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USAFOEHL REPORT

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COMPLIANCE TESTING OF HOT WATER AND STEAM BOILERS, SHAW AFB SC

JAMES A. GARRISON, Major, USAF, BSC

February 1989

Final Report

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USAF Occupational and Environmental Health Laboratory
Human Systems Division (AFSC)
Brooks Air Force Base, Texas 78235-5501

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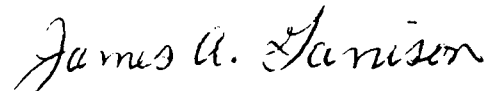
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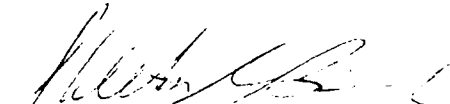
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This report has been reviewed and is approved for publication.



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Chief, Consultant Services Division

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At the request of HQ TAC/DEEV, personnel of the USAFOEHL Air Quality Function conducted source testing of eighteen small hot water and steam boilers to determine stack gas moisture content and velocity. The data obtained during the survey was necessary for boiler operating permit application. Final results were determined on-site and provided to 363 CES/DEEV personnel so that permit application could be initiated immediately.					
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I. INTRODUCTION

On 8-24 Aug 1988, a stationary source emission survey was conducted at Shaw AFB by personnel of the Air Quality Function, USAF Occupational and Environmental Health Laboratory (USAFOEHL) to determine stack exhaust gas moisture content and velocity for 18 small oil and gas fired boilers. This survey was requested by HQ TAC/DEEV to assist Shaw AFB in obtaining the necessary boiler operating permits required by the State of South Carolina. Personnel involved with on-site testing are listed in Appendix A.

II. DISCUSSION

A. Background

Shaw AFB received a consent order from the South Carolina Department of Health and Environmental Control, Bureau of Air Quality Control for not having obtained operating permits for 18 boilers located on the base. Permit applications were then filed, but were returned due to lack of data on moisture content and velocity. USAFOEHL was requested to provide this information so that the base could obtain the necessary operating permits and demonstrate and maintain compliance with all provisions under the South Carolina Department of Health and Environmental Control; Regulation 61-62 - Air Pollution Control Regulations and Standards.

B. Site Description

The 18 boilers tested ranged in size from 1.05×10^6 to 8.4×10^6 BTU/hr input and were located in 13 separate buildings. The primary purpose of the boilers is to provide steam heat or hot water at the particular location. The location and operating parameters of each boiler are found on the permit applications provided in Appendix B. Typical boilers tested are shown in Figures 1 and 2. Typical stacks and test sites are pictured in Figures 3-8.

C. Applicable Standards

Permit procedures are defined under Regulation No. 62.1, Air Pollution Control, Section II, Permit Requirements. Emission Standards are defined under Regulation No. 62.5, Air Pollution Control Standards, Standard No.1, Emissions From Fuel Burning Operations. These regulations are provided in Appendix C.

D. Sampling Methods and Procedures

All stack tests were conducted in accordance with the procedures and analysis methods specified in Chapter 40, Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Methods 1-4. Therefore, test methods, equipment, sample train preparations, sampling and recovery, calibration requirements and quality assurance were done in accordance with the methods and procedures outlined in 40 CFR 60, Appendix A.

Sampling ports were installed in the exhaust stack or ducting and traverse points determined for each site in accordance with Method 1.

Exhaust gas moisture content and velocity were determined simultaneously using the sampling train pictured in Figure 9. The train consisted of a button-hook probe nozzle, heated glass probe, heated glass filter, impingers and pumping and metering device. Flue gas velocity pressure was measured at the nozzle tip using a Type-S pitot tube connected to a 10 inch inclined-venturi manometer. Where stack/duct diameters were less than 12 inches, a detached pitot tube was used so as not to significantly block the duct cross section. A 1-inch inclined manometer was used where gas velocity pressure was less than 0.05 inches of water. Type K thermocouples were used to measure flue gas as well as sampling train temperatures. The probe was heated to minimize moisture condensation. The heated filter was used to remove particulate materials. The impinger train (first, third and fourth impingers; modified Greenburg-Smith type; second impinger; standard Greenburg-Smith design) was used as a condenser to collect stack gas moisture. The pumping and metering system was used to control and monitor the sample gas flow rate. Equipment calibration data is presented in Appendix P.

The sampling time and sample rate for each test run was selected to provide the minimum 21 standard cu ft sample volume and 0.75 cu ft per minute sample rate required by Method 4.

During initial sample runs, flue gas samples for orsat analysis (measures oxygen and carbon dioxide for stack gas molecular weight determination) were taken. Molecular weights determined from these samples averaged about 29.6. This value was assumed for all subsequent calculations. Orsat sampling and analysis equipment are shown in Figures 10 and 11.

Moisture and velocity calculations were done using "Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators" (EPA-340/ 1-85-018) developed by the EPA Office of Air Quality Planning and Standards, Research Triangle Park NC. This is our standard method for calculating emissions data. Moisture and velocity calculations are found in Appendix Q.

III. CONCLUSIONS AND RECOMMENDATIONS

Table 1 provides the survey results for all boilers tested. In some cases, modifications to the stack were made to accommodate the sampling ports. Duct diameters shown were obtained where the ports were installed. Where the inside stack or duct diameter measured during testing was different from that on the permit application, the velocity was corrected to the diameter listed on the application. These results were determined on site and provided to 363 CES/DEEV personnel so that permit application could be initiated immediately.

The USAFOEHL will continue to support Shaw AFB as necessary in this project with consultative and testing assistance.

