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COMPLIANCE TESTING OF GRISSOM AFB CENTRAL HEATING PLANT COAL-FIRED BOILERS 3, 4, AND 5, GRISSOM AFB IN

JAMES A. GARRISON, Major, USAF, BSC

JUNE 1989

Final Report

Distribution is unlimited; approved for public release

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

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At the request of HQ SAC/SGPB source compliance testing (particulate and visible emissions) of boilers 3, 4, and 5 in the Grissom AFB Central Heating Plant was accomplished 29 Jan - 15 Feb 89. The survey was conducted to determine compliance with regards to Indiana Administrative Code, Title 325 - Air Pollution Control Board, Article 5, Opacity Regulations, and Article 6, Particulate Regulations. Boiler 3 was tested through scrubber B, Boiler 4 through scrubber A and Boiler 5 through scrubber B and the bypass stack. Results indicate that each boiler met applicable visible and particulate emissions standards.

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I. INTRODUCTION

On 29 Jan to 15 Feb 1989, a stationary source sampling survey for particulate and visible emissions was conducted on coal-fired boilers 3, 4 and 5 at the Grissom AFB Central Heating Plant, by the Air Quality Function, Consultant Services Division, Air Force Occupational and Environmental Health Laboratory (AFOEHL). This survey was requested by HQ SAC/SGPB to determine particulate emission compliance status with regards to Indiana Administrative Code, Title 325 - Air Pollution Control Board, Article 5, Opacity Regulations (325 IAC 5), and Article 6, Particulate Regulations (325 IAC 6). Personnel involved with on-site testing are listed in Appendix A.

II. DISCUSSION

A. Background

On 7 Nov 1986, the Director, Air and Radiation Division, U.S. Environmental Protection Agency (EPA), Region V, issued a notice of violation (NOV) to Grissom AFB for violation of 325 IAC 5, Opacity Regulations. The NOV was based on information submitted by the State of Indiana Department of Environmental Management and by the EPA. Observations indicated that oil-fired boiler 1 and coal-fired boilers 3 and 4 (boiler 5 was out of service during the State observations) were out of compliance with respect to visible emissions.

To demonstrate and maintain compliance with 325 IAC 5 and other rules set forth by the Indiana Air Pollution Control Board, EPA, Region V required Grissom AFB to: (1) conduct stack particulate emission testing on boilers 3, 4 and 5 (when operational) as specified in Title 40, Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A, Reference Method 5, (2) determine visible emissions from boilers 1-4 and 5 (when operational) as specified in 40 CFR 60, Appendix A, Reference Method 9 and (3) request stack testing following future major modifications to the central heating plant.

This compliance testing project involved conducting source compliance testing (particulate and visible emissions determination) on boiler 3 through scrubber B, boiler 4 through scrubber A and boiler 5 through scrubber B and the bypass stack. Figure 1 below shows the pass/fail status of each boiler based on prior testing by AFOEHL during Nov 87 and Mar 88.

Figure 1. Boiler Pass/Fail Status

Boiler	Bypass Stack	Scrubber A	Scrubber B
3	P	P	F
4	P	-	P
5	F	P	-

P = passed emissions testing
F = failed emissions testing
- = not tested previously due to equipment failure

B. Site Description

The Central Heating Plant operates a total of five boilers for steam production:

Boiler No./ Manufacturer	Steam Capacity (lb/hr)	Year Installed	Fuel
1/Springfield Boiler Co.	40,000	1955	oil
2/Springfield Boiler Co.	40,000	1955	oil
3/Springfield Boiler Co.	40,000	1955	coal
4/E. Keeler Co.	40,000	1960	coal
5/Zurn Ind.	65,000	1980	coal

Coal-fired boilers 3, 4 and 5 are spreader-stoker fired units, each having forced-draft and induced-draft fans and mechanical fly ash collection systems. Each unit is fitted with a steam-operated soot blower to remove fly ash and soot from heat exchanger tubing. Boiler 5 is also fitted with an economizer to further increase operating efficiency by preheating the feed water using exhaust gas heat.

Air pollution control consists of individual multiclone dust collectors on each boiler and an optional wet scrubber common to the three coal-fired boilers. The multiclone dust collectors on boilers 3, 4 and 5 were manufactured by Western Precipitation Division-Joy Manufacturing Co. The collector on both boiler 3 and 4 is a Model 9VM-10 and consists of 36 nine-inch diameter cyclonic collectors operating in parallel. The collector on boiler 5 is a Model 9VMU-10 and consists of 48 nine-inch diameter cyclonic collectors operating in parallel. Each unit is located in the boiler exhaust duct upstream of the induced-draft fan. Ash collected by the multiclones is carried by gravity to a hopper.

The exhaust effluent from each boiler is ducted to a common breeching and can be routed to the wet-scrubber or to a bypass stack. The scrubber is a double-alkali flue-gas desulfurization system using soda ash (sodium carbonate) in the scrubbing fluid and lime (calcium hydroxide) slurry for regeneration of the scrubbing liquid. The primary purpose of the unit is to remove sulfur from the flue gas; a secondary purpose is to remove particulates from the flue gas. The system has two identical scrubber units, A and B, each designed to handle 50% of the flue gas from the three coal-fired boilers. Each unit has a 5 foot (ft) diameter stack and terminates about 70 feet above the ground. There is no requirement at this time to use the scrubber system because of the low-sulfur coal being used by the plant. The bypass stack has a 5.5 ft diameter and terminates approximately 70 ft above ground level. The scrubber stacks and the bypass stack can be seen in Figure 2. A flue gas flow diagram is shown in Figure 3.

C. Applicable Standards

The monitoring requirements, opacity regulations and particulate regulations are defined under 325 IAC 3, 5 and 6, respectively. Article 3 states that emissions tests shall be conducted in accordance with the procedures and analysis methods specified in Chapter 40, Code of Federal Regulations, Part 60, Appendix A. EPA Methods 1-5 were used for the determination of particulate emissions and Method 9 for visible emissions.

