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PROTOCOL TO PERFORM A SAMPLING AND ANALYTICAL TESTING PROGRAM
for
WHEELABRATOR ENVIRONMENTAL SYSTEMS, INC
of
HAMPTON, NEW HAMPSHIRE
at the
WHEELABRATOR SOUTH BROWARD, INC. RESOURCE RECOVERY FACILITY
FORT LAUDERDALE, FLORIDA

Submitted By:
ENTROPY ENVIRONMENTALISTS, INC.
P.O. Box 12291
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APRIL 22, 1991

REFERENCE #10041

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REVISION EXPLANATION LIST

Revision No.	Explanation

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SECTION 1.0
SOURCE INFORMATION

1.1 Plant Name and Address

Wheelabrator South Broward Inc. Resource Recovery Facility

4400 South State Road 7

Fort Lauderdale, Florida 33314

1.2 Source Identifications

Three (3) mass-fired municipal refuse boilers

1.3 Person to Contact

Mr. Tim Porter - Wheelabrator Environmental Systems, Inc.

Mr. Chuck Faller - Wheelabrator South Broward, Inc.

1.4 Telephone

(603) 929-3375 - Porter

(305) 581-6606 - Faller

SECTION 2.0
TESTING FIRM INFORMATION

2.1 Company Name

Entropy Environmentalists, Inc.

2.2 Company Address

P.O. Box 12291, Research Triangle Park, North Carolina 27709

2.3 Person to Contact

Gary L. Williams, Project Manager

2.4 Telephone

(919) 781-3550

SECTION 3.0
TEST PROGRAM DESCRIPTION

3.1 General

A sampling and analytical program will be conducted at the Wheelabrator South Broward, Inc. Resource Recovery Facility (WSBI) located in Fort Lauderdale, Florida to demonstrate compliance and characterize emissions. The program will follow NESCAUM's Recommended Guidelines for Stack Testing at MWC Facilities. The sampling program will be conducted at the Spray Dryer Absorber (SDA) inlets and at the fabric filter (FF) outlets. The test programs will require particulate and lead, sulfur dioxide (SO_2), sulfuric acid mist (H_2SO_4), nitrogen oxides (NO_x), opacity, carbon monoxide (CO), hydrogen fluoride (HF), total hydrocarbons, mercury, and beryllium emissions testing. The testing will be performed in strict conformance with 40 CFR 60, Appendix A, EPA Reference Methods 1-5/12, 6, 7A, 8, 9, 10B, 13B, 25A, 101A, and 104, and Florida Administrative Code Rule 17-2.700. Additional sampling will be performed at the Ash Conditioning System Baghouse Outlet for particulate and opacity in accordance with EPA Methods 5 and 9, respectively. Table 3-1 presents an outline and tentative test schedule for the compliance test program.

Testing will be performed to determine emissions of the pollutants listed above. Three runs of each test type will be performed during the program. Inlet and outlet testing for SO_2 will be performed simultaneously in order to determine the removal efficiency of SO_2. Velocity, flue gas dry molecular weight, and moisture determinations will be performed according to EPA Method 2-4 in conjunction with each isokinetic test run and at the inlet location to calculate pounds per hour of emissions. All sample recovery and laboratory operations will be performed in a mobile office trailer onsite.

3.2 Process Performance Information

Process information will be collected by the Bailey Network 90 system in conjunction with the testing program. Process measurements will be provided in hourly averages during each test period. The process data will be presented as collected in the appendices of the final report.

The process data that will be collected will consist of the following:

1. Boiler Measurements
   - a. Steam production, klb/hr (Set Point is 192 KLb/hr)
   - b. Furnace temperature, ° F
   - c. Furnace draft, inches H_2O
   - d. Superheater outlet steam temperature, ° F
   - e. Superheater outlet steam pressure, psig
   - f. Feed water flow, klb/hr
   - g. Economizer water outlet temperature, ° F
   - h. Economizer flue gas outlet temperature, ° F
   - i. Total air flow, KACFM

TABLE 3-1
COMPLIANCE PROGRAM OUTLINE AND TENTATIVE TEST SCHEDULE
WHEELABRATOR SOUTH BROWARD, INC. RESOURCE RECOVERY FACILITY

DATE	UNIT	LOCATION	METHOD	PARAMETER	LENGTH OF RUN	# OF RUNS
7/15	1	Setup test equipment for Compliance Tests			------	-
	1,2,3	Setup test equipment for Boiler Performance Tests			------	-
7/16	1	SDA Inlet	EPA Method 6	SO_2	60 minutes	3
		FF Outlet	EPA Method 8	SO_2 and H_2SO_4	60 minutes	3
			EPA Method 13B	Hydrogen Flouride	120 minutes	3
	1,2,3	SDA Inlets	EPA Methods 2 - 4	Air Flow, $\%O_2$, $\%CO_2$, $\%H_2O$	60 minutes	18*
	2	FF Outlet	EPA Methods 5 & 12	Particulate and Lead	120 minutes	3
			EPA Method 7A	Nitrogen Oxides	60 minutes	3
			EPA Method 9	Opacity	120 minutes	3
			EPA Method 10B	Carbon Monoxide	60 minutes	3
			EPA Method 25A	Total Hydrocarbons	120 minutes	3
	3	FF Outlet	EPA Method 104	Beryllium	120 minutes	3
			EPA Method 101A	Mercury	120 minutes	3
7/17	2	SDA Inlet	EPA Method 6	SO_2	60 minutes	3
		FF Outlet	EPA Method 8	SO_2 and H_2SO_4	60 minutes	3
			EPA Method 13B	Hydrogen Flouride	120 minutes	3
	1,2,3	SDA Inlets	EPA Methods 2 - 4	Air Flow, $\%O_2$, $\%CO_2$, $\%H_2O$	60 minutes	18*
	3	FF Outlet	EPA Methods 5 & 12	Particulate and Lead	120 minutes	3
			EPA Method 7A	Nitrogen Oxides	60 minutes	3
			EPA Method 9	Opacity	120 minutes	3
			EPA Method 10B	Carbon Monoxide	60 minutes	3
			EPA Method 25A	Total Hydrocarbons	120 minutes	3
	1	FF Outlet	EPA Method 104	Beryllium	120 minutes	3
			EPA Method 101A	Mercury	120 minutes	3
7/18	3	SDA Inlet	EPA Method 6	SO_2	60 minutes	3
		FF Outlet	EPA Method 8	SO_2 and H_2SO_4	60 minutes	3
			EPA Method 13B	Hydrogen Flouride	120 minutes	3
	1,2,3	SDA Inlets	EPA Methods 2 - 4	Air Flow, $\%O_2$, $\%CO_2$, $\%H_2O$	60 minutes	18*
	1	FF Outlet	EPA Methods 5 & 12	Particulate and Lead	120 minutes	3
			EPA Method 7A	Nitrogen Oxides	60 minutes	3
			EPA Method 9	Opacity	120 minutes	3
			EPA Method 10B	Carbon Monoxide	60 minutes	3
			EPA Method 25A	Total Hydrocarbons	120 minutes	3
	2	FF Outlet	EPA Method 104	Beryllium	120 minutes	3
			EPA Method 101A	Mercury	120 minutes	3
7/19	Ash System	FF Vent	EPA Method 5	Particulate	60 minutes	3
			EPA Method 9	Opacity	60 minutes	3
	Lime System	Vent	EPA Method 9	Opacity	60 minutes	3

* Six (6) test runs will be performed on each unit for a total of 18 test runs per day.

2. Spray Dryer Absorber Measurements
   a. SDA inlet flue gas temperature, ° F
   b. SDA outlet flue gas temperature, ° F
   c. Lime slurry concentration, %
   d. SDA dilution water flow, gpm
   e. SDA atomizer air flow, SCFM
   f. SDA total flow, gpm

3. Fabric Filter Measurements
   a. FF outlet flue gas temperature, ° F
   b. FF pressure differential, inches H_2O

4. Hourly plant CEM Data
   a. SDA Inlet - SO_2, O_2
   b. FF Outlet - SO_2, NO_x, CO, O_2, CO_2, opacity

The test runs will be performed under normal, non-upset feed and operating conditions to represent long-term conditions. The refuse fed during testing must represent the normal range of conditions for the facility. The following upset or atypical process conditions will be considered valid reasons for delaying or interrupting the testing:

1. Crane outage
2. Fan outage
3. Plugged atomizer
4. Broken grate block
5. Plugged feed chute
6. Plugged ash conveyor system
7. Turbine trip
8. Hydraulic failure of stoker system
9. Steam flow greater than $\pm$ 10% of setpoint
10. SDA outlet temperature greater than 310^{O}F

Radio communications will be maintained throughout the test program between the control room and the test crew. Boiler steam flow will be maintained at or below 192 Klb/hr (3 hour rolling average).

SECTION 4.0
SOURCE AND SAMPLING LOCATION DESCRIPTIONS

4.1 Source Description

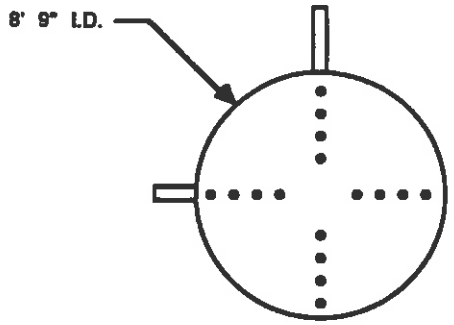
The South Broward Resource Recovery Facility in Fort Lauderdale, Florida operates three (3) 750 tons per day municipal refuse fired, water wall boiler trains manufactured by Babcock and Wilcox which produce electricity for sale to a local utility company. Each of the boilers is equipped with a Spray Dryer Absorber (SDA) for acid gas removal. The SDA is followed by a Fabric Filter (FF) baghouse for the control of suspended particulate emissions. The control equipment is manufactured by Wheelabrator Air Pollution Control, Inc. Each FF is followed by an induced draft fan which directs the flue gas to a dedicated flue in a common stack. The facility has continuous emissions monitors for SO_2, and O_2 at the SDA inlet and for SO_2, NO_x, O_2, CO_2, CO, and opacity at the fabric filter outlets. A microprocessor-based data acquisition system receives data from the monitoring system and is equipped with a printer which provides hard copies of emission values.

