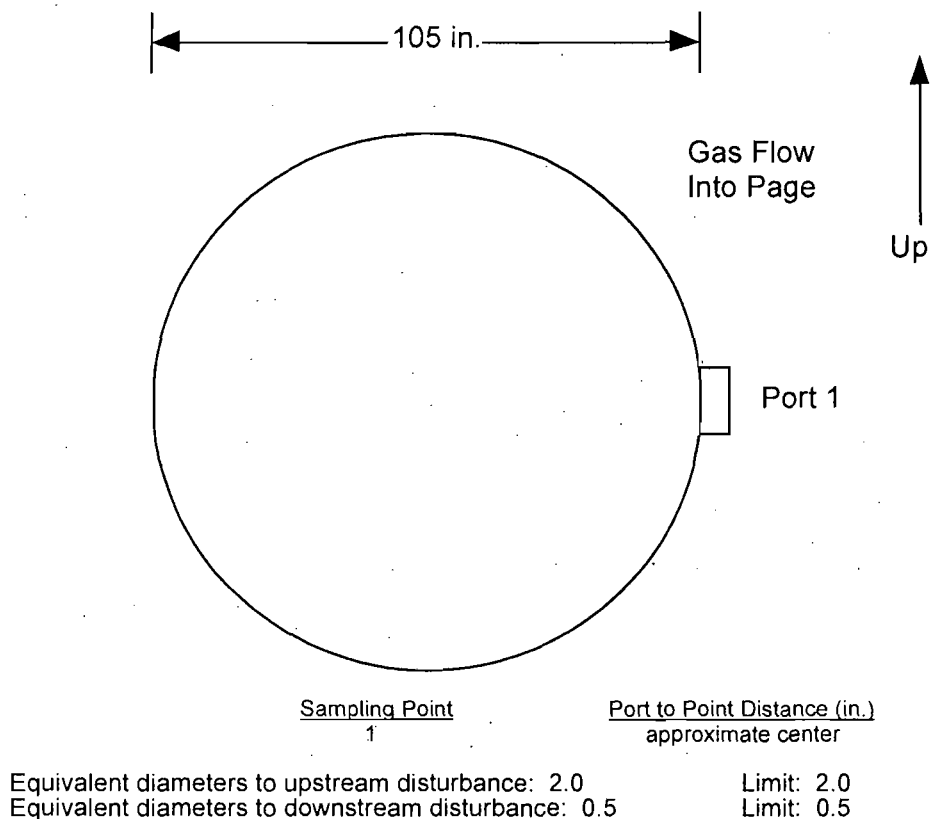
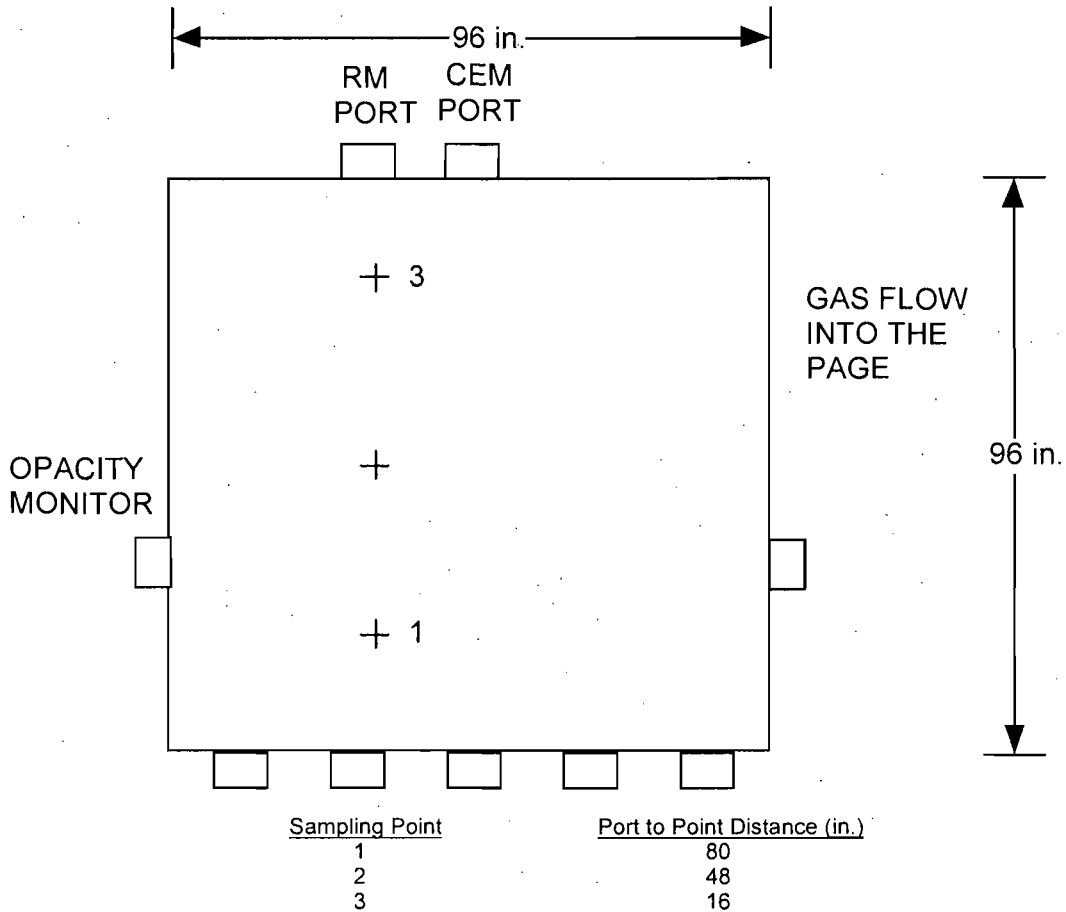


Figure 3-1: SDA Inlets - Sampling Point Determination (HCI Sampling)
(Units 1, 2 and 3 are identical)

METHODOLOGY

SAMPLING POINT DETERMINATION (CONTINUED)