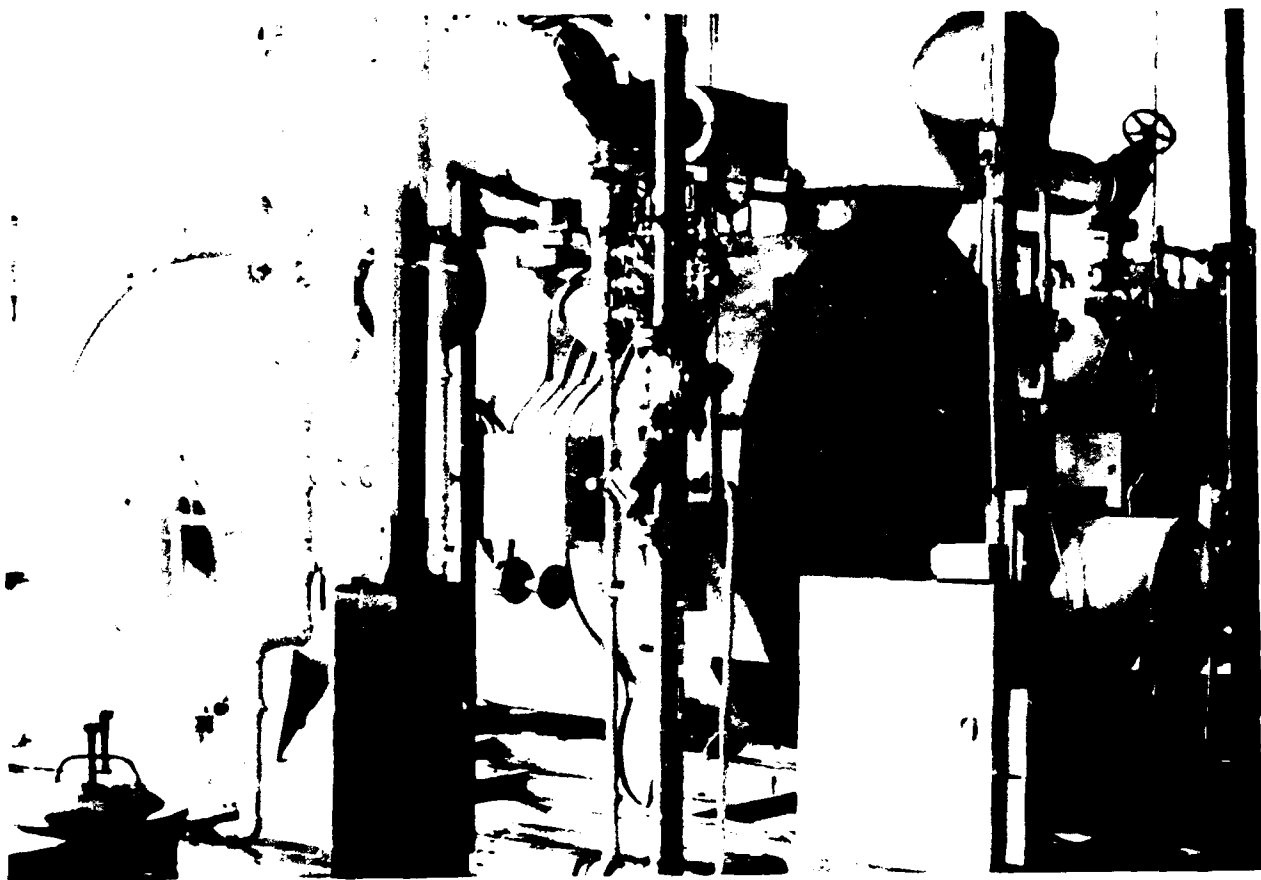


Figure 1. Heat Plant Steam Boiler

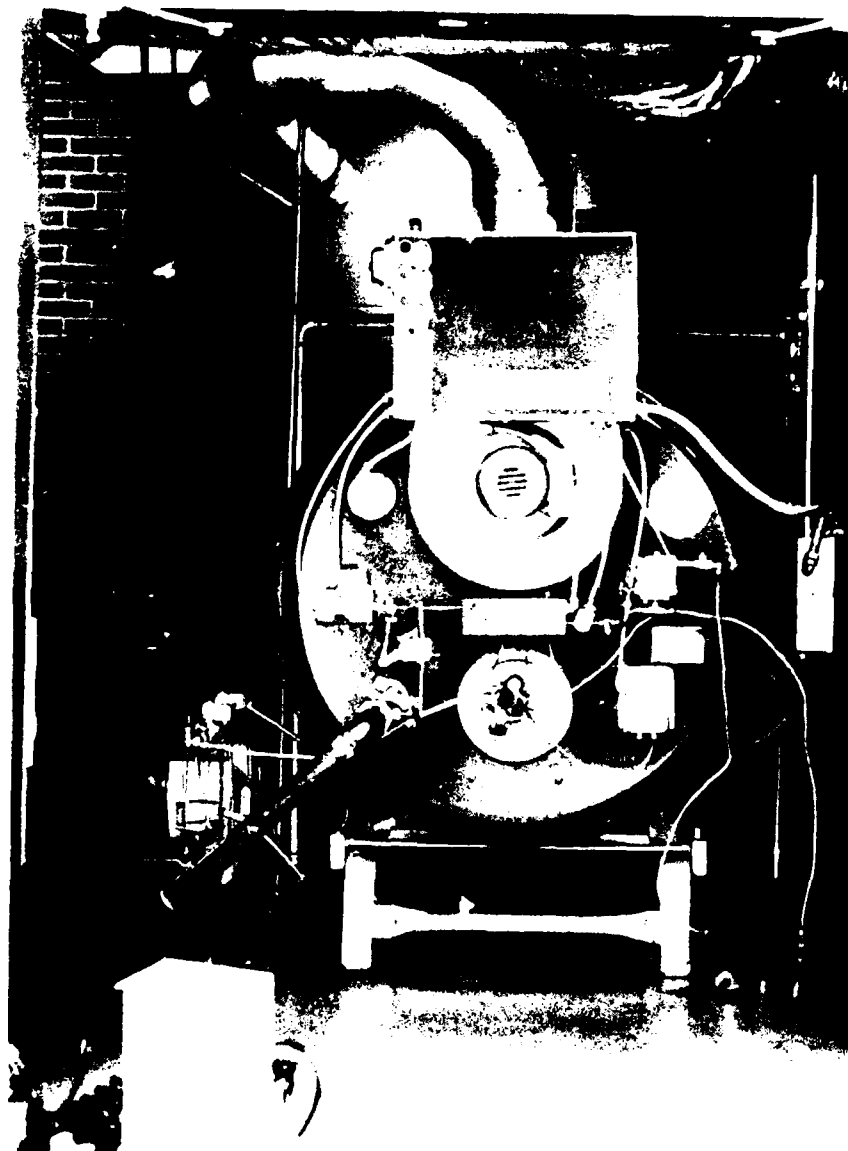


Figure 2. Bullding 1102, Hot Water Boller



Figure 3. Building 611, Test Site



Figure 4. Building 922, Test Site



Figure 5. Building 1046, Test Site

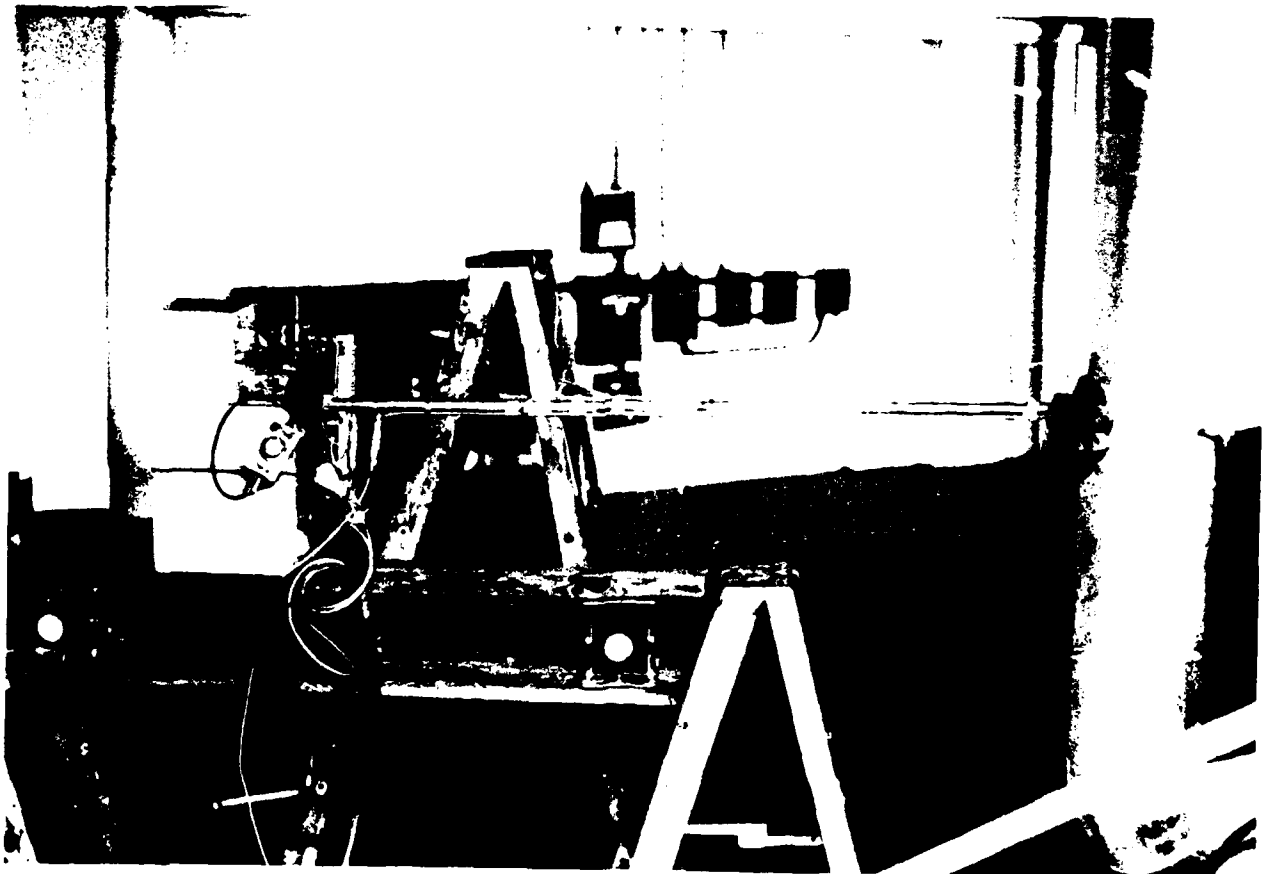


Figure 6. Building 1130, Test Site



Figure 7. Building 1200, Test Site

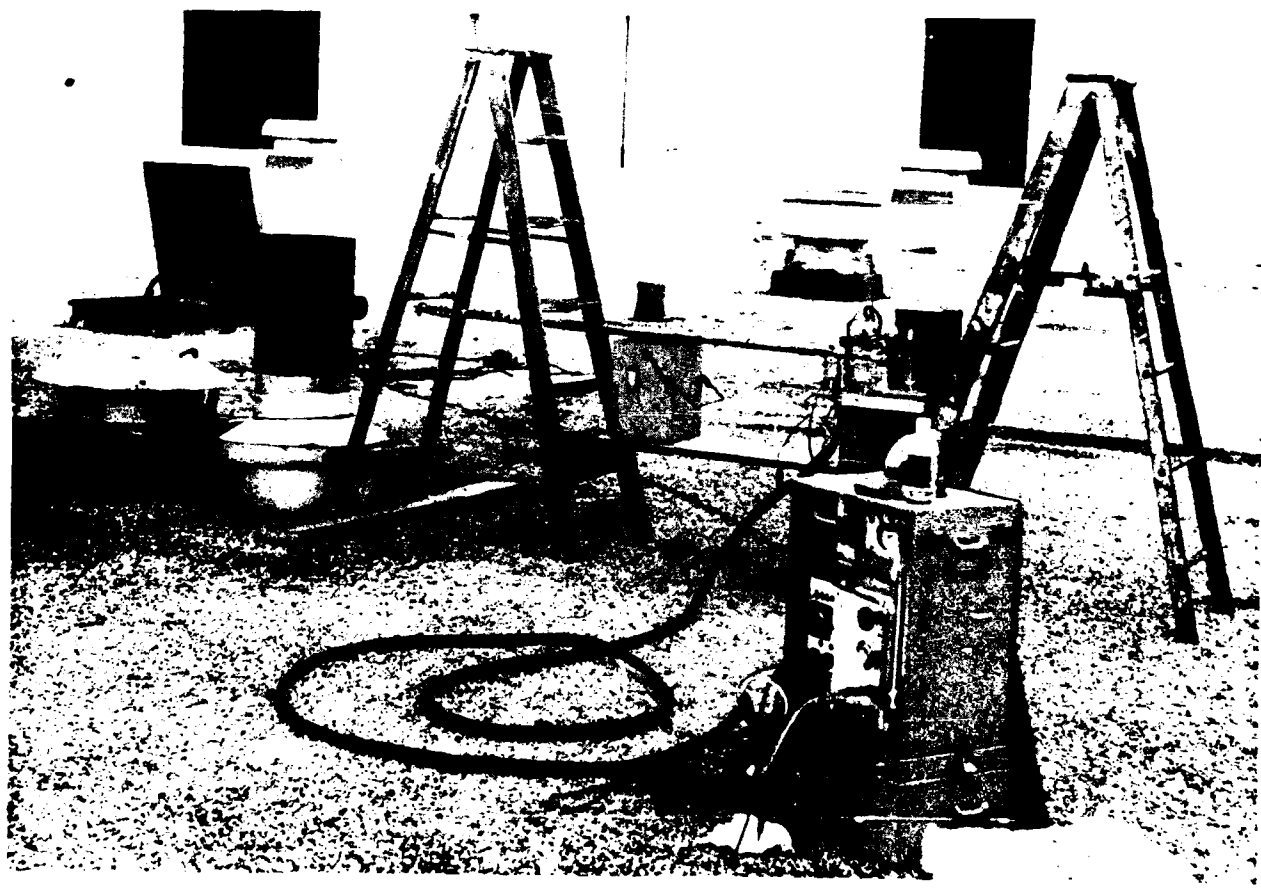


Figure 8. Building 1206, Test Site

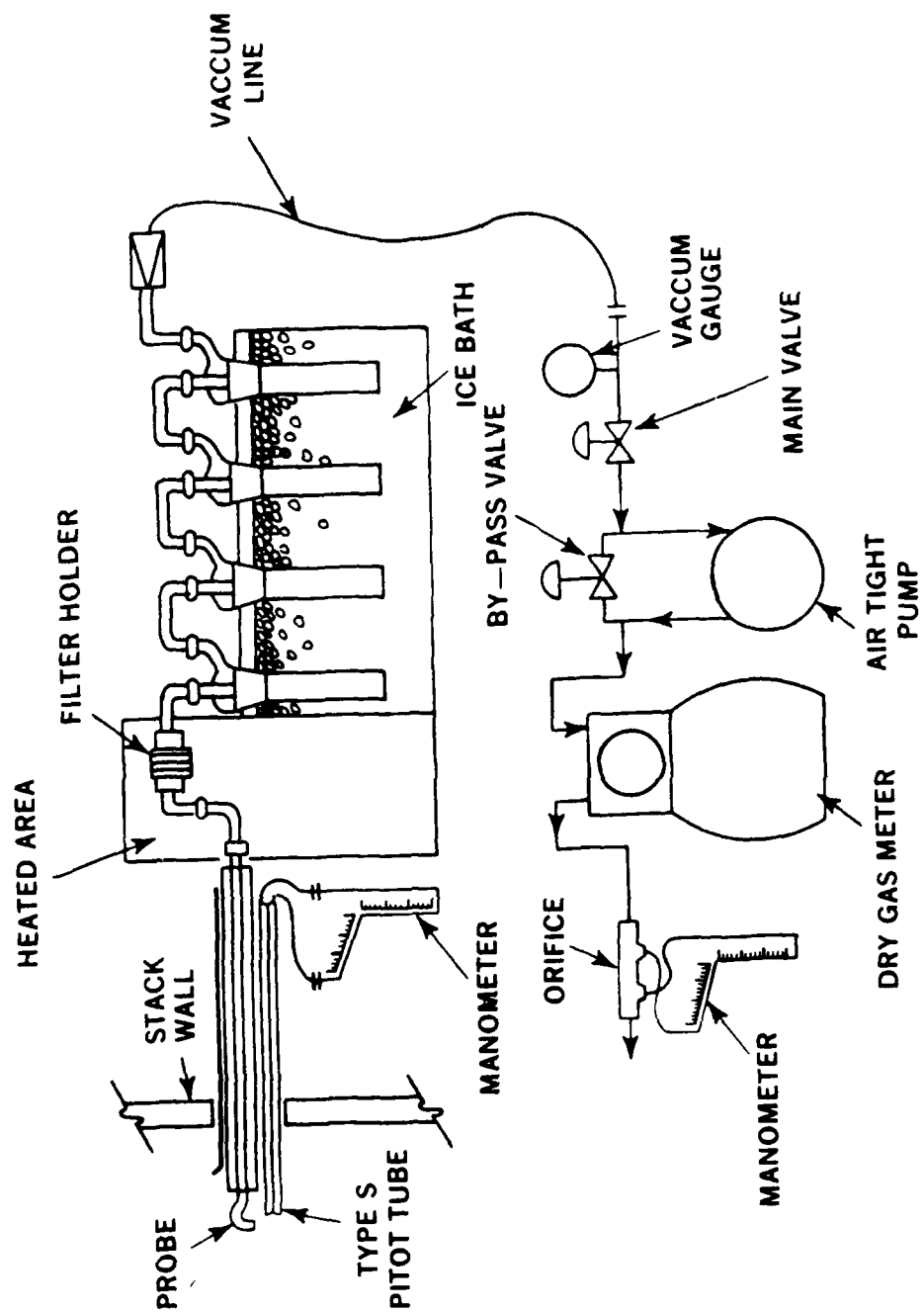


Figure 9. Moisture Sampling Train

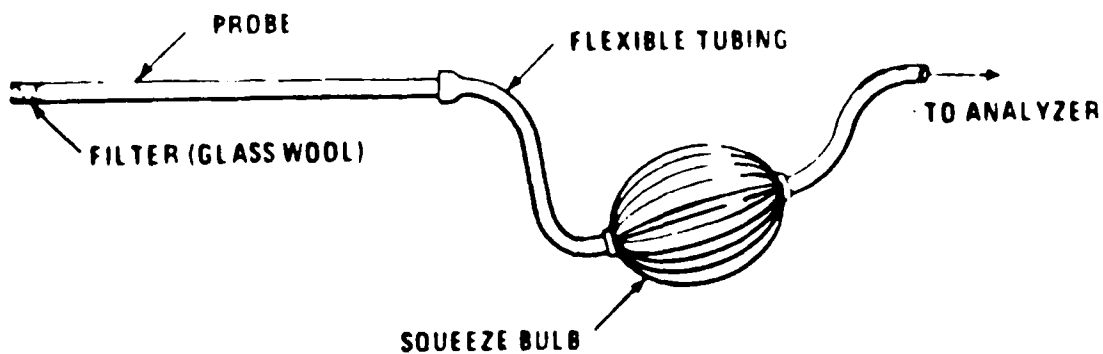


Figure 10. ORSAT Sampling Train

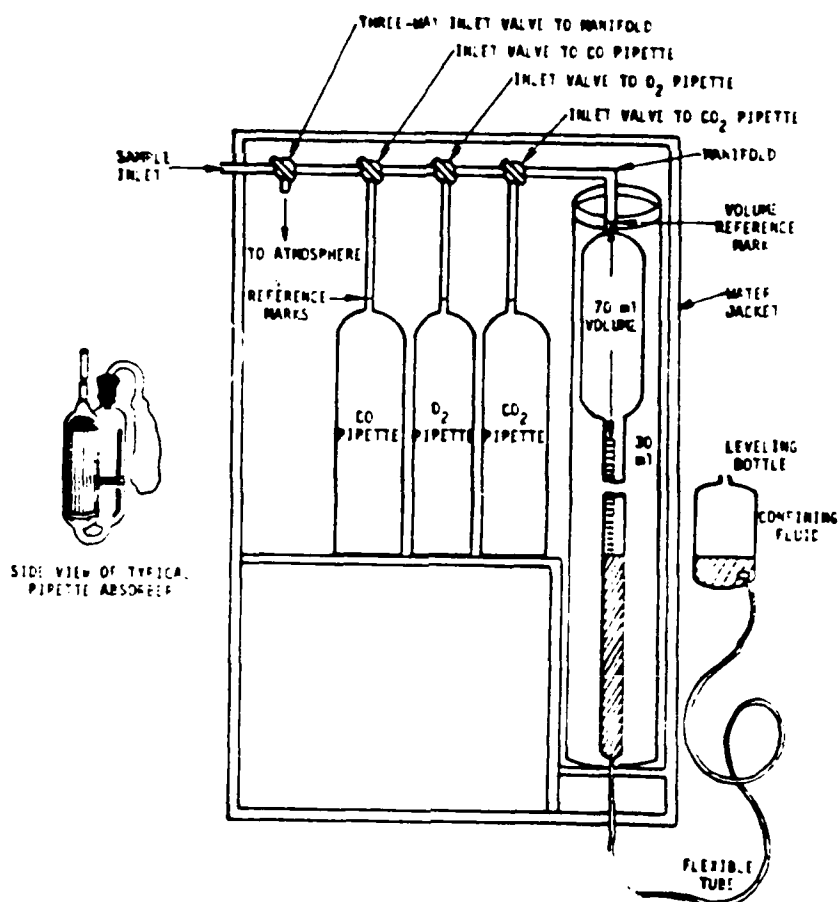


Figure 11. ORSAT Apparatus

TABLE 1

% MOISTURE AND VELOCITY TEST RESULTS

BLDG NO.	TYPE* BOILER	% MOISTURE BY VOLUME	DUCT** DIAMETER (ft)	VELOCITY*** (fps)
403	#2, ST	15.26	1.02(1.00)	30.0
	#3, ST	14.73	1.02(1.00)	27.0
	#5, ST	15.54	1.31(1.66)	26.0(16.0)
611	ST	11.28	1.15(0.66)	26.0(77.0)
922	HW	7.58	0.66(0.66)	3.0
	ST	19.94	0.81(0.66)	11.0(17.0)
1046	HW	12.55	1.25(0.66)	15.0(55.0)
1102	HW	9.90	0.81(0.66)	15.0(23.0)
1130	ST	9.02	0.83(0.66)	28.0(45.0)
1200	#1, ST	9.01	0.78(1.0)	22.0(14.0)
	#2, ST	12.42	0.78(1.0)	11.0(7.0)
	#3, ST	10.88	0.78(1.0)	20.0(13.0)
1206	ST	10.54	1.16(0.66)	8.0(24.0)
1402	HW	9.50	0.90(0.66)	11.0(20.0)
1422	HW	12.27	1.46(0.66)	9.0(45.0)
1604	HW	10.56	0.63(0.66)	22.0(20.)
1614	#1, ST	10.65	1.33(1.0)	12.0(21.0)
	#2, ST	9.41	1.33(1.0)	12.0(21.0)

* ST = Steam boiler
HW = Hot water boiler

** Duct diameter measured during testing. () indicates duct diameter listed on permit.

*** Velocity for duct diameter measured during testing. () indicates stack velocity corrected to stack diameter listed on permit.

REFERENCES

1. "Standards of Performance for New Stationary Sources," Title 40, Part 60, Code of Federal Regulations, July 1, 1987.
2. Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III, Stationary Source Specific Methods, U.S. Environmental Protection Agency, EPA-600/4-77-027-b, Research Triangle Park, North Carolina, December 1984.
3. Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators. U.S. Environmental Protection Agency, EPA-340/1-85-018, Research Triangle Park, North Carolina, May 1987.

APPENDIX A
Personnel Information

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Personnel Information

1. USAFOEHL Test Team

Maj James Garrison, Chief, Air Quality Function
Capt Paul T. Scott, Consultant, Air Resources Meteorologist
SSgt Shelley Schelin, Bioenvironmental Engineering Technician
SSgt Pietro LaPorta, Bioenvironmental Engineering Technician

USAFOEHL/ECQ
Brooks AFB TX 78235-5501

Phone: AUTOVON 240-2891
Commercial (512) 536-2891

2. Shaw AFB on-site representatives

Capt Michael Rusden, 363 Medical Group (TAC)/SGPB
SSgt Edward Meltz, 363 Medical Group (TAC)/SGPB
SSgt Deral Freysinger, 363 Medical Group (TAC)/SGPB
Karl Chandler, 363 CES/DEEV
Penny Spell, 363 CES/DEEV
Joe Bartlett, 363 CES/DEMMH
TSgt Paul Trageser, 363 CES/DEMMH

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APPENDIX B
Permit Applications

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U.S. DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

BUREAU USE
Permit No.:
ID. No.:
Date:
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Steam Boiler Heating BLDG 403
Unit Description: Heat Plant Boilers #2 & #3

2. Make: Superior Aztec Model: 5-5-402
Capacity: Rated Input 2.76 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel	BTU	% Sulfur	% Ash	Consumption
Impurity	Content	by weight	by weight	@ rated capacity
Natural Gas	1035 BTU/Ft ³	NIL	NIL	2566 Ft ³ /HR
Oil	140,000 BTU/Gal	0.17	NIL	20 GAL/HR

4. Fuel type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Fluidized Bed _____ Other (specify _____)
If other, give description of unit used, give % reinjection: _____

5. Air Pollution Control Device Description: None

6. Stack Data:
Height Above Ground 35 ft Gas Velocity _____ ft/sec
Inside Diameter 1.0 ft Temperature _____ °F
Exit Moisture _____ Location (UTM or Lat-Long) BLDG 402

7. Emissions Data (rated capacity (lb/hr)):

	Before Control	After Control	Method of Estimating Emissions
CO	<u>6.0</u>	<u>0.1</u>	
Particulate Matter	<u>.003</u>	<u>.04</u>	<u>AP 42 Dec 84</u>
SO ₂	<u>.002</u>	<u>.49</u>	<u>AP 42 Dec 84</u>
NO _x	<u>.03</u>	<u>0.1</u>	<u>AP 42 Dec 84</u>
Other	<u>.03</u>	<u>0.1</u>	<u>AP 42 Dec 84</u>

8. Are there any hazardous materials or substances of the S.D. Hazardous Waste Manifest Act in this unit? (specify): _____

9. Are there any hazardous materials or substances of the S.D. Hazardous Waste Manifest Act in this unit? (specify): _____

10. Are there any hazardous materials or substances of the S.D. Hazardous Waste Manifest Act in this unit? (specify): N/A

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

BUREAU USE
Permit No.:
ID. No.:
Date:
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Steam Boiler Heating BLDG 403
Unit Designation: Heat Plant Boiler #5

2. Make: Kewanee Model: H-35-200-G06
Capacity: Rate: Input 8.369 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>Natural Gas</u>	<u>1035 BTU/ft³</u>	<u>NIL</u>	<u>NIL</u>	<u>2086 ft³/hr</u>
<u>7.5 GPM</u>	<u>140,000 BTU/gal</u>	<u>0.17</u>	<u>NIL</u>	<u>50 gal/hr</u>

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 35 ft Gas Velocity _____ ft/sec
Inside Diameter 1.66 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) Bldg 403

7. Emission Data at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.024</u>	<u>.12</u>	<u>AP 42 Dec 84</u>
CO	<u>.005</u>	<u>1.47</u>	<u>AP 42 Dec 84</u>
SO ₂	<u>.10</u>	<u>.30</u>	<u>AP 42 Dec 84</u>
NO _x	<u>.30</u>	<u>1.4</u>	<u>AP 42 Dec 84</u>
Other (specify):			

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or regulation to be burned in this unit? (specify): _____

9. How many hours per year: _____ hours/day _____ days/week _____ weeks/year
_____ Mar.-May _____ June-Aug. _____ Sept.-Nov. _____

10. How will waste material from process and control equipment be disposed of?

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

PART IIA

SHAW AFB
Permit No.:
ID. No.:
Date:
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Hot Water Boiler
Unit Designation: Bldg 922 H/W Boiler

2. Make: A.O. Smith Model: BT 80-916
Capacity: Rated Input 1,7085 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>Natural Gas</u>	<u>1035 BTU/Ft³</u>	<u>NIL</u>	<u>-</u>	<u>1631 Ft³/HR</u>

4. Burner Type (solid fuels only): Pulverized Traveling Grate
 Underfeed Stoker Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter .60 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) 1100 1411

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.005</u>		<u>12 CF Reg 62</u>
SO ₂	<u>.000</u>		<u>12 CF Reg 62</u>
CO	<u>.00</u>		<u>12 CF Reg 62</u>
NO _x	<u>.00</u>		<u>12 CF Reg 62</u>
Other (specify):			

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management and Control Regulations to be burned in this unit? (specify): _____

9. How will the material from pre- and post-control equipment be disposed of? _____

10. How will the material from pre- and post-control equipment be disposed of? _____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

CURRENT USE
Permit No.:
ID. No.:
Date:
Reviewed By:

PART III

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Steam Boiler Heating
Unit Designation: Bldg 922 Boiler for Heat

2. Make: Crane Model: 615-N-51-2 NP
Capacity: Rated Input 1.722 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>Natural Gas</u>	<u>1035 BTU/ft³</u>	<u>N/A</u>	<u>N/A</u>	<u>1664 ft³/hr</u>
<u>#2 Oil</u>	<u>140,000 BTU/gal</u>	<u>N/A</u>	<u>N/A</u>	<u>12.3 gal/hr</u>

4. Burner Type (solid fuels only): Pulverized Traveling Grate
 Underfeed Stoker Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: CDH

6. Stack Data:

Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter .36 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) Bldg 922

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.005</u>	<u>.005</u>	<u>AP 42 Sec 84</u>
SO ₂	<u>.001</u>	<u>.001</u>	<u>AP 42 Sec 84</u>
CO	<u>.133</u>	<u>.133</u>	<u>AP 42 Sec 84</u>
VOC	<u>.001</u>	<u>.001</u>	<u>AP 42 Sec 81</u>
Other (specify):			

8. Are there materials subject to regulation under the S.D. Hazardous Waste Management Act which are to be burned in this unit? (specify): NO

9. How many times per week? _____ days/week _____ weeks/year
What is the operating season? _____ Jan.-Mar. _____ Sept.-Nov. _____

10. How will waste material from process and control equipment be disposed of? _____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

PART IIA

UNCLASSIFIED

Permit No.:

ID. No.:

Date:

Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Hot Water Boiler Heating
Unit Designation: Bldg 1046 Boiler

2. Make: Peerless Model: 0-714-FD-W
Capacity: Rated Input 1.2117 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10⁶ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
Natural Gas	1035 BTU/Ft ³	NIL	NIL	117/Ft ³ /HR
#2 Oil	138,500 BTU/Gal	0.17	NIL	3.55 Gal/Hr

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: NONE

6. Stack Data:
Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter _____ ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) Bldg 1046

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	.002	.017	AP 42 Dec 84
SO ₂	.001	.012	AP 42 Dec 84
CO	.025	.045	AP 42 Dec 84
NO _x	.117	.137	AP 42 Dec 84
Other (specify):			

8. Are any wastes, in subject to provisions of the S.C. Hazardous Waste Management Act or Regulation, to be burned in this unit? (specify): NO

9. Name of person who will be responsible for the operation of the unit: _____
Address: _____
City: _____ State: _____ Zip: _____

10. How will waste material from process and control equipment be disposed of? _____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

SHAW AFB
Permit No.:

ID. No.:

Date:

Reviewed By: _____

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88

Type of Fuel Burning Operation: Hot Water Boiler

Unit Designation: Bldg 1102 H/W Boiler

2. Make: Cleaver-Brooks Model: CB H186-S0

Capacity: Rated Input 1.95 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
#2 Oil	140,000 BTU/Gal	0.17	NIL	14 gal/hr

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate

_____ Underfeed Stoker _____ Other (specify) _____

If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 25 ft Gas Velocity _____ ft/sec

Inside Diameter .62 ft Temperature _____ °F

Est. Moisture _____ % Location (UTM or Lat/Long) Bldg 1102

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.003</u>		<u>10-10-80-84</u>
SO ₂	<u>.012</u>		<u>10-10-80-84</u>
CO	<u>.070</u>		<u>10-10-80-84</u>
NH ₃	<u>.001</u>		<u>10-10-80-84</u>
Other (specify):			

8. Are any materials subject to prohibitions of the S.C. Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): No

9. Normal operating schedule: _____ days per _____ week. Start _____ End _____

10. How will waste material from process and control equipment be disposed of? _____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

PART IIA

BUREAU USE
Permit No.:
ID. No.:
Date:
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Steam Boiler Heating
Unit Designation: Bldg 1130 Boiler

2. Make: Kewanee Model: _____
Capacity: Rated Input 2,532 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>Natural Gas</u>	<u>1035 BTU/Ft³</u>	<u>NIL</u>	<u>NIL</u>	<u>2476 Ft³/HR</u>
<u>72 OIL</u>	<u>140,000 BTU/Gal</u>	<u>1.1</u>	<u>NIL</u>	<u>13.3 Gal/HR</u>

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: None

6. Stack Data:
Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter .66 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long): Bldg 1130

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.007</u>	<u>.000</u>	<u>16 12 Dec 81</u>
SO ₂	<u>.004</u>	<u>.0</u>	<u>12 11 Dec 81</u>
CO	<u>.05</u>	<u>.00</u>	<u>12 11 Dec 81</u>
NO _x	<u>.15</u>	<u>.0</u>	<u>12 11 Dec 81</u>
Other (specify):			

8. Are any materials subject to provisions of the U.S. Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): _____

9. Normal operating schedule: _____ how often _____ days week _____ month year
_____ and _____ at _____ _____ _____ _____ _____

10. How will waste material from process and control equipment be disposed of?
11/1

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

PART IIA

BUREAU USE
Permit No.:
ID. No.:
Date:
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88

2. Type of Fuel Burning Operation: Steam Boiler Heating

Unit Designation: Bldg 1200 Boilers #1 & #2

3. Make: Kewanee

Model: _____

Capacity: Rated Input 2.50 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
Natural Gas	1035 BTU/ft ³	NIL	NIL	2415 ft ³ /hr
Oil	140,000 BTU/gal	0.17	NIL	18 gal/hr

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: None

6. Stack Data:

Height Above Ground 30 ft Gas Velocity _____ ft/sec

Inside Diameter 1.5 ft Temperature _____ °F

Est. Moisture _____ % Location (UTM or Lat/Long) Bldg 1200

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	0.07	0.02	AP 42 Dec 84
SO ₂	0.01	0.01	AP 42 Dec 84
CO	0.04	0.04	AP 42 Dec 84
NO _x	0.01	0.01	AP 42 Dec 84
Other (specify):			

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or its amendments to be burned in this unit? (specify): NO

9. Normal operating schedule: _____ days/week _____ weeks/year

_____ days/week _____ weeks/year

10. How will waste material from process and control equipment be disposed of?

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

BUREAU USE
Permit No.:
ID. No.:
Date:
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Steam Boiler Heating
Unit Designation: Bldg 1200 Boiler #3

2. Make: Kewanee Model: _____
Capacity: Rated Input 2.05 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
Natural Gas	1035 BTU/Ft ³	NIL	NIL	1931 Fm ³ /hr
AC Fuel	140,000 BTU/Gal			12.5 Gal/hr

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify): _____
If flyash reinjection is to be used, give % reinjection: _____

5. Air Pollution Control Device Description: _____

6. Stack Data:

Height Above Ground 30 ft Gas Velocity _____ ft/sec
Inside Diameter 1.0 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) 7100 1100

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	0.08 0.09		12 12 12 12
SO ₂	0.08 0.08		12 12 12 12
CO	0.04 0.04		12 12 12 12
NO _x			12 12 12 12
Other (specify):			

8. Are any materials subject to provisions of the Solid Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): _____

9. Will particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, or any other pollutant be emitted from this unit? (specify): _____

10. Will waste material from process and control equipment be disposed of? _____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

BUREAU NO.
PERMIT NO. 1

ID. No.:
Date:
Reviewed By:

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 68
Type of Fuel Burning Operation: Steam Boiler Heating
Unit Designation: Bldg 1206 Heating Boiler

2. Make: York Shipley Model: SPHW25-2-12915
Capacity: Rated Input 1.05 x 10⁶ BTU/hr - Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>#2 Oil</u>	<u>140,000 BTU/Ft³</u>	<u>0.17</u>	<u>NIL</u>	<u>7.5 Gal/hr</u>

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify) _____
If Flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: NONE

6. Stack Data:
Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter .60 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) 21N 100E

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.145</u>		<u>AP-42 Table 11</u>
SO ₂	<u>.131</u>		<u>AP-42 Table 11</u>
CO	<u>.110</u>		<u>AP-42 Table 11</u>
NO _x	<u>.110</u>		<u>AP-42 Table 11</u>
Other (specify):			

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or Regulations to be burned in this unit? (specify): _____

9. Normal operating hours: _____ days/week _____ hrs/day
_____ days/week _____ hrs/day

10. How will waste material from process and control equipment be disposed of?
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SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

PART IIA

COPIES OF THIS
PERMIT NO.:
ID. No.:
Date:
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88
Type of Fuel Burning Operation: Hot Water Boiler Heating
Unit Designation: Blldg 1402 Boiler #1

2. Make: Superior - Pawnee Model: C2-20-20A
Capacity: Rated Input 1.512 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>Natural Gas</u>	<u>1035 BTU/Ft³</u>	<u>NIL</u>	<u>NIL</u>	<u>1451 Ft³/hr</u>
<u>Oil</u>	<u>140,000 BTU/gal</u>	<u>NIL</u>	<u>NIL</u>	<u>0.0 gal/hr</u>

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify): _____
If flyash reinjection is to be used, give % reinjection: _____

5. Air Pollution Control Device Description: _____

6. Stack Data:
Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter .36 ft Temperature _____ °F
Est. Moisture _____ % Location (City or Lat/Long) Blldg 1402

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>0.1</u>		<u>10 ft x 12 ft x 12 ft</u>
SO ₂	<u>0.003</u>		<u>10 ft x 12 ft x 12 ft</u>
CO	<u>0.001</u>		<u>10 ft x 12 ft x 12 ft</u>
NH ₃			
Other (specify):			

8. Are any other air quality standards or regulations applicable to this unit? (specify): _____

9. Are there any other air quality standards or regulations applicable to this unit? (specify): _____

10. How will waste material from this unit be disposed of? _____

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

PART IIA

SUPPLEMENTAL
Permit No.:
ID. No.:
Date:
Reviewed By:

1. Company Name: SHAW AFB Date: 27 Apr 88
Type of Fuel Burning Operation: Hot Water Boiler Heating
Unit Designation: Bldg 1422 Boiler

2. Make: Spencer Model: 4F-450-50W
Capacity: Rated Input 3.015 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
<u>2 Oil</u>	<u>140,000 BTU/Gal</u>	<u>0.1</u>	<u>NIL</u>	<u>21.5 Gal/hr</u>

4. Burner Type (solid fuels only): Pulverized Traveling Grate
 Underfeed Stoker Other (specify) _____
If oil or gas reinjection is to be used, give % reinjection: _____

5. Air Pollution Control Device Description:

6. Stack Data:

Height Above Ground 25 ft Gas Velocity _____ ft/sec
Inside Diameter .66 ft Temperature _____ °F
Est. Moisture .3 Location (UTM or Lat/Long)

7. Emission Rate at rated capacity (lb/hr):

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	<u>.023</u>		
SO ₂	<u>.53</u>		
CO	<u>.10</u>		
NO _x	<u>.1</u>		
Other (specify):			

8. Is this unit subject to permit requirements for the burning of hazardous waste or materials to be burned in this unit?