4.2 Sampling Location Descriptions

Sampling will be performed at the SDA inlets and FF outlets. Exhaust gases from the FF flow through a duct to an ID Fan and are emitted to the atmosphere through the stack. Figure 4-1 presents a schematic of the SDA inlets with the sampling ports identified. The sampling ports are located 274 inches downstream and 55 inches upstream from the nearest flow disturbances. Traversing at the SDA inlet will be performed at each of 16 points. All measurements will be verified by the test crew prior to testing.

Figure 4-2 presents a schematic of the FF outlets with the sampling ports identified. The sampling ports are located 16 feet downstream and 4 feet upstream from the nearest flow disturbances. Sampling at the FF outlet will be performed at each of 25 points. All measurements will be verified by the test crew prior to testing. The non-isokinetic sampling port is shown in Figure 4-2.

Figure 4-3 presents a schematic of the Ash Conditioning System Baghouse Outlet test locaiton with the sampling ports identified. The sampling ports are located approximately 128 inches downstream and approximately 42 inches upstream from the nearest flow disturbances. Sampling at the Ash Conditioning System Baghouse Outlet will be performed at each of 16 points. All measurements will be verified by the test crew prior to testing.



SECTION N-N

TRAVERSE POINTS

2 AXES
8 POINTS / AXIS
16 TOTAL POINTS

% OF DUCT DEPTH	
POINT 1	3.2
POINT 2	10.5
POINT 3	19.4
POINT 4	32.3
POINT 5	67.7
POINT 6	80.6
POINT 7	89.5
POINT 8	96.8

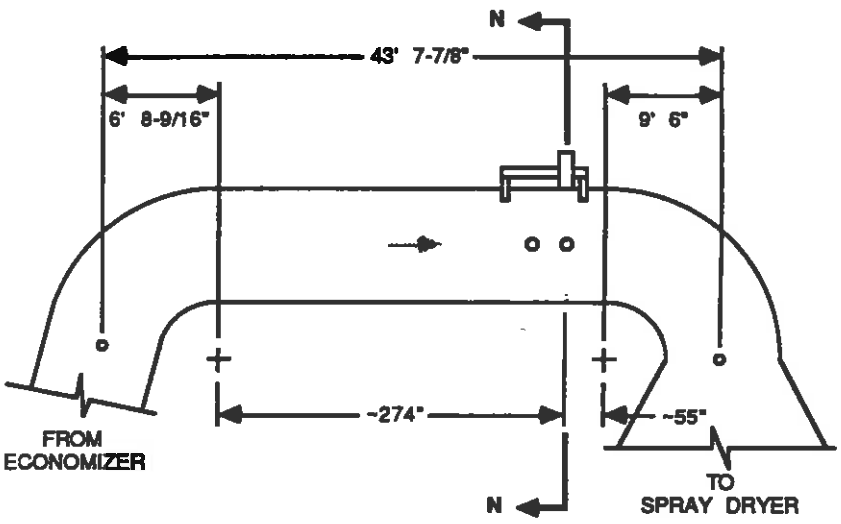


FIGURE 4-1 SDA INLET TEST LOCATIONS WITH SAMPLING PORT LOCATIONS

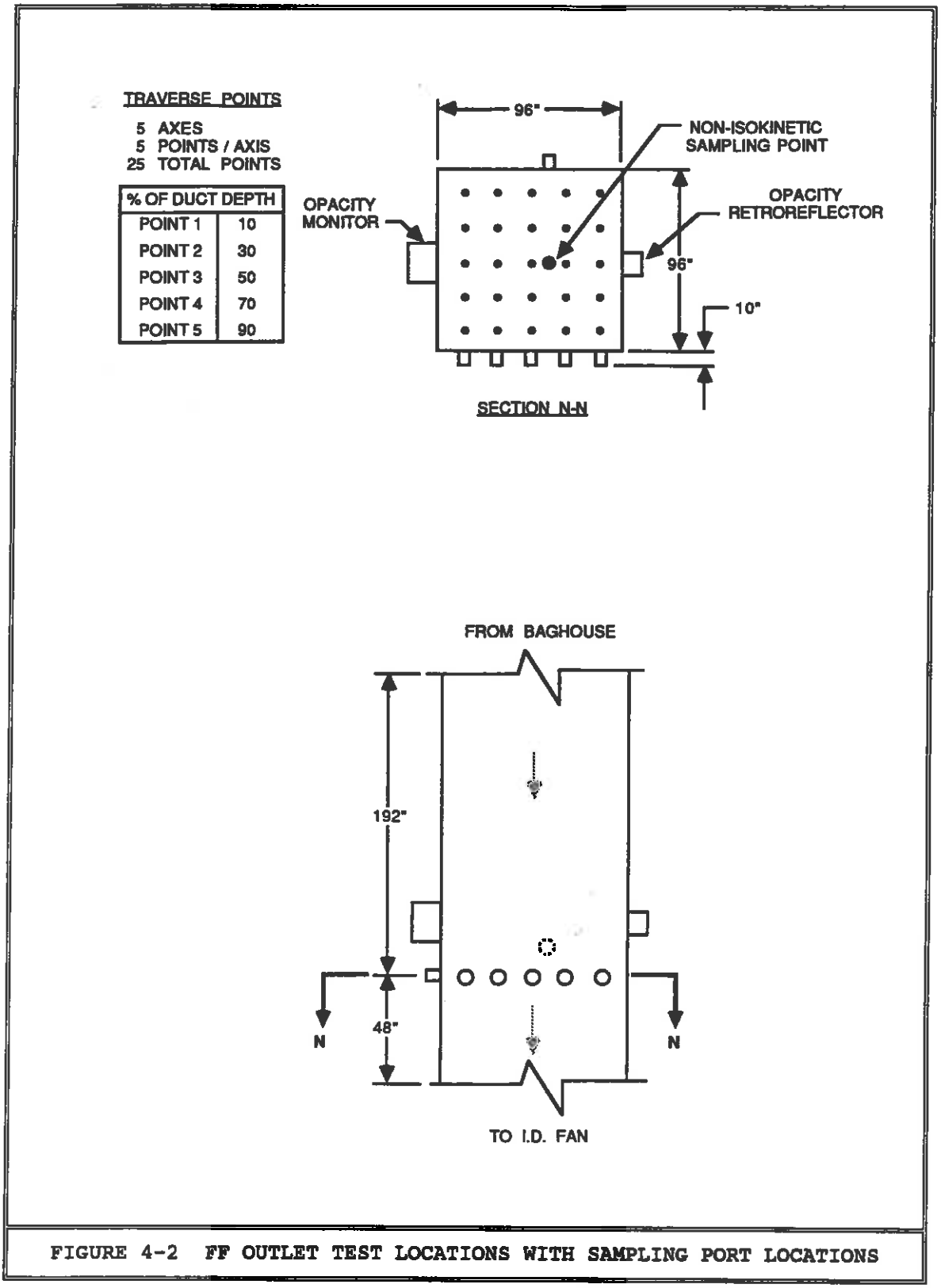
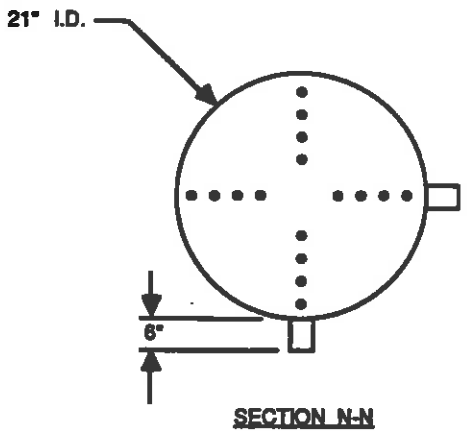


FIGURE 4-2 FF OUTLET TEST LOCATIONS WITH SAMPLING PORT LOCATIONS



SECTION N-N

TRAVERSE POINTS

2 AXES
8 POINTS / AXIS
16 TOTAL POINTS

% OF DUCT DEPTH	
POINT 1	3.2
POINT 2	10.5
POINT 3	19.4
POINT 4	32.3
POINT 5	67.7
POINT 6	80.6
POINT 7	89.5
POINT 8	96.8

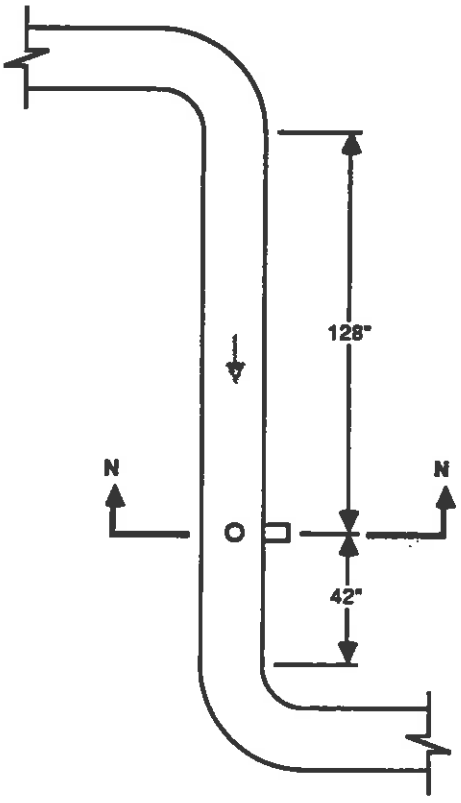


FIGURE 4-3 ASH CONDITIONING SYSTEM BAGHOUSE OUTLET TEST LOCATION WITH SAMPLING PORT LOCATIONS

SECTION 5.0
SAMPLING AND ANALYTICAL PROCEDURES

This section contains a brief description of the sampling and analytical procedures for each method that will be employed during the test program. All equipment, procedures, and quality assurance measures necessary for the completion of the test program meet or exceed the specifications of the appropriate methods. Any deviations from the methods to ensure quality and representativeness of the results are also discussed.