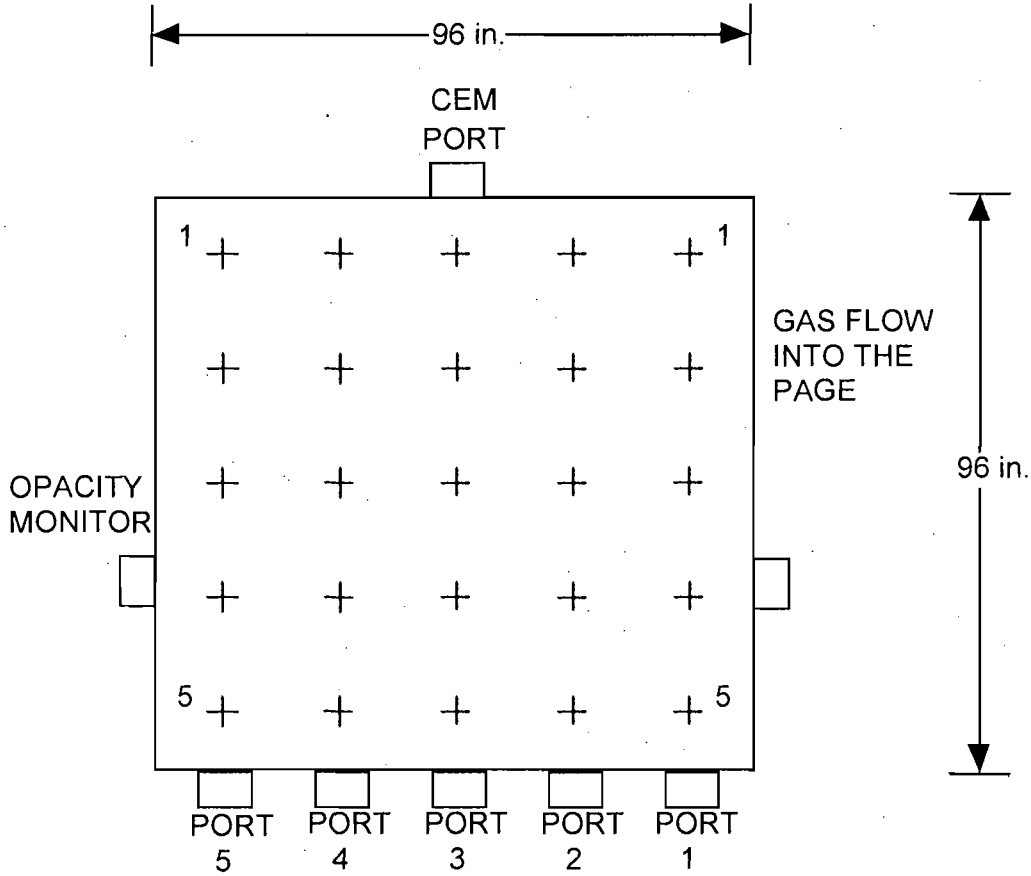
Equivalent diameters to upstream disturbance: 2.0 Limit: 2.0
 Equivalent diameters to downstream disturbance: 0.5 Limit: 0.5

**Figure 3-2: FF Outlets - Sampling Point Determination (CEM RATA Sampling)
 (Units 1, 2 and 3 are identical)**

METHODOLOGY

3-5

SAMPLING POINT DETERMINATION (CONTINUED)



Sampling Point	Port to Point Distance (in.)
1	86.4
2	67.2
3	48.0
4	28.8
5	9.6

Equivalent diameters to upstream disturbance: 2.0 Limit: 2.0
 Equivalent diameters to downstream disturbance: 0.5 Limit: 0.5

Figure 3-3: FF Outlets - Sampling Point Determination (EPA Method 1)

METHODOLOGY

3-6

VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2

EPA Method 2 will be used, in conjunction with the wet method testing, to determine the gas velocity and flow rate at each of the test locations.

Each set of velocity determinations will include the measurement of gas velocity pressure and gas temperature at each of the EPA Method 1 traverse points. The velocity pressures will be measured with a Type S pitot tube. Gas temperature measurements will be made using a Type K thermocouple and digital pyrometer. Figure 3-5 includes the components of the EPA Method 2 sampling apparatus.

GAS COMPOSITION AND MOLECULAR WEIGHT - EPA METHOD 3A

To determine the oxygen (O₂) concentration, carbon dioxide (CO₂) concentration and gas molecular weight for all isokinetic compliance testing, a time-integrated sample of the gas will be obtained for each sampling train and analyzed in accordance with EPA Method 3A. The gas sample will be collected into a vinyl sample bag from each isokinetic test method. The contents of the bag will be analyzed for O₂ and CO₂ concentrations using an O₂/CO₂ continuous monitoring analyzers calibrated with EPA Protocol gases. A linearity and bias check will be performed on the analyzers prior to any analysis. All data will be stored using a Labtech data acquisition system. If deemed necessary, due to analyzer malfunction or other problems, the bags will be analyzed using an Orsat analyzer as per EPA Method 3B.

GAS COMPOSITION AND MOLECULAR WEIGHT - EPA METHOD 3 AND 3B

To determine the oxygen (O₂) concentration, carbon dioxide (CO₂) concentration and gas molecular weight for the quarterly mercury tests, a time-integrated sample of the gas will be obtained for each sampling train and analyzed in accordance with EPA Method 3 and 3B. The gas sample will be collected into a vinyl sample bag from each wet method test run. The contents of the bag may be analyzed for O₂ and CO₂ concentrations using an Orsat gas analyzer.

MOISTURE CONTENT - EPA METHOD 4

The flue gas moisture content at each of the test locations will be determined in accordance with EPA Method 4, in conjunction with the wet method testing. Figure 3-5 includes the components of the EPA Method 4 sampling apparatus. The gas moisture will be determined by quantitatively condensing the water in chilled impingers. The amount of moisture condensed will be determined gravimetrically. A dry gas meter will be used to measure the volume of gas sampled. The amount of water condensed and the volume of gas sampled will be used to calculate the gas moisture content in accordance with EPA Method 4.

METHODOLOGY

3-7

PARTICULATE AND METALS EMISSIONS - EPA METHOD 5/29

Particulate sampling (EPA Method 5) will be combined with EPA Method 29 as referenced in Method 29 Section 1.2 Principle, "This method may be used to determine particulate emissions in addition to the metals emissions if the prescribed procedures and precautions are followed". EPA Method 5/29 will be used to measure particulate, beryllium, cadmium, lead and mercury emissions at the FF Outlet. Three test runs will be performed for each performance test along with three provisional mercury test runs (utilizing Method 29 only) on each unit. These provisional runs will be only be analyzed if necessary. This method defines metal emissions as particulate and gaseous material isokinetically withdrawn through a temperature controlled probe and collected on a high-efficiency filter and in acidified absorbing solutions.