9. Is this unit subject to permit requirements for the burning of hazardous waste or materials to be burned in this unit?

10. Is this unit subject to permit requirements for the burning of hazardous waste or materials to be burned in this unit?

SUPPLEMENT
PERMIT NO.:

ID. No.:
Date:
Reviewed By:

1. Company Name: SHAW AFB Date: 20 Apr 88
 Type of Fuel Burning Operation: Hot Water Boiler Heating
 Unit Designation: 31dg 1604 Boiler

3. Make: Burnham Model: R8-1-60-25
Capacity: Rated Input 1.541 x 10⁶ BTU/hr = Rated Output _____ x 10⁶ BTU/hr
x 10⁶ lbs of steam/hr @ _____ °F and _____ PSIG

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash - by weight	Consumption @ rated capacity
#2 Oil	140,000 BTU/Gal	0.17	NIL	11 Gal/HR

4. Fuel Type (solid fuels only): Pulverized Traveling Grate
 Underfeed Stoker Other (specify)
If slash collection is to be used, give % replacement.

4. Air Pollution Control Device Description: None

6. Stack Data:
Height Above Ground 25 ft Gas Velocity ft/sec
Inside Diameter .55 ft Temperature °F
Exh. Moisture % Location (UTM or Lat/Long) 3140 1601

Pollutant	Before	After	Method of Estimating Emissions
	Control Device	Control Device	
Particulate Matter	0.0	0.0	AP 11, 100, 10
SO ₂	0.07	0.07	AP 12, 200, 1
NO _x	1.5	1.5	AP 12, 200, 1
CO	0.0	0.0	AP 12, 200, 1
Other (unspecified)	0.0	0.0	AP 12, 200, 1

1. The following information is being furnished to you by the U.S. District Court for the District of Columbia:

Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains. The concentration of the *Agrobacterium* suspension was 10⁶ cells/ml (A), 10⁷ cells/ml (B), 10⁸ cells/ml (C), and 10⁹ cells/ml (D). The concentration of the *Agrobacterium* suspension was 10⁶ cells/ml (A), 10⁷ cells/ml (B), 10⁸ cells/ml (C), and 10⁹ cells/ml (D). The concentration of the *Agrobacterium* suspension was 10⁶ cells/ml (A), 10⁷ cells/ml (B), 10⁸ cells/ml (C), and 10⁹ cells/ml (D). The concentration of the *Agrobacterium* suspension was 10⁶ cells/ml (A), 10⁷ cells/ml (B), 10⁸ cells/ml (C), and 10⁹ cells/ml (D).

1. The following information is provided for control equipment for 11/1/1971:

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
BUREAU OF AIR QUALITY CONTROL
FUEL BURNING PERMIT APPLICATION

BUREAU USE
Permit No. _____
ID. No.: _____
Date: _____
Reviewed By: _____

PART IIA

1. Company Name: SHAW AFB Date: 20 Apr 88

Type of Fuel Burning Operation: Steam Boiler Heating

Unit Designation: Bldg 1614 Boilers (2)

2. Make: Kewanee Model: M335-KX
Capacity: Rated Input 3.35 x 10⁶ BTU/hr Rated Output _____ x 10⁶ BTU/hr
_____ x 10³ lbs of steam/hr @ _____ °F and _____ PSIG

3. Fuel Data (indicate all units):

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity
Natural Gas	1035 BTU/Ft ³	NIL	NIL	3237 Ft ³ /HR
_____	140,000 BTU/Gal	0.17	NIL	24 Gal/HR
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

4. Burner Type (solid fuels only): _____ Pulverized _____ Traveling Grate
_____ Underfeed Stoker _____ Other (specify) _____
If flyash reinjection is to be used, give % reinjection. _____

5. Air Pollution Control Device Description: None

6. Stack Data:
Height Above Ground 30 ft Gas Velocity _____ ft/sec
Inside Diameter 1.0 ft Temperature _____ °F
Est. Moisture _____ % Location (UTM or Lat/Long) Bldg 1614

7. Emission Rate at rated capacity (lb/hr):

	Before Control Device	After Control Device	Method of Estimating Emissions
<u>Particulate Matter</u>	<u>.0097</u>	<u>.043</u>	<u>AP 42 Dec 84</u>
CO ₂	<u>.33</u>	<u>.33</u>	<u>AP 42 Dec 84</u>
CO	<u>.05</u>	<u>.12</u>	<u>AP 42 Dec 84</u>
SO ₂	<u>.32</u>	<u>.32</u>	<u>AP 42 Dec 84</u>
Other (specify):	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

8. Are any materials subject to provisions of the S.C. Hazardous Waste Management Act or Regulation, to be burned in this unit? (specify): _____

9. Fuel burning: _____ hours per _____ days per _____ weeks per _____ year
Seasonal Variation: Dec.-Feb. _____ % Mar.-May _____ % June-Aug. _____ % Sept.-Nov. _____ %

10. How will waste material from process and control equipment be disposed of?

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APPENDIX C
State Regulations

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SOUTH CAROLINA AIR POLLUTION CONTROL REGULATIONS

(South Carolina Department of Health and Environmental Control; Regulation 61-62 — Air Pollution Control Regulations and Standards; Adopted July 26, 1972; As amended through May 28, 1981; December 16, 1982; April 22, 1983; June 24, 1983; May 24, 1985; May 23, 1986)

CONTENTS

Regulation No. 62.1 — Air Pollution Control
 Regulation No. 62.2 — Prohibition of Open Burning
 Regulation No. 62.3 — Air Pollution Episodes
 Regulation No. 62.4 — Hazardous Air Pollution Conditions
 Regulation No. 62.5 — Air Pollution Control Standards
 [See page 506.1001]
 Regulation No. 62.6 — Control of Fugitive Particulate Matter
 Regulation No. 62.7 — Good Engineering Practice Stack Height

REGULATION NO. 62.1 AIR POLLUTION CONTROL

Section 1 — Definitions

The following words and phrases when used in the Regulations and Standards shall for the purpose of these regulations have the meanings respectively ascribed to them in this section, unless a different meaning is clearly indicated. This section augments Section 1 of the South Carolina Pollution Control Act.

1. *Acid Mist* — Mist or droplets of sulfuric or other strong acids. Sulfuric acid mist includes sulfur trioxide (SO₃) and sulfuric acid vapor as well as liquid mist.
2. *Add* — Additions to a process which will increase size, scope or emissions from such process.
3. *Alter* — Alter means modification or change in a process or processes which would affect emissions to the atmosphere.
4. *Ambient Air Quality Standards* — That standard for the quality of ambient air at or beyond a property line on which a source of pollution is emitting.

5. *Application* — Means a form provided by the Department which is prescribed to provide the information required to grant approval to construct and operate a source or an incinerator; or to report an existing incinerator.

6. *Board* — Board means Board of Health and Environmental Control.

7. *Commissioner* — Commissioner means the Commissioner of the Department of Health and Environmental Control.

8. *Department* — Department means the Department of Health and Environmental Control.

9. *Emission Data* — The definition contained in 40 CFR 2.301(a)(2), July 1, 1982, is incorporated by reference.

10. *Emission Limitation (and emission standard)* — A requirement established by the State or by the Administrator of the Environmental Protection Agency which limits the quantity, rate, or concentration of emissions of air pollutants on a continuous basis, including any requirements which limit the level of opacity, prescribe equipment, set fuel specifications, or prescribe operation or maintenance procedures for a source to assure continuous emission reduction.

11. *Fuel Burning Operation* — Use of furnace, boiler, device or mechanism used principally but not exclusively, to burn any fuel for the purpose of indirect heating in which the material being heated is not contacted by and adds no substance to the products of combustion.

12. *Fugitive Dust* — A type of particulate emission that becomes airborne by forces of wind, man's activity or both, including but not limited to, construction sites, tilled land, materials storage piles, and materials handling.

13. *Fugitive Emissions* — Air contaminants which escape to the air not through an exhaust system, but

through other means, including but not limited to, windows, vents, doors, ill-fitting closures or poorly maintained equipment

14. *Garbage* — Animal and vegetable waste resulting from the handling, preparation, cooking and serving of foods.

15. *Hazardous Air Pollutant* — A pollutant which is the subject of National Emission Standards for Hazardous Air Pollutants promulgated by the United States Environmental Protection Agency by publication in the Federal Register

16. *Incinerator* — An engineered apparatus and all appurtenances thereto, designed to reduce combustible solid, semi-solid, liquid, or gaseous waste by high temperature burning

17. *Kraft pulp mill* — Any stationary source which produces pulp from wood by cooking (digesting) wood chips in a water solution of sodium hydroxide and sodium sulfide (white liquor) at a high temperature and pressure. Regeneration of the cooking chemicals through a recovery process is also considered part of the kraft pulp mill

18. *Major Plant* — Except as otherwise provided, this term refers to any plant which directly emits, or has the potential to emit, one hundred tons per year or more of any regulated air pollutant.

19. *Mass Emission Rate* — The weight discharged per unit of time.

20. *Opacity* — The degree to which emissions reduce the transmission of light and obscure the view of an object in the background.

21. *Open Burning* — Any fire or smoke-producing process which is not conducted in any boiler plant, furnace, high-temperature processing unit, incinerator or flare, or in any other such equipment primarily designed for the combustion of fuel or waste material

22. *Particulate Matter* — Any material, except uncombined water, that exists in a finely divided form as a liquid or solid at standard conditions.

23. *Plant* — Except as otherwise provided, any stationary source or combination of stationary sources, which is located on one or more contiguous or adjacent properties and owned or operated by the same person(s) under common control

24. *Potential to Emit* — The maximum capacity of a plant to emit a regulated pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the plant to emit a regulated pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed,

shall be treated as part of its design only if the limitation or the effect it would have on emissions is federally enforceable. Secondary emissions do not count in determining the potential to emit of a plant.

25. *Process Industry* — Any source engaged in the manufacture, processing, handling, treatment, forming, storing or any other action upon materials except fuel-burning operations

26. *Process Weight* — The total weight of all materials introduced into a source operation, including air and water where these materials become an integral part of the product, and solids used as fuels but excluding liquids and gases used solely as fuels.

27. *Process Weight Rate* — A rate established as follows:

(a) For continuous or long-run steady-state source operations, the total process weight for the entire period of continuous operation or for a typical portion thereof, divided by the number of hours of such period or portion thereof.

(b) For cyclical or batch unit operations, or unit processes, the total process weight for a period that covers a complete operation or an integral number of cycles, divided by the hours of actual process operation during such a period

Where the nature of any process or operation or the design of an equipment is such as to permit more than one interpretation of this definition, the interpretation that results in the minimum value for allowable emission shall apply.

28. *Refuse* — Garbage, rubbish and/or trade waste.

29. *Rubbish* — Solid wastes from residences and dwellings, commercial establishments, and institutions.

30. *Salvage Operations* — Any operation of a business, trade, or industry engaged in whole or in part in salvaging or reclaiming any product or material, including, but not limited to, metals, chemicals, shipping containers, drums or automobiles

31. *Secondary Emissions* — Emissions which would occur as a result of the construction or operation of a major plant or major modification, but do not come from the major plant or major modification itself. Secondary emissions must be specific, well defined, quantifiable, and must impact the same general area as the plant or modification which causes the secondary emissions. Secondary emissions may include, but are not limited to:

(a) emissions from ships or trains moving to or from the new or modified plant

(b) emissions from any offsite support facility operation which would not otherwise be constructed or increase its emissions as a result of the construction or operation of the major plant or major modification

32. *Smoke* — Small gas-borne and airborne particles arising from a process of combustion in sufficient number to be observable by a person of normal vision under normal conditions.

33. *Solid Fuel* — A fuel which is fired as a solid such as coal, lignite and wood.

34. *Stack* — Any flue, conduit, duct, chimney, or opening arranged to conduct an effluent into the open air.

35. *Stack Height* — The vertical distance measured in feet between the point of discharge from the stack or chimney into the outdoor atmosphere and the elevation of the land thereunder.

36. *Standard Conditions* — 760 millimeters of mercury at 25 degrees Centigrade.

37. *Stationary Source* — Any building, structure, installation or process which emits or may emit an air pollutant subject to regulation by any national or state standard. Use of the term "source" is to be construed to mean "stationary source."

38. "Total reduced sulfur (TRS)" means the sum of the sulfur compounds hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, that are released during the kraft pulping operation and measured by Federal Reference Method 16.

39. *Trade Waste* — All solid, liquid, or gaseous material or rubbish resulting from construction, building operations, or the prosecution of any business, trade or industry including, but not limited to, plastic products, cartons, paint, grease, oil and other petroleum products, chemicals and cinders.

40. *Volatile Organic Compound (VOC)* — any chemical compound containing carbon which has a vapor pressure greater than one-tenth (0.1) mmHg at standard conditions excluding:

1. methane
2. ethane
3. 1,1,1-trichloroethane (methyl chloroform)
4. benzene
5. acetonitrile
6. chloroform
7. carbon tetrachloride
8. ethylene dichloride
9. ethylene dibromide
10. methylene chloride
11. trichlorofluoromethane (CFC-11)
12. dichlorodifluoromethane (CFC-12)
13. chlorodifluoromethane (CFC-22)
14. trifluoromethane (FC-23)
15. trichlorotrifluoroethane (CFC-113)
16. dichlorotetrafluoroethane (CFC-114)
17. chloropentafluoroethane (CFC-15)
18. carbon monoxide
19. carbon dioxide

20. carbonic acid

21. ammonium carbonate

22. metallic carbides or carbonates

SECTION II - PERMIT REQUIREMENTS

A. Construction Permit

1. Applicability

Any person who plans to construct, alter or add to a source of air contaminants, including installation of any device for the control of air contaminant discharges, shall first obtain a construction permit from the Department. The Department may grant permission to proceed with minor alterations or additions without issuance of a permit when the Department determines that the alteration or addition will not increase the quantity and will not alter the character of the source's emissions.

2. Permit Application

Construction permit applications shall be reviewed and signed by a professional engineer registered to practice in the State of South Carolina and shall provide, as a minimum, the following information:

- a. The name and location of the plant and its planned operating schedules;
- b. Sufficient description including physical and chemical properties of materials and processes necessary for the Department to determine actual and potential emissions;
- c. Identification of all emission points;
- d. A description, including physical and chemical properties of all emissions.
- e. A complete description including engineering design and operating characteristics of any air pollution control device or system that is to be installed; and
- f. Source information and calculations to demonstrate compliance with "Good Engineering Practice Stack Height" rules; and
- g. Other information as may be necessary for proper evaluation of the proposed source as determined by the Department.

Package-type incinerators of 750 pounds/hr rated capacity or smaller which burn types 0 and 1 wastes as defined by the Incinerator Institute of America and package-type boilers of 100×10^6 BTU/hr input capacity or smaller which burn natural gas or oil as fuel are exempt from the requirement that the construction permit applications be prepared and submitted by a registered professional engineer provided the proposed unit is identical to a proto-type model which has been previously designed or otherwise certified by a professional engineer.

B. Operating Permit

1. Original

A written request to obtain an operating permit shall be submitted to the Department no later than fifteen (15) days prior to placing any new, increased or altered source into operation.

2. Renewal

Prior to the expiration date of a source's operating permit, the source will be inspected by the Department in order to decide whether to renew the permit. The past record of compliance and future probability of compliance will be given appropriate weight in making the decision regarding renewal.

Any special condition in a permit should be verified during the inspection and specifically mentioned in the report. Any additional provisions that the inspector believes warrants inclusion in the renewed permit are to be clearly and concisely stated in the inspection report.

C. Standard Permit Conditions

All permits shall contain, in addition to such special conditions as the Department finds appropriate, the following standard conditions:

1. No applicable law, regulation or standard will be contravened.

2. All official correspondence, plans, permit applications and written statements are an integral part of the permit.

3. For sources not required to have continuous emission monitors, any malfunction of air pollution control equipment or system, process upset or other equipment failure which results in discharges of air contaminants lasting for one hour or more and which are greater than those discharges described for normal operation in the permit application shall be reported to the Department within twenty-four hours after the beginning of the occurrence and a written report submitted to the Department within thirty (30) days. The written report shall include as a minimum, the following:

a. The identity of the stack and/or emission point where the excess emissions occurred.

b. The magnitude of the excess emissions expressed in the units of the applicable emission limitation and the operating data and calculations used in determining the excess emissions.

c. The time and duration of the excess emissions.

d. The identity of the equipment causing the excess emissions.

e. The nature and cause of such excess emissions.

f. The steps taken to remedy the malfunction and the steps taken or planned to prevent the recurrence of such malfunction.

g. The steps taken to limit the excess emissions.

h. Documentation that the air pollution control equipment, process equipment, or processes were at all times maintained and operated, to the maximum extent practi-

cable, in a manner consistent with good practice for minimizing emissions.

4. Sources required to have continuous emission monitors will make quarterly reports as specified in applicable parts of the Regulations.

D. Exceptions

1. Upon request, the Department may alter operating permits, compliance schedules, or other restrictions on operation of a source provided that resulting ambient air concentration levels will not exceed any national or state ambient air quality standard. Factors to be considered by the Department may include, but are not limited to, technology, economics, national energy policy, and existing air quality. The request by the source must also show the following:

a. Good faith efforts have been made to comply with the state requirements.

b. The source is unable to comply with the state requirements because the necessary technology or other alternative methods of control are not reasonably available, or have not been available for a sufficient period of time.

c. Any available operating procedures, or control measures, reducing the impact of the source on ambient air concentrations, have been implemented.

d. The request is submitted in a timely manner.

2. The provisions of this paragraph shall not apply to mass emission limits which are imposed upon any source by the following requirements:

a. Federal New Source Performance Standards;

b. National Emission Standards for Hazardous Air Pollutants;

c. Federal or State Prevention of Significant Deterioration Regulations; or,

d. Non-attainment requirements.

3. Where a permanent increase in the visible emission limitation for a source is requested, the source must demonstrate that it will remain in compliance with the applicable particular emission standard.

4. Any alternative compliance schedule shall provide for compliance with the applicable regulations as expeditiously as practicable, based on a plan submitted with the request for the alternative compliance schedule.

5. Any request under this section will be subjected to public notice and opportunity for a public hearing. Upon approval by the Board, the recommendations of this Department shall be sent to the Administrator of the Environmental Protection Agency, or his designated representative, for approval or disapproval.

6. Where alternative compliance schedule provisions are contained elsewhere in the air pollution control regulations, those provisions shall supersede the requirements in this section.

E. Transfer of Ownership/Operation

Whenever the ownership/operation of a source has been transferred, the Bureau shall be notified by the new owner/operator within thirty (30) days of the transaction. A transfer of the operation or construction permit will be effective upon written approval by the Department.

F. Exemptions

1. No permits shall be required for the following sources constructed prior to February 11, 1971:

- a. Natural gas boilers.
- b. Oil-fired boilers of 50×10^6 BTU/HR rated input capacity or smaller.
- c. Coal-fired boilers of 20×10^6 BTU/HR rated input capacity or smaller.