5.1 SAMPLING POINT DETERMINATION - EPA METHOD 1

The number and locations of the sampling and/or traverse points for EPA Methods 2, 3, 4, and 5 will be determined according to the procedures outlined in EPA Method 1. Cyclonic flow checks will be performed prior to testing at each test location.

5.2 FLUE GAS VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2

The flue gas velocity and volumetric flow rate will be determined according to the procedures outlined in EPA Method 2. Velocity measurements will be made using Type S pitot tubes conforming to the geometric specifications outlined in EPA Method 2. Accordingly, each has been assigned a coefficient of 0.84. Differential pressures will be measured with Magnehelic gauges of appropriate range or with fluid manometers. Effluent gas temperatures will be measured with chromel-alumel thermocouples equipped with hand-held digital readouts.

5.3 FLUE GAS COMPOSITION AND MOLECULAR WEIGHT - EPA METHOD 3

Flue gas analysis for carbon dioxide and oxygen and the calculation of percent excess air and flue gas dry molecular weight will be performed in accordance with EPA Method 3. Multi-point, integrated sampling will be used to obtain a flue gas sample concurrent with any isokinetic testing. A stainless steel probe will be affixed to the isokinetic sampling probe for this purpose. If no isokinetic testing is being performed, single point integrated sampling will be used. A peristaltic pump delivering 500 to 750 mL/min of flue gas will be used to fill a Tedlar bag. Moisture will be removed from the sample gas by means of a knockout jar located prior to the pump. Sampling will be of the same duration (except purges following port changes) as the test runs.

Analysis will be performed by Orsat apparatus. Prior to each series of analyses, the Orsat will be leak checked to confirm that there is less than 0.2 mL change in five minutes. Analyses for a given sample must agree within 0.3% by volume.

5.4 FLUE GAS MOISTURE CONTENT - EPA METHOD 4

The flue gas moisture content will be determined in conjunction with each EPA Method 5 type train and according to the sampling and analytical procedures outlined in EPA Method 4. The impingers will be connected in series and will contain reagents as listed in the following method descriptions. The impingers will be contained in an ice bath to assure condensation of the flue gas stream moisture. Any moisture that is not condensed in the impingers is captured in the preweighed silica gel, therefore all moisture can be weighed and entered into moisture content calculations.

5.5 PARTICULATE - EPA METHOD 5

The concentration and emission rate of particulate will be determined using the procedures and equipment described in EPA Method 5, in combination with Methods 1 through 4 described above. Particulate matter is withdrawn isokinetically from the source and collected on a glass filter maintained at a temperature in the range of 248 ± 25^{O} F. The particulate mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after removal of uncombined water.

Probe liners made of borosilicate glass are normally used for probe lengths less than ten feet, and clean, rust-free stainless steel when the probe length exceeds ten feet. Nozzles, probe liners, and filter holders will be rinsed thoroughly prior to testing.

Entropy routinely retains particulate samples following analysis. Samples are placed in uniquely identified, airtight containers, and stored in a controlled temperature and humidity environment.

5.6 PARTICULATE MATTER AND INORGANIC LEAD - EPA METHOD 5 AND 12

A combined EPA Method 5 and EPA Method 12 sampling train will be used to collect particulate and inorganic lead. This train is operated in the same manner as a regular EPA Method 5 sampling train. The average sampling rate for each run will be within ± 10% of 100% isokinetic conditions. Each test run will be a minimum of two (2) hours in duration and will sample 60 DSCF. Borosilicate glass probe liners and stainless steel nozzles will be used to avoid possible contamination.

The reagents placed in the impingers will be as follows: 100 ml 0.1 N HNO_3 in each of the first two impingers, the third impinger will remain empty, and 200 grams of silica gel in the fourth impinger. In addition a low metal filter (Pallflex 2500QAT-UP quartz filter) will be used instead of the normal EPA Method 5 filter.

The front half of the sampling train will be rinsed first with acetone to recover the particulate matter, then with 0.1 N nitric acid to recover the lead. After impinger solution recovery, all exposed sample components will be rinsed into appropriate containers with 0.1 N nitric acid. The amount of condensate and particulate will be determined in accordance with EPA Method 4 and 5, respectively. Then, the inorganic lead analysis will be performed on the filter, acetone rinse, nitric rinse, and nitric reagents in accordance with EPA Method 12 procedures using Flame Atomic Absorption (FAA). This provision is discussed in Section 8 of EPA Method 12.

Duplicate analyses will be performed for at least 10% of the samples (minimum of 1). Three field blanks, a reagent blank and a filter blank will be analyzed for lead. During analysis, a matrix spike (Method of Standard Additions) will be added to determine recovery efficiency for lead from the sample matrix.

5.7 SULFUR DIOXIDE - EPA METHOD 6

Entropy will use the equipment and procedures described in EPA Method 6 for determining sulfur dioxide emissions. A heated glass probe equipped with a glass wool plug to remove particulate matter will be used for sample collection. Each EPA Method 6 run will consist of one (1) sample, conducted at a constant sampling rate of 1 liter per minute for 60 minutes. The midget impinger reagents will be 15 milliliters of 80% isopropyl alcohol in the first impinger and 15 milliliters of 5% hydrogen peroxide in each of the second and third impingers. Emission rates for SO_2 will be calculated based on results derived from EPA Methods 2 through 4 which will be conducted simultaneously with EPA Method 6. Entropy uses 5% H_2O_2 rather than 3% H_2O_2 to account for dilution during testing and to help ensure collection efficiency. The H_2O_2 is prepared at Entropy prior to testing. Titrations for SO_2 will be performed onsite.

5.8 NITROGEN OXIDES - EPA METHOD 7A

Entropy will use the equipment and procedures outlined in EPA Method 7A to determine emissions of nitrogen oxides (NO_X). Five NO_X flask grab samples will be collected during each run. All samples will be separated by a minimum of 15 minutes. Calculation of NO_X emission rates will be based on results derived from EPA Methods 2-4 which will be conducted simultaneously with Method 7A.

NO_X flask grab samples will be collected using the sampling train depicted in EPA Method 7. A sample of flue gas will be withdrawn from the central portion of the stack into an evacuated two-liter flask containing a sulfuric acid-hydrogen peroxide absorbing solution. The NOx reagent is prepared at Entropy prior to testing and transported in brown bottles in a cooler.

Each flask will be evacuated to a pressure equal to or less than 75 mm Hg (3 in. Hg) absolute. Immediately following evacuation, a leak check will be performed and any flask having a pressure deviation greater than 10 mm Hg (0.4 in. Hg) within one minute will not be used for sampling until the leakage is corrected. The sampling train will be purged prior to collecting each sample.

Entropy will analyze the NO_X samples as prescribed in EPA Method 7A using high performance liquid chromatography (HPLC) at Entropy's lab. The analytical column used will be a Hamilton PRP X100 anion exchange column (100mm x 4.1mm). A Milton Roy ConductoMonitor II conductivity detector with sensitivity set at 1.0us will be used. The eluent solution will be 4mM phthalic acid adjusted to a pH of 3.7 with saturated sodium borate. The mobile phase flow rate will be 2.0 mL/minute. Peak integration will be performed by PE Nelson 900 Series interface.

5.9 SULFURIC ACID MIST AND SULFUR DIOXIDE - EPA METHOD 8

The sampling and analytical procedures outlined in EPA Method 8 will be followed to determine sulfuric acid mist (including sulfur trioxide) and sulfur dioxide emissions. The EPA Method 8 sampling train impinger system will contain 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. The sampling train will be operated and leak-checked in the same manner as an EPA Method 5 sampling system. This includes leak checking the train from the nozzle. A filter bypass will be used between the probe and the first impinger. An unheated glass filter will be used between the first and second impingers. Entropy uses 5% H_2O_2 rather than 3% H_2O_2 to account for dilution during testing and to help ensure collection efficiency. The H_2O_2 is prepared at Entropy prior to testing.

Following determination of the amount of condensate collected, the reagents will be analyzed titrametrically according to the procedures in EPA Method 8. The first impinger (isopropyl alcohol) condensate catch will be measured gravimetrically, not volumetrically. Titrations for SO_2 will be performed onsite.

5.10 OPACITY - EPA METHOD 9

The procedures outlined in EPA Method 9 will be used for the determination of the stack plume opacity. Entropy will place a certified, experienced visible emissions observer on site to record plume opacity for the duration of each particulate run, unless otherwise directed.