Figure 3-4 illustrates the EPA Method 5/29 sampling train which will be used. The sampling apparatus contains a glass-lined temperature-controlled probe equipped with a pitot tube (for measuring stack flow rate) and a sharp-edged glass button-hook nozzle. The exit of the probe will be connected to a tared high efficiency quartz fiber filter (Pallflex 2500QAT-UP) supported in a glass filter holder inside an oven. The exit of the filter holder connects directly to a series of seven full size impingers. The probe and filter box for this train will be maintained at $120^{\circ}\text{C} \pm 14^{\circ}\text{C}$ ($248^{\circ}\text{F} \pm 25^{\circ}\text{F}$)

The first impinger of the sampling train will be left empty to accommodate collection of the flue gas moisture. The second and third impingers of the sampling apparatus will each contain 100 milliliters of 5% nitric acid/10% hydrogen peroxide solution. The fourth impinger will be left empty. The fifth and sixth impingers each contain 100 milliliters of 4% potassium permanganate/10% sulfuric acid solution. The seventh impinger contains 300 grams of silica gel. All of the impingers will be maintained at a temperature below 68°F for the duration of each test.

Procedures for selecting sampling locations and for the operation of the apparatus will be derived from EPA Method 29 and associated EPA Methods 1 through 5. The entire sampling apparatus will be leak-checked before and after each test run. Sampling will be performed at an isokinetic rate greater than 90% and less than 110%.

At the conclusion of each test run, the probe and nozzle will be rinsed and brushed at the test location first with acetone to remove any particulate matter and subsequently with 0.1 Normal nitric acid to collect any metals residue. The acetone rinse will be collected in a glass sample container and the 0.1 N nitric acid rinse will be collected into a polyethylene sample container. The quartz filter and associated particulate catch will be recovered quantitatively into the original filter container and sealed.

The liquid from the first three impingers will be transferred to a leak-free polyethylene storage container. The back-half of the filter housing, the first three impingers and all connecting glassware will be rinsed with 0.1 Normal nitric acid which will be added to the storage container.

METHODOLOGY

3-8

PARTICULATE AND METALS EMISSIONS (CONTINUED)

Any liquid collected in the fourth impinger will be transferred to a separate polyethylene container, and the impinger will be rinsed into the container with 0.1 Normal nitric acid. The contents of impingers 5 and 6 will be collected into an amber glass container. Both impingers 5 and 6 and the connecting glassware will then be rinsed with acidified potassium permanganate followed by distilled water. These rinses will be collected in the glass container. Any residual potassium permanganate retained by the impingers will be removed using a rinse of 8 Normal hydrochloric acid, which will be collected into a separate glass container. 200 milliliters of distilled water will be used to rinse impingers 5 and 6 and added to the same container to dilute the acid.

All containers will be sealed, labeled and liquid levels marked prior to transport to the laboratory. The silica gel weight and the volume (determined gravimetrically) of the condensate collected in the impingers will be used to determine moisture content of the stack gas.

The probe and nozzle acetone wash will be transferred to tared metals prepped beakers, evaporated to dryness and weighed to a constant weight. The weight differentials of the filter and acetone washes will be combined to determine total particulate matter. The particulate analysis will be performed by Clean Air Engineering located in Palatine, Illinois. Once the particulate weights are determined the probe and nozzle rinse will be redissolved in 10 ml of concentrated HNO₃ per Method 29 Section 8.3.2. The reconstituted rinses and filters will then be shipped to Element One of Wilmington, NC for metals analysis.

The reconstituted nozzle and probe rinses, nitric acid nozzle and probe rinses and filter will be combined by Element One. The combined samples, as well as the samples recovered from impingers 1 through 3, will each be reduced to near dryness and digested with hydrofluoric acid and concentrated nitric acid. The samples obtained from Impingers 4, 5 and 6 will be digested separately with acidified potassium permanganate and subsequently analyzed only for mercury. The digested samples will be analyzed by cold vapor atomic absorption spectroscopy (CVAAS) for mercury, per Method 7470 (EPA publication SW-846) and by inductively coupled plasma emission spectroscopy (ICPMS) for beryllium, cadmium and lead, per Method 6020 (EPA publication SW-846). Element One will provide all metals analysis.

The metals results will be blank corrected. The front and back half fractions will be combined for analysis of Beryllium, Cadmium and Lead.

METHODOLOGY

3-9

PARTICULATE AND METALS EMISSIONS (CONTINUED)