2. No permits shall be required for the following sources:

- a. Boilers and space heaters of less than 1.5×10^6 BTU/HR rated input capacity.
- b. Comfort air-conditioning or ventilation systems.
- c. Motor vehicles.
- d. Laboratory hoods.
- e. Emergency power generators of less than 150 KW rated capacity.

f. Sources emitting only steam, air, nitrogen, oxygen, carbon dioxide, or any physical combination of these.

g. Sources with an uncontrolled particulate emission rate of less than 1 lb/hr and/or uncontrolled VOC emission rate of less than 1000 lbs/mo. may not require permits. However, source information needs to be submitted to the Department and a determination on the need for permits will be made. This determination will take into consideration, but will not be limited to, the nature and amount of the pollutants, location, proximity to residences and commercial establishments, etc.

h. Sources whose only emissions are fugitive must submit source information, and the need for permit(s) will be made by the Department on a case by case basis. This determination will take into consideration, but will not be limited to, the nature and amount of the pollutants, location, proximity to residences and commercial establishments, etc.

SECTION III — EMISSIONS INVENTORY

Emissions inventory is a study or compilation of pollutant emissions. Emissions inventories are designed to locate air pollution sources, to define the type and size of sources, to define the type and amount of emissions from each source, to determine pollutant frequency and duration, to determine the relative contributions to air pollution problems of classes of sources and of individual sources and to determine the adequacy of regulations and standards.

The emissions inventory for all major plants will be reviewed annually. Information required for this review will include, but is not limited to, the following:

- A. Information on fuel burning equipment.
- B. Types and quantities of fuel used;
- C. Fuel analysis;
- D. Exhaust parameters;
- E. Raw process materials and quantities used.
- G. Design and normal process rates;
- H. Hours of operation;
- I. Significant emission generating points or processes.
- J. Any desired information listed in 40 CFR 51, Appendix E (July 1, 1982).

Every even calendar year a new updated emissions inventory will be completed by the plant. All applicable information will be recorded on the current form for reporting emission data.

In the intervening calendar years, any change in emission data will be recorded on the annual compliance inspection report.

The above requirements notwithstanding, an emissions inventory may be required at any time in order to determine the compliance status of any plant.

REGULATION NO. 62.2**PROHIBITION OF OPEN BURNING**

Open burning is prohibited except as provided below:

A. Open burning of leaves, tree branches or yard trimmings originating on the premises of private residences and burned on those premises.

B. Open burning in connection with the preparation of food for immediate consumption.

C. Campfires and fires used solely for recreational purposes, ceremonial occasions, or human warmth.

D. Fires purposely set to forest lands for specific forest management purposes in accordance with practices acceptable to the Department and as administered by the South Carolina Forestry Commission. Such management practices shall include:

1. Prescribed burning under existing standards for various management objectives; and

2. Site preparation burning for purposes of clearing an area for regeneration.

E. Fires purposely set for agricultural control of diseases, weeds, pests and other specific agricultural purposes in accordance with practices acceptable to the Department of Health and Environmental Control.

F. Open burning of trees, brush, grass and other vegetable matter for game management purposes in accordance with practices acceptable to the Department of Health and Environmental Control.

SOUTH CAROLINA AMBIENT AIR QUALITY STANDARDS

(South Carolina Department of Health and Environmental Control; Regulation 61-62.5 — Air Pollution Control Standards; As last amended April 25, 1984; May 24, 1985; January 23, 1986)

CONTENTS

Standard No. 1 — Emissions from Fuel Burning Operations
Standard No. 2 — Ambient Air Quality Standards
Standard No. 3 — Emissions from Incinerators
Standard No. 4 — Emissions from Process Industries
Standard No. 5 — Volatile Organic Compounds

REGULATION NO. 62.5 AIR POLLUTION CONTROL STANDARDS

STANDARD NO. 1 EMISSIONS FROM FUEL BURNING OPERATIONS

SECTION I — VISIBLE EMISSIONS

A. Existing Sources

No one shall discharge to the ambient air from any existing source constructed prior to February 11, 1971, smoke which exceeds an opacity of forty (40) percent. For a total of six (6) minutes in one hour or twenty-four (24) minutes in a twenty-four (24) hour period, forty (40) percent opacity

may be exceeded for soot blowing; but shall in no case exceed an opacity of sixty (60) percent.

B. New Sources

No one shall discharge to the ambient air from any source constructed on or after February 11, 1971, smoke which exceeds an opacity of twenty (20) percent. For a total of six (6) minutes in one hour or twenty-four (24) minutes in a twenty-four (24) hour period, twenty (20) percent opacity may be exceeded for soot blowing; but shall in no case exceed an opacity of sixty (60) percent.

C. Special Provisions

The opacity standards set forth above do not apply during startup or shutdown. Owners and operators shall, to the extent practicable, maintain and operate any source including associated air pollution control equipment in a manner consistent with good air pollution control practices for minimizing emissions. In addition, the owner or operator shall maintain a log of the time, magnitude, duration and any other pertinent information to determine periods of startup and shutdown and make available to the Department upon request.

SECTION II — PARTICULATE EMISSIONS

A. Allowable Discharge

The allowable discharge of particulate matter resulting from fuel burning operations shall be limited to the values obtained by use of Figure 1 and/or Part B. (For the purpose of determining heat input, total equipment capacity refers to total equipment capacity discharging through each stack. If a boiler has more than one (1) stack the total rated capacity will be the boiler rated capacity discharging to these stacks). Interpolation of Figure 1 for fuel burning operations of 1300 million BTU per hour heat input and larger shall be accomplished by use of the equation:

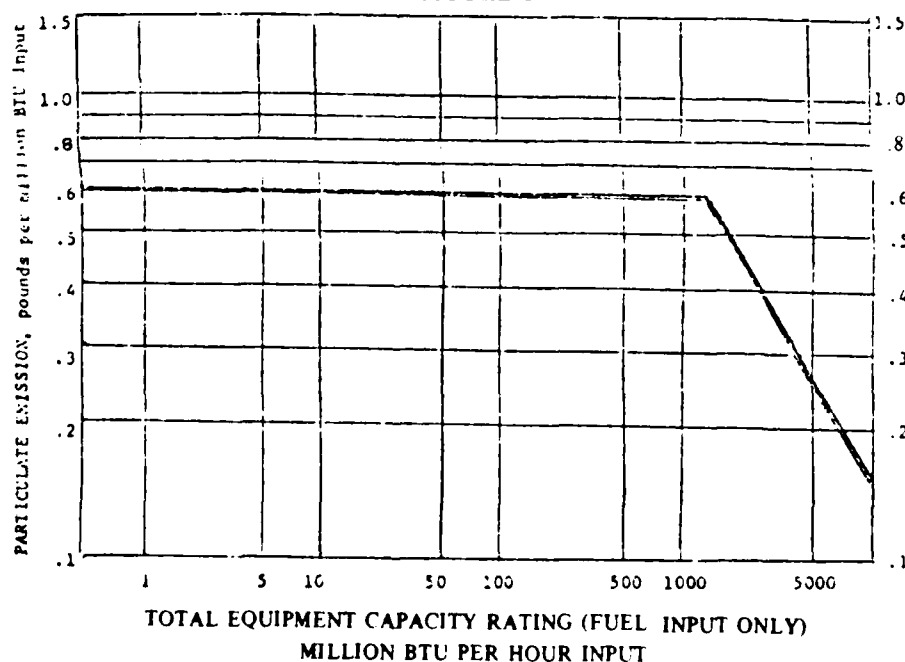
$$E = 57.84 P^{.667}$$

where E = the allowable emission rate in pounds per million BTU heat input, and P = million BTU heat input per hour

B. Special Provisions

All fuel burning operations of 10 million BTU per hour heat input and smaller constructed prior to February 11, 1971 shall be allowed 0.8 pounds per million BTU input.

FIGURE 1



SECTION III — SULFUR DIOXIDE EMISSIONS

A. General

The maximum allowable discharge of sulfur dioxide (SO₂) from fuel burning operations shall be in accordance with a system of priorities as specified hereinafter in paragraph B. The classifications shall be delineated on a county basis. The maximum allowable discharge for the various classes is specified in paragraph C of this Section.

B. Classifications

1. The class into which a given county falls has been determined by mathematical atmospheric diffusion models and other methods which evaluate those factors which necessitate limits on sulfur dioxide emissions. These factors included but were not limited to: (1) total sulfur dioxide emissions, (2) spatial distribution of sulfur dioxide sources, (3) effects of single, large sources, (4) existing, measured air quality, (5) topographical features of the county, (6) contributions to background levels due to sources outside the county being considered, (7) population density.

2. The assigned classifications will be reviewed periodically at intervals not to exceed three years, and changes will be made as required. When a county is assigned to a more restrictive class, individual compliance schedules will be established in such a way that reasonable time will be allowed for the source to make necessary changes in equipment and/or fuel contracts.

3. The following classifications are assigned:

Class I — Charleston County

Class II — Aiken County — Anderson County

Class III — All others

C. Allowable Discharges

Sulfur dioxide emissions from fuel burning sources located in various counties will not exceed the following limits:

1. Counties in Class I

Rated Source Size	Maximum Allowable Emissions (lb SO ₂ /million BTU Input)
Up to and including 10 million BTU/hr	3.5
Greater than 10 million BTU/hr	2.3

2. Counties in Class II

Rated Source Size	Maximum Allowable Emissions (lb SO ₂ /million BTU Input)
Up to and including 10 million BTU/hr	2.3
Greater than 10 million BTU/hr	2.3

3. Counties in Class III

Rated Source Size	Maximum Allowable Emissions (lb SO ₂ /million BTU Input)
All	3.5

D. Special Provisions

If it can be demonstrated to the satisfaction of the Board that ambient air standards will not be contravened by a source, alone or in combination with other sources, a greater allowance for sulfur dioxide discharges may be made on a case by case basis.

SECTION IV — OPACITY MONITORING REQUIREMENTS

A. Applicable Sources

1. Fossil Fuel Fired Boilers. The owner or operator of any fossil fuel-fired steam generator of more than 250 million BTU per hour heat input capacity shall install, calibrate, operate, and maintain no later than June 14, 1978, continuous monitoring system(s) for the measurement of opacity which meets the performance specifications of Paragraph D of this Section except where:

a. Gaseous fuel is the only fuel burned,

b. Oil or a mixture of gas and oil are the only fuels burned and the steam generator is able to comply with the provisions of Sections I and II of this Standard without utilization of particulate matter collection equipment, and where the steam generator has never been found, through any administrative or judicial proceedings, to be in violation of Section I of this Standard.

c. The steam generator operates with an annual average capacity factor of 30 percent or less, as reported to the Federal Power Commission for calendar year 1974 or otherwise adequately demonstrated to the Department; and has not subsequently increased this factor to more than 30 percent.

2. Woodwaste Boilers. The owner or operator of any woodwaste boiler, not equipped with a wet scrubber, will be required to install, calibrate, operate and maintain continuous monitoring system(s) approved by this Department for the measurement of opacity, if it meets one or more of the following criteria:

a. Any woodwaste boiler of at least 60,000 lb steam/hr rated output.

b. Any woodwaste boiler, regardless of size, that has been operating in non-com-

pliance with any applicable state air pollution control regulations and standards.

If a boiler is fired on more than one fuel, the total capacity will determine the applicability of above requirements.

B. Continuous Opacity Monitor Reporting Requirements

The owner or operator of any fossil fuel-fired steam generator subject to the provisions of Paragraph A of this Section shall submit a written continuous Opacity Monitor report to the Department at least quarterly, or more often if requested. All quarterly reports must be postmarked by the 30th day following the end of each calendar quarter.

The report shall include the following minimum information:

a. All integrated six minute opacity measurements for periods during which the applicable provisions of Section I have been exceeded, together with their nature and cause.

b. For periods of monitoring system malfunction:

(i) The date and time identifying each period during which the monitoring system was inoperative, except for zero and span checks.

(ii) The nature of monitoring system repairs or adjustments.

(iii) Proof of opacity monitoring system performance may be required by the Department whenever repairs or adjustments have been made.

c. boiler system repairs or adjustments made to correct violations of the provisions of Section I.

If no reportable incidents occur during a quarter, a report is also required indicating as such.

2. Alternative data reporting procedures may be allowed if the owner or operator shows, to the satisfaction of the Department, that these procedures are at least as accurate as those described.

3. The owner or operator shall maintain a file of all information contained in the quarterly reports, calibration data for the opacity monitoring system(s), relevant records of adjustments and maintenance performed on such system(s), and all other data generated by the continuous opacity monitoring system(s), for a minimum of two years from the date of submission of such reports or collection of such data.

The information contained on file must be made available for review by Department personnel upon request.

C. Exemption from Reporting Requirements

A temporary exemption from the opacity monitoring and reporting requirements of this Section may be granted during any period of monitoring system(s) malfunction, provided the owner or operator shows, to the satisfaction of the Department, that the malfunction was unavoidable and is being repaired as expeditiously as possible.

D. Equipment Performance Specifications

The continuous opacity monitoring system(s) required by Paragraph A.1 of this Section for fossil fuel fired steam generators shall conform with the performance specifications set forth in 40 CFR, part 60, Appendix B, Performance Specification 1 which is incorporated by reference as a part of this Standard except that where the term "Administrator" is used the term "Department" shall be substituted. In addition, the opacity monitoring system(s) shall complete a minimum of one cycle of operation for each successive 10-second period; be installed such that representative measurements of opacity from the affected steam generator are obtained; and have an instrument span of approximately 80 percent opacity.

The owner or operator shall record the zero and span drift in accordance with the method prescribed by the manufacturer of such opacity monitoring system(s); subject the system(s) to the manufacturer's recommended zero and span check at least once daily unless the manufacturer has recommended adjustments at shorter intervals, in which case such recommendations shall be followed; adjust the zero and span whenever the 24-hour zero drift or 24-hour calibration drift limits of 40 CFR, Part 60, Appendix B, Performance Specification 1 are exceeded; adjust the opacity monitoring system(s) purchased prior to September 11, 1974 whenever the 24-hour zero drift or 24-hour calibration drift exceeds 4 percent opacity for those generators constructed prior to February 11, 1971 and 2 percent opacity for those generators constructed after February 11, 1971.

The monitoring systems must be approved by this agency prior to installation.

E. Monitor Location

When the effluents from two or more affected steam generators of similar design and operating characteristics are combined before being released to the atmosphere, the opacity monitoring system(s) shall be installed on the combined effluent. When the affected steam generators are not of similar design and operating characteristics, or when the effluent from one affected steam generator is released to the atmosphere through more than one point, the owner or operator shall apply for an alternate procedure to comply with the requirements of this Section.

F. Exemptions from Monitoring Requirements

Whenever the requirements for continuous opacity monitoring cannot be implemented by the owner or operator due to physical plant limitations, extreme economic burden, or infrequent steam generator operation of less than 30 days per year, or when the specified monitoring procedure would not provide accurate opacity determinations, alternate monitoring and reporting requirements may be approved on a case-by-case basis provided the owner or operator submits a written request to the Department which includes, but not limited to:

1. The basis of reason(s) that alternate requirements are necessary;
2. A proposal of the alternate monitoring and reporting requirements; and
3. Any other information needed by the Department to make a determination that the alternate requirements are adequate to meet the intent of this Section.

SECTION V — EXEMPTIONS

The following sources shall be exempt from the provisions of this standard:

- A. Residences of four families or less.
- B. Ocean-going vessels actually engaged in the physical process of national or international trade or defense.

SECTION VI — PERIODIC TESTING

Scheduled periodic tests for particulates will be required of the sources listed below every two years, or as required by permit conditions to demonstrate compliance with this Standard. Compliance with sulfur dioxide will be by source testing, continuous monitoring, or fuel analysis as required by the permit conditions.

- A. Oil-fired boilers greater than 250 × 10⁶ BTU/hr rated input.

- B. Coal-fired boilers greater than 50 × 10⁶ BTU/hr rated input.

- C. Woodwaste, or combination woodwaste boilers greater than 20 × 10⁶ BTU/hr rated input.

SECTION VII — SOURCE TEST REQUIREMENTS

A. The owner or operator required to comply with Section VI above shall conduct such tests as required by the Department in order to demonstrate compliance with this Standard. EPA test methods or such alternative methods as approved by the Department prior to testing.

Tests shall be conducted while the source is operating at the expected maximum production rate or other production rate or operating conditions which would result in the highest emissions. Any production rate less than rated capacity may result in production limitations on the permits.

All tests shall be made by, or under the direction of, a person qualified by training and/or experience in the field of air pollution testing.

B. Any source owner or operator proposing to conduct tests in accordance with paragraph A. above shall notify the Department in the manner set forth below of the intent to test, not less than two weeks before the proposed initiation of the tests so the Department may observe the test if it desires to do so.

Notification shall include the following minimum information:

1. the purpose of the proposed test;
2. a description of the source to be tested;
3. a description of the test procedures, equipment, and sampling sites;
4. a timetable setting forth the dates on which the testing will be started and concluded.

C. The final test results must be submitted no later than 30 days after completion of the on-site testing, containing as a minimum, the following:

1. process weight rates (lb/hr)
2. process design and load rates at which the test was conducted
3. procedure used for determining process weight rates
4. calculations used to determine process weight rates
5. signature of responsible company official

D. The owner or operator proposing a source test under the provisions of this section shall be responsible for providing

1. sampling ports, pipes, lines, or appurtenances for the collection of samples and data required by the test procedure

2. safe access to the sample and data collection locations

3. light, electricity, and other utilities required for sample and data collection

E. Any proposed deviations from the procedures and requirements stated above must be thoroughly explained and must be approved by this Department prior to testing. Failure to observe any of these proce-

dures or requirements may be grounds for not accepting the tests

STANDARD NO. 2 AMBIENT AIR QUALITY STANDARDS

The following table constitutes the ambient air quality standards for the State of South Carolina. The analytical methods to be used will be those applicable Federal Reference Methods published in 40 CFR 51, Appendices A-F. In the case of fluorides either the double paper tape sampler methods (ASTMD-3266-73T) or the sodium bicarbonate-coated glass tube and particulate filter methods (ASTM-3268-73T) may be used

POLLUTANT	MEASURING INTERVAL (1)(2)	MEASURING MICROGRAMS/CUBIC METER
Sulfur Dioxide	3 hour	1300 (4)
	24 hours	365 (4)
	annual	80
Suspended Particulates	24 hours	250
	annual G.M. (3)	60
Carbon Monoxide	1 hour	40 mg per cubic meter
	8 hour	10 mg per cubic meter
Ozone	1 hour	0.12 ppm (5)
Gaseous Fluorides (as HF)	12 hr. avg.	3.7
	24 hr. avg.	2.9
	1 wk. avg.	1.6
	1 mo. avg.	0.8
Nitrogen Dioxide	annual	100
Lead	Calendar Quarterly Mean	1.5

(1) Arithmetic Average except in case of suspended particulates

(2) At 25° C and 760 mm Hg.

(3) Geometric Mean

(4) Not to be exceeded more than once a year

(5) Not to be exceeded more than one day per year

STANDARD NO. 3 EMISSIONS FROM INCINERATORS

All incinerators shall operate within the following emission limitations:

A. Particulates in the flue gas discharged into the atmosphere shall not exceed 0.5

pounds per million BTU of heat input to the incinerator, excluding auxiliary fuel

B. Emissions shall not produce smoke which exceeds twenty (20) percent opacity for an aggregate of more than six (6)

minutes in any one hour or twenty-four (24) minutes in a twenty-four hour period

C. Odors from the incinerator shall be reduced to such a level as not to create an undesirable level

D. Emissions shall not contain individual particles which are sufficiently large as to be visible as individual particles at the emission point or are of such size and nature as to be visible individually as incandescent particles. This requirement shall only apply if particles fall on real property other than that of the person responsible for the emission

STANDARD NO. 4 EMISSIONS FROM PROCESS INDUSTRIES

SECTION I — GENERAL

A. The method which is approved by the Department for determining compliance with opacity limitations under this Standard is EPA Reference Method 9 (40 CFR 60, Appendix A, as revised July 1, 1984). Alternate methods may be utilized only if approved in advance by the Department and by the Environmental Protection Agency.

B. This standard will not supersede any requirements imposed by Federal New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants, Federal or State Prevention of Significant Deterioration Regulations, nor special permit conditions, unless this Standard would impose a more restrictive emission limit.

SECTION II — SULFURIC ACID MANUFACTURING

A. The rate of emissions of sulfur dioxide from sulfuric acid manufacturing shall be limited to no more than 4 pounds of sulfur dioxide per ton of 100% sulfuric acid produced and emissions of acid mist to 0.5 pounds of sulfuric acid per ton of 100% acid produced.