5.11 CARBON MONOXIDE - EPA METHOD 10B

EPA Method 10B will be performed for the determination of carbon monoxide (CO) concentrations. An integrated sample is extracted from the flue gas by an evacuated tank or EPA Method 3. An evacuated tank would collect a single-point continuous 60 minute gas sample while EPA Method 3 would collect a multi-point integrated gas sample in a tedlar bag. Following Orsat analysis of the Tedlar bag, the remaining sample would be transferred to an evacuated tank. The evacuated tank samples will be transported to Entropy's laboratory for CO analysis. Collection and/or transferring samples into an evacuated tank will prevent any sample degradation that might occur during transport. The evacuated tank procedures are discussed in EPA Method 25.

Sample analysis will be performed according to EPA Method 10B with a Byron Model 401 GC/FID. The GC/FID uses the principle of gas chromatography to separate the CO from other gaseous components. Carbon monoxide is then hydrogenated to methane (CH_4), and the carbon atoms are measured by flame ionization detection.

Using the GC/FID eliminates the need to remove CO_2 and moisture from the sample gas as required for measurement by an NDIR analyzer. Also eliminated is the need for correcting the measured CO concentration for the volume fraction of CO_2 scrubbed from the sample.

Since an evacuated tank is used, a correction to the CO concentration as analyzed must be made to adjust for the dilution of the sample caused by the pressurization procedures. Essentially, the EPA Method 25 temperature and pressure correction equations will be used to make the "as analyzed" diluted carbon monoxide results reflect the original undiluted sample CO concentration.

5.12 TOTAL FLUORIDES - EPA METHOD 13B

The concentration and emission rate of hydrogen fluoride will be determined using the procedures and equipment described in EPA Method 13B. In all cases, the test runs will be performed within ± 10% of 100% isokinetic conditions. Pretest preparations, preliminary determinations, and leak check procedures are identical to those outlined in EPA Method 5. A Whatman 541 filter will be placed between the probe exit and the first impinger. The first two impingers will each contain 100 milliliters of deionized/distilled water, the third will remain empty, and the fourth will contain 200 grams of silica gel.

For analysis, the filter will be washed with deionized, distilled water to dissolve particulate fluorides. Aliquots of the filter and of the deionized, distilled water impinger solution will be analyzed for fluoride content using the specific ion electrode method.

5.13 TOTAL GASEOUS ORGANIC - EPA METHOD 25A

The total gaseous hydrocarbon concentration (THC) will be determined in accordance with the procedures outlined in EPA Method 25A. A continuous sample of the flue gas will be directed into either a Ratfisch Model RS55 or a Beckman Model 402 hydrocarbon analyzer.

These instruments operate on the principle of flame ionization, a phenomena in which combustion of hydrocarbons results in the generation of carbon ions. This process yields a current directly proportional to the carbon content of the molecules in the gas stream. The current is converted to a voltage output and recorded continuously on a strip chart, as well as a computerized data acquisition system.

The instrument is calibrated using National Bureau of Standards concentrations of propane in nitrogen (N_2). The wet-basis concentration of THC is then reported in ppmv as propane.

Calibration and linearity checks are performed through the entire sampling system before and after each test period. "Zero drift" checks are made after each run to adjust the concentration bias due to drift. All parts of the sampling train are heated to a temperature of approximately 300^{o} F.

EPA Method 25A is preferred in lieu of EPA Method 18 since the parameter of interest is total VOC emissions. EPA Method 18 is used to speciate various organics while EPA Method 25A is used to quantify total VOC emissions as propane. Both methods have sililar detection limits, approximately 1ppm.

5.14 MERCURY - EPA METHOD 101A

EPA Method 101A will be followed for the determination of mercury emissions. Pretest preparations, preliminary determinations, and leak check procedures will be identical to those outlined in EPA Method 5. The isokinetic sampling rate for EPA Method 101A will be maintained below 28 L/min (1.0 cfm). A minimum two hour sampling time will be employed andthe mercury will be collected on a filter and in acidic 4% potassium permanganate. Borosilicate glass probe liners will be used to avoid contamination. All materials and equipment used in testing by Entropy meet or exceed USEPA requirements.

All glassware (probe, impingers, and connectors) will be precleaned by rinsing with 50% nitric acid, tap water, 8 N hydrogen chloride, tap water, and finally deionized, distilled water. The train reagents will consist of 50 mL of 4% $KMnO_4$ in the first impinger and 100 mL in each of the second and third impingers. A Pallflex 2500QAT-UP quartz filter supported by a Teflon frit will be placed between the probe exit and the first impinger to prevent organic particulate from depleting the permanganate solution.

After sampling, recovery begins by transferring the contents of the first three impingers into a 1000mL glass sample bottle. Mercury will be quantitatively recovered as follows: the components will be rinsed with a total of 250 to 400 mL of fresh 4% potassium permanganate solution; washing will be added to the 1000mL precleaned glass sample bottle containing reagents; any residual brown deposits on the glassware will be removed by rinsing with 8 N hydrogen chloride and added to the sample reagent.

The filter will be carefully removed as per EPA Method 5 and placed in a precleaned glass sample container. Approximately 20 to 40 mL of 4% potassium permanganate solution will be added to the filter.

An unused filter from the same sampling filter lot will be treated in the same manner as above, and designated as a blank. An absorbing solution blank will be made by placing 400 mL of 4% potassium permanganate absorbing solution in a 500-mL sample bottle. Also, a field blank will be recovered for each boiler and a matrix spike (Method of Standard Additions) will be added during analysis for recovery efficiency. Duplicate analyses will be performed.

The sample will be submitted to the laboratory for cold vapor atomic absorption (CVAA) analysis. Samples, standards, QA/QC materials, and blanks will be prepared in the same matrix prior to measurement.

5.15 BERYLLIUM - EPA METHOD 104

Pretest preparations, preliminary determinations, and leak check procedures are identical to those outlined in EPA Method 5. The isokinetic sampling rate is to be maintained below 28 L/min (1.0 cfm). A minimum two hour sampling time per run will be employed. Borosilicate glass probe liners will be used to avoid contamination.

Prior to assembly, all glassware will be cleaned by soaking in wash acid for two hours, followed by rinsing with water. The first two impingers will each contain 100 mL of water, the third will be empty, and the fourth wil contain 200 grams of silica gel. The filter, located between the probe exit and the first impinger, will be a Pallflex 2500QAT-UP supported by a Teflon frit. EPA Method 104 procedures will be followed during sample recovery.

Since very low Beryllium (Be) levels are expected at this location, then more sensitive graphite furnace atomic absorption (GFAA) analysis will be used. SW-846 Method 3050 digestion will be used to prepare the sample for the GFAA beryllium analysis. This method is suitable for solid wastes and involves a more dilute acid digest suitable for GFAA.

A field blank will be analyzed for each unit, a filter blank, and a reagent blank will be recovered, and a matrix spike (Method of Standard Additions) will be added during analysis for recovery efficiency.

5.16 F-FACTOR CALCULATION PROCEDURE

In accordance with the EPA PSD Permit part I Condition 2, F-Factors at 12% CO_2 (Fd) used to determine emission rates in lbs/MMBtu for each test run will be calculated using the following equation.

Fd at 12% CO_2 = Qs/QH

Where: Qs = volumetric flow rate of combustion gases measured during test adjusted to 12% CO_2. (Dry standard cubic feet per hour.)

QH = maximum heat input (MMBtu/hour) calculated from the average boiler steam flow for each test run, and the average efficiency and steam enthalpy determined from boiler as a calorimeter testing in accordance with Power Test Code 4.1 - Modified Heat Loss Method.

Daily average F-factors will be calculated and used with the daily test results to calculate lbs/MMBtu emission rates as required in the US EPA PSD and Florida PPSC permits.

SECTION 6.0
QUALITY ASSURANCE PROGRAM
ORGANIZATION AND RESPONSIBILITY

Entropy assumes responsibility for all measurements made in connection with this project, and therefore responsibility for the implementation of an adequate quality assurance (QA) program. This section discusses Entropy's approach to management of the QA aspects of the subject test program. Provisions and procedures which are incorporated in the overall management structure to promote implementation of QA procedures and adherence to QA guidelines are described.

The management structure and organization employed by Entropy facilitates the development and performance of quality assurance/quality control (QA/QC) functions by accurately defining the QA/QC direct lines of communication and authority between different levels of project management and the QA management structure. Entropy's QA program is designed in a way that facilitates interaction between QA program personnel and the project team. QA program personnel interface independently with project team members at all levels, monitoring data representativeness, accuracy, precision, and completeness. QA program personnel are free to interact directly with project team members at any time QA considerations in one of these areas need to be addressed.

The organization of the Entropy project team, including QA functions, is shown in the project organization chart (see Figure 6-1). Note that the QA structure is independent of the organizational groups who will generate environmental measurement data during this project.

The focus of the Entropy QA program is the quality assurance manager. He is responsible for the day-to-day oversight of QA activities. The quality assurance manager reports to the quality assurance coordinator. The quality assurance coordinator occupies a level higher than the project manager, and reports directly to the project director.