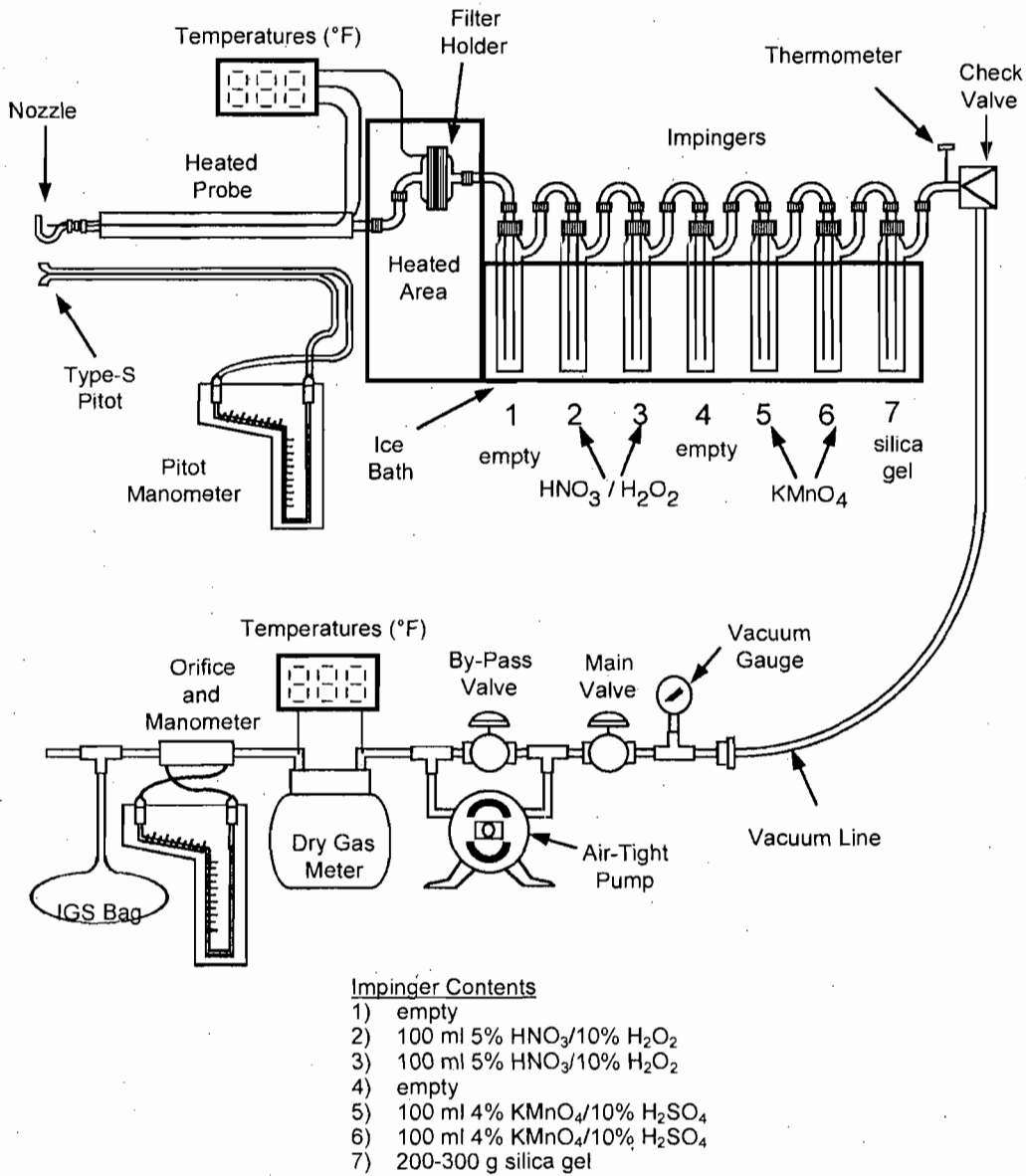


Figure 3-4: Particulate and Metals Sampling Apparatus (EPA Method 5/29)

METHODOLOGY

3-10

HYDROGEN FLUORIDE EMISSIONS - EPA METHOD 13B

The hydrogen fluoride emissions will be determined following procedures detailed in EPA Method 13B. Figure 3-5 illustrates the EPA Method 13B sampling apparatus. The sampling apparatus is the same as EPA Method 5 except a non tared filter is used. Gaseous fluoride is withdrawn isokinetically from the source onto a heated filter and then into glass impingers. After sampling and weighing the impingers for stack gas moisture determination, all glassware is rinsed with deionized water into the one sample container. The filter, probe/nozzle rinse, impinger contents and rinses are all combined into one sample container. The fluoride concentration is then determined by ion chromatography. The hydrogen fluoride analyses will be performed by Clean Air Engineering located in Palatine, Illinois.

METHODOLOGY

3-11

HYDROGEN FLUORIDE EMISSIONS - (CONTINUED)

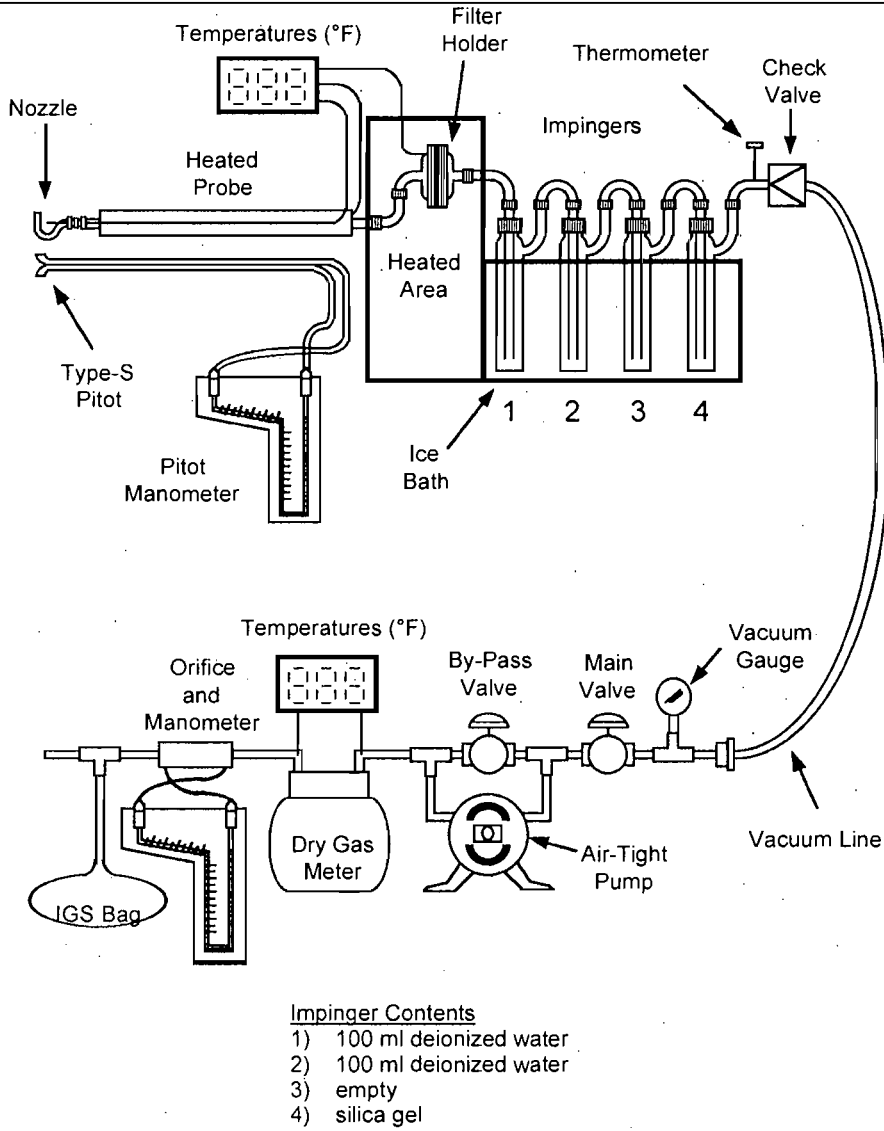


Figure 3-5: Hydrogen Fluoride Sampling Apparatus (EPA Method 13B)