B. The maximum allowable stack outlet opacity from any source under this category is 20%.

SECTION III — KRAFT PULP AND PAPER MANUFACTURING

The rate of emissions from kraft pulp and paper manufacturing shall be limited to the following:

	Maximum allowable Stack Opacity	Maximum allowable emission of particulates in pounds/equivalent ton of air dried, unbleached pulp produced
Recovery Furnace	40%	2.75
Dissolving Tank	20%	1.0
lime Kiln	20%	1.0

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APPENDIX D

Building 403, Steam Boilers 2, 3 and 5 Field Data

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PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION



RUN NUMBER
 DATE
 PLANT
 BASE
 SAMPLE BOX NUMBER
 METER BOX NUMBER
 OPERATOR

2
 3
 4
 1

2.07
 11.5388

EQUATIONS

$$Q_R = 0.7 \sqrt{1 + 460}$$

$$H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m \cdot V_p}{T_s}$$

Probed at 18 m Hg
 Probed at 18 m Hg

AMBIENT TEMP
 STATION PRESS
 HEATER BOX TEMP
 PROBE HEATER SETTING
 PROBE LENGTH
 NOZZLE AREA (A)
 Cp
 DRY GAS FRACTION (Fd)

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O)	STACK TEMP		VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP			SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
			(°F)	(T _s) (°R)				IN (°F)	AVG (T _m) (°R)	OUT (°F)		
A 1	5	-3.0	500		135	2.0	745.475	124		124	253	76
2	5	-3.5	556		135	2.0		127		127	260	73
3	15	-3.5	637		135	2.0		129		125	263	71
4	15	-3.5	633		135	2.0	758.756	129		126	265	72
B 1	0	-3.5	515		135	2.0	758.756	130		126	267	75
2	5	-3.5	546		135	2.0		132		124	261	73
3	10	-3.5	615		135	2.0		133		128	254	75
4	15	-3.5	634		135	2.0	772.562	136		136	255	76
			T _s = 578.9		AVG = 135	64.2.0		T _m = 128.2				
							TOTAL CORRECT = 27.084					
							SAMPLING RATE = 0.677 DCFM					

PRELIMINARY SURVEY DATA SHEET NO. 2
(Velocity and Temperature Traverse)

BASE

Shaw

DATE _____

10 Aug 88

BOILER NUMBER

BOILER ~~two~~ Bldg 403

INSIDE STACK DIAMETER

ER
12.25

Inches

STATION PRESSURE

29.86¢
SURE

In Hg

STACK STATIC PRESSURE

- 58

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE Shaw	DATE 10 Aug	RUN NUMBER Boiler #2
BUILDING NUMBER Bldg 403		SOURCE NUMBER

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
	Total Weight of Particulates Collected		gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	313.8	200	113.8
IMPINGER 2 (H2O)	180	200	-20.0
IMPINGER 3 (Dry)			
IMPINGER 4 (Silica Gel)	206.7	200	6.7
	Total Weight of Water Collected		100.5 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂	6.8	7.0	6.9		6.9
VOL % O ₂	8.0	7.8	7.9		7.9
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

Bulver #5

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER				SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				AMBIENT TEMP								
DATE				STACK #3				$^{\circ}R = ^{\circ}F + 460$ $H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				STATION PRESS								
PLANT				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				HEATER BOX TEMP								
BASE				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				HEATER BOX TEMP								
SAMPLE BOX NUMBER				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				PROBE HEATER SETTING								
METER BOX NUMBER				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				PROBE LENGTH								
NOTECH				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				NOZZLE AREA								
Qw/Qm				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				Cp								
Co				② AC③ ④				$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				DRY GAS FRACTION (Fd)								
1	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
2	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
3	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
4	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
5	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
6	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
7	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
8	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
9	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
10	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
11	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
12	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
13	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
14	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
16	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
17	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
18	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15
19	0	5	10	15	0	5	10	15	0	5	10	15	0	5	10	15	0			

(Velocity and Temperature Traverse)

30.0

BASE

DATE _____

SHAW AFB

10 AUG-88

BOILER NUMBER

#3 BLDG 403

INSIDE STACK DIAMETER

BACK DIAMETER
12.25"

Inches

STATION PRESSURE

29,860

In Hg

STACK STATIC PRESSURE

- 408

In H₂O

SAMPLING TEAM

OFFAL

Cyclonic $\sqrt{V_a}$

(Stack Geometry)

Inches

Inches

POINT

PERCENT OF
DIAMETER

DISTANCE FROM
INSIDE WALL
(Inches)

TOTAL DISTANCE FROM OUTSIDE
OF NIPPLE TO SAMPLING POINT
(Inches)

/

0.8

4.1

2

3. ~~D~~

6.3

3

9.2

12.4

4

11.4

14.7

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE Shaw	DATE 10 Aug 88	RUN NUMBER Boiler # 3
BUILDING NUMBER Bldg 403		SOURCE NUMBER

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
	Total Weight of Particulates Collected		gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	196	200	-4.0
IMPINGER 2 (H2O)	292	200	92.0
IMPINGER 3 (Dry)			
IMPINGER 4 (Silica Gel)	206.2	200	6.2
	Total Weight of Water Collected		94.2 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂	8.1	8.0	8.0		8.0
VOL % O ₂	7.2	7.2	7.1		7.2
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

RUN NUMBER	Boiler # 5		Pre leak check & 15 in/sy good Post leak check $\bar{T}_S = 333.8^\circ\text{F}$ $\bar{T}_m = 120.7^\circ\text{F}$ $\Delta H = 1.4$ PSTS = 10.3136	EQUATIONS $^{\circ}\text{R} = ^{\circ}\text{F} + 460$ $H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$	AMBIENT TEMP	102
DATE	19 Aug 88				STATION PRESS	29.605
PLANT	Bldg 403				HEATER BOX TEMP	
BASE	Shore				PROBE HEATER SETTING	
SAMPLE BOX NUMBER					PROBE LENGTH	48
METER BOX NUMBER		NOZZLE AREA (A)	.51			
Qw/Qm		Cp	.84			
Co		DRY GAS FRACTION (Fd)				

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP		VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (in)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP			SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
			(°F)	(Ts) (°R)				IN (°F)	AVG (Tm) (°R)	OUT (°F)		
A	0	-4.5	317		.175	1.4	61.464	115		114	250	72
	5	-5.0	353		.175	1.4		118		114	250	72
	10	-5.0	342		.145	1.4		121		115	253	71
	15	-5.0	340		.150	1.4	72.920	124		117	249	68
B	0	-5.0	300		.070	1.4		129		119	248	68
	5	-5.0	337		.080	1.4		127		121	249	68
	10	-5.0	341		.140	1.4		128		121	246	68
	15	-5.0	340		.160	1.4	84.455	131		122	246	70
					TOTAL		93 = 22.991					

(Stack Geometry)

BASE	Shaw		PLANT	Healy Shop (Bldg 403)	
DATE	19 Aug 88		SAMPLING TEAM		
SOURCE TYPE AND MAKE	Hot Water Boiler		Bldg 403		
SOURCE NUMBER	Boiler #5		INSIDE STACK DIAMETER	15.75	
RELATED CAPACITY			TYPE FUEL	Gas	
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER			19.0 (3.25)		
NUMBER OF TRAVERSES			NUMBER OF POINTS/TRAVERSE		

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]

(Velocity and Temperature Traverse)

BASE

DATE _____

BOILER NUMBER

INSIDE STACK DIAMETER

STATION PRESSURE

Inches

STACK STATIC PRESSURE

In Hg

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw AFB</i>	DATE <i>19 Aug 88</i>	RUN NUMBER <i>Boiler #5</i>
-------------------------	--------------------------	--------------------------------

BUILDING NUMBER <i>Steam-gas-fired</i>	SOURCE NUMBER <i>Bldg 403</i>
---	----------------------------------

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H ₂ O)	267.0	200	67.0
IMPINGER 2 (H ₂ O)	212.0	200	12.0
IMPINGER 3 (D ₂ O)	0.4	0	.4
IMPINGER 4 (Silica Gel)	208.0	200	8.0
Total Weight of Water Collected			87.4 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

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APPENDIX E

Building 611, Steam Boiler Field Data

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PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				TEMPERATURES			
TRaverse POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O)	STACK TEMP (°F)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (in)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)		
1	0	-3.0	333	.135	1.4	38.6	84	241	72		
2	2.5	-3.0	404	.156	1.4		84	241	68		
3	5.0	-3.0	424	.156	1.4		84	243	67		
4	7.5	-3.0	424	.156	1.4		84	243	66		
5	10.0	-3.0	421	.156	1.4		84	243	66		
6	12.5	-3.0	434	.156	1.4		84	245	67		
7	15.0	-3.0	423	.156	1.4		84	245	67		
8	17.5	-3.0	424	.156	1.4	50.015	84	245	67		
1	0	-3.0	317	.115	1.4		100	247	72		
2	2.5	-3.0	387	.136	1.4		101	247	69		
3	5.0	-3.0	411	.170	1.4		103	251	68		
4	7.5	-3.0	426	.130	1.4		104	250	68		
5	10.0	-3.0	421	.130	1.4		104	250	68		
6	12.5	-3.0	428	.130	1.4		107	249	68		
7	15.0	-3.0	433	.130	1.4		109	249	68		
8	17.5	-3.0	438	.130	1.4	60.898	109	250	68		
				TOTAL SA = 22.298							

DATE: 19 Aug 88

PLANT: Bldg 611

CASE: Show AFB

SAMPLE BOX NUMBER

METER BOX NUMBER

Q_w/Q_m

C_o

$$H \approx \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$$

Pre leak check good at 15 min

AMBIENT TEMP: 83 °F
 STATION PRESS: 29.6015 in Hg
 HEATER BOX TEMP: °F
 PROBE HEATER SETTING: °F
 PROBE LENGTH: 48 in
 NOZZLE AREA (A): 5 sq ft
 C_p: 1.84
 DRY GAS FRACTION (F_d):

[illegible]

(Velocity and Temperature Traverse)

BASE

Shaw

DATE _____

19 Aug 88

BOILER NUMBER

Bldg 611
METER

INSIDE STACK DIAMETER

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

- .035

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw AFB</i>		DATE <i>19 Aug 80</i>		RUN NUMBER	
BUILDING NUMBER <i>611</i>		SOURCE NUMBER <i>oil-fired steam boiler</i>			

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H ₂ O)	<i>249.5</i>	<i>200</i>	<i>49.5</i>
IMPINGER 2 (H ₂ O)	<i>204.5</i>	<i>200</i>	<i>4.5</i>
IMPINGER 3 (Dry)	<i>1.0</i>	<i>0</i>	<i>1.0</i>
IMPINGER 4 (Silica Gel)	<i>206.2</i>	<i>200</i>	<i>6.2</i>
Total Weight of Water Collected			<i>61.2 gm</i>

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX F

Building 922, Hot Water and Steam Boiler Field Data

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13-05-922

OEHL FORM 18
MAY 78

PRELIMINARY SURVEY DATA SHEET NO. 1

(Stack Geometry)

(Stack Geometry)

[illegible]

(Velocity and Temperature Traverse)

BASE

DATE _____

Shaw

22 Ave

BOILER NUMBER

Offices Used: Hot Water Heater

INSIDE STACK DIAMETER

8. c

Inches

STATION PRESSURE

29.815

In Hg

STACK STATIC PRESSURE

- .005

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw</i>		DATE <i>22 April 88</i>		RUN NUMBER	
BUILDING NUMBER <i>922 (Office Club)</i>		SOURCE NUMBER <i>Hot Water Heater</i>			

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H ₂ O)	<i>226.0</i>	<i>200.0</i>	<i>26.0</i>
IMPINGER 2 (H ₂ O)	<i>206.2</i>	<i>200.0</i>	<i>6.2</i>
IMPINGER 3 (Dry)	<i>∅</i>	<i>∅</i>	<i>∅</i>
IMPINGER 4 (Silica Gel)	<i>207.5</i>	<i>200.0</i>	<i>7.5</i>
Total Weight of Water Collected			<i>39.7</i> gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				GAS METER TEMP				SAMPLE		IMPINGER											
TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O)	STACK TEMP (°F)	STACK TEMP (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (in)	GAS SAMPLE VOLUME (cu ft)	IN (°F)	AVG (T _m) (°R)	OUT (°F)	BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)													
13426 422 Officers Club 18 Aug 83 STREAM gas: fuel heat base: Shaw ATP SAMPLE BOX NUMBER METER BOX NUMBER Qw/Qm Co													AMBIENT TEMP 89 STATION PRESS 29.635 HEATER BOX TEMP PROBE HEATER SETTING PROBE LENGTH 49.342 NOZZLE AREA (A) 51 Cp 84 DRY GAS FRACTION (F_d)												
Pre leak check at 15 in good Post leak check at 5 in by good													$H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ $OR = OR + 460$												
A 1	0	-2.5	261	261	.01	1.4	992.000	88	88	87	229	68													
3	5	-2.5	293	293	.03	1.4		92	92	87	241	74													
3	10	-3.0	331	331	.035	1.4		94	94	90	242	69													
4	15	-3.0	340	340	.035	1.4	1003.640	97	97	91	242	23													
B 1	0	-3.0	206	206	.01	1.4		98	98	96	243	73													
2	5	-3.0	276	276	.03	1.4		102	102	97	242	71													
3	10	-3.0	323	323	.035	1.4		105	105	98	243	68													
4	15	-3.0	334	334	.030	1.4	1015.244	101	101	100	241	68													
TOTAL CUBIC FT = 23.444																									

PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE Shaw AFB	PLANT Officers Club
DATE 18 Aug 88	SAMPLING TEAM
SOURCE TYPE AND NAME gas ~~at fuel~~	STREAM hot water & heat
SOURCE NUMBER	INSIDE STACK DIAMETER 9.75 Inches
RELATED CAPACITY	TYPE FUEL ~~gas~~ gas
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER 13 ϕ	(3.25) Inches
NUMBER OF TRAVERSES 2	NUMBER OF POINTS/TRAVERSE 4

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]

(Velocity and Temperature Traverse)

Shaw AFB

18 Aug 88

Officers Club

STEAM BOILER

9.75

Inches

In Hg

-02

In H₂O

SAMPLING TEAM

AVERAGE

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE SHAW AFB	DATE 18 Aug 88	RUN NUMBER
BUILDING NUMBER ~~142E~~ STEAM BOILER Officers Club	SOURCE NUMBER	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
	Total Weight of Particulates Collected		gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	304.0	200.0	104.0
IMPINGER 2 (H2O)	216.0	200.0	16.0
IMPINGER 3 (Dry)	Ø	Ø	Ø
IMPINGER 4 (Silica Gel)	206.2	200.0	6.2
	Total Weight of Water Collected		126.2 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX G

Building 1046, Hot Water Boiler Field Data

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34DG-1046

RUN NUMBER		SCHEMATIC OF STACK CROSS SECTION		EQUATIONS		AMBIENT TEMP										
DATE	PLANT			$T_m = \frac{Q_g + Q_l + Q_v}{Q_d + Q_e + Q_f}$	$H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$	STATION PRESS	HEATER BOX TEMP	PROBE HEATER SETTING	PROBE LENGTH	NOZZLE AREA (A)	Cp	DRY GAS FRACTION (Fg)				
SAMPLE BOX NUMBER	METER BOX NUMBER	Qw/Qm	Co	TRAVEL POINT NUMBER	SAMPLING TIME (min)	STANDING PRESSURE (lb./sq.in.)	STACK TEMP (°F)	STACK TEMP (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Im) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
A 1					0	-3.0	193		.03	1.4	84.66φ	92		89	23φ	71
2					2.5	-3.0	319		.04	1.4	↑	92		91	231	70
3					5.0	-3.0	348		.04	1.4	↑	95		93	231	65
4					7.5	-3.0	373		.04	1.4	11.445	98		95	236	66
5					10.0	-3.0	436		.07	1.4	↓	102		98	236	66
6					12.5	-3.0	340		.06	1.4	↓	107		102	236	67
7					15.0	-3.0	388		.05	1.4	↓	113		114	234	68
8					17.5	-3.0	380		.03	1.4	96.105	115		115	238	68
B 1					0	-3.0	198		.02	1.4	122.362	84		82	231	68
2					2.5	-3.0	351		.05	1.4	↑	88		83	235	68
3					5.0	-3.0	370		.05	1.4	↑	89		84	234	67
4					7.5	-3.0	411		.075	1.4	11.3	90		85	240	66
5					10.0	-3.0	439		.080	1.4	↓	91		86	241	66
6					12.5	-3.0	416		.050	1.4	↓	101		98	24	68
7					15.0	-3.0	354		.040	1.4	↓	102		98	240	68
8					17.5	-3.0	348		.020	1.4	133.682	103		98	241	68
										TOTAL ST-3 = 22,765						

(Stack Geometry)

InchesInches

POINT

PERCENT OF
DIAMETER

DISTANCE FROM
INSIDE WALL
(Inches)

TOTAL DISTANCE FROM OUTSIDE
OF NIPPLE TO SAMPLING POINT
(Inches)

1

6.3

2

7.3

3

8.7

4

10.6

5

15.9

6

17-8

7

19.2

4

20.3

(Velocity and Temperature Traverse)

BASE

Shaw AFB

DATE _____

22 Aug 88

BOILER NUMBER

R NUMBER
Dental Clinic

INSIDE STACK DIAMETER

15. $\emptyset$

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

-055

In H₂O

SAMPLING TEAM

TRAVERSE POINT NUMBER	VELOCITY HEAD, V _p IN H ₂ O	$\sqrt{V_p}$	STACK TEMPERATURE (°F)
1		5	
2		5	
3		5	
4		10	
5		5	
6		∅	
7		∅	
8		∅	
	AVERAGE		

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw</i>		DATE <i>22 August 88</i>		RUN NUMBER	
BUILDING NUMBER <i>10 Dental Clinic</i>		SOURCE NUMBER			

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
	Total Weight of Particulates Collected		gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	255.6	200.0	55.6
IMPINGER 2 (H2O)	208.0	200.0	8.0
IMPINGER 3 (Dry)	Ø	Ø	Ø
IMPINGER 4 (Silica Gel)	207.4	200.0	7.4
	Total Weight of Water Collected		71.0 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

125716

APPENDIX H

Building 1102, Hot Water Boiler Field Data

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AMBIENT TEMP	50°F	of
STATION PRESS	29.815	in Hg
HEATER BOX TEMP		of
PROBE HEATER SETTING		
PROBE LENGTH	48	in
NOZZLE AREA (A)	51	sq ft
Cp	84	
DRY GAS FRACTION (Fd)		

EQUATIONS

$$^{\circ}R = ^{\circ}F + 460$$
$$H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$$

Pre leak check good at 15 in H₂O

SCHEMATIC OF STACK CROSS SECTION

$\bar{T}_2 = 237.7^\circ\text{F}$
 $\bar{T}_m = 87.7$
 $\Delta T = 1.4$
 $\bar{T}_2 = 6.0948$

RUN NUMBER	BLD 1102
DATE	23 Aug 88
PLANT	oil-fired-water boiler
BASE	Shaw AFB
SAMPLE BOX NUMBER	
METER BOX NUMBER	
Qw/Qm	
Co	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. H ₂ O)	STACK TEMP		VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu. ft)	GAS METER TEMP				SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
			(°F)	(T _s) (°R)				IN (°F)	AVG (T _m) (°R)	OUT (°F)			
A	0	-5.0	194		.030	1.4	133.851	82		81	238	68	
	2.5	-5.0	198		.035	1.4		83		82	239	68	
	5.0	-5.0	206		.040	1.4		88		82	241	68	
	7.5	-5.0	210		.050	1.4		89		83	244	65	
	10.0	-5.0	216		.060	1.4		89		83	246	68	
	12.5	-5.0	224		.050	1.4		89		83	243	68	
	15.0	-5.0	232		.060	1.4		89		83	247	68	
	17.5	-5.0	238		.065	1.4		89		84	246	68	
B	0	-5.0	240		.040	1.4		92		85	249	68	
	2.5	-5.0	253		.050	1.4		93		85	250	68	
	5.0	-5.0	257		.052	1.4		94		86	246	68	
	7.5	-5.0	260		.055	1.4		94		87	243	68	
	10.0	-5.0	263		.060	1.4		95		87	247	69	
	12.5	-5.0	265		.075	1.4		95		87	248	68	
	15.0	-5.0	268		.070	1.4		96		88	252	69	
	17.5	-5.0	271		.070	1.4	156.427	97		88	253	68	
TOTAL							573 = 22.576						

(Stack Geometry)

BASE Shw AEB		PLANT Bldg 1102	
DATE 23 Aug 88		SAMPLING TEAM	
SOURCE TYPE AND MAKE Hot Water Boilers			
SOURCE NUMBER		INSIDE STACK DIAMETER 9.25 Inches	
RELATED CAPACITY		TYPE FUEL Oil	
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER 13.0 (3.25)		Inches	
NUMBER OF TRAVERSES		NUMBER OF POINTS/TRVERSE 8	

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]

(Velocity and Temperature Traverse)

Shaw AFB

23 ~~AUG~~ 88

BW 1102

9.75

Inches

STATION PRESSURE

In Hg

-04

In H₂O

SAMPLING TEAM

AVERAGE

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw</i>	DATE <i>23 Aug 88</i>	RUN NUMBER
BUILDING NUMBER <i>#1102</i>	SOURCE NUMBER <i>oil-fired water boiler</i>	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H ₂ O)	<i>229.0</i>	<i>200.0</i>	<i>29.0</i>
IMPINGER 2 (H ₂ O)	<i>214.0</i>	<i>200.0</i>	<i>14.0</i>
IMPINGER 3 (Dry)	<i>2.0</i>	<i>∅</i>	<i>2.0</i>
IMPINGER 4 (Silica Gel)	<i>209.7</i>	<i>200</i>	<i>9.7</i>
Total Weight of Water Collected			<i>54.7 gm</i>

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX I

Building 1130, Steam Boiler Field Data

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PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				AMBIENT TEMP							
TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STACK PRESSURE (in H ₂ O)	STACK TEMP (°F)	STACK TEMP (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	OUT (°F)	SAMPLE BOX TEMP (°F)	IMPIGGER OUTLET TEMP (°F)			
DATE: 18 Aug 88 PLANT: Bldg 1130 BASE: SRA SAMPLE BOX NUMBER: RBL METER BOX NUMBER: NUTEC Qw/Qm: PSTS = 11.3643 Co				$H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ $\Delta T = 407.9^\circ F$ $\bar{T}_m = 100.2^\circ F$ $\Delta H = 1.4$				$\Delta R = 0^\circ F + 460$				$\Delta R = 0^\circ F + 460$			
1	0	-3.0	280	280	0.18	1.4	15.675	95	95	94	238	78			
2	2.5	-3.0	282	282	0.19	1.4		95	95	95	238	74			
3	5.0	-3.0	348	348	0.19	1.4		96	95	95	238	68			
4	7.5	-3.0	441	441	0.18	1.4		98	95	95	241	68			
5	10.0	-3.0	495	495	0.12	1.4		100	96	96	250	68			
6	12.5	-3.0	495	495	0.12	1.4		102	96	96	252	68			
7	15.0	-3.0	496	496	0.12	1.4		102	97	97	254	68			
8	17.5	-3.0	496	496	0.12	1.4	27.100	104	98	98	256	75			
1	0	-3.0	220	220	0.06	1.4		102	96	96	258	76			
2	2.5	-3.0	220	220	0.10	1.4		103	98	98	259	74			
3	5.0	-3.0	327	327	0.10	1.4		103	99	99	258	68			
4	7.5	-3.0	362	362	0.11	1.4		107	100	100	258	68			
5	10.0	-3.0	484	484	0.17	1.4		107	100	100	258	68			
6	12.5	-3.0	495	495	0.21	1.4		108	101	101	258	68			
7	15.0	-3.0	497	497	0.24	1.4		109	101	101	259	66			
8	17.5	-3.0	498	498	0.23	1.4	38.301	109	102	102	260	72			
				TOTAL 43 = 22.626											