6.1 PROJECT DIRECTOR

The Project Director (PD) oversees the Project Managers' test program planning, organization, and performance. He also assists in technical supervision and oversees protocol development and review, data interpretation, and report preparation. The PD for this sampling project will be Mr. Tony Wong. Mr. Wong serves as the PD for all testing projects including hazardous waste, Municipal Solid Waste/Refuse Derived Fuel (MSW/RDF) incinerators. He has been PD for over 25 RCRA/TSCA trial burns and over 15 MSW/RDF testing projects. Some of the complex projects include high temperature, moisture, and pressure locations, dioxins/furans, emissions inventories, and ambient air. He is often involved in site surveys, method design, and method evaluation. Prior to becoming PD, he served as Project Manager for

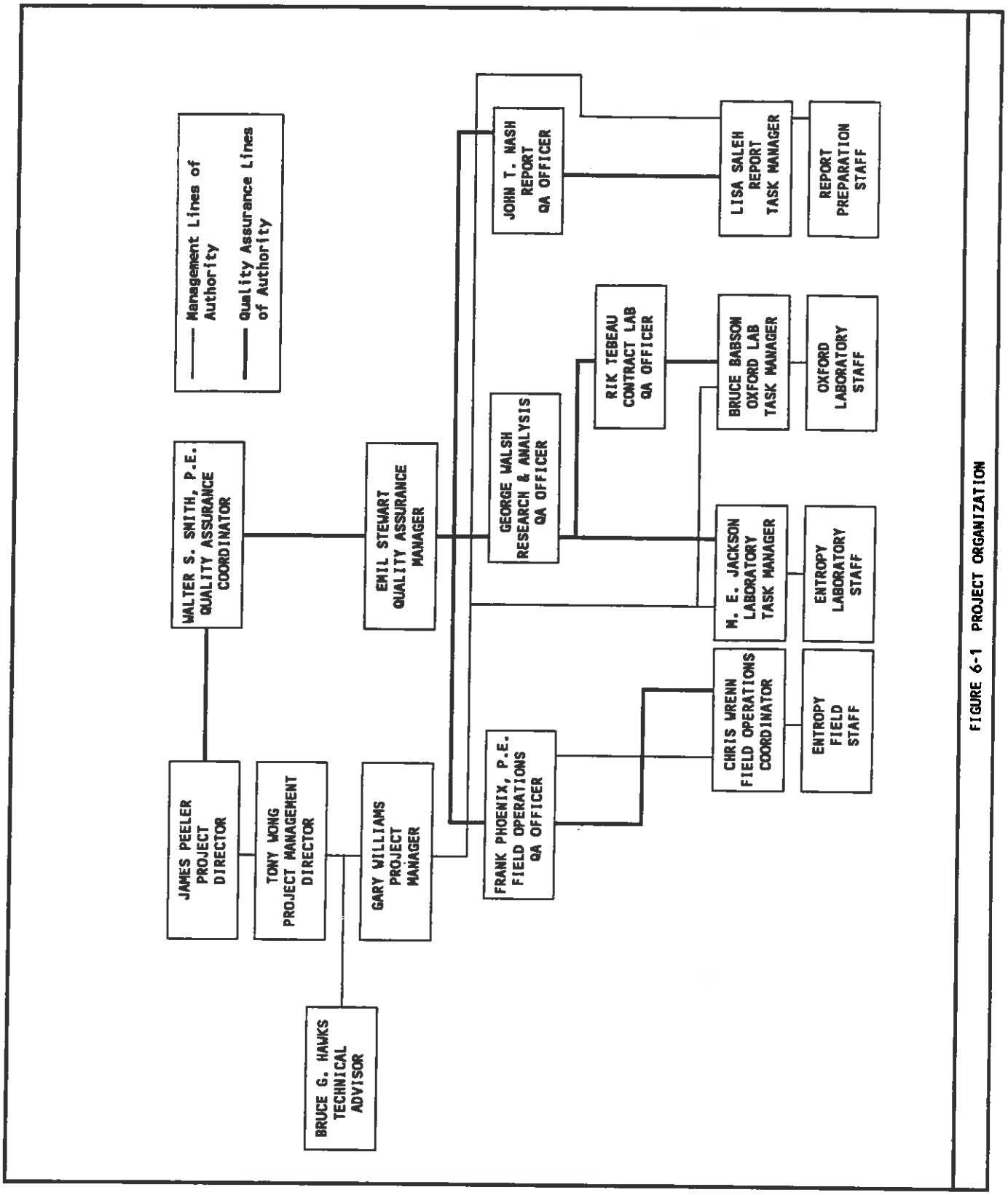


FIGURE 6-1 PROJECT ORGANIZATION

over 20 RCRA/TSCA trial burns, which involved developing sections of the trial burn plan, negotiating with regulatory agencies, supervising field operations, evaluating data, and preparing the final report.

6.2 PROJECT MANAGER

The Project Manager (PM) assists the PD in the planning, oversight and review functions associated with the various elements of the test program. In practice, the PD has responsibility for several ongoing projects at any given time. The PM's responsibilities are more narrowly focused; he usually has responsibility for one test project at a time. The PM for this sampling project will be Gary Williams. To obtain a complete working knowledge of field work, Mr. Williams spent numerous hours serving as a technician and team leader for RCRA/TSCA, Municipal Waste Combustors (MWC), and indoor air pollution testing. He has been project manager for over 20 RCRA trial burns which involved developing the trial burn plan, negotiating with regulatory agencies, supervising the trial burn testing, and preparing the final report. He has been project manager for over 30 MWC testing projects which included developing the test protocol, negotiations, organizing, managing the test program, and preparing the final report.

6.3 QUALITY ASSURANCE COORDINATOR

The Quality Assurance Coordinator (QAC) has the primary responsibility for ensuring that all reported data meet the QA objectives associated with the measurement project. The QAC is independent of project management, reporting directly to upper corporate management.

Walter S. Smith, P.E. (B.S., Chemical Engineering) President and co-founder of Entropy, serves as the uality Assurance Coordinator of the company. Prior to 1972, Mr. Smith served with the U.S. Public Health Service and, later, the U.S. EPA. His duties at both organizations included the development of sampling methods and emissions factors for numerous source categories. He headed the team which developed EPA Methods 1 through 8.

Mr. Smith will provide supervision of all technical aspects of the work effort, which includes but is not limited to, method development, sample analysis, interpretation of test results, and preparation of the final report. We anticipate that the level of Mr. Smith's participation in the proposed work effort will be more extensive than for Entropy's more routine testing projects.

6.4 QUALITY ASSURANCE MANAGER

Entropy's Quality Assurance Manager (QAM) is Mr. Emil Stewart. His responsibilities include (1) the review of QA project plans, (2) oversight of QA consideration of field testing projects, (3) oversight of QA aspects of major EPA contracts, and (4) recommendation and implementation of QA activities within Entropy's internal systems to enhance the overall quality of the product.

If problems arise which have the potential to adversely affect data, he will make recommendations to the project manager, and higher management levels as necessary, to ensure that appropriate corrective actions are taken.

6.5 TECHNICAL ADVISOR

Bruce G. Hawks is Entropy's Technical Advisor. This role involves working with project managers and coordinators to ensure that project goals and objectives are recognized, and efforts necessary for their attainment are implemented. At the inception of the sampling project, Mr. Hawks will meet with the Project Director and the Project Manager to discuss the goals of the project, the strategy of project implementation, and necessary QA/QC. A major function of the interaction at this management level is the selection of personnel to manage, perform, or assist in the performance of project activities. In this area, the Technical Advisor assists the Project Manager in evaluating the qualifications and experience of the candidate personnel, providing input on the suitability of individuals with reference to their ability to carry out the intended activities.

In his capacity as Technical Advisor, Mr. Hawks also will oversee preparatory operations that occur prior to conducting environmental measurements using the VOST or MM5 protocols. Some of the activities which Mr. Hawks will bear responsibility for during this test project are:

1. observing calibration techniques to ensure that operators follow prescribed procedures;
2. checking calibration records to ensure that record keeping practices are adequate, prescribed calibration frequencies are observed, and QC criteria are attained and maintained;
3. performing system audits of facilities and equipment to ensure that the status of these reflect the effective operation of the QA program;
4. conducting performance audits on measurement systems to assess the adequacy of QC systems; and
5. periodic reporting to the project director, quality assurance coordinator, project manager, and other involved personnel with regard to the QA status of on-going projects.

Most of the items listed for Mr. Hawks are routine activities, and reflect the lines of authority which are present when the team leaders and technical staff are at the home office/laboratory. In the field, many of these routine QA activities become the responsibility of the Project Manager and/or Project Supervisor and pertinent task managers, who oversee QA practices and procedures in the field.

6.6 CONTRACT LAB QUALITY ASSURANCE OFFICER

The Entropy contract laboratory Quality Assurance Officer for this project will be Rik Tebeau. Mr. Tebeau will oversee the efforts of Bruce Babson, Task Manager for Oxford Laboratories, Inc., and Dr. J.R. Hass of Triangle Laboratories, Inc., as well as any other outside labs whose services may be required.

Mr. Tebeau's responsibilities are to insure that proper QA/QC protocols are followed by all outside labs, and to review raw data before it is processed. He also sees that the samples are properly shipped and received by the respective labs in good shape, that the correct analytical method is performed on the samples, and the results are sent to him in a timely fashion.

6.7 ENTROPY LABORATORY TASK MANAGER

The Entropy Laboratory Task Manager for this project will be Mary Ellen Jackson. Ms. Jackson has ten years of experience in the analysis of air pollution samples. She serves as supervisor for Entropy's Reference Methods Laboratory, directing the efforts of the laboratory staff in all analyses. She also is responsible for purchasing and maintenance of inventories of all laboratory equipment and supplies. She oversees preparation of reagents for all field stack testing efforts undertaken by Entropy's Stack Sampling Division. Ms. Jackson directs Entropy's participation in both state and federal laboratory QA programs.