Article 5 states that visible emissions shall not exceed an average of 40% opacity in 24 consecutive readings or 60% opacity for more than a cumulative total of 15 minutes (60 readings) in a 6-hour period. When conducting a soot blowing operation, visible emissions may exceed these standards except that visible emissions may not exceed 60% opacity nor shall visible emissions in excess of the standards continue for more than 5 minutes in any 60 minute period.

Under 325 IAC 6, the maximum allowable particulate emission rate from the combustion of fuel for indirect heating facilities (either existing and in operation or with permits to construct prior to the effective date of 325 IAC 6, 26 Sep 1980) is determined by the following equation:

$$Pt = \frac{C \times a \times h}{76.5 \times Q^{0.75} \times N^{0.25}}$$

Where:

Pt = Pounds of particulate matter emitted per million BTU heat input (lb/mm BTU).

C = Maximum ground level concentration with respect to distance from the point source at the "critical" wind speed for level terrain (50 micrograms per cubic meter - provided in standard).

Q = Total source maximum operating capacity rating in million BTU per hour (mmBTU/hr) heat input (50.0 mmBTU/hr for boilers 3 and 4, 83 mmBTU/hr for boiler 5 - determined from plant operation).

N = Number of stacks in fuel burning operation (1).

a = Plume rise factor (0.67 is used for Q less than or equal to 1,000 mmBTU/hr heat input).

h = Stack height in feet (70 ft).

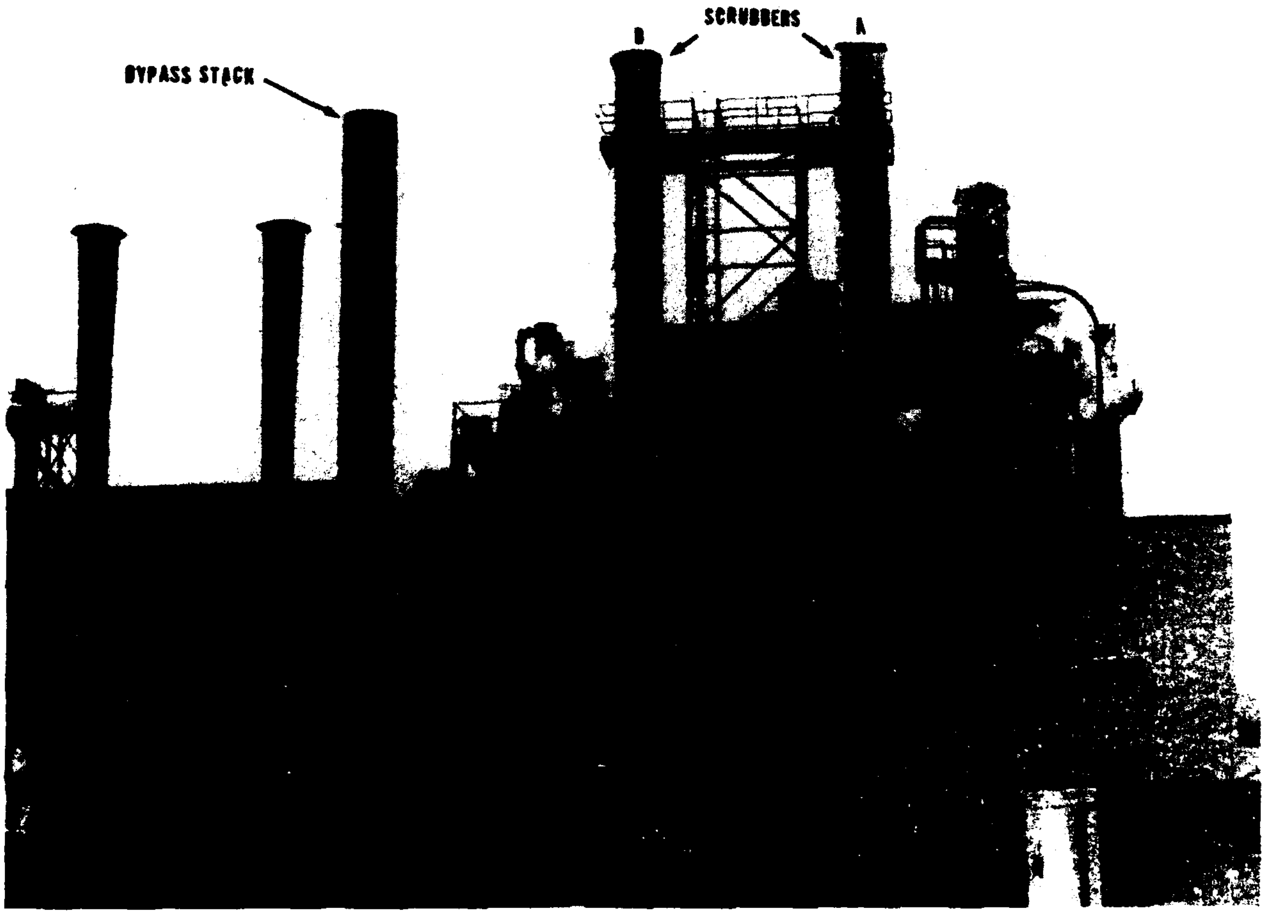
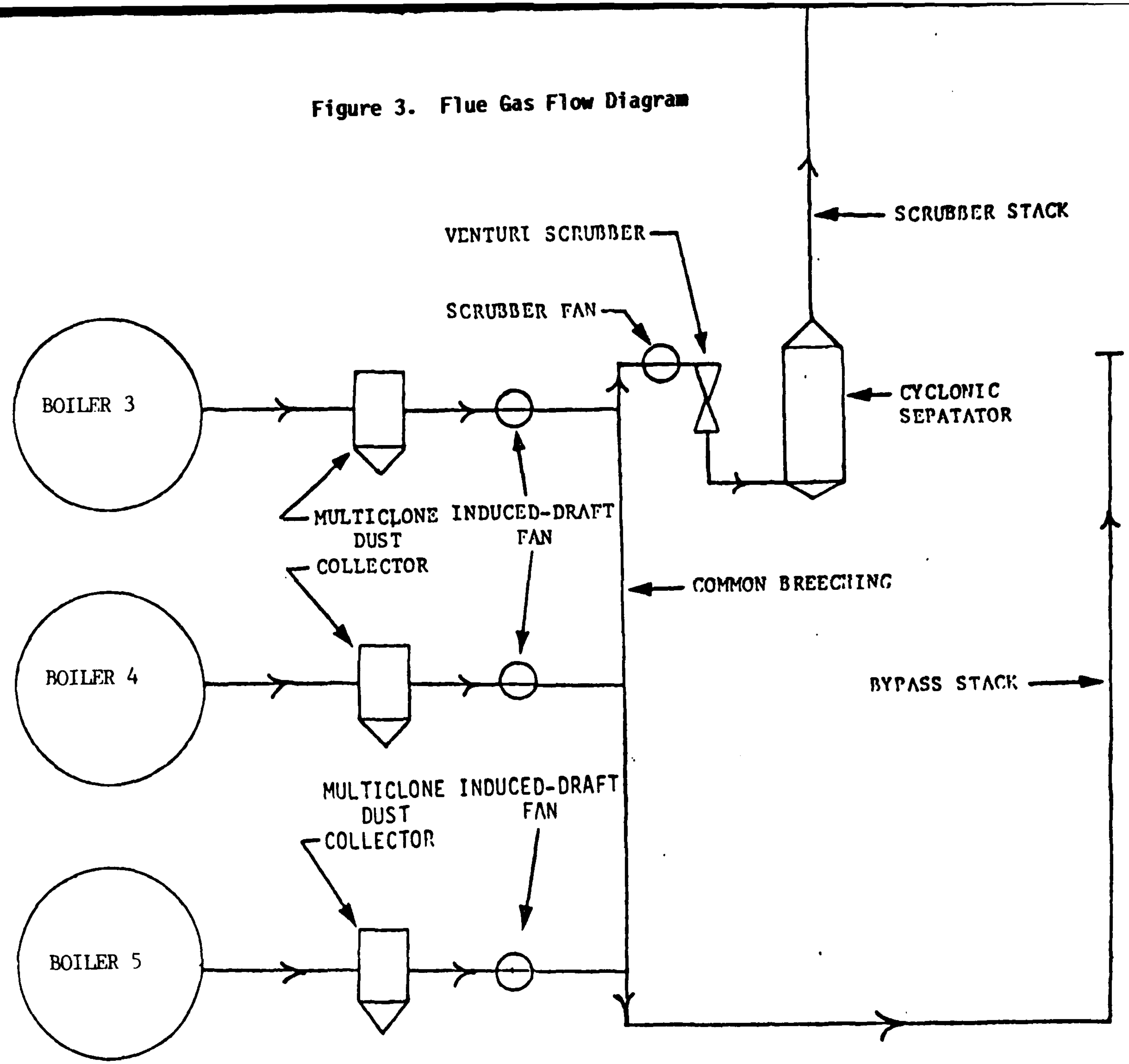