(Stack Geometry)

[illegible]

(Velocity and Temperature Traverse)

BASE

Shaw AEB

DATE _____

18 Aug 88

BOILER NUMBER

9th AF HQ Bldg 1130

INSIDE STACK DIAMETER

10.000

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

-16

LC H 20

SAMPLING TEAM

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H ₂ O	$\alpha \frac{\sqrt{V_p}}{\text{CYCLONIC}}$	STACK TEMPERATURE (°F)
1		18	
2		5	
3		2	
4		10	
5		7	
6		6	
7		6	
8		6	
		AVG = 6.8°	
AVERAGE			

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw</i>	DATE <i>18 Aug 88</i>	RUN NUMBER
BUILDING NUMBER <i>#1130</i>	SOURCE NUMBER	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	<i>238.0</i>	<i>200.0</i>	<i>38.0</i>
IMPINGER 2 (H2O)	<i>204.0</i>	<i>200.0</i>	<i>4.0</i>
IMPINGER 3 (Dry)			
IMPINGER 4 (Silica Gel)	<i>206.1</i>	<i>200</i>	<i>6.1</i>
Total Weight of Water Collected			<i>48.1</i> gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX J

Building 1200, Steam Boilers 1, 2 and 3 Field Data

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PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				AMBIENT TEMP				
TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O) $\frac{1}{2}$	STACK TEMP (°F)	STACK TEMP (°R)	VELOCITY HEAD (V)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (T _m) (°R)	OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
oil fired $T_s = 369.1$ $T_m = 89.4$ $\Delta H = 1.37$ $PSJS = 9.1134$				$OR = °F + 460$ $H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$				29 STATION PRESS 29.945 HEATER BOX TEMP PROBE HEATER SETTING PROBE LENGTH 72 NOZZLE AREA .51 Cp .84 DRY GAS FRACTION (Fd)				
A1	0	2.0	173		.07	.85	797.954	78		78	232	68
A2	3	2.0	345		.075	.90		80		78	232	68
A3	6	2.0	390		.090	1.20		85		81	237	65
A4	9	2.0	421		.124	1.7		86		83	238	65
A5	17	2.5	441		.14	1.9		90		85	247	66
A6	15	2.5	441		.13	1.8		93		86	247	68
A7	18	2.5	441		.125	1.7		95		87	241	68
A8	21	2.5	438		.115	1.6	812.412	96				
B1	0	2.0	170		.05	.70		97		87	239	65
B2	3	2.0	200		.07	.80		94		87	238	65
B3	6	2.0	338		.08	1.0		96		87	238	65
B4	9	2.0	407		.115	1.6		97		86	238	65
B5	12	2.3	435		.125	1.7		98		90	238	65
B6	13	2.5	437		.12	1.7		100		91	238	65
B7	18	2.5	436		.10	1.4		101		92	238	65
B8	21	2.5	436		.09	1.2	874.878	101		92	238	65
				PSJS = 9.1134								
				PSJS = 9.1134								

(Velocity and Temperature Traverse)

BASE

Shaw

DATE _____

12 Aug 88

BOILER NUMBER

~~XXXXXXXXXX~~ 1

BLDG 1200

INSIDE STACK DIAMETER

9.63

Inches

STATION PRESSURE

29.945

In Hg

STACK STATIC PRESSURE

-045

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>SITAW AFB</i>	DATE <i>12 AUG 88</i>	RUN NUMBER <i>1</i>
BUILDING NUMBER <i>BLDG 1200</i>		SOURCE NUMBER <i>BOILER # 1</i>

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
	Total Weight of Particulates Collected		gm

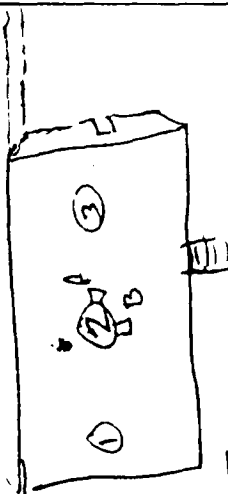
II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	<i>246.0</i>	<i>200</i>	<i>46.0</i>
IMPINGER 2 (H2O)	<i>206.0</i>	<i>200</i>	<i>6.0</i>
IMPINGER 3 (Dry)	<i>1.1</i>	<i>0</i>	<i>1.1</i>
IMPINGER 4 (Silica Gel)	<i>205.8</i>	<i>200</i>	<i>5.8</i>
	Total Weight of Water Collected		<i>58.9</i> gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂	<i>6.8</i>	<i>6.8</i>	<i>6.8</i>		<i>6.8</i>
VOL % O ₂	<i>11.4</i>	<i>11.4</i>	<i>11.4</i>		<i>11.4</i>
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				AMBIENT TEMP							
TRaverse POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in Hg)	STACK TEMP (°F)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (in)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP (°F)	OUT (°F)	IMPINGER OUTLET TEMP (°F)	NOZZLE AREA (sq ft)	PROBE LENGTH (in)	PROBE HEATER SETTING (°F)	HEATER BOX TEMP (°F)	STATION PRESS (in Hg)	RUN NUMBER
1	0	2.0	160	0.013	1.20	826.340	116	114	68	5.68	72			29.945	one Boiler #2
2	3	2.0	200	0.025	1.30		116	115	68						12 Aug 88
3	4	2.0	270	0.03	1.40		118	116	68						Blow 1200
4	9	2.0	295	0.04	1.50		119	116	68						Spaw
5	12	2.0	305	0.04	1.90		122	117	68						
6	15	2.5	304	0.04	1.90		122	118	68						
7	18	2.5	300	0.04	1.90		123	119	68						
8	21	2.5	310	0.03	1.50	838.346	123	119	68						
1	0	2.0	165	0.010	1.1		122	120	68						
2	3	2.0	194	0.015	1.2		123	121	68						
3	6	2.0	226	0.020	1.25		127	122	68						
4	9	2.5	276	0.040	1.90		127	122	68						
5	12	2.5	309	0.040	1.90		130	122	68						
6	15	2.5	312	0.030	1.90		131	123	68						
7	18	2.5	313	0.030	1.50		128	122	68						
8	21	2.5	313	0.02	1.25	851.712	128	122	68						
				TOTAL FP = 25.322											



$\bar{T}_s = 266.12$
 $\bar{T}_m = 121.4$
 $\Delta H = 1.57$
 $PSI_s = 4.6228$

(Velocity and Temperature Traverse)

BASE

Shaw

DATE _____

12 Aug 88

BOILER NUMBER

#2

Bldg 1200

INSIDE STACK DIAMETER

$9\frac{5}{8}'' (9.625'')$

Inches

STATION PRESSURE

29.945.

In Hg

STACK STATIC PRESSURE

-045

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>SITAX AFB</i>	DATE <i>12 AUG 88</i>	RUN NUMBER <i>1</i>
--------------------------	--------------------------	------------------------

BUILDING NUMBER <i>BLDG 1200</i>	SOURCE NUMBER <i>BOILER # 2</i>
-------------------------------------	------------------------------------

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
	Total Weight of Particulates Collected		gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	<i>262</i>	<i>200</i>	<i>62.0</i>
IMPINGER 2 (H2O)	<i>206</i>	<i>200</i>	<i>6.0</i>
IMPINGER 3 (Dry)	<i>0.5</i>	<i>0.0</i>	<i>0.5</i>
IMPINGER 4 (Silica Gel)	<i>206.5</i>	<i>200</i>	<i>6.5</i>
	Total Weight of Water Collected		<i>75.0</i> gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

AMBIENT TEMP	84	OF
STATION PRESS	29.929	in Hg
HEATER BOX TEMP		OF
PROBE HEATER SETTING		
PROBE LENGTH	72	in
NOZZLE AREA	1.54	sq ft
Cp	.84	
DRY GAS FRACTION (Fd)		

EQUATIONS

$$^{\circ}R = ^{\circ}F + 460$$

$$H = \left[\frac{5130 \cdot F \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$$

$\frac{2}{18} \text{ in}$

Break check at 18 in^{1/2}

ΔP'S OBTAINED WITH DETACHED
PISTON BIE.

8 in
Depth creek at 18 in 11 g
ΔP'S OBTAINED WITH DETACHED
PISTON BIE.

$$x_{\text{RK}} = 8.1510$$
$$\bar{r} = 0.10$$

100

၆

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O)	STACK TEMP		VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP			SAMPLE BOX TEMP (°F)	IMPINGING OUTLET TEMP (°F)
			(°F)	(Ts) (°R)				IN (°F)	AVG (Tm) (°R)	OUT (°F)		
A 1	0	2.5	180		0.08	1.1	772.85	99		96	247	76
A 2	3	3.0	200		0.11	1.5		102		98	243	67
A 3	4	3.0	225		0.135	1.86		104		98	240	65
A 4	9	3.0	307		0.17	2.2		108		99	244	66
A 5	12	3.0	346		0.18	2.3		109		100	243	67
A 6	15	3.0	347		0.09	1.2		110		101	244	70
A 7	18	3.0	355		0.14	.5		111		102	244	72
A 8	21	3.0	319		0.03	.4	786.125	109		105	244	83
B 1	0	2.0	177		0.13	.9		100		106	244	85
B 2	3	2.0	200		0.05	1.69		110		106	244	76
B 3	6	2.5	240		0.09	1.2		111		100	247	75
B 4	9	2.5	287		0.14	1.9		113		109	249	77
B 5	12	2.5	339		0.16	2.2		113		109	249	77
B 6	15	2.5	344		0.13	1.8		118		111	248	77
B 7	18	3.0	351		0.08	1.1		120		113	247	77
B 8	21	3.0	308		0.07	.4	798.320	120		113	249	75
							798.320					
							25.415	ft ³				
							SAMPLING RATE = 0.53 ACFM					

SAMPLING RATE = 0.531 CFM

25,415 f³

(Stack Geometry)

BASE Shaw	PLANT BLDG 1200	
DATE 11 Aug 88	SAMPLING TEAM	
SOURCE TYPE AND MAKE BLDG 1200 - BOILER # 3		
SOURCE NUMBER	INSIDE STACK DIAMETER 9 5/8 (9.63)	Inches
RELATED CAPACITY	TYPE FUEL OIL	
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER 3 3/8 (3.4)		Inches
NUMBER OF TRAVERSES 2	NUMBER OF POINTS/TRAVERSE 8	

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

[illegible]

(Velocity and Temperature Traverse)

DATE

INSIDE STACK DIAMETER

Inches

STATION PRESSURE

In Hg

STACK STATIC PRESSURE

In H₂O

SAMPLING TEAM

TRAVERSE POINT NUMBER	VELOCITY HEAD, V _p IN H ₂ O	L ~~V_v~~ CYCLONIC	STACK TEMPERATURE (°F)
1	.08	13	185
2	.09	15	205
3	.12	15	237
4	.135	14	310
5	.156	15	345
6	.13	14	338
7	.03	15	330
8	.01	13	305
		AVG = 14.3	
AVERAGE			

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>Shaw</i>	DATE <i>11 Aug 88</i>	RUN NUMBER <i>N/C</i>
BUILDING NUMBER <i>1200</i>	SOURCE NUMBER <i>Boiler #3 Oil Fired</i>	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	<i>289.5</i>	<i>200.0</i>	<i>89.5</i>
IMPINGER 2 (H2O)	<i>169.0</i>	<i>200.0</i>	<i>- 31.0</i>
IMPINGER 3 (Dry)	<i>1.6</i>	<i>0</i>	<i>1.6</i>
IMPINGER 4 (Silica Gel)	<i>206.2</i>	<i>200.0g</i>	<i>6.2</i>
Total Weight of Water Collected			<i>66.3</i> ~~<i>128.3</i>~~ gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

Vol % N₂ = (100% - % CO₂ - % O₂ - % CO)

APPENDIX K

Building 1206, Steam Boiler Field Data

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER		SCHEMATIC OF STACK CROSS SECTION		EQUATIONS		AMBIENT TEMP	
DATE 15 Aug 88				$^{\circ}R = ^{\circ}F + 460$ $H = \left[\frac{5130 \cdot F \cdot d \cdot p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$		STATION PRESS 92	
PLANT Bldg 1206				Pre leak check - good. 15 in Hg		HEATER BOX TEMP 29.840	
BASE SHEW				Post leak check - good at 7 in Hg		PROBE HEATER SETTING	
SAMPLE BOX NUMBER RAC						PROBE LENGTH 72	
METER BOX NUMBER NUTECH						NOZZLE AREA 13.88	
Qw/Qm						Cp 84	
Co						DRY GAS FRACTION (F _d)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O)	STACK TEMP		VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP		SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
			(°F)	(Ts) (°R)				IN (°F)	AVG (Tm) (°R)		
1	0	3.5	101		.01	1.0	851.965	100		234	70
2	3	3.5	200		.01	1.0		101		242	66
3	6	3.5	207		.02	1.5		102		243	64
4	9	4.0	238		.02	1.5		102		246	64
5	12	4.0	280		.02	1.5		104		247	65
6	15	4.0	298		.02	1.5		105		247	66
7	18	3.5	302		.01	1.0		106		248	68
8	21	3.5	303		.01	1.0	864.922	107		249	68
1	0	3.4	100		.01	1.0		92		235	68
2	3	3.0	185		.01	1.0		94		245	68
3	6	3.5	196		.02	1.5		94		243	66
4	9	4.0	270		.02	1.5		96		242	68
5	12	4.5	286		.02	1.5		97		245	68
6	15	4.5	290		.02	1.5		99		245	68
7	18	4.0	288		.01	1.0		99		245	68
8	21	4.0	288		.01	1.0	877.601	99		245	68
							TOTAL ST = 25.636				

(Stack Geometry)

OEHL FORM 15
APR 78

(Velocity and Temperature Traverse)

BASE

DATE _____

SHAW AFB	BLDG 1206	15 AUG 88
----------	-----------	-----------

BOILER NUMBER

Oil-Fired Bldg 1206 (one boiler only tested)

INSIDE STACK DIAMETER

13.88元

Inches

STATION PRESSURE

29.840

In Hg

STACK STATIC PRESSURE

- .005

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE Shaw AF3, SC	DATE 15 Aug 88	RUN NUMBER
BUILDING NUMBER ~~11614~~ 1206	SOURCE NUMBER OIL FIRED BOILER	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	253.4	200 mL	53.4
IMPINGER 2 (H2O)	205	200 mL	5
IMPINGER 3 (Dry)	1 mL	0	1
IMPINGER 4 (Silica Gel)	206 gras	200 gras	6
Total Weight of Water Collected			65.4 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$

APPENDIX L

Building 1402, Hot Water Boiler Field Data

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER		SCHEMATIC OF STACK CROSS SECTION		EQUATIONS		AMBIENT TEMP	
DATE	17 Aug 80	Piping Layout		$\Delta R = \Delta T + 460$		STATION PRESS	
PLANT	NCO Club BLDG 1402	NCO Club		$H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$		HEATER BOX TEMP	
BASE	Show AFB	NCO Club				PROBE HEATER SETTING	
SAMPLE BOX NUMBER	RIC	heating boiler				PROBE LENGTH	
METER BOX NUMBER	MUTEC					NOZZLE AREA (A)	
Qw/Qm						Cp	
Co						DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	VFAc PRESSURE (inches Hg)	STACK TEMP		VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP			SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
			(°F)	(Ts) (°R)				IN (°F)	AVG (Tm) (°R)	OUT (°F)		
1	0	-2.5	249		.01	1.4	946.880	80		80	246	68
2	5	-2.5	262		.03	1.4		84		84	243	66
3	10	-2.5	271		.04	1.4		87		83	241	68
4	15	-2.5	266		.02	1.4	958.137	91		85	243	68
1	0	-2.5	217		.03	1.4		94		89	243	68
2	5	-2.5	231		.03	1.4		97		90	244	68
3	10	-2.5	267		.04	1.4		99		91	241	68
4	15	-2.5	278		.02	1.4	969.184	100		92	240	68
TOTAL TIME 39 min (BOILER START DOWN)							TOTAL GAS = 22,304					

Scotch Marine Boiler (Panmeyer)	
1971 Built	
306 ft ² heating sfc	
150 lbs max H ₂ O pressure	
2070 lbs steam per hour	
Superior Boiler Works, Inc	

[illegible]

(Velocity and Temperature Traverse)

DATE

17 JUL 88

BLDG 1402

Inches

In Hg

In H₂O

STACK TEMPERATURE (°F)

12

12

12

12

$$\text{AVG} = 12^\circ$$

OEHL FORM 16
APR 78

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE SHAW AFB, SC	DATE 17 Aug 88	RUN NUMBER
BUILDING NUMBER BLDG 1403 BX NCO Club	SOURCE NUMBER	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	262.0	200.0	62.0
IMPINGER 2 (H2O)	184.0	200.0	- 16.0
IMPINGER 3 (Dry)	Ø	Ø	Ø
IMPINGER 4 (Silica Gel)	205.6	200.0	5.6
Total Weight of Water Collected			51.6 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX M

Building 1422, Hot Water Boiler Field Data

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PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				AMBIENT TEMP			
TRaverse POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H ₂ O)	STACK TEMP (°F) (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP (°F) (Tm) (°R)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)		
$OR = 9°F + 460$ $H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co} \right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$				95 STATION PRESS 29.850 HEATER BOX TEMP PROBE HEATER SETTING PROBE LENGTH NOZZLE AREA (A) Cp .84 DRY GAS FRACTION (Fd)							
RUN NUMBER DATE 17 Aug 88 PLANT BW BLDG 1422 BASE Shaw SAMPLE BOX NUMBER RMC METER BOX NUMBER WOTEC Qw/Qm Co				$T_s = 241.6°F$ $T_m = 93.9$ $\Delta T = 1.4$ $P_{STS} = 3.7343$							
1	0	-2.5	107	.01	1.4	969.400	102	247	68		
2	2.5	-2.5	185	.01	1.4		102	243	68		
3	5.0	-2.3	235	.02	1.4		103	244	68		
4	7.5	-2.5	260	.02	1.4		104	244	68		
5	10.0	-2.3	264	.03	1.4		107	241	68		
6	12.5	-2.3	265	.03	1.4		108	242	68		
7	15.0	-2.5	268	.03	1.4		108	247	68		
8	17.5	-2.5	283	.01	1.4	980.820	109	247	68		
1	0	-2.5	165	.01	1.4	980.967	84	232	68		
2	2.5	-2.5	235	.01	1.4		85	236	68		
3	5.0	-2.5	240	.02	1.4		85	240	68		
4	7.5	-2.5	253	.02	1.4		85	241	68		
5	10.0	-2.5	260	.03	1.4		86	241	68		
6	12.5	-2.5	272	.03	1.4		86	240	68		
7	15.0	-2.5	274	.03	1.4	991.374	86	239	68		
8	17.5	-2.5	279	.02	1.4	10.403	86	241	68		
				TOTAL 93 = 21.873							

[illegible]

(Velocity and Temperature Traverse)

BASE

STRAW

DATE

17 AUG 8 P

BOILER NUMBER

BX BLDG 1422

INSIDE STACK DIAMETER

17.5

Inches

STATION PRESSURE

29.850

In Hg

STACK STATIC PRESSURE

- 01

In H₂O

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE Sitaw AF-B	DATE 17 AUG 88	RUN NUMBER
---	--	------------

BUILDING NUMBER BX BLDG 1422	SOURCE NUMBER
--	---------------

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
	Total Weight of Particulates Collected		gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	276.0	200.0	76.0
IMPINGER 2 (H2O)	184.0	200.0	-16.0
IMPINGER 3 (Dry)	Ø	Ø	Ø
IMPINGER 4 (Silica Gel)	206.8	200.0	6.8
	Total Weight of Water Collected		66.8 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX N

Steam Boiler Field Data

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PARTICULATE SAMPLING DATA SHEET

[illegible]

(Stack Geometry)

[illegible]

(Velocity and Temperature Traverse)

BASE

DATE

BOILER NUMBER

INSIDE STACK DIAMETER

STATION PRESSURE

STACK STATIC PRESSURE

SAMPLING TEAM

[illegible]

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE SHAW AFB	DATE 16 Aug 77	RUN NUMBER
--	---	-----------------------

BUILDING NUMBER 1604	SOURCE NUMBER OIL FIRED
---	--

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H ₂ O)	244	200	44
IMPINGER 2 (H ₂ O)	206	200	6
IMPINGER 3 (Dry)	1	0	1
IMPINGER 4 (Silica Gel)	206.2	200	6.2
Total Weight of Water Collected			57.2 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX O

Building 1614, Steam Boiler Field Data

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(Stack Geometry)

OEHL FORM 15
APR 78

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE SHAW AFB		DATE 16 Aug 88		RUN NUMBER	
BUILDING NUMBER 1614			SOURCE NUMBER Boiler # 1		