METHODOLOGY

3-12

HYDROGEN CHLORIDE - MODIFIED EPA METHOD 26A

The hydrogen chloride concentrations will be determined at the FF Outlet and SDA Inlet using procedures detailed in EPA Method 26A and associated Methods 1-5. Figure 3-6 illustrates the Modified EPA Method 26A sampling apparatus. The methodology used will be the same as EPA Method 26A except it will be operated at a single point at a constant sampling rate

The train components will include a heated glass lined probe, heated Teflon[®] glass mat fiber filter (FF Outlet), heated quartz fiber filter (SDA Inlet) and five full size impingers. The first impinger will have 50 milliliters of 0.1 N sulfuric acid solution and a short stem. The second and third impingers will each have 100 milliliters of 0.1 N sulfuric acid solution. The fourth impinger will be empty and the fifth will contain 200 to 300 grams of silica gel. The sodium hydroxide impingers will not be used as chlorine (Cl₂), does not need to be determined. The end of the probe will be located approximately at the center of the SDA Inlet or FF Outlet ductwork during testing. An integrated sample of at least 30 dry standard cubic feet will be extracted from the gas stream and passed through this dilute sulfuric acid. In the dilute acid, the HCl gas dissolves and forms chloride (Cl⁻) ions.

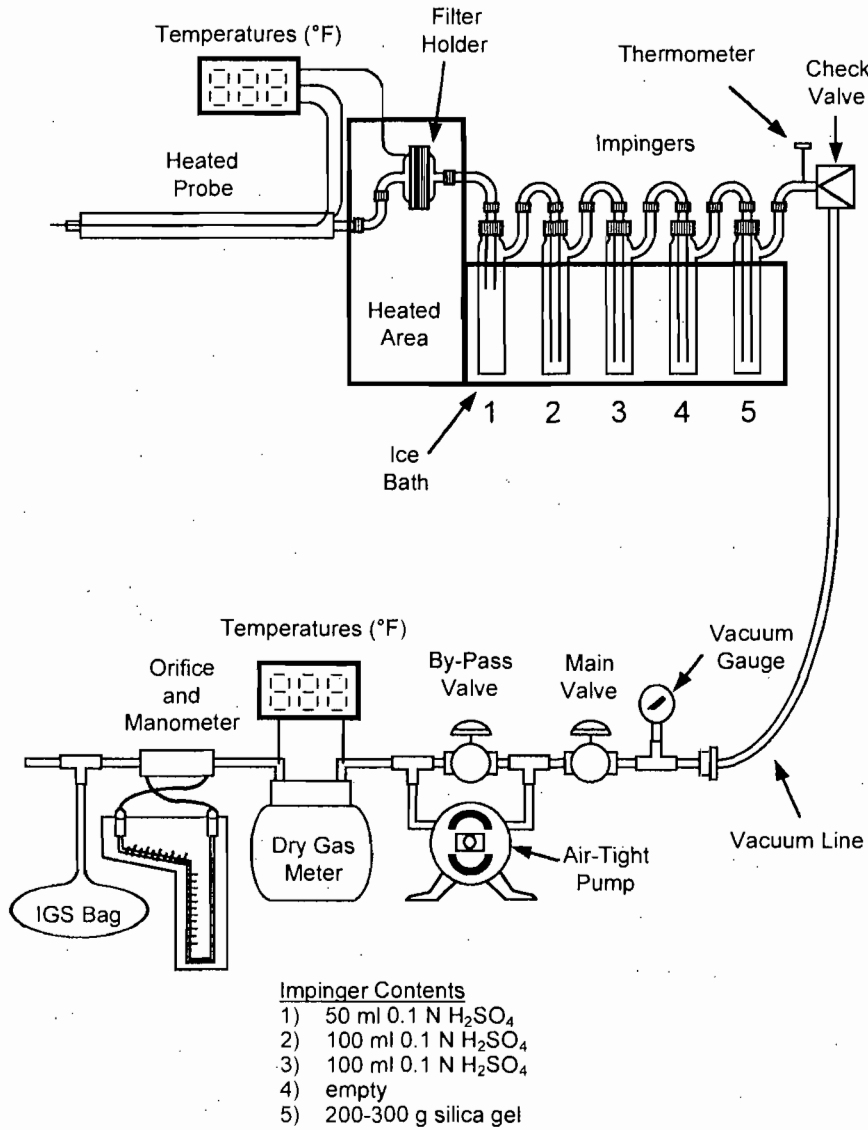
The train will be leak checked as described in Method 5 from the end of the glass probe liner after testing. After each 60 minute test the first four impingers, all connecting glassware and back half of the filter housing will be rinsed into one polyethylene container. The probe liner, filter and filter housing will not be recovered. The liquid level of the one sample container will be marked. The Cl⁻ concentration will be determined by ion chromatography. The hydrogen chloride analyses will be performed by Clean Air Engineering located in Palatine, Illinois.

As part of the quality assurance program, duplicate analysis will performed on every sample as specified in Method 26A. In addition, a spike analysis will be performed on one of the samples. Three runs will be performed for each unit. The hydrogen chloride removal efficiency will be calculated using the ppm_{dv} @ 7% O₂ concentration at the SDA Inlet and FF Outlet.

METHODOLOGY

HYDROGEN CHLORIDE (CONTINUED)

3-13



**Figure 3-6: Hydrogen Chloride Sampling Apparatus
(Modified EPA Method 26A)**

METHODOLOGY

3-14

OPACITY - EPA METHOD 9

Stack opacity readings will be taken for one hour at 15 second intervals by a certified visible emissions reader. The visible emissions readings will be conducted for an hour during each of the particulate (EPA Method 5) test runs. The readings will be made at the exit of the tested unit's dedicated flue. Minor particulate sources to be tested by a certified visible emissions reader is the lime silo. The lime silo will be observed once for the duration of one truck unloading operation. Due to operational constraints the lime silo may have to be done at a separate time than the rest of the wet method testing.

The results will be reported as average opacity reading for each six-minute period (24 fifteen second readings) for each source. A copy of the visible emissions reader's current certification will be included in the report.