The laboratory staff, under the direction of Ms. Jackson, performs a high volume of gravimetric and volumetric analyses, titrations, colorimetry, HPLC, spectrophotometry, gas chromatography, and wet chemistry. Ms. Jackson supervises all analyses required by EPA Methods 4, 5 (front and back half), 6, 7, 8, and 17. She also handles particle size analyses, both microscopy and cascade impactor.

6.8 OPERATIONS QUALITY ASSURANCE OFFICER

The Entropy Operations Quality Assurance Officer is Frank Phoenix. Mr. Phoenix is responsible for directing 32 engineers and technicians on six to eight weekly emissions measurement projects. Mr. Phoenix is responsible for all the manual method and VOC testing performed by Entropy. In this capacity he oversees training, equipment maintenance and calibration, project scheduling, project planning and preparation, test protocol design and standardization, and test program implementation. He has over 13 years of experience in point source, area and fugitive emissions studies, and has managed hundreds of emissions characterization projects. He has been involved with every aspect of this process including personnel management and training, methodology development, and data validation and quality assurance.

6.9 FIELD OPERATIONS COORDINATION

Entropy's Field Operations Coordinator is Chris Wrenn. Mr. Wrenn's responsibilities include scheduling, coordination of sampling tasks, and support for the sampling teams while they are in the field.

The Field Operations Coordinator works together with project managers, equipment and laboratory managers in an effort to identify and eliminate potential problems that could occur during the test program. Mr. Wrenn also coordinates changes in the scope of work that develop while in the field. He

serves as support should any questions, problems, or situations arise which would require the assistance of the home office in the form of equipment, personnel, or technical information.

6.10 REPORT QUALITY ASSURANCE OFFICER

Data reduction and report preparation will be under the direction of John Nash. Mr. Nash and the staff of technical writers design appropriate data forms for the collection of field data, debrief test team members on their return from the field, apply appropriate laboratory results and data gathered in the field to generate test results using computerized data reduction programs, design and implement programs for data reduction, prepare the test reports, and submit the final product to the client. An average of 15 to 20 test reports are in process at any given time, and an average of eight to ten reports per week are completed and submitted.

Entropy designs its own computerized data reduction programs. Entropy has developed appropriate programs for virtually all types of testing; each of these programs are designed to print out the final test results in a manner appropriate for direct inclusion in the test report. Mr. Nash's responsibilities demand that he possess a thorough understanding of EPA test methods as applied at different source categories and of the relationship between field activities and test results data.

Entropy developed the reporting format recommended in Volume III of the EPA Division of Stationary Source Enforcement's Quality Assurance Handbook, and prepares all reports accordingly. All compliance test reports prepared by Entropy carry a guarantee that they will be acceptable to the control agencies to whom they are submitted, provided Entropy is allowed to participate in protocol negotiations with the agencies prior to testing. Entropy will provide any interpretations or clarifications that may be requested. In the unlikely event that testing or analytical errors compromise the data to the extent that a control agency will not accept the results of the test, Entropy will repeat the test at its own expense.

6.11 DATA REPORT TASK MANAGER

Data reduction and report preparation will be performed by Marshall Cannon. Mr. Cannon is responsible for the management of the report progress. After the field data has been reduced and analytical results have been evaluated, Mr. Cannon will calculate the pollutant concentrations and emission rates and present them in a report that meets guidelines established by the EPA and state agency.

6.12 OXFORD LABORATORIES, INC. TASK MANAGER

Bruce A. Babson will be the Task Manager for Oxford Laboratories, Inc. (OLI) if their services are required. OLI was assembled in April, 1983 as a branch of Grainger Laboratories of Raleigh, North Carolina. In March, 1985 Roger Oxford, laboratory manager, bought the assets of Grainger Laboratories and built the new OLI facility in Wilmington, North Carolina. Current staff members have performed

Entropy's hazardous waste incineration analyses for over five years. These analyses include all waste feed, ash, and scrubber makeup and discharge samples. The years of association with OLI personnel has enabled Entropy to develop an interlaboratory QA/QC program.

The analytical methods and results from previous testing projects performed with the aforementioned labs have been thoroughly examined and approved by appropriate governing regulatory agencies. All sampling and analytical results are guaranteed to be acceptable to the governing regulatory agencies.

SECTION 7.0
SAMPLE CUSTODY

Sample custody procedures for this program are based on EPA recommended procedures (Quality Assurance Handbook for Air Pollution Measurement Systems: Volume 3, Stationary Source-Specific Methods (1977)). Since samples will be analyzed by one or more laboratories as well as in the field, the custody procedures emphasize careful documentation of sample collection and field analytical data and the use of chain of custody records for samples being transported. The procedures which will be used are discussed below.

7.1 FIELD SAMPLING OPERATIONS

The project supervisor will be responsible for ensuring that proper custody and documentation procedures are followed for the field sampling and field analytical efforts. He will be assisted in this effort by key sampling personnel involved in sample recovery.

Samples are collected, transported, and stored in clean containers which are constructed of materials inert to the analytical matrix such as glass jars. Only containers which allow air tight seals are used. Amber glass jars are employed when containers are needed to inhibit photochemical reactions.

All sampling data, including information regarding sampling times, locations, and any specific considerations associated with sample acquisition will be recorded on preformatted data sheets. The field sampling data form for the Method 5 sampling train is shown in Figure 7-1. The analytical data form for the Method 5 sampling train is shown in Figure 7-2.

Following sample collection, all samples will be given a unique alphanumeric sample identification code as shown in Figure 7-3. Actual sample code could vary slightly depending upon sample location and type. Figure 7-4 is the chain of custody sheet which will accompany all Modified Method 5 reagent boxes used during the testing program.

Process samples (feed, scrubber, ash, etc.) that are collected during testing will be packed for shipment to the appropriate laboratories and process sample chain of custody forms (Figure 7-5) will be completed for each shipment box. The chain of custody forms and a letter specifying the treatment of each sample will also be enclosed in the sample shipment container. Samples to be combined and analyzed immediately, extracted and stored for later analysis, or simply stored as is, will be clearly stated in this letter. The purpose of the letter will be to ensure that the correct samples are combined, that samples containing moisture will be analyzed on an as-received basis, and that samples with a limited shelf life (those containing water) are extracted within the allowable time of 7 to 14 days after collection.

Samples are stored for transport from the lab to the field to the lab in storage boxes constructed in a fashion which minimizes movement and thus prevents breakage of containers. For example, boxes used for transporting glass containers have foam inserts with form-fitting cutouts. Sample transport boxes are always locked except when in use. Vans containing equipment and samples are locked whenever they are left unattended.

A daily activity log will be maintained by the project supervisor. This will be an informal log used to record various types of information, such as minor problems which arise, sketches of sampling locations, names and phone numbers of plant contacts, daily activity summaries, etc.

7.2 ANALYTICAL OPERATIONS

Analytical operations will be performed on-site in the laboratory as well as in the Entropy laboratories. The analytical data form to be used for on-site fixed gas (molecular weight) determinations using Orsat analyzer is shown in Figure 7-6. Samples analyzed by outside laboratories are transported with a Request-For-Analysis form as shown in Figure 7-7. This form will list sample identifications, analytical parameters, sample matrices, anticipated date of results, and other relevant information necessary to ensure the appropriate analyses are performed and to document the progress of the samples.

PARTICULATE FIELD DATA

COMPANY NAME ______________________________ RUN NUMBER _______
ADDRESS ______________________________ TIME START _______
SAMPLING LOCATION ______________________ TIME FINISH _______
DATE ___________ TEAM LEADER __________ TECHNICIANS __________
BAROMETRIC PRESSURE. IN. HG ____ STATIC PRESSURE IN. H20 _____
SAMPLING TRAIN LEAK VACUUM IN. HG ______________________
SAMPLING TRAIN LEAK RATE, CU.FT/MIN ______________________

EQUIPMENT CHECKS	IDENTIFICATION NUMBERS	LK.TEST READING
___PITOTS, PRE-TEST	REAGENT BOX ___ NOZZLE ____ DIAMETER ____	
___PITOTS, POST-TEST	METER BOX ________ T/C READOUT ________	
___ORSAT SAMPL. SYS.	UMBILICAL ________ T/C PROBE ________	
___TEDLAR BAG	SAMPLE BOX ______ ORSAT PUMP ________	
___THERMOCOUPLE @______ °F	PROBE __________ TEDLAR BAG ________	
FILTER # TARE		
________ ________	DELTA H@ ______ C FACTOR __________	
________ ________	METER TEMP ______ STACK TEMP __________	
________ ________	% MOISTURE _____ REF. DELTA P ________	

SAMPLE POINT	CLOCK TIME MIN.	DRY GAS METER READING CU. FT.	PITOT READING IN. H20	ORIFICE SETTING IN. H20 IDEAL ACTUAL	GAS METER TEMP. °F	VACUUM IN. HG GAUGE	GAS TEMP. OF °F___ FILTER BOX	CONDEN. EXIT	IMPIN. EXIT	STACK TEMP.	*

Figure 7-1 Method 5 Data Sheet

PARTICULATE SAMPLING LABORATORY RESULTS

Plant Name EEI Ref. #
Sampling Location
Date Received Date Analyzed Reagent Box(es)

Run Number
Run Date

SUMMARY OF PARTICULATE ANALYSES

Sum of Particulate, mg.
Total Filter Tare mg.
Blank Residue, mg. (mL) (mL) (mL)

TOTAL PARTICULATE CATCH, mg. [ ] [ ] [ ]

ANALYSIS OF MOISTURE CATCH

Reagent 1 ( ):
Final Weight, g.
Tared Weight, g.
Water Catch, g.