Figure 2. View of Scrubbers and Bypass Stack

Figure 3. Flue Gas Flow Diagram



The limits on particulate emissions determined by the equation and values of the variables applicable to this facility are 1.6 lb/mmBTU for boilers 3 and 4 and 1.1 lb/mmBTU for boiler 5. However, particulate emissions from facilities used for indirect heating purposes shall in no case exceed the following emission limitations: (1) 0.8 lb/mmBtu heat input for facilities existing and in operation on or before 8 June 1972 or (2) 0.6 lb/mmBTU heat input for any facility which has 250 mmBTU/hr heat input or less and which began operation after 8 June 1972. Item (1) applies to boilers 3 and 4 and item (2) applies to boiler 5. State regulations are presented in Appendix B.

D. Sampling Methods and Procedures

Boiler 3 was tested through scrubber B, boiler 4 through scrubber A and boiler 5 through scrubber B and the bypass stack. Coordination was made with plant personnel to try and operate each boiler at 95% capacity or greater during testing. One of the three runs which comprised a complete test included a soot blow; this is indicated on the field data sheets. Boiler operating logs for the test periods are provided in Appendix C. These logs indicate hourly steam output and coal usage. Laboratory results for the coal analysis are provided in Appendix D. Each coal sample represents an integrated sample collected over a particular one hour test run as noted on the analysis sheet.

325 IAC 3 requires that all emissions tests be conducted in accordance with the procedures and analysis methods specified in 40 CFR 60, Appendix A, Methods 1-5. 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 in place on both scrubber stacks and located 1.4 stack diameters upstream from the stack exit and 5.6 stack diameters downstream from any disturbance (cyclonic separator). Based on a 5 ft inside stack diameter, port location and type of sample (particulate), a total of 20 traverse points were determined for emission evaluation. Sampling ports were also in place on the bypass stack and were located 2 stack diameters upstream from the stack exit and 7 stack diameters downstream from the nearest disturbance (common breeching inlet). Based on a 5.5 ft inside stack diameter, port location and type of sample (particulate), a total of 12 traverse points were determined for emission evaluation. The sampling time for each sampling run was 60 minutes; therefore, the sampling time per traverse point in each scrubber stack was 3 minutes and 5 minutes per point in the bypass stack. Illustrations showing port locations and sampling points are provided in Appendixes E, F, G and H.