FUGITIVE EMISSIONS - EPA METHOD 22

Fugitive emissions from the ash handling and transfer system will be determined using EPA Method 22 - "Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares." This method determines the amount of time that any visible emissions occur during the observation period. It does not require that the opacity of emission to be determined, only that visible emissions are present. Three hours of observations will be done during regular ash handling, i.e. not during maintenance and repair activities. The length of time during which any visible emissions occur will be recorded using a stop watch. The length of time of the continuous observation will be kept with another separate stop watch. Five to ten minute observer breaks will be taken every 15 to 20 minutes during the observations. The time of any observed emissions will be reported as a percentage of each hour. The runs will be averaged to determine compliance with the standard.

METHODOLOGY

3-15

PCDD AND PCDF EMISSIONS - EPA METHOD 23

EPA Method 23 will be used to measure the concentrations of tetrachloro through octachloro polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) at the Fabric Filter Outlets. Particulate will be collected on a filter and vaporous emissions will be retained by a sorbent cartridge. Following sampling, the appropriate components of the train will be recovered and transferred to the laboratory for analysis. The components will be extracted, the extracts will be cleaned to remove excessive levels of potential interference, and the cleaned extracts will be analyzed for PCDDs and PCDFs using combined high resolution gas chromatography and high resolution mass spectrometry.

Figure 3-7 illustrates the EPA Method 23 sampling train which will be used at the Fabric Filter Outlet location. All sampling train components that contact the recovered sample will be composed of borosilicate glass, polytetrafluoroethylene (PTFE) or similar materials to avoid potential sample contamination or reactions with PCDDs and PCDFs. The sampling train will contain a glass-lined temperature-controlled probe equipped with a pitot tube (for measuring stack gas flow rate) and a sharp-edged pyrex button-hook nozzle. The exit of the probe will be connected to a high efficiency glass fiber filter supported in a glass filter holder inside an oven.

The exit of the filter holder will be connected to a water jacketed glass coil condenser and adsorbent trap unit, configured such that the flue gas and condensed moisture will flow down through the resin in the cartridge. The adsorbent trap will contain an Amberlite/XAD-2 resin cartridge to adsorb the PCDDs and PCDFs present in the vapor and condensed portion of the sample. The resin cartridges will be precleaned and spiked with isotopically labeled surrogates by Alta Laboratories prior to use in the field. During operation, a leak-free submersible pump will be used to recirculate cooling water through the coil condenser to ensure proper cooling of the condenser and resin cartridge unit.

Immediately following the adsorbent cartridge will be a series of four full size leak-free glass impingers. All impingers will be of the modified Greenburg-Smith design, with the first impinger being further modified to have a short stem, to prevent the sample gas from bubbling through the collected condensate. The first impinger will be empty, the second and third impingers each contained 100 milliliters of HPLC-grade distilled water, the fourth empty and the fifth will be charged with approximately 300 grams of silica gel. The impingers will be immersed in an ice bath for the duration of the test.

All train components will be cleaned before use with to avoid organic contamination. This cleaning will include a hot soapy wash, three deionized water rinses, two hours of heating at 450 °F, three acetone rinses and three methylene chloride rinses. All glassware components are then covered with methylene chloride rinsed aluminum foil until assembled at the site.

METHODOLOGY

3-16

PCDD AND PCDF EMISSIONS (CONTINUED)

The impingers will be connected to the metering system via an umbilical. The metering system includes a vacuum gauge, a leak-free pump, thermometers accurate to within $\pm 5.4^{\circ}\text{F}$, and a dry gas meter accurate to within 2%.

Procedures for selecting sampling locations and for operation of the train will be derived from EPA Method 23 and associated Methods 1 through 5. The flue gas sample will be collected by operating the train according to the Method 5 specifications, including leak-checking, isokinetic sampling rates, and stack traversing. Sampling will be performed isokinetically (within $\pm 10\%$).

At the conclusion of each test run, the probe and umbilical will be carefully removed from the sampling train. The inlet to the sampling train will be and removed to a clean field laboratory for sample recovery. The sample from the probe nozzle and probe liner will be recovered at the sampling location. The recovered sample will consist of the following components:

- Glass fiber filter and particulate catch;
- Adsorbent trap containing the XAD-2 resin;
- Acetone rinse: Probe liner and nozzle rinsed and brushed three times with acetone. This rinse is combined with three acetone rinses of the filter holder, coil condenser and all interconnecting glassware and with three acetone soaks of the condenser (the methylene chloride rinse is being omitted per the EPA letter presented in Appendix B);
- Toluene rinse: Probe liner and nozzle rinsed three times combined with three rinses of the filter holder, coil condenser and all interconnecting glassware with three soaks of the condenser with toluene;
- The volume of water collected in the impinger train will be measured gravimetrically and the water stored in sample containers and archived.

One field train blank will be assembled, recovered and analyzed in the same manner as a sample train.