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (If needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H ₂ O)	~~200~~ 244.0	200.0	44.0
IMPINGER 2 (H ₂ O)	207.0	200.0	7.0
IMPINGER 3 (Dry)	Ø	Ø	Ø
IMPINGER 4 (Silica Gel)	206.7	200.0	6.7
Total Weight of Water Collected			57.7 gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

PARTICULATE SAMPLING DATA SHEET

SCHEMATIC OF STACK CROSS SECTION				EQUATIONS				AMBIENT TEM			
TRaverse POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in. Hg)	STACK TEMP (°F)	STACK TEMP (°F)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (in. Hg)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)	
DATE: 16 AUG 58 PLANT: BLDG-1614, BOILER #2 BASE: SHAW AFB SAMPLE BOX NUMBER: RAC METER BOX NUMBER: NUTEC Qw/Qm Co				°R = °F + 460 $H = \left[\frac{5130 \cdot F_d \cdot C_p \cdot A}{C_o} \right]^2 \cdot \frac{T_m}{T_s} \cdot V_p$ Pre checked at 1614 Hg $\bar{B} = 260.3$ $\bar{T}_m = 88.6$ $\Delta H = 1.4$ PSTS = 4.8660				AMBIENT TEM: 81 STATION PRESS: 29.866 HEATER BOX TEMP PROBE HEATER SETTING PROBE LENGTH: 72 NOZZLE AREA: .51 Cp: .84 DRY GAS FRACTION (Fd)			
A 1	0	-2.5	129	129	.025	1.4	877.846	81	231	63	
A 2	5	-2.5	294	294	.040	1.4		81	235	64	
A 3	10	-2.5	310	310	.040	1.4		83	239	66	
A 4	15	-2.5	317	317	.025	1.4	889.335	85	241	68	
B 1	0	-2.5	136	136	.025	1.4		93	240	68	
B 2	5	-2.5	278	278	.040	1.4		95	243	65	
B 3	10	-2.5	308	308	.040	1.4		97	243	68	
B 4	15	-2.5	317	317	.030	1.4	900.760	100	244	67	
				TOTAL STS = 22.87							

(Stack Geometry)

OEHL FORM 15
APR 78

PRELIMINARY SURVEY DATA SHEET NO. 2
(Velocity and Temperature Traverse)

BASE SITAW AFB	DATE 16 DATE 88
BOILER NUMBER BLDG 1614, BOILER # 2	
INSIDE STACK DIAMETER 16 Inches	
STATION PRESSURE 29.806 In Hg	
STACK STATIC PRESSURE -0.01 In H2O	
SAMPLING TEAM	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H2O	α ~~$\sqrt{V_p}$~~ cyclonic	STACK TEMPERATURE (°F)
1		10	
2		10	
3		10	
4		10	
		AVG = 10°	
AVERAGE			

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE <i>SITAW AF3</i>	DATE <i>16 AUG 88</i>	RUN NUMBER
BUILDING NUMBER <i>1614</i>	SOURCE NUMBER <i>BOILER # 2</i>	

I. PARTICULATES			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)			
BACK HALF (if needed)			
Total Weight of Particulates Collected			gm

II. WATER			
ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H2O)	<i>238.0</i>	<i>200.0</i>	<i>38.0</i>
IMPINGER 2 (H2O)	<i>209.0</i>	<i>200.0</i>	<i>9.0</i>
IMPINGER 3 (Dry)	<i>Ø</i>	<i>Ø</i>	<i>Ø</i>
IMPINGER 4 (Silica Gel)	<i>205.3</i>	<i>200.0</i>	<i>5.3</i>
Total Weight of Water Collected			<i>52.3</i> gm

III. GASES (Dry)					
ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO ₂					
VOL % O ₂					
VOL % CO					
VOL % N ₂					

$$\text{Vol \% N}_2 = (100\% - \% \text{CO}_2 - \% \text{O}_2 - \% \text{CO})$$

APPENDIX P
Calibration Data

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METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 12 Jul 88

Meter box number 2010 NUTECH

Barometric pressure, $P_b =$ 29.119 in. Hg Calibrated by Fagin & Scott

Val in. H ₂ O	Orifice manometer setting (ΔH), in. H ₂ O	Gas volume		Temperature			Time (θ), min	Y _i	ΔH@ _i in. H ₂ O	
		Wet test meter (V _w), ft ³	Dry gas meter (V _d), ft ³	Wet test meter (t _w), °F/R	Dry gas meter					
					Inlet (t _{d_i}), °F/R	Outlet (t _{d_o}), °F/R				Avg ^a (t _d), °F/R
4	0.5	5	4.668	78 79 538	76 83 539.5	75 78 536.5	538	13.1	1.070	2.010
4	1.0	5	4.670	78 78 538	89 81 546.5	78 81 539.5	543	9.3	1.078	2.008
4	1.5	10	9.390	78 78 538	90 96 553	82 86 544	548.5	15.5	1.082	2.070
4	2.0	10	9.455	79 80 539.5	96 101 558.5	87 90 548.5	553.5	13.5	1.070	2.087
4	3.0	10	9.470	80 81 540.5	101 106 563.5	90 93 551.5	557.5	11.1	1.081	2.109
4	4.0	10.1	9.590	81 81 541	106 109 567.5	94 96 555	561.3	9.8	1.082	2.138
								Avg	1.077	2.070

ΔH , in. H ₂ O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460) \theta}{V_w} \right]^2$
0.5	0.0368	$y_1 = \frac{(5)(29.119)(538)}{(4.668)(29.119 + \frac{0.5}{13.6})(538)}$	$H@_1 = \frac{(0.0317)(0.5)}{(29.119)(538)} \left[\frac{(538)(13.1)}{5} \right]^2$
1.0	0.0737	$y_2 = \frac{(5)(29.119)(543)}{(4.67)(29.119 + \frac{1.0}{13.6})(538)}$	$H@_2 = \frac{(0.0317)(1)}{(29.119)(543)} \left[\frac{(538)(9.3)}{5} \right]^2$
1.5	0.110	$y_3 = \frac{(10)(29.119)(548.5)}{(9.39)(29.119 + \frac{1.5}{13.6})(538)}$	$H@_3 = \frac{(0.0317)(1.5)}{(29.119)(548.5)} \left[\frac{(538)(15.5)}{10} \right]^2$
2.0	0.147	$y_4 = \frac{(10)(29.119)(553.5)}{(9.455)(29.119 + \frac{2.0}{13.6})(539.5)}$	$H@_4 = \frac{(0.0317)(2.0)}{(29.119)(553.5)} \left[\frac{(539.5)(13.5)}{10} \right]^2$
3.0	0.221	$y_5 = \frac{(10)(29.119)(557.5)}{(9.47)(29.119 + \frac{3.0}{13.6})(540.5)}$	$H@_5 = \frac{(0.0317)(3)}{(29.119)(557.5)} \left[\frac{(540.5)(11.1)}{10} \right]^2$
4.0	0.294	$y_6 = \frac{(10.1)(29.119)(561.3)}{(9.59)(29.119 + \frac{4.0}{13.6})(541)}$	$H@_6 = \frac{(0.0317)(4)}{(29.119)(561.3)} \left[\frac{(541)(9.8)}{10.1} \right]^2$

^a If there is only one thermometer on the dry gas meter, record the temperature under t_d .

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 13 Jul 88

Meter box number RAC

Barometric pressure, $P_b = 29.131$ in. Hg Calibrated by FAGIN ESCOTT $R = (4.23)$

Orifice manometer setting (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Y_i	$\Delta H \theta_i$ in. H_2O
	Wet test meter (V_w), ft ³	Dry gas meter (V_d), ft ³	Wet test meter (t_w), °R	Dry gas meter					
				Inlet (t_{d_i}), °R	Outlet (t_{d_o}), °R	Avg ^a (t_d), °R			
0.5	5	4.712	~~78~~ 77 537.5	~~94~~ 101 557.5	~~76~~ 78 537	548.25	12.0	1.081	1.652
1.0	5.2	4.940	~~77~~ 78 537.5	~~104~~ 109 560.5	~~78~~ 80 539	552.75	8.9	1.080	1.666
1.5	10	9.600	~~78~~ 78 538	~~111~~ 113 572	~~81~~ 84 542.5	557.25	15.0	1.075	1.908
2.0	10	9.529	~~78~~ 79 538.5	~~115~~ 116 575.5	~~85~~ 86 545.5	560.5	13.0	1.087	1.903
3.0	10	9.636	~~79~~ 79 539	~~117~~ 120 578.5	~~87~~ 88 547.5	563.0	14.6	1.076	1.893
4.0	10	9.605	~~79~~ 79 539	~~120~~ 122 581	~~88~~ 89 548.5	564.75	9.1	1.080	1.391
							Avg	1.080	1.736

ΔH , in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H \theta_i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460) \theta}{V_w} \right]^2$
0.5	0.0368	$Y_1 = \frac{(5 \times 29.131 \times 548.25)}{(4.712 \times 29.131 + 5/13.6 \times 537.5) (77 + 460)}$	$H_{\theta 1} = \frac{(0.0317 \times 0.5)}{29.131 (548.25)} \left[\frac{(537.5)(12.0)}{5} \right]^2$
1.0	0.0737	$Y_2 = \frac{(5.2 \times 29.131 \times 552.75)}{(4.94 \times 29.131 + 1.0/13.6 \times 537.5) (77 + 460)}$	$H_{\theta 2} = \frac{(0.0317 \times 1.0)}{(29.131 \times 552.75)} \left[\frac{(537.5)(8.9)}{5.2} \right]^2$
1.5	0.110	$Y_3 = \frac{(10 \times 29.131 \times 557.25)}{(9.6 \times 29.131 + 1.5/13.6 \times 538) (78 + 460)}$	$H_{\theta 3} = \frac{(0.0317 \times 1.5)}{(29.131 \times 557.25)} \left[\frac{(538 \times 15)}{10} \right]^2$
2.0	0.147	$Y_4 = \frac{(10 \times 29.131 \times 560.5)}{(9.529 \times 29.131 + 2/13.6 \times 538.5) (78 + 460)}$	$H_{\theta 4} = \frac{(0.0317 \times 2.0)}{(29.131 \times 560.5)} \left[\frac{(538.5)(13)}{10} \right]^2$
3.0	0.221	$Y_5 = \frac{(10 \times 29.131 \times 563)}{(9.636 \times 29.131 + 3/13.6 \times 539) (79 + 460)}$	$H_{\theta 5} = \frac{(0.0317 \times 3.0)}{(29.131 \times 563.0)} \left[\frac{(539 \times 14.6)}{10} \right]^2$
4.0	0.294	$Y_6 = \frac{(10 \times 29.131 \times 564.75)}{(9.605 \times 29.131 + 4/13.6 \times 539) (79 + 460)}$	$H_{\theta 6} = \frac{(0.0317 \times 4.0)}{(29.131 \times 564.75)} \left[\frac{(539 \times 9.1)}{10} \right]^2$

^a If there is only one thermometer on the dry gas meter, record the temperature under t_d .

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number Post-078 Date 9 Aug 88 Meter box number _____ Plant Skidway AFB ^{Post} RE SHAW
 Barometric pressure, $P_b = 29.76$ in. Hg Dry gas meter number NOTECH Pretest Y 1.077

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i $\frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), $^{\circ}F$	Inlet (t_{d_i}), $^{\circ}F$	Outlet (t_{d_o}), $^{\circ}F$	Average (t_d), $^{\circ}F$				
2.5	10	9.327	79 53.9	84 54.5	79 53.5	542.25	12.2	-20.0	1.072	$\frac{10 \times 29.76 \times 542.25}{79.327 \times 29.76 + 2.5/13.6 \times 539}$
2.5	10	9.336	79 53.9	84 54.5	79 53.5	544.0	12.2	-20.0	1.074	$\frac{10 \times 29.76 \times 544.0}{79.336 \times 29.76 + 2.5/13.6 \times 539}$
2.5	10	9.368	79 53.5	84 54.5	79 53.5	546.25	12.2	-20.0	1.074	$\frac{10 \times 29.76 \times 546.25}{79.368 \times 29.76 + 2.5/13.6 \times 539.5}$
$Y = 1.073$										

^a If there is only one thermometer on the dry gas meter, record the temperature under t_d
 where

V_w = Gas volume passing through the wet test meter, ft^3
 V_d = Gas volume passing through the dry gas meter, ft^3
 t_w = Temperature of the gas in the wet test meter, $^{\circ}F$
 t_{d_i} = Temperature of the inlet gas of the dry gas meter, $^{\circ}F$
 t_{d_o} = Temperature of the outlet gas of the dry gas meter, $^{\circ}F$
 t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o} , $^{\circ}F$
 ΔH = Pressure differential across orifice, in. H_2O
 Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.
 Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs;
 tolerance = pretest $Y \pm 0.05Y$
 P_b = Barometric pressure, in. Hg.
 θ = Time of calibration run, min.

POST Y RANGE: PRETEST $Y \pm 0.05Y$
 $= 1.0232 \rightarrow 1.1309$

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Eielson (Post)
Shaw (Pre)

Test number #1

Date 9 Aug 88

Meter box number

Plant

Barometric pressure, $P_b = 29.760$ in. Hg Dry gas meter number **RAC**

Pretest Y **1.080**

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Time (θ), min	Vacuum setting, in. Hg	Y_i	Y_i	$V_w P_b (t_d + 460)$ $V_d \left(P_b + \frac{\Delta H}{13.6} \right) (t_w + 460)$
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), $^{\circ}F$	Dry gas meter		Average (t_d), $^{\circ}F$					
				Inlet (t_{d_i}), $^{\circ}F$	Outlet (t_{d_o}), $^{\circ}F$						
2.5	10	9.401	81 546.5	111 58.5	76 539.5	11.44	20.0	1.097	$(10)(29.76)(546.5)$	$(10)(29.76)(539.5)$	
2.5	10	9.516	80 540.5	141 597.5	83 545.5	11.47	20.0	1.104	$(10)(29.76)(540.5)$	$(10)(29.76)(545.5)$	
2.5	10	9.646	81 544.5	143 605	80 557.5	11.50	20.0	1.101	$(10)(29.76)(544.5)$	$(10)(29.76)(557.5)$	
								$Y = 1.101$			

^a If there is only one thermometer on the dry gas meter, record the temperature under t_d

where

V_w = Gas volume passing through the wet test meter, ft^3 .

V_d = Gas volume passing through the dry gas meter, ft^3 .

t_w = Temperature of the gas in the wet test meter, $^{\circ}F$.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, $^{\circ}F$.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, $^{\circ}F$.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o} , $^{\circ}F$.

ΔH = Pressure differential across orifice, in. H_2O .

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs;
tolerance = pretest $Y \pm 0.05Y$.

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

POST Y RANGE = PRETEST $Y \pm Y$
 $= 1.026 \rightarrow 1.134$

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POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number 042 Date 6 Sept 88 Meter box number Nitech Plant Post Shaw Pre Griffs
 Barometric pressure, $P_b = 29.176$ in. Hg Dry gas meter number 1.077 Pretest Y 1.077

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature			Time (Θ), min	Vacuum setting, in. Hg	Y_i	$V_w P_b (t_d + 460)$ $V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)$
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), $^{\circ}F$	Inlet (t_{d_i}), $^{\circ}F$	Outlet (t_{d_o}), $^{\circ}F$				
2.5	10	9.202	77.537	83	78	80.5	20.0	1.088	$\frac{10(29.176)(540)}{9.202(29.176+32)(537)}$
2.5	10	9.308	77.537	84	77	81.5	20.0	1.079	$\frac{10(29.176)(540)}{9.308(29.176+32)(537)}$
2.5	10	9.500	77.537	86	80	83.0	20.0	1.059	$\frac{10(29.176)(540)}{9.500(29.176+32)(537)}$
								$Y = 1.075$	

^a If there is only one thermometer on the dry gas meter, record the temperature under t_d where

V_w = Gas volume passing through the wet test meter, ft^3 .

V_d = Gas volume passing through the dry gas meter, ft^3 .

t_w = Temperature of the gas in the wet test meter, $^{\circ}F$.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, $^{\circ}F$.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, $^{\circ}F$.

t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o} , $^{\circ}F$.

ΔH = Pressure differential across orifice, in. H_2O .

Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest $Y \pm 0.05Y$.

P_b = Barometric pressure, in. Hg.

Θ = Time of calibration run, min.

$$POST Y RANGE = PRETEST Y \pm 0.05 Y$$

$$= 1.0232 \rightarrow 1.1309$$

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number One Date 6 Sept 88 Meter box number Nutech Plant Post Shaw / Pre Gr. 33
 Barometric pressure, $P_b = 29.17$ in. Hg Dry gas meter number Pretest Y 1.077

Orifice manometer setting, (ΔH), in. H_2O	Gas volume		Temperature				Vacuum setting, in. Hg	Y_i	Y_i $V_w P_b (t_d + 460)$ $V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)$
	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), $^{\circ}F$	Inlet (t_{d_i}), $^{\circ}F$	Outlet (t_{d_o}), $^{\circ}F$	Average (t_d), $^{\circ}F$			
2.5	10	9.202	77.537	83.78	79.80.5	81.5541	20.0	1.088	$(9.202)(29.17)(537)$ $(10.2917)(537)$
2.5	10	9.308	77.537	84.79	80.81.5	83.05425	20.0	1.079	$(9.308)(29.17)(537)$ $(10.2917)(537)$
2.5	10	9.500	77.537	86.80	82.83.0	84.554375	20.0	1.059	$(9.500)(29.17)(537)$ $(10.2917)(537)$
								$Y = 1.075$	

^a If there is only one thermometer on the dry gas meter, record the temperature under t_d where

V_w = Gas volume passing through the wet test meter, ft^3
 V_d = Gas volume passing through the dry gas meter, ft^3
 t_w = Temperature of the gas in the wet test meter, $^{\circ}F$
 t_{d_i} = Temperature of the inlet gas of the dry gas meter, $^{\circ}F$
 t_{d_o} = Temperature of the outlet gas of the dry gas meter, $^{\circ}F$
 t_d = Average temperature of the gas in the dry gas meter, obtained by the average of t_{d_i} and t_{d_o} , $^{\circ}F$
 ΔH = Pressure differential across orifice, in. H_2O
 Y_i = Ratio of accuracy of wet test meter to dry gas meter for each run.
 Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs;
 tolerance = pretest $Y \pm 0.05Y$
 P_b = Barometric pressure, in. Hg.
 θ = Time of calibration run, min.

POST Y RANGE = PICK TEST $Y \pm 0.05 Y$
 $= 1.0232 \rightarrow 1.1309$

APPENDIX Q

Exhaust Gas Moisture Content and Velocity Calculations

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XROM "METH 5"

RUN NUMBER
BLDG 403, BOILER 2

METER BOX Y? RUN
1.0770 RUN

DELTA H? RUN
2.0000 RUN

BAR PRESS ? RUN
29.8600 RUN

METER VOL ? RUN
27.0840 RUN

MTR TEMP F? RUN
128.2000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ? RUN

STATIC HOH IN ? RUN
-.0000 RUN

STACK TEMP. RUN
578.9000 RUN

ML. WATER ? RUN
100.5000 RUN

IMP. % HOH = 15.3

% HOH=15.3

% CO2?

6.9000 RUN

% OXYGEN? RUN
7.9000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.42
MW WET=27.68

SORT PSTS ? RUN
11.6388 RUN

TIME MIN ? RUN
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN
12.2500 RUN

* VOL MTR STD = 26.260
STK PRES ABS = 29.85
VOL HOH GAS = 4.73
% MOISTURE = 15.26
MOL DRY GAS = 0.847
% NITROGEN = 85.20
MOL WT DRY = 29.42
MOL WT WET = 27.68
VELOCITY FPS = 29.58
STACK AREA = 0.82
STACK ACFM = 1.452.
* STACK DSCFM = 624.

XROM "METH 5"

RUN NUMBER
BLDG 403, BOILER 3

METER BOX Y? RUN
1.0770 RUN

DELTA H? RUN
1.9000 RUN

BAR PRESS ? RUN
29.8600 RUN

METER VOL ? RUN
25.8910 RUN

MTR TEMP F? RUN
115.3000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ? RUN

STATIC HOH IN ? RUN
-.0000 RUN

STACK TEMP. RUN
502.5000 RUN

ML. WATER ? RUN
94.2000 RUN

IMP. % HOH = 14.7

% HOH=14.7

% CO2?

8.0000 RUN

% OXYGEN? RUN
7.2000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.57
MW WET=27.86

SORT PSTS ? RUN
10.9672 RUN

TIME MIN ? RUN
40.0000 RUN

NOZZLE DIA ? RUN
.5000 RUN

STK DIA INCH ? RUN
12.2500 RUN

* VOL MTR STD = 25.660
STK PRES ABS = 29.85
VOL HOH GAS = 4.43
% MOISTURE = 14.73
MOL DRY GAS = 0.853
% NITROGEN = 84.80
MOL WT DRY = 29.57
MOL WT WET = 27.86
VELOCITY FPS = 27.31
STACK AREA = 0.82
STACK ACFM = 1.341.
* STACK DSCFM = 626.

XROM "METH 5"

RUN NUMBER
BLDG 403, BOILER 5

METER BOX Y? RUN
1.0770 RUN

DELTA H? RUN
1.4000 RUN

BAR PRESS ? RUN
29.6050 RUN

METER VOL ? RUN
22.9910 RUN

MTR TEMP F? RUN
120.7000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ? RUN

STATIC HOH IN ? RUN
-.0450 RUN

STACK TEMP. RUN
333.8000 RUN

ML. WATER ? RUN
87.4000 RUN

IMP. % HOH = 15.5

% HOH=15.54

% CO2?