Prior to each emissions test, a preliminary velocity pressure traverse was accomplished and cyclonic flow was determined. For acceptable flow conditions to exist in a stack, the average of the absolute values of the flow angles taken at each traverse point must be less than or equal to 20 degrees. Based on prior testing experience at this location, straightening vanes were installed directly above the cyclonic separator in both scrubber A and scrubber B to prevent cyclonic flow within the stack. The resulting flow angle in the scrubber A stack averaged 14 degrees and that in the scrubber B stack averaged 15 degrees. The average of the flow angles in the bypass stack averaged 5 degrees. The flow angle averages indicated an acceptable flow condition existed in all three stacks.

During each sample run, a flue gas sample for ORSAT analysis (measures oxygen, and carbon dioxide for stack gas molecular weight determination and emissions correction) was taken. ORSAT sampling and analysis equipment are shown in Figures 4 and 5. Flue gas moisture content, also needed for determination of gas molecular weight, was obtained during particulate sampling.

Particulate samples were collected using the sampling train shown in Figure 6. The train consisted of a buttonhook probe nozzle, heated inconel probe, heated glass filter, impingers and pumping and metering device. The nozzle was sized prior to each test so that the gas stream could be sampled isokinetically; in other words, the velocity at the nozzle tip was the same as the stack gas velocity at each point sampled. Flue gas velocity pressure was measured at the nozzle tip using a Type-S pitot tube connected to a 10-inch inclined-vertical manometer. 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 collect 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 I.

Particulate emissions 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. Emissions calculations from the EPA programs are found in Appendix J.

Visible emissions determinations were accomplished during each sample run. Visible emissions results are presented in Appendixes E through H.

III. CONCLUSIONS

Table 1 provides operating parameters for boilers 3, 4 and 5 during testing and the resultant particulate and visible emissions determined from these tests. Results indicate that emissions from boilers 3 through scrubber B and boiler 4 through scrubber A were well below the emission standard of 0.8 lb/mmBTU with an emission rate of 0.37 lb/mmBTU for both units. Boiler 5 emissions through scrubber B and the bypass stack were well below the emission standard of 0.60 lb/mmBTU with particulate emission rates of 0.19 lb/mmBTU and 0.44 lb/mmBTU, respectively. All visible emissions were equal to or below applicable standards.

To date, boilers 3, 4 and 5 have been tested through both scrubbers and the bypass stack and meet applicable state particulate and visible standards.