Reagent 2 ( ):
Final Weight, g.
Tared Weight, g.
Water Catch, g.

CONDENSED WATER, g.

Silica Gel:
Final Weight, g.
Tared Weight, g.

ABSORBED WATER, g.

TOTAL WATER COLLECTED, g. [ ] [ ] [ ]

Blank Beaker #____	--- Legend ---	Notes and Comments
Final wt. mg. _____	= Final Weight	
Tare wt. mg. _____	L = Loose Particulate	
Residue, mg. _____	F = Filter D = Dish	
	R = Rinse P = Pan	
Concen., mg/mL [ ]		

Figure 7-2 Moisture Impinger Catch Data Sheet Performed in Lab

1	O	M5	1	A
Unit Number	Sampling Location	Sample Type	Run Number	Multiple Samples Collected at Same Time (if applicable)
1, 2 or 3	O=Outlet I=Inlet	M5 MMTL M7A M8	1,2,...	A,B,C,...

Figure 7-3 Alphanumeric Sample Identification Number

CUSTODY SHEET FOR REAGENT BOX

Date of Makeup _____ Initials _____ Locked? _____

Individual Tare of Reagent: _____ mls. of _____

Individual Tare of Reagent: _____ mls. of _____

Individual Silica Gel Tare Weight _____ gms.

PLANT NAME _____

SAMPLING LOCATION _____

Run Number	Date Used	Initials	Locked?	Date Cleanup	%S. Gel Spent	Initials	Locked?

	Date	Initials	Locked?
Received in Lab			

Zero & Span Balance Initials _____

Sampling Method:

Remarks:

Filter #	Tare Weight (mgms)	Used on Test

Figure 7-4 Custody Sheet for Reagent Box

PROCESS SAMPLE CHAIN OF CUSTODY

PLANT NAME _____

PLANT LOCATION _____

DESCRIBE PROCESS _____

_____

DESCRIBE SAMPLE _____

_____

DESCRIBE SAMPLING PROCEDURES (i.e. Grab or Intergrated sample; single or composite, etc.) _____

_____

SAMPLING LOG				
SAMPLE ID	DATE	TIME	TAKEN BY	SAMPLING LOCATION

SAMPLES RECEIVED FROM THE PLANT BY _____ ON _____

SAMPLES RECEIVED IN THE LAB BY _____ ON _____

Figure 7-5 Process Sample Chain of Custody Form

ORSAT FIELD DATA

Plant Name____

Sampling Location________________________Fuel Type__________

Run and/or Sample No. _____Leak Test?_____Date______Operator_____

Time of Sample Collection	Time of Analysis	CO2 Reading A	O2 Reading B	CO Reading C	%O2 B-A	%CO C-B	%N2 100-C
	Avg.			Avg.			

Run and/or Sample No. _____Leak Test?_____Date______Operator_____

Time of Sample Collection	Time of Analysis	CO2 Reading A	O2 Reading B	CO Reading C	%O2 B-A	%CO C-B	%N2 100-C
	Avg.			Avg.			

Run and/or Sample No. _____Leak Test?_____Date______Operator_____

Time of Sample Collection	Time of Analysis	CO2 Reading A	O2 Reading B	CO Reading C	%O2 B-A	%CO C-B	%N2 100-C
	Avg.			Avg.			

Figure 7-6 Orsat Analytical Data Sheet

ENTROPY ENVIRONMENTALISTS INC.
POST OFFICE BOX 12291
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27709-2291
919/781-3550

REQUEST FOR ANALYSIS

PURCHASE ORDER #_____ JOB NAME:_____

LABORATORY:_____

DATE SAMPLES WERE TRANSMITTED:_____ EXPECTED DATE OF RESULTS:_____

SAMPLE MATRIX:_____

TYPE OF ANALYSIS REQUESTED:_____

SUBMITTED BY:_____

FIGURE 7-7 REQUEST FOR ANALYSIS FORM

SECTION 8.0
INTERNAL QUALITY CONTROL CHECKS

Specific quality control (QC) procedures will be followed to ensure the continuous production of useful and valid data throughout the course of this test program. The QC checks and procedures described in this section represent an integral part of the overall sampling and analytical scheme. Strict adherence to prescribed procedures is quite often the most applicable QC check. A discussion of both the sampling and analytical QC checks that will be utilized during this program is presented below.

8.1 EQUIPMENT INSPECTION AND MAINTENANCE

Each item of field test equipment purchased by Entropy is assigned a unique, permanent identification number. An effective preventive maintenance program is necessary to ensure data quality. Each item of equipment returning from the field is inspected before it is returned to storage. During the course of these inspections, items are cleaned, repaired, reconditioned, and recalibrated where necessary.

Each item of equipment transported to the field for this test program is inspected again before being packed to detect equipment problems which may originate during periods of storage. This minimizes lost time on the job site due to equipment failure.

Occasional equipment failure in the field is unavoidable despite the most rigorous inspection and maintenance procedures. For this reason, Entropy routinely transports to the job site replacement equipment for all critical sampling train components.

8.2 EQUIPMENT CALIBRATION

New items for which calibration is required are calibrated before initial field use. Equipment whose calibration status may change with use or time is inspected in the field before testing begins and again upon return from each field use. When an item of equipment is found to be out of calibration, it is repaired and recalibrated or retired from service. All equipment is periodically recalibrated in full, regardless of the outcome of these regular inspections.

Calibrations are conducted in a manner, and at a frequency, which meets or exceeds US EPA specifications. Entropy follows the calibration procedures outlined in the EPA Methods, and those recommended within the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III (EPA-600/4-77-027b, August, 1977). When these methods are inapplicable, Entropy uses methods such as those prescribed by the American Society for Testing and Materials (ASTM).

Data obtained during calibrations are recorded on standardized forms, which are checked for completeness and accuracy by the quality assurance director or the quality assurance manager. Data reduction and subsequent calculations are performed using Entropy's own computer facilities.

Calculations are checked at least twice for accuracy. Copies of calibration forms are included in the test or project reports.

Emissions sampling equipment requiring calibration includes pitot tubes, pressure gauges, thermometers, dry gas meters, and barometers. The following sections elaborate on the calibration procedures followed by Entropy for these items of equipment.

A: Pitot Tubes. All Type S pitot tubes used by Entropy, whether separate or attached to a sampling probe, are constructed in-house or by Nutech Corporation. Each new pitot is calibrated in accordance with the geometry standards contained in EPA Method 2. A Type S pitot tube, constructed and positioned according to these standards, will have a coefficient of 0.84 ± 0.02. This coefficient should not change as long as the pitot tube is not damaged. Each pitot tube is inspected visually upon return from the field. If a cursory inspection indicates damage or raises doubt that the pitot remains in accordance with the EPA geometry standards, the pitot tube is refurbished as needed and recalibrated.

B: Differential Pressure Gauges. Some meter consoles used by Entropy are equipped with 10-in. water column (W.C.) inclined-vertical manometers. Fluid manometers do not require calibration other than leak checks. Manometers are leak checked in the field prior to each test series, and again upon return from the field.

Most of Entropy's meter consoles are equipped with Magnehelic differential pressure gauges. Each set of gauges is calibrated initially over its full range, 0-10 inches W.C. After each field use, the calibration of the gauge set is checked against an inclined manometer at the average delta p encountered during the test. If the agreement is within ± 5 percent, the calibration is acceptable.

C: Impinger Thermometer. Prior to the start of testing, the thermometer used to monitor the temperature of the gas leaving the last impinger is compared with a mercury-in-glass thermometer which meets ASTM E-1 No. 63F specifications. The impinger thermometer is adjusted if necessary until it agrees within 2° F of the reference thermometer. If the thermometer is not adjustable, it is labeled with a correction factor.

D: Dry Gas Meter Thermometer. The thermometer used to measure the temperature of the metered gas sample is checked prior to each field trip against an ASTM mercury-in-glass thermometer. The dry gas meter thermometer is acceptable if the values agree within ± 5.4° F. Thermometers not meeting this requirement are adjusted or labeled with a correction factor.

E: Flue Gas Temperature Sensor. All thermocouples employed by Entropy for the measurement of flue gas temperatures are calibrated upon receipt. Initial calibrations are performed at three points (ice bath, boiling water, and hot oil). An ASTM mercury-in-glass thermometer is used as a reference. The thermocouple is acceptable if the agreement is within ± 1.5 percent (absolute) at each of the three calibration points.

On-site, prior to the start of testing, the reading from the flue gas thermocouple-potentiometer combination is compared with an ASTM mercury-in-glass reference thermometer. If the two agree within ± 1.5 percent (absolute), the thermocouple and potentiometer are considered to be in proper working order for the test series.

After each field use, the thermocouple-potentiometer system is compared with an ASTM mercury-in-glass reference thermometer at a temperature within ± 10 percent of the average absolute flue gas temperature. If the absolute temperatures agree within ± 1.5 percent, the temperature data are considered valid.

F: Dry Gas Meter and Orifice. Two procedures are used to calibrate the dry gas meter and orifice simultaneously. The full calibration is a complete laboratory procedure used to obtain the calibration factor of the dry gas meter. Full calibrations are performed over a wide range of orifice settings. A simpler procedure, the posttest calibration, is designed to check whether the calibration factor has changed. Posttest calibrations are performed after each field test series at an intermediate orifice setting (based on the test data) and at the maximum vacuum reached during the test.

Entropy uses, as a transfer standard, a dry gas meter that is calibrated annually against a spirometer. During the annual calibration, triplicate calibration runs are performed at seven flow rates ranging from 0.25 to 1.40 cfm.