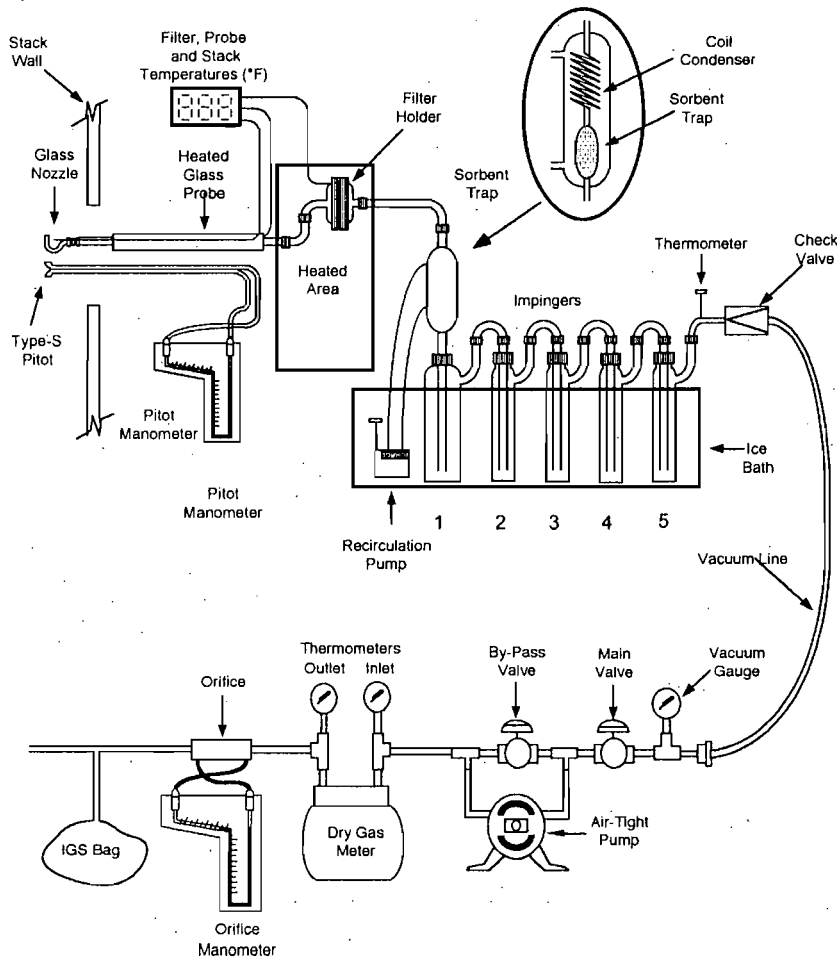
The samples will be analyzed for PCDDs and PCDFs in accordance with EPA Method 23 protocol using high resolution gas chromatography and high resolution mass spectrometry (GC/MS). All Method 23 samples will be analyzed with the DB-5S column with modified calibration and additional quality assurance procedures as a direct substitute for the DB-5 and DB-225 columns. Confirmation of the 2,3,7,8 TCDF and 2,3,7,8 isomers will be performed on the DB-5S column. The DB-5S column and modified calibration procedures meets the column separation requirement and can be used as a direct substitute for the DB-5 and DB-225 columns in accordance with Method 23 as approved by the USEPA

All of the organic analytical work will be performed by Analytical Perspectives in Wilmington, NC. All components of the recovered sampling train, including the toluene rinse, will be pooled and extracted for one analysis.

METHODOLOGY

3-17

PCDD AND PCDF EMISSIONS (CONTINUED)



Impinger Contents

- 1) empty
- 2) 100 ml HPLC water
- 3) 100 ml HPLC water
- 4) empty
- 5) 200 - 300 g silica gel

Figure 3-7: PCDDs and PCDFs Sampling Apparatus (EPA Method 23)

METHODOLOGY

3-18

CONTINUOUS EMISSIONS MONITORING

Monitoring of sulfur dioxide (SO₂), nitrogen oxides (NO_x) and carbon monoxide (CO) emissions will be performed using a combination of EPA Methods 6C, 7E and 10. In addition to the pollutant monitoring, oxygen (O₂) and CO₂ concentrations will also be monitored using EPA Method 3A. A gas sample will be continuously extracted from the particular source and delivered to a series of gas analyzers which measure the pollutant or diluent concentrations in the gas. The analyzers will be calibrated on-site using EPA protocol mixtures of calibration gases.

Figure 3-9 contains a general schematic of the continuous emissions monitoring (CEM) system. The system utilizes a heated stainless steel probe for gas withdrawal. The probe tip will be equipped with a sintered stainless steel filter for particulate removal. The end of the probe will be connected to a heated Teflon sample line which will deliver the sample gases from the source to the CEM system. The heated sample line is designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line.

Table 3-3 lists the analyzers that will be used to perform the continuous emissions monitoring.