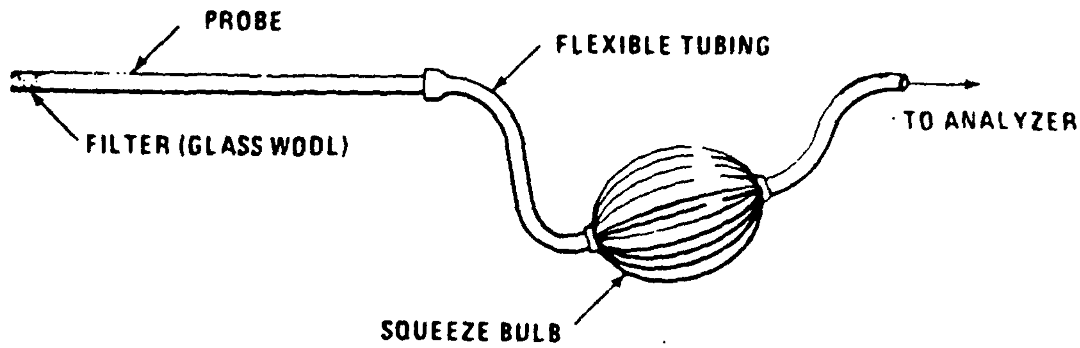


Figure 4. ORSAT Sampling Train

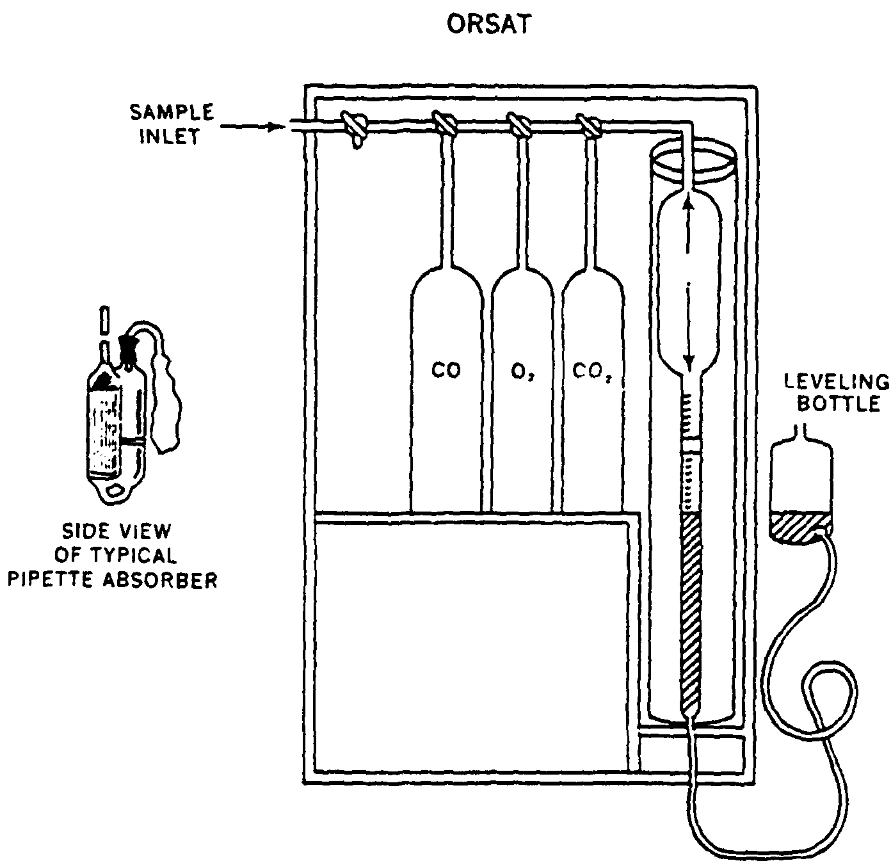
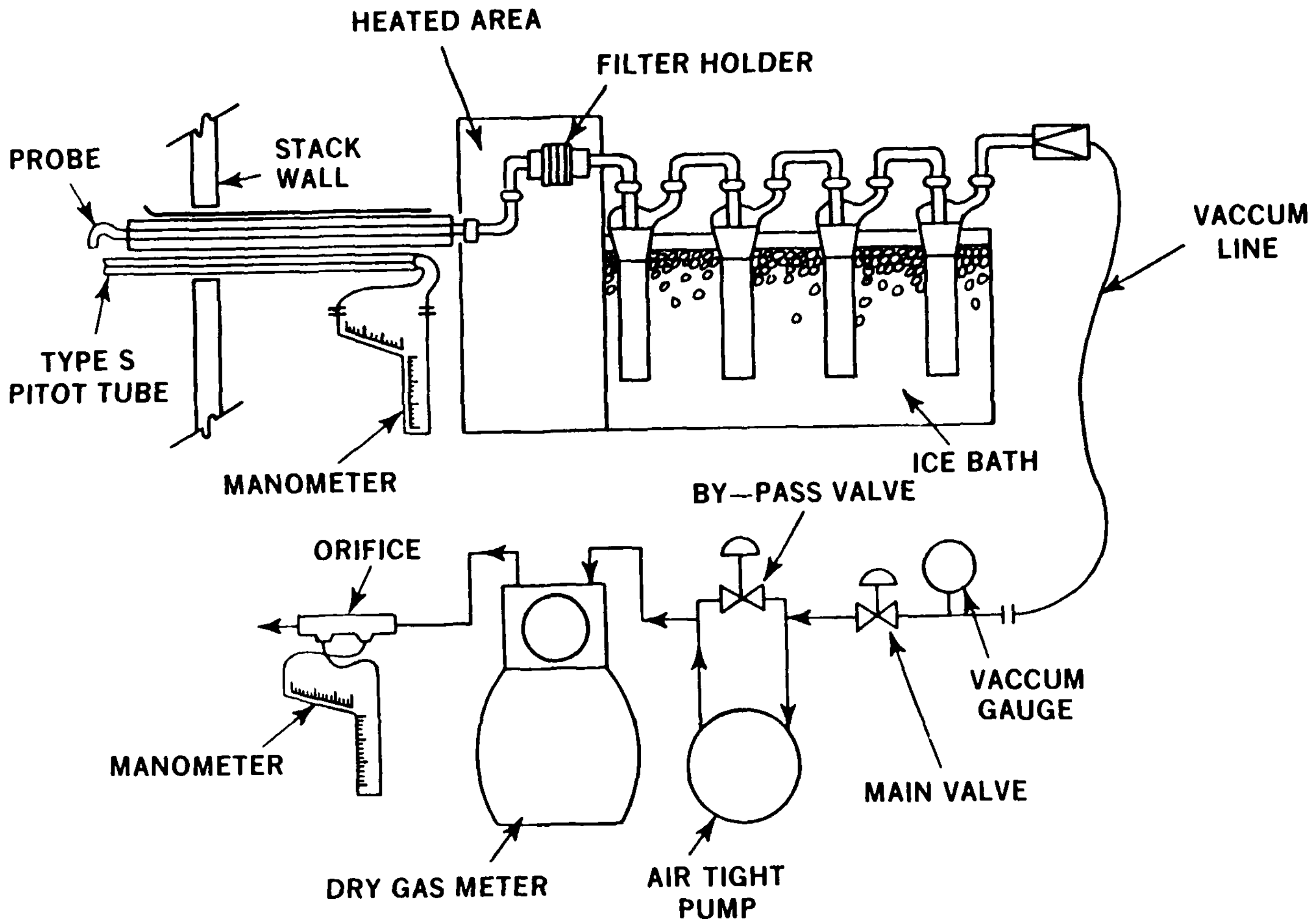


Figure 5. ORSAT Apparatus

Figure 6. Particulate Sampling Train



IV. RECOMMENDATIONS

AFOEHL will remain active in providing consultant and testing services to Grissom AFB with respect to the central heating plant.

TABLE 1

STACK EMISSION TESTING RESULTS

DATE	TIME (MILITARY)	BOILER NO.	STACK NO.*	RUN NO.	BOILER OPERATING CAPACITY (%)	SOOT BLOW	COAL HEAT VALUE (Btu/lb)	COAL USE (lb/hr)	HEAT INPUT (mmBtu/hr)	PM EMISSIONS** (lb/hr)	% CO2 IN FLUE GAS	PM EMISSIONS CORRECTED TO 12% CO2 (lb/mmBtu)	VISIBLE EMISSIONS (% OPACITY)
13 FEB 89	1013	3	SCR B	1	90.0		11209	4000	44.8	5.8	4.4	0.35	0.0
13 FEB 89	1208	3	SCR B	2	93.0	X	11281	4000	45.1	4.7	4.2	0.30	0.0
13 FEB 89	1347	3	SCR B	3	93.0		11316	4000	45.3	7.1	4.0	0.47	0.0
					AVG = 92.0							AVG = 0.37	
14 FEB 89	0944	4	SCR A	1	95.0		11433	4149	47.4	5.7	3.0	0.48	0.0
14 FEB 89	1124	4	SCR A	2	95.0		11369	4149	47.2	3.0	2.8	0.27	0.0
14 FEB 89	1314	4	SCR A	3	95.0	X	11365	4149	47.2	3.0	2.2	0.35	0.0
					AVG = 95.0							AVG = 0.37	
10 FEB 89	1020	5	SCR B	1	98.0	X	11794	6882	81.2	11.2	7.2	0.23	0.0
10 FEB 89	1217	5	SCR B	2	98.0		11463	6882	78.9	7.5	6.2	0.18	0.0
10 FEB 89	1417	5	SCR B	3	98.0		11895	6882	82.5	7.1	6.0	0.17	0.0
					AVG = 98.0							AVG = 0.19	
12 FEB 89	1011	5	BP	1	99.0		11339	6864	77.6	21.4	9.0	0.37	7.9
12 FEB 89	1226	5	BP	2	100.0		11359	6864	78.0	20.0	10.6	0.29	14.6
12 FEB 89	1422	5	BP	3	97.0	X	11344	6864	77.9	31.4	7.4	0.65	32.3
					AVG = 99.0							AVG = 0.44	