G: Dry Gas Meter. Each metering system receives a full calibration at the time of purchase and a posttest calibration after each field use. If the calibration factor, Y, deviates by less than five percent from the initial value, the test data are acceptable. If Y deviates by more than 5 percent, the meter is recalibrated and the meter coefficient (initial or recalibrated) that yields the lowest sample volume for the test runs is used.

EPA Method 5 requires another full calibration anytime the posttest calibration check indicates that Y has changed by more than 5 percent. Standard practice at Entropy is to recalibrate the dry gas meter anytime Y is found to be outside the range of 0.97 to 1.03.

H: Orifice. An orifice calibration factor is calculated for each flow setting during a full calibration. If the range of values does not vary by more than 0.15 in. H_2O over the range of 0.4 to 4.0 in. H_2O, the arithmetic average of the values obtained during the calibration is used.

I: Barometer. Each field barometer is adjusted before each test series to agree within ± 0.1 inches of a reference aneroid barometer. The reference barometer is checked weekly against the station pressure value (corrected for elevation difference) reported by the National Weather Service station at the Raleigh-Durham Airport, approximately 2.5 miles from Entropy's location.

8.3 SAMPLING QUALITY CONTROL PROCEDURES

The following pretest QC checks will be conducted:

- All sampling equipment will be thoroughly checked to ensure clean and operable components.
- Equipment will be inspected for possible damage from shipment.
- The oil manometer or Magnehelic gauge used to measure pressure across the Type S pitot tube will be leveled and zeroed.
- The number and location of the sampling traverse points will be checked before taking measurements.
- The temperature measurement system will be visually checked for damage and operability by measuring the ambient temperature prior to each traverse.

In addition to the general QC procedures listed above, QC procedures specific to each sampling method will also be incorporated into the sampling scheme. These method specific procedures are discussed below.

A: Sampling Train QC Checks. The following QC procedures will be emphasized:

Prior to Start of Tests

- Keep all cleaned glassware and sample train components sealed until train assembly.
- Assemble the sampling trains in an environment free from uncontrolled dust.
- Visually inspect each sampling train for proper assembly.
- Perform pretest calculations to determine the proper sampling nozzle size.

Prior to Testing Each Day

- Visually inspect the sampling nozzle.
- Visually inspect the Type S pitot tube.
- Leak check each leg of the Type S pitot tube.
- Leak check the entire sampling train.

During Testing Each Day

- Readings of temperature and differential pressure will be taken at each traverse point.
- All sampling data and calculations will be recorded on preformatted data sheets.
- All calibration data forms will be reviewed for completeness and accuracy.
- Any unusual occurrences will be noted during each run on the appropriate data form.
- The project supervisor will review sampling data sheets daily during testing.
- Properly maintain the roll and pitch axis of the Type S pitot tube and the sampling nozzle.
- Leak check the train before and after any move from one sampling port to another during a run or if a filter change takes place.
- Conduct additional leak checks if the sampling time exceeds 4 hours.
- Maintain the probe, filter, and impingers at the proper temperature.
- Maintain ice in the ice bath at all times.
- Make proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum during sampling at each traverse point.
- Maintain isokinetic sampling within ± 10% of 100%.

After Testing Each Day

- Visually inspect the sampling nozzle.
- Visually inspect the Type S pitot tube.
- Leak check each leg of the Type S pitot tube.
- Leak check the entire sampling train.

8.4 QC FOR VOLUMETRIC AIR FLOW RATE DETERMINATIONS

A: Flue Gas Velocity. Data required to determine the flue gas velocity will be collected using the methodology specified in EPA Method 2. Quality control procedures are as follows:

- Visually inspect the Type S pitot tube before and after sampling.
- Leak check both legs of the pitot tube before and after sampling.
- Check the number and location of the sampling traverse points before taking measurements.

B: Flue Gas Molecular Weight. Samples to be used for determination of flue gas molecular weight will be collected using the integrated sampling technique specified in EPA Method 3. Quality control will focus on the following procedures:

- The sampling train will be leak checked before and after each run.
- A constant sampling rate will be used in withdrawing a sample.
- The sampling train will be purged prior to sample collection.

- The sampling port will be properly sealed to prevent air in leakage.

C: Moisture Content. The moisture content of the gas stream will be determined using the technique specified in EPA Method 5. The following QC checks will be performed:

- The sampling train will be leak checked before and after each run.
- Ice will be maintained in the ice bath throughout each run.

8.5 ANALYTICAL QUALITY CONTROL PROCEDURES

All analyses for this program will be performed using accepted laboratory procedures in accordance with the specified analytical protocols. Adherence to prescribed QC procedures will ensure data of consistent and measurable quality. Analytical QC will focus upon the use of control standards to provide a measure of analytical precision and accuracy. Also, specific acceptance criteria are defined for various analytical operations including calibrations, control standard analyses, drift checks, blanks, etc. The following general QC procedures will be incorporated into the analytical effort:

- The on-site project supervisor will review all analytical data and QC data on a daily basis for completeness and acceptability.
- Analytical QC data will be tabulated using the appropriate charts and forms on a daily basis.
- Copies of the QC data tabulation will be submitted to the quality assurance manager following the completion of the test program.
- All hardcopy raw data (i.e., chromatograms, computer printouts, etc.) will be maintained in organized files.

Specific analytical QC procedures for the Orsat analyzer are listed below.

- The analyzer will be leveled and the fluid levels zeroed prior to use.
- The analyzer will be leak checked prior to use.
- The analyzer will be thoroughly purged with sample prior to analysis.
- The analyzer will be checked by analyzing an ambient air sample.

SECTION 9.0
REPORTING

Entropy has prepared more than 8000 technical reports detailing source testing programs conducted for industrial clients. These reports cover compliance testing, continuous monitor performance testing, guarantee testing, and a variety of engineering studies. Entropy developed the reporting format recommended in Volume III of the Quality Assurance Handbook, and prepares all reports accordingly.

Entropy treats all data, samples, and results obtained during field testing as privileged information belonging to the client. No information regarding a stack test will be divulged by Entropy to any other party, unless Entropy receives permission to do so from the client. The report will be presented in a format acceptable to the state agency and will include all necessary information.

9.1 REPORT CONTENTS

Copies of the test report will be submitted after the test series has been completed. Results reported will include, but not be limited to, emission rates and concentrations of particulates and gaseous pollutants, any ash or residue determinations, any liquid stream constituents determinations, any particle size distribution determinations, and any other type of data requested by the client. This report will also include a list of all personnel present during testing, summary of results, descriptions of test procedures used, a description of the source and its operation during testing, test locations, example calculations, raw field data, copies of the EPA Methods used during the test series, and equipment calibrations.

9.2 REPORT FORMAT

A: Title Page. The title page will include the company's name where the testing was performed, the company's location, a list of pollutants tested for, test locations, the company for which the testing was performed if other than the company where the testing was performed and the date(s) on which the testing was conducted.

B: Report Certification. The report certification verifies that the report has been reviewed and certified by the Project Director who was present during the testing and a Professional Engineer.

C: Table of Contents. The table of contents will contain an outline of the test report sections, section names and page numbers on which those sections will appear.

D: Introduction. The introduction will include a background statement addressing sampling purpose, location and date(s) of testing. Also included is a Test Matrix table which will

outline the testing program, indicate the date(s) of testing, provide the testing objectives and methods used throughout the entire testing series, and appropriate run numbers for each test. In addition, a Table of Participants will be presented which will indicate all persons from the host company, state agency, and Entropy that were present during the testing.

E: Summary of Results. The summary of results section will present a summary of pollutant emission rates and concentrations determined from the testing performed. This includes tables of emission rates and concentrations of pollutants that will be found in the flue gas and/or any other pollutant streams tested. Concentrations will be presented in parts per million by volume on a dry basis (ppmdv) for gaseous pollutants, in grains per dry standard cubic foot (Gr/DSCF) for particulate pollutants, and in pounds per hour (Lbs/Hr) and pounds per million Btu (Lbs/MMBtu) for emission rates. Any other units can be reported if requested. In addition, this section will contain a discussion of any sampling or analytical problems encountered during the test program.

F: Process Description and Operation. Included in this section is a description of the process being tested and a summary of its operation during testing, if necessary. This operating data will be incorporated into table form for quick and easy reference. Also a schematic of the process with the sampling locations indicated will be provided in this section.

G: Sampling and Analytical Procedures. This section will indicate the methods used and their applicability to the testing performed. Descriptions of sampling equipment and procedures will be referenced to their appropriate section in the Appendix. Also a schematic of the sampling locations indicating up and downstream dimensions will be provided for your reference.

H: QA/QC Summary. This section summarizes the results of all QA/QC measures implemented throughout the testing program to meet the objectives outlined in the appropriate methodologies and/or QA/QC Project Plan. The section also tabulates the data objectives, criteria for acceptance, and the quality of data not meeting the stated criteria.

I: Appendices. The appendices will include, but not be limited to, the following sections: Test Results and Example Calculations (refer to Appendix B for sample example calculations), Field and Analytical Data, Process Data, Sampling and Analytical

Procedures, and Calibration Data. The Test Results and Example Calculations appendix will contain all test and analytical results and their respective example calculations. The Field and Analytical Data section will contain all raw field and analytical data. The Process Data appendix will include all boiler process data. The Sampling and Analytical Procedures section will contain all methods used and their procedures as described in 40 CFR 60. The Calibration Data appendix contains all calibration data involving equipment used during the testing. This includes any on site calibrations of equipment.