8.0000 RUN

% OXYGEN? RUN
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWd =29.60
MW WET=27.80

SORT PSTS ? RUN
10.3136 RUN

TIME MIN ? RUN
40.0000 RUN

~~██████████~~ RUN

STK DIA INCH ? RUN
15.7500 RUN

* VOL MTR STD = 22.355
STK PRES ABS = 29.60
VOL HOH GAS = 4.11
% MOISTURE = 15.54
MOL DRY GAS = 0.845
% NITROGEN = 84.00
MOL WT DRY = 29.60
MOL WT WET = 27.80
VELOCITY FPS = 25.82
STACK AREA = 1.35
STACK ACFM = 2.096.
* STACK DSCFM = 1,165.

XROM -METH 5-

RUN NUMBER
BLDG 611, BOILER 1

METER BOX Y? RUN
1.0770 RUN
DELTA H? RUN
1.4000 RUN
BAR PRESS ? RUN
29.6050 RUN
METER VOL ? RUN
22.2980 RUN
MTR TEMP F? RUN
95.6000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?

STATIC HOH IN ? RUN
-.0350 RUN

STACK TEMP. RUN
409.1000 RUN

ML. WATER ? RUN
61.2000 RUN

IMP. % HOH = 11.3

% HOH=11.3

% CO2? RUN
7.0000 RUN

% OXYGEN? RUN
11.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWD =29.56
MW WET=28.26

SQRT PSTS ? RUN
10.2839 RUN

TIME MIN ? RUN
40.0000 RUN

~~XXXXXXXXXX~~ RUN

STK DIA INCH ? RUN
13.7500 RUN

* VOL MTR STD = 22.660
STK PRES ABS = 29.60
VOL HOH GAS = 2.88
% MOISTURE = 11.28
MOL DRY GAS = 0.887
% NITROGEN = 82.00
MOL WT DRY = 29.56
MOL WT WET = 28.26
VELOCITY FPS = 25.53
STACK AREA = 1.03
STACK ACFM = 1,580.
* STACK DSCFM = 843.

XROM -METH 5-

RUN NUMBER
BLDG 922, HW BOILER

METER BOX Y? RUN
1.0770 RUN
DELTA H? RUN
1.4000 RUN
BAR PRESS ? RUN
29.8150 RUN
METER VOL ? RUN
22.9060 RUN
MTR TEMP F? RUN
111.9000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?

STATIC HOH IN ? RUN
-.0050 RUN

STACK TEMP. RUN
253.6000 RUN

ML. WATER ? RUN
39.7000 RUN

IMP. % HOH = 7.6

% HOH=7.6

% CO2? RUN
8.0000 RUN

% OXYGEN? RUN
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWD =29.60
MW WET=28.72

SQRT PSTS ? RUN
1.4105 RUN

TIME MIN ? RUN
40.0000 RUN

~~XXXXXXXXXX~~ RUN

STK DIA INCH ? RUN
8.0000 RUN

* VOL MTR STD = 22.774
STK PRES ABS = 29.81
VOL HOH GAS = 1.87
% MOISTURE = 7.58
MOL DRY GAS = 0.924
% NITROGEN = 84.00
MOL WT DRY = 29.60
MOL WT WET = 28.72
VELOCITY FPS = 3.46
STACK AREA = 0.35
STACK ACFM = 72.
* STACK DSCFM = 49.

XROM -METH 5-

RUN NUMBER
BLDG 922, BOILER 1

METER BOX Y? RUN
1.0770 RUN
DELTA H? RUN
1.4000 RUN
BAR PRESS ? RUN
29.6350 RUN
METER VOL ? RUN
23.4440 RUN
MTR TEMP F? RUN
95.7000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?

STATIC HOH IN ? RUN
-.0200 RUN

STACK TEMP. RUN
295.5000 RUN

ML. WATER ? RUN
126.2000 RUN

IMP. % HOH = 19.9

% HOH=19.9

% CO2? RUN
8.0000 RUN

% OXYGEN? RUN
8.0000 RUN

% CO ? RUN

MOL WT OTHER? RUN

MWD =29.60
MW WET=27.29

SQRT PSTS ? RUN
4.4233 RUN

TIME MIN ? RUN
40.0000 RUN

~~XXXXXXXXXX~~ RUN

STK DIA INCH ? RUN
9.7500 RUN

* VOL MTR STD = 23.845
STK PRES ABS = 29.63
VOL HOH GAS = 5.94
% MOISTURE = 19.94
MOL DRY GAS = 0.801
% NITROGEN = 84.00
MOL WT DRY = 29.60
MOL WT WET = 27.29
VELOCITY FPS = 11.17
STACK AREA = 0.52
STACK ACFM = 348.
* STACK DSCFM = 193.

XROM "METH 5"
 RUN NUMBER
 BLDG 1046, BOILER 1
 METER BOX Y? RUN
 1.0770 RUN
 DELTA H? RUN
 1.4000 RUN
 BAR PRESS ? RUN
 29.8150 RUN
 METER VOL ? RUN
 22.7650 RUN
 MTR TEMP F? RUN
 96.0000 RUN
 % OTHER GAS
 REMOVED BEFORE
 DRY GAS METER ? RUN
 STATIC HOH IN ? RUN
 -.0550 RUN
 STACK TEMP. RUN
 358.0000 RUN
 ML. WATER ? RUN
 71.0000 RUN
 IMP. % HOH = 12.6
 % HOH=12.6

% CO2? RUN
 8.0000 RUN
 % OXYGEN? RUN
 8.0000 RUN
 % CO ? RUN
 MOL WT OTHER? RUN

MWd =29.60
 MW WET=28.14

SORT PSTS ? RUN
 6.1812 RUN
 TIME MIN ? RUN
 40.0000 RUN
~~██████████~~ RUN
 STK DIA INCH ? RUN
 15.0000 RUN

* VOL MTR STD = 23.282
 STK PRES ABS = 29.81
 VOL HOH GAS = 3.34
 % MOISTURE = 12.55
 MOL DRY GAS = 0.874
 % NITROGEN = 84.00
 MOL WT DRY = 29.60
 MOL WT WET = 28.14
 VELOCITY FPS = 15.32
 STACK AREA = 1.23
 STACK ACFM = 1.128.
 * STACK DSCFM = 635.

XROM "METH 5"
 RUN NUMBER
 BLDG 1102, BOILER 1
 METER BOX Y? RUN
 1.0770 RUN
 DELTA H? RUN
 1.4000 RUN
 BAR PRESS ? RUN
 29.8150 RUN
 METER VOL ? RUN
 22.5760 RUN
 MTR TEMP F? RUN
 87.7000 RUN
 % OTHER GAS
 REMOVED BEFORE
 DRY GAS METER ? RUN
 STATIC HOH IN ? RUN
 -.0400 RUN
 STACK TEMP. RUN
 237.7000 RUN
 ML. WATER ? RUN
 54.7000 RUN
 IMP. % HOH = 9.9
 % HOH=9.9

% CO2? RUN
 8.0000 RUN
 % OXYGEN? RUN
 8.0000 RUN
 % CO ? RUN
 MOL WT OTHER? RUN

MWd =29.60
 MW WET=28.45

SORT PSTS ? RUN
 6.0948 RUN
 TIME MIN ? RUN
 40.0000 RUN
~~██████████~~ RUN
 STK DIA INCH ? RUN
 9.7500 RUN

* VOL MTR STD = 23.430
 STK PRES ABS = 29.81
 VOL HOH GAS = 2.57
 % MOISTURE = 9.90
 MOL DRY GAS = 0.901
 % NITROGEN = 84.00
 MOL WT DRY = 29.60
 MOL WT WET = 28.45
 VELOCITY FPS = 15.03
 STACK AREA = 0.52
 STACK ACFM = 468.
 * STACK DSCFM = 318.

XROM "METH 5"
 RUN NUMBER
 BLDG 1130, BOILER 1
 METER BOX Y? RUN
 1.0770 RUN
 DELTA H? RUN
 1.4000 RUN
 BAR PRESS ? RUN
 29.6350 RUN
 METER VOL ? RUN
 22.6260 RUN
 MTR TEMP F? RUN
 100.2000 RUN
 % OTHER GAS
 REMOVED BEFORE
 DRY GAS METER ? RUN
 STATIC HOH IN ? RUN
 -.1600 RUN
 STACK TEMP. RUN
 407.9000 RUN
 ML. WATER ? RUN
 40.1000 RUN
 IMP. % HOH = 9.0
 % HOH=9.0

% CO2? RUN
 7.0000 RUN
 % OXYGEN? RUN
 11.0000 RUN
 % CO ? RUN
 MOL WT OTHER? RUN

MWd =29.56
 MW WET=28.52

SORT PSTS ? RUN
 11.3643 RUN
 TIME MIN ? RUN
 40.0000 RUN
~~██████████~~ RUN
 STK DIA INCH ? RUN
 10.0000 RUN

* VOL MTR STD = 22.920
 STK PRES ABS = 29.62
 VOL HOH GAS = 2.26
 % MOISTURE = 9.02
 MOL DRY GAS = 0.910
 % NITROGEN = 82.00
 MOL WT DRY = 29.56
 MOL WT WET = 28.52
 VELOCITY FPS = 28.00
 STACK AREA = 0.55
 STACK ACFM = 919.
 * STACK DSCFM = 504.

XROM "METH 5"

RUN NUMBER
BLDG 1200, BOILER #1

METER BOX Y? RUN

1.0770 RUN

DELTA H? RUN

1.3700 RUN

BAR PRESS ? RUN

29.9450 RUN

METER VOL ? RUN

26.9280 RUN

MTR TEMP F? RUN

89.4000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?

RUN

STATIC HOH IN ?

-0.0450 RUN

STACK TEMP.

369.1000 RUN

ML. WATER ?

58.9000 RUN

IMP. % HOH = 9.0

% HOH=9.0

% CO2?

6.8000 RUN

% OXYGEN?

11.4000 RUN

% CO ?

RUN

MOL WT OTHER?

RUN

MWd =29.54

MW WET=28.50

SORT PSTS ?

9.1134 RUN

TIME MIN ?

48.0000 RUN

██████████ RUN

██████████ RUN

STK DIA INCH ?

9.6300 RUN

* VOL MTR STD = 27.989

STK PRES ABS = 29.94

VOL HOH GAS = 2.77

% MOISTURE = 9.01

MOL DRY GAS = 0.910

% NITROGEN = 81.80

MOL WT DRY = 29.54

MOL WT WET = 28.50

VELOCITY FPS = 22.40

STACK AREA = 0.51

STACK ACFM = 680.

* STACK DSCFM = 394.

XROM "METH 5"

RUN NUMBER
BLDG 1200, BOILER 2

METER BOX Y? RUN

1.0770 RUN

DELTA H? RUN

1.5700 RUN

BAR PRESS ? RUN

29.9450 RUN

METER VOL ? RUN

25.3220 RUN

MTR TEMP F? RUN

121.4000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?

RUN

STATIC HOH IN ?

-0.0450 RUN

STACK TEMP.

266.2000 RUN

ML. WATER ?

75.0000 RUN

IMP. % HOH = 12.4

% HOH=12.4

% CO2?

7.0000 RUN

% OXYGEN?

11.0000 RUN

% CO ?

RUN

MOL WT OTHER?

RUN

MWd =29.56

MW WET=28.12

SORT PSTS ?

4.6228 RUN

TIME MIN ?

48.0000 RUN

██████████ RUN

██████████ RUN

STK DIA INCH ?

9.6300 RUN

* VOL MTR STD = 24.883

STK PRES ABS = 29.94

VOL HOH GAS = 3.53

% MOISTURE = 12.42

MOL DRY GAS = 0.876

% NITROGEN = 82.00

MOL WT DRY = 29.56

MOL WT WET = 28.12

VELOCITY FPS = 11.44

STACK AREA = 0.51

STACK ACFM = 347.

* STACK DSCFM = 221.

XROM "METH 5"

RUN NUMBER
BLDG 1200, BOILER #3

METER BOX Y? RUN

1.0770 RUN

DELTA H? RUN

1.3000 RUN

BAR PRESS ? RUN

29.9290 RUN

METER VOL ? RUN

25.4150 RUN

MTR TEMP F? RUN

107.5000 RUN

% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?

RUN

STATIC HOH IN ?

-0.0900 RUN

STACK TEMP.

281.6000 RUN

ML. WATER ?

66.3000 RUN

IMP. % HOH = 10.9

% HOH=10.9

% CO2?

8.0000 RUN

% OXYGEN?

8.0000 RUN

% CO ?

RUN

MOL WT OTHER?

RUN

MWd =29.60

MW WET=28.34

SORT PSTS ?

8.1510 RUN

TIME MIN ?

48.0000 RUN

██████████ RUN

██████████ RUN

STK DIA INCH ?

9.6300 RUN

* VOL MTR STD = 25.556

STK PRES ABS = 29.92

VOL HOH GAS = 3.12

% MOISTURE = 10.88

MOL DRY GAS = 0.891

% NITROGEN = 84.00

MOL WT DRY = 29.60

MOL WT WET = 28.34

VELOCITY FPS = 20.10

STACK AREA = 0.51

STACK ACFM = 610.

* STACK DSCFM = 387.

XROM "METH 5"
 RUN NUMBER
 BLDG 1206, SMALL BOILER
 RUN
 METER BOX Y?
 1.0770 RUN
 DELTA H?
 1.2500 RUN
 BAR PRESS ?
 29.8400 RUN
 METER VOL ?
 25.6360 RUN
 MTR TEMP F?
 98.2500 RUN
 % OTHER GAS
 REMOVED BEFORE
 DRY GAS METER ?
 RUN
 STATIC HOH IN ?
 -.0050 RUN
 STACK TEMP.
 238.1000 RUN
 ML. WATER ?
 65.4000 RUN
 IMP. % HOH = 10.5
 % HOH=10.5

% CO2?
 7.0000 RUN
 % OXYGEN?
 11.0000 RUN
 % CO ?
 RUN
 MOL WT OTHER?
 RUN

MWD =29.56
 MW WET=28.34

SORT PSTS ?
 3.1900 RUN
 TIME MIN ?
 48.0000 RUN
~~██████████~~ RUN
 STK DIA INCH ?
 13.8800 RUN

* VOL MTR STD = 26.124
 STK PRES ABS = 29.84
 VOL HOH GAS = 3.08
 % MOISTURE = 10.54
 MOL DRY GAS = 0.295
 % NITROGEN = 82.00
 MOL WT DRY = 29.56
 MOL WT WET = 28.34
 VELOCITY FPS = 7.88
 STACK AREA = 1.85
 STACK ACFM = 497.
 * STACK DSCFM = 335.

XROM "METH 5"
 RUN NUMBER
 BLDG 1402, BOILER 1
 RUN
 METER BOX Y?
 1.0770 RUN
 DELTA H?
 1.4000 RUN
 BAR PRESS ?
 29.8500 RUN
 METER VOL ?
 22.3040 RUN
 MTR TEMP F?
 88.9000 RUN
 % OTHER GAS
 REMOVED BEFORE
 DRY GAS METER ?
 RUN
 STATIC HOH IN ?
 -.0100 RUN
 STACK TEMP.
 255.1000 RUN
 ML. WATER ?
 51.6000 RUN
 IMP. % HOH = 9.5
 % HOH=9.5

% CO2?
 7.0000 RUN
 % OXYGEN?
 11.0000 RUN
 % CO ?
 RUN
 MOL WT OTHER?
 RUN

MWD =29.56
 MW WET=28.46

SORT PSTS ?
 4.3536 RUN
 TIME MIN ?
 39.5000 RUN
~~██████████~~ RUN
 STK DIA INCH ?
 10.7500 RUN

* VOL MTR STD = 23.132
 STK PRES ABS = 29.85
 VOL HOH GAS = 2.43
 % MOISTURE = 9.50
 MOL DRY GAS = 0.905
 % NITROGEN = 82.00
 MOL WT DRY = 29.56
 MOL WT WET = 28.46
 VELOCITY FPS = 10.73
 STACK AREA = 0.63
 STACK ACFM = 406.
 * STACK DSCFM = 270.

XROM "METH 5"
 RUN NUMBER
 BLDG 1422, BOILER 1
 RUN
 METER BOX Y?
 1.0770 RUN
 DELTA H?
 1.4000 RUN
 BAR PRESS ?
 29.8500 RUN
 METER VOL ?
 21.8730 RUN
 MTR TEMP F?
 93.9000 RUN
 % OTHER GAS
 REMOVED BEFORE
 DRY GAS METER ?
 RUN
 STATIC HOH IN ?
 -.0100 RUN
 STACK TEMP.
 241.6000 RUN
 ML. WATER ?
 66.8000 RUN
 IMP. % HOH = 12.3
 % HOH=12.3

% CO2?
 7.0000 RUN
 % OXYGEN?
 11.0000 RUN
 % CO ?
 RUN
 MOL WT OTHER?
 RUN

MWD =29.56
 MW WET=28.14

SORT PSTS ?
 3.7343 RUN
 TIME MIN ?
 40.0000 RUN
~~██████████~~ RUN
 STK DIA INCH ?
 17.5000 RUN

* VOL MTR STD = 22.480
 STK PRES ABS = 29.85
 VOL HOH GAS = 3.14
 % MOISTURE = 12.27
 MOL DRY GAS = 0.877
 % NITROGEN = 82.00
 MOL WT DRY = 29.56
 MOL WT WET = 28.14
 VELOCITY FPS = 9.25
 STACK AREA = 1.67
 STACK ACFM = 927.
 * STACK DSCFM = 611.

XROM -METH 5-

RUN NUMBER
BLDG 1604, BOILER 1
METER BOX Y? RUN
1.0770 RUN
DELTA H? RUN
1.4000 RUN
BAR PRESS ? RUN
29.8060 RUN
METER VOL ? RUN
22.6450 RUN
MTR TEMP F? RUN
104.5000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ? RUN
STATIC HOH IN ? RUN
-.0700 RUN
STACK TEMP. RUN
151.8000 RUN
ML. WATER ? RUN
57.2000 RUN
IMP. % HOH = 10.6
% HOH=10.6

% CO2? RUN
7.0000 RUN
% OXYGEN? RUN
11.0000 RUN
% CO ? RUN
MOL WT OTHER? RUN

MWd =29.56
MW WET=28.34

SORT PSTS ? RUN
8.8416 RUN
TIME MIN ? RUN
40.0000 RUN
██████████ RUN
██████████ RUN
STK DIA INCH ? RUN
7.5000 RUN

* VOL MTR STD = 22.803
STK PRES ABS = 29.80
VOL HOH GAS = 2.69
% MOISTURE = 10.56
MOL DRY GAS = 0.894
% NITROGEN = 82.00
MOL WT DRY = 29.56
MOL WT WET = 28.34
VELOCITY FPS = 21.85
STACK AREA = 0.31
STACK ACFM = 402.
* STACK DSCFM = 309.

XROM -METH 5-

RUN NUMBER
BLDG 1614, BOILER 2
METER BOX Y? RUN
1.0770 RUN
DELTA H? RUN
1.4000 RUN
BAR PRESS ? RUN
29.8060 RUN
METER VOL ? RUN
22.8700 RUN
MTR TEMP F? RUN
88.6000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ? RUN
STATIC HOH IN ? RUN
-.0100 RUN
STACK TEMP. RUN
260.3000 RUN
ML. WATER ? RUN
52.3000 RUN
IMP. % HOH = 9.4
% HOH=9.4

% CO2? RUN
7.0000 RUN
% OXYGEN? RUN
11.0000 RUN
% CO ? RUN
MOL WT OTHER? RUN

MWd =29.56
MW WET=28.47

SORT PSTS ? RUN
4.8660 RUN
TIME MIN ? RUN
40.0000 RUN
██████████ RUN
██████████ RUN
STK DIA INCH ? RUN
16.0000 RUN

* VOL MTR STD = 23.697
STK PRES ABS = 29.81
VOL HOH GAS = 2.46
% MOISTURE = 9.41
MOL DRY GAS = 0.906
% NITROGEN = 82.00
MOL WT DRY = 29.56
MOL WT WET = 28.47
VELOCITY FPS = 12.00
STACK AREA = 1.40
STACK ACFM = 1.005.
* STACK DSCFM = 665.

XROM -METH 5-

RUN NUMBER
BLDG 1604, BOILER 1
METER BOX Y? RUN
1.0770 RUN
DELTA H? RUN
1.4000 RUN
BAR PRESS ? RUN
29.8060 RUN
METER VOL ? RUN
22.7500 RUN
MTR TEMP F? RUN
107.6000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ? RUN
STATIC HOH IN ? RUN
-.0100 RUN
STACK TEMP. RUN
272.5000 RUN
ML. WATER ? RUN
57.7000 RUN
IMP. % HOH = 10.6
% HOH=10.6

% CO2? RUN
7.0000 RUN
% OXYGEN? RUN
11.0000 RUN
% CO ? RUN
MOL WT OTHER? RUN

MWd =29.56
MW WET=28.33

SORT PSTS ? RUN
4.6759 RUN
TIME MIN ? RUN
40.0000 RUN
██████████ RUN
██████████ RUN
STK DIA INCH ? RUN
16.0000 RUN

* VOL MTR STD = 22.792
STK PRES ABS = 29.81
VOL HOH GAS = 2.72
% MOISTURE = 10.65
MOL DRY GAS = 0.894
% NITROGEN = 82.00
MOL WT DRY = 29.56
MOL WT WET = 28.33
VELOCITY FPS = 11.56
STACK AREA = 1.40
STACK ACFM = 968.
* STACK DSCFM = 621.

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