* SCR = SCRUBBER
BP = BYPASS
** PARTICULATE EMISSIONS

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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1. AFOEHL Test Team

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Capt Paul Scott, Consultant, Air Resources Meteorologist
SSgt Daniel Schillings, Bioenvironmental Engineering Technician
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Smedley Graham Jim Williams Michael Esca Michael Ryan	305 CES/DEMMHZ AUTOVON 928-3253 Commercial (317) 689-3253

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APPENDIX B

State Regulations

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period over which they are limited must be consistent with existing applicable state rules but no longer than twenty-four (24) consecutive hours.

326 IAC 2-4-3 Compliance determination; guidelines

Sec. 3. (a) Compliance will be determined based on the emission limitations and conditions established in the permits issued in conjunction with the bubble. Compliance tests shall be performed in accordance with the test methods specified in individual rules under this title (326 IAC).

(b) Records must be kept in accordance with sub-section (f) of this section and with 326 IAC 2-4-2(a)(9). These records must be kept for a period of the length of the permit unless the commissioner requires they be kept for a longer period of time.

(c) The owner or operator of an emission source under a bubble shall make available copies of reports to the commissioner or its authorized representatives upon written request, at any reasonable time, which include but are not limited to, the nature, specific emission points, and total quantities of all emission.

(d) The bubble shall not exempt any owner/operator from complying with any other applicable rule.

(e) No owner or operator under the bubble is relieved the responsibility for achieving and maintaining a reduction of emissions as expeditiously as practicable, but no later than the compliance date required under the applicable regulation, unless the commissioner grants a later compliance date.

(f) VOC emission sources subject to this rule (326 IAC 2-4) shall maintain records which include as a minimum all data and production information necessary to determine compliance of the process, equipment, or process line under the bubble. This shall include, but not be limited to the following:

(1) type of VOC materials applied;
(2) VOC content of materials applied;
(3) amount of VOC material used; and
(4) estimated emission rates.

326 IAC 2-4-4 SIP revisions

Sec. 4. (a) The following types of bubbles shall be incorporated in the permits and submitted to U.S. EPA as SIP revisions.

(1) Bubbles which do not have fixed emission limitations for the emission points within the bubble but will have single overall emission limit for each pollutant for the entire bubble.

(2) Bubbles including fugitive emissions (defined in 326 IAC 2-2-1).

(3) Bubbles which will include sources that are subject to a federal enforcement action. Federal enforcement action means an order issued under 42 USC, Section 7413(a), a civil action under 42 USC, Section 7413(c), a notice imposing non-compliance penalties under 42 USC, Section 7604.

(4) Bubbles resulting in extension of compliance dates.

(5) Bubbles not exempt from dispersion modeling under 326 IAC 2-4-2(a)(4)(A) and 326 IAC 2-4-2(a)(4)(B).

326 IAC 2-4-5 Public notice; comment procedure

Sec.5. All bubble submittals shall be subject to public notice and comment procedures as specified in 326 IAC 2-1-5(a)(1) and 326 IAC 2-1-5(a)(3), and in the Clean Air Act, 42 USC, Section 7410(a)(2)(H). All bubble proposals received by the state shall be submitted to the U.S. EPA for its comments. However, only the bubbles submitted to the U.S. EPA pursuant to 326 IAC 2-4-4 shall constitute SIP revisions. All bubbles approved by the commissioner will become effective after they are approved by U.S. EPA.

326 IAC 2-4-6 Effect of future emission limitation requirements

Sec. 6. Should a new or more restrictive emission limitation, as required by the board, become applicable to any source included in a bubble under this rule (326 IAC 2-4) the source's permit shall be modified to demonstrate reductions in total bubble emissions equal to the reduction required by the new emission standards.

326 IAC 2-4-7 Enforceability

Sec. 7. All bubbles shall be enforced by the department and may be enforced by the U.S. EPA as part of the SIP.

ARTICLE 3. MONITORING REQUIREMENTS

Rule 1. Continuous Monitoring of Emissions

326 IAC 3-1-1 Applicability of rule

Sec. 1. (a) Sources in the following categories shall continuously monitor and record emissions of air pollutants in accordance with this rule (326 IAC 3-1).

(1) Fossil fuel-fired steam generators of greater than two hundred fifty (250) million Btu per hour heat input capacity.

(2) Nitric acid plants of greater than three hundred (300) tons per day production capacity, the production capacity being expressed at one hundred percent (100%) acid.

(3) Sulfuric acid plants of greater than three hundred (300) tons per day production capacity, the production capacity being expressed at one hundred percent (100%) acid.

(4) Petroleum refinery catalyst regenerators for fluid bed catalytic cracking units of greater than twenty thousand (20,000) barrels (eight hundred forty thousand (840,000) gallons) per day fresh feed capacity.