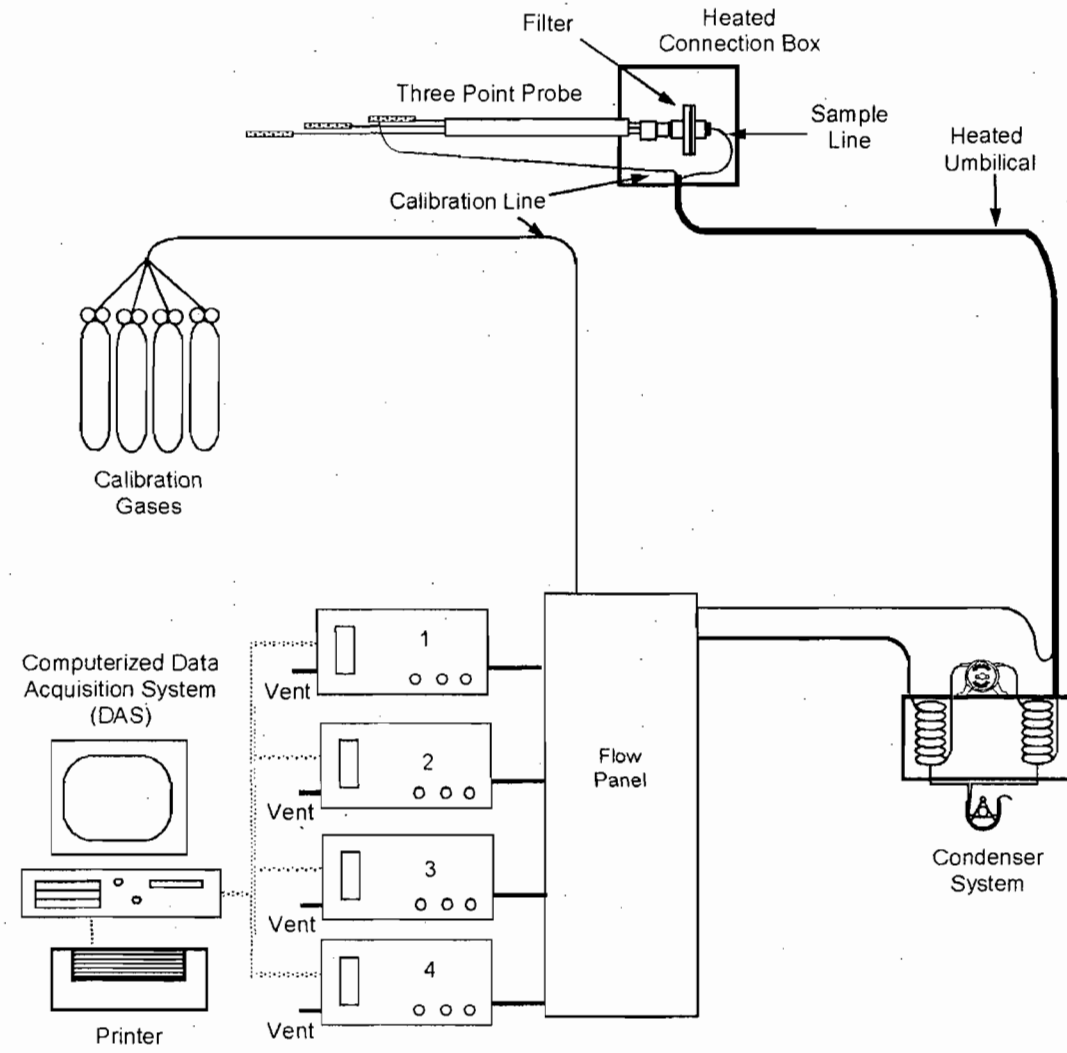
Table 3-3
Gas Analyzers

<u>GAS</u>	<u>METHOD</u>	<u>REFERENCE ANALYZER MANUFACTURER</u>	<u>PRINCIPLE OF OPERATION</u>
O ₂	EPA 3A	Servomex 1415B	Paramagnetic
CO ₂	EPA 3A	Servomex 1420B	NDIR
SO ₂	EPA 6C	WESTERN RESEARCH 921ATM	UV Absorption
NO _x	EPA 7E	TECO 42C-HL	Chemiluminescence
CO	EPA 10	TECO 48C	Gas Filter Correlation NDIR

Before entering the analyzers, the gas sample passes directly into a refrigerated condenser that cools the gas to approximately 35°F to remove the stack gas moisture. After passing through the condenser, the dry gas enters a Teflon-head diaphragm pump and a flow control panel, which delivers the gas in parallel to the (CO₂/O₂), SO₂, NO_x and CO analyzers. Each of these analyzers measures the respective gas concentrations on a dry volumetric basis.

METHODOLOGY
CONTINUOUS EMISSIONS MONITORING (CONTINUED)

3-19



No	Gas	Monitor	Approximate Range Used	Approximate Concentrations
1)	SO ₂	WESTERN RESEARCH 721AT	0-80 ppm	0, 40, 80
2)	NO _x	TECO 42H	0-450 ppm	0, 235, 450
3)	CO	TECO 48	0-100 ppm	0, 50, 100
4)	O ₂ /CO ₂	Servomex 1415B/1420B	0-13.5%	0, 7.5 13.5

Figure 3-8: FF Outlet CEM Apparatus (EPA Methods 3A, 6C, 7E and 10)

METHODOLOGY

3-20

CONTINUOUS EMISSIONS MONITORING (CONTINUED)

Each of the analyzers will be calibrated according to the respective reference method procedures. Before testing, each analyzer will be checked for calibration error by introducing a zero, mid-level and high-level certified calibration gas directly into the analyzer. All of the reference method criteria as specified in Method 7E for calibration error will be demonstrated for each analyzer before testing will proceed.

EPA Protocol No. 1 certified calibration mixtures will be used to calibrate the analyzers. All calibration gases will be blended with nitrogen.

Before and after each of the test runs, the zero gas and one up-scale gas for each analyzer will be introduced into the sampling line at the exit of the heated probe to check for sampling system bias and calibration drift. The demonstration of reference method criteria for bias as specified in Method 7E (pre- and post-test) and calibration drift will be required for a valid test run. The results of the pre-test and post-test bias checks will be used to correct the average flue gas concentration measured during each test run for analyzer drift during that period.

Interference checks from a past test program at a municipal waste combustor, as specified in Method 7E section 8.2.7, will be included in the final report.

A NO₂ to NO conversion efficiency will be determined on the NO_x analyzer prior to field use and will be reported, as required by Method 7E section 8.2.4, for the NO_x emission monitor.

METHODOLOGY

3-21

RELATIVE ACCURACY TEST APPROACH

A relative accuracy test audit (RATA) will be performed on Wheelabrator North and South Broward, Inc.'s CEM system. The RATA program will follow procedures as detailed in U.S. Environmental Protection Agency (EPA) Performance Specification 2, 3 and 4A as well as 40 CFR 60.58b. The performance specifications appear in detail in Title 40 of the Code of Federal Regulations (CFR), Part 60, Appendix B.

The RATA for each CEM system consists of concurrent pollutant emissions measurements using the facility CEM system and a reference method (RM) monitoring system. A complete RATA is comprised of at least nine runs of paired measurements, with each run being performed for thirty minutes. If more than nine runs are performed, selected runs can be omitted from the RATA calculations, as long as a total of nine runs are used for the final RATA determination. The differences between the RM results and the CEM system results are determined for each run. The relative accuracy will be determined based on the average of nine of these differences, plus the 95% statistical confidence coefficient.

Relative accuracy comparisons will be made between the arithmetic average of the twenty seven one-minute-average RM readings with the twenty seven one-minute average readings supplied by the CEM system data acquisition system print-out. Pollutant and diluent O₂ measurements will be made concurrently by both the facility CEM system and RM system to facilitate the O₂ corrected comparisons. The facility CEM system will provide 27 minute averages in the same units as the emission standard (7% O₂).

Continuous Emission Monitors Three Point Probe

During the Relative Accuracy testing, a three-point traverse will be performed across the duct. The three points will be determined from 40 CFR Part 60 Appendix B Performance Specification 2. Three separate, heated, filtered lines will be inserted into the stack. The three lines are then connected to a heated, electrically actuated ball valve. The ball valve is controlled remotely, by the RM system operator, to switch between the three lines at equally spaced intervals. The calibration gas is injected through the end of one of the three sample lines.

METHODOLOGY

3-22

QUALITY ASSURANCE AND QUALITY CONTROL

All testing will follow the EPA quality assurance and quality control guidelines as outlined in the respective methods. Field blanks and matrix spikes for the wet method testing will be done as shown in the following Table 3-5.

**Table 3-4
Method Field Blanks and Matrix Spikes**

<u>Method</u>	<u>Reagent Blank Sets</u>	<u>Field Blank</u>	<u>Duplicate Analysis</u>	<u>Matrix Spikes</u>
EPA M29	1 per site utilized for metals blank corrections	1 per site	On all Hg analysis as required by M29, at least one duplicate for Be, Cd and Pb	1 predigested filter blank and 1 postdigested sample
EPA M13B/26A	1 per site	None	On all samples	1 per analysis set
EPA M23	Archived reagents Laboratory blank as per M23	1 per site	N/A	Isotopic recoveries on all samples
EPA M5	1 per site	None	N/A	N/A