(b) Other monitoring requirements are contained in 326 IAC 2-1-3(h) and 326 IAC 7-1.

326 IAC 3-1-2 Compliance date

Sec. 2. All sources must be in compliance with this rule (326 IAC 3-1) by July 1, 1978.

326 IAC 3-1-3 Scope of rule

Sec. 3. This rule (326 IAC 3-1) sets forth the minimum requirements for continuous emission monitoring and recording. These requirements include the source categories to be affected; emission monitoring, recording, and reporting requirements for those sources; performance specifications for accuracy, reliability, and durability to acceptable monitoring systems; and techniques to convert emission data to units of the applicable state emission standard. Such data must be reported to the commissioner as an indication of whether proper maintenance and operating procedures are being utilized by source operators to maintain emission levels at or below emission standards. Such data may be used directly or indirectly for compliance determination or any other purpose deemed appropriate by the commissioner.

326 IAC 3-1-4 Monitoring requirements for applicable pollutants

Sec. 4. (a) The owner or operator of an emission source in a category listed in this rule (326 IAC 3-1) shall:

(1) install, calibrate, operate, and maintain all monitoring equipment necessary for continuously monitoring the pollutants specified in this rule (326 IAC 3-1) for the applicable source category; and

(2) complete the installation and performance tests of such equipment and begin monitoring and recording by July 1, 1978.

(b) The source categories and the respective monitoring requirements are listed below:

(1) Fossil fuel-fired steam generators, as specified in 326 IAC 3-1-8(1), shall be monitored for opacity, nitrogen oxides emissions, sulfur dioxide emissions, and oxygen or carbon dioxide.

(2) Fluid bed catalytic cracking unit catalyst regenerators, as specified in 326 IAC 3-1-8(4), shall be monitored for opacity.

(3) Sulfuric acid plants, as specified in 326 IAC 3-1-8(3), shall be monitored for sulfur dioxide emissions.

(4) Nitric acid plants, as specified in 326 IAC 3-1-8(2), shall be monitored for nitrogen oxides emissions.

326 IAC 3-1-5 Monitoring requirements; exemptions

Sec. 5. Exemptions from the monitoring requirements of 326 IAC 3-1-4 shall be granted by the commissioner to any source which is:

(1) subject to new source performance standards promulgated in 40 CFR 60, pursuant to Section 111 of the Clean Air Act; or

(2) not subject to an applicable emission standard of the state implementation plan (SIP); or

(3) scheduled for retirement by October 6, 1980, provided that adequate evidence and guarantees are provided that clearly show that the source will cease operations prior to such date.

326 IAC 3-1-6 Extensions of time

Sec. 6. Extensions of the time provided for installation of monitors may be granted by the board for facilities unable to meet the prescribed timeframe (compliance by July 1, 1978) provided the owner or operator of such facility demonstrates that good faith efforts have been made to obtain and install such devices within such prescribed timeframe.

326 IAC 3-1-7 Monitoring system malfunction; report

Sec. 7. When a malfunction of any monitoring system lasts more than one (1) hour, the commissioner or the commissioner's appointed representative shall be notified by telephone, or telegraph, as soon as practicable but in no event later than four (4) daytime business hours after the beginning of said occurrence. Information of the scope and expected duration of the malfunction shall be provided. A temporary exemption from the monitoring and reporting requirement of this rule (326 IAC 3-1) may be granted, provided that the owner or operator shows, to the satisfaction of the commissioner, that the malfunction was unavoidable and is being repaired as expeditiously as practicable.

326 IAC 3-1-8 Minimum monitoring requirements

Sec. 8. The sources listed in 326 IAC 3-1-4 shall, as a minimum, meet the following basic requirements:

(1) Each fossil fuel-fired steam generator, except as provided in the following subparagraphs, with an annual average capacity factor of greater than thirty percent (30%), as reported to the Federal Power Commission for calendar year 1974 or as otherwise demonstrated to the commissioner by the owner or operator, shall conform with the following monitoring requirements when such facility is subject to an emission standard of the SIP for the pollutant in question.

(A) A continuous monitoring system for the measurement of opacity which meets the performance specifications of 326 IAC 3-1-9(1)(A) of this rule shall be installed, calibrated, maintained, and operated in accordance with the procedures of this rule (326 IAC 3-1) by the owner or operator of any such steam generator of greater than two hundred fifty (250) million BTU per hour heat input except where:

(i) gaseous fuel is the only fuel burned; or

(ii) oil or a mixture of gas and oil are the only fuels burned and the source is able to comply with 326 IAC 5-1 and 326 IAC 6-2 without utilization of particulate matter collection equipment, and where the source has never been found, through any administrative or judicial proceedings, to be in violation of 326 IAC 5-1.

(B) a continuous monitoring system for the measurement of sulfur dioxide which meets the performance specifications of 326 IAC 3-1-9(1)(C) shall be installed, calibrated, maintained, and operated on any fossil fuel-fired steam generator of greater than two hundred fifty (250) million BTU per hour heat input which has installed sulfur dioxide pollutant control equipment.

(C) A continuous monitoring system for the measurement of nitrogen oxides which meets the performance specifications of 326 IAC 3-1-9(1)(B) shall be installed, calibrated, maintained, and operated on fossil fuel-fired steam generators or greater than one thousand (1,000) million BTU per hour heat input when such facility is located in an air quality control region (AQCR) where the administrator of the U.S. EPA has specifically determined that a control strategy for nitrogen dioxide is necessary to attain the national standards, unless the source owner or operator demonstrates during source compliance tests as required by the commissioner that such a source emits nitrogen oxides at levels thirty percent (30%) or more below the emission standard set forth in 326 IAC 12.

(D) A continuous monitoring system for the measurement of the percent oxygen or carbon dioxide which meets the performance specifications of 326 IAC 3-1-9(1)(D) or 326 IAC 3-1-9(1)(E) shall be installed, calibrated, operated, and maintained on all fossil fuel-fired steam generators where measurements of oxygen or carbon dioxide in the flue gas are required to convert either sulfur dioxide or nitrogen oxides continuous monitoring data, or both, to units of the emission standard in the SIP.

(2) Each nitric acid plant of greater than three hundred (300) tons per day production capacity, the production capacity being expressed as one hundred percent (100%) acid, located in an AQCR where the administrator of the U.S. EPA has specifically determined that a control strategy for nitrogen dioxide is necessary to attain the national standard shall install, calibrate, maintain, and operate a continuous monitoring system for the measurements of nitrogen oxides which meets the performance specifications of 326 IAC 3-1-9(1)(B) for each nitric acid producing facility within such plant.

(3) Each sulfuric acid plant of greater than three hundred (300) tons per day production capacity, the production capacity being expressed as one hundred percent (100%) acid, shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of sulfur dioxide which meets the performance specifications of 326 IAC 3-1-9(1)(C) for each sulfuric acid producing facility within such plant.

(4) Each catalyst regenerator for fluid bed catalytic cracking units of greater than twenty thousand (20,000) barrels per day of fresh feed capacity shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of opacity which meets the performance specifications of 326 IAC 3-1-9(1)(A).

326 IAC 3-1-9 Minimum performance specifications; alternative procedures

Sec. 9. Owners and operators of monitoring equipment installed to comply with this rule (326 IAC 3-1) except as provided in subdivision (2) of this section shall demonstrate compliance with the following performance specifications.

(1) Performance specifications: The performance specifications set forth in 40 CFR 60, Appendix B, are incorporated herein by reference, and shall be used to determine acceptability of monitoring equipment installed pursuant to this rule (326 IAC 3-1) except that where reference is made to the "Administrator" in 40 CFR 60, Appendix B, the term "commissioner" should be inserted for the purpose of this rule (326 IAC 3-1). Performance specifications to be used with each type of monitoring system are listed below.

(A) Continuous monitoring systems for measuring opacity shall comply with Performance Specification 1.

(B) Continuous monitoring systems for measuring nitrogen oxides shall comply with Performance Specification 2.

(C) Continuous monitoring systems for measuring sulfur dioxide shall comply with Performance Specification 2.

(D) Continuous monitoring systems for measuring oxygen shall comply with Performance Specification 3.

(E) Continuous monitoring systems for measuring carbon dioxide shall comply with Performance Specification 3.

(2) Any source which has purchased an emission monitoring system(s) prior to September 11, 1974, may be granted an exemption by the commissioner from meeting such test procedures prescribed in 40 CFR 60, Appendix B, for a period not to extend past October 1, 1981.

(3) For nitrogen oxides monitoring systems installed on fossil fuel-fired steam generators the pollutant gas used to prepare calibration gas mixtures (40 CFR 60, Section 2.1, Performance Specification 2, Appendix B) shall be nitrogen oxide (NO). For nitrogen oxides monitoring systems installed in nitric acid plants the pollutant gas used to prepare calibration gas mixtures (40 CFR 60, Section 2.1, Performance Specification 2, Appendix B) shall be nitrogen dioxide (NO_2). This gas shall also be used for daily checks under subdivision (7) of this section as applicable. For sulfur dioxide monitoring systems installed on fossil fuel-fired steam generators or sulfuric acid plants the pollutant gas used to prepare calibration gas mixtures (40 CFR 60, Section 2.1, Performance Specification 2, Appendix B) shall be sulfur dioxide (SO_2). Span and zero gases should be traceable to National Bureau of Standards reference gases whenever these reference gases are available. Every six (6) months from date of manufacture, span and zero (0) gases shall be reanalyzed by conducting triplicate analyses using the reference methods in 40 CFR 60, Appendix A, as follows: for sulfur dioxide, use Reference Method 6; for nitrogen oxide, use Reference Method 7; and for carbon dioxide or oxygen, use Reference Method 3. The gases may be analyzed at less frequent intervals if longer shelf lives are guaranteed by the manufacturer.

(4) Cycling times include the total time a monitoring system requires to sample, analyze, and record an emission measurement.

(A) Continuous monitoring systems for measuring opacity shall complete a minimum of one (1) cycle of operation sampling, analyzing, and data recording for each successive ten (10) second period.

(B) Continuous monitoring systems for measuring oxides of nitrogen, carbon dioxide, oxygen, or sulfur dioxide shall complete a minimum of one (1) cycle of operation (sampling, analyzing, and data recording) for each successive fifteen (15) minute period.

(5) All continuous monitoring systems or monitoring devices shall be installed such that representative measurements of emissions or process parameters (i.e., oxygen, or carbon dioxide) from the affected facility are obtained. Additional guidance for location of continuous monitoring systems to obtain representative samples are contained in the applicable 40 CFR 60, Performance Specifications of Appendix B.

(6) When the effluents from two (2) or more affected facilities of similar design and operating characteristics are combined before being released to the atmosphere, the commissioner may allow monitoring systems to be installed on the combined effluent, if the owner or operator shows that measurement of the combined effluents is at least as accurate as simultaneous measurement of each effluent prior to their combining in their common stack.

(7) Owners or operators of all continuous monitoring systems installed in accordance with the requirements of this rule (326 IAC 3-1) shall record the zero (0) and span drift in accordance with the method prescribed by the manufacturer of such instruments; subject the instruments to the manufacturer's recommended zero (0) and span check at least once daily unless the manufacturer has recommended adjustments at shorter intervals, in which case such recommendations should be followed; adjust the zero (0) and span whenever the twenty-four (24) hour zero (0) drift or twenty-four (24) hour calibration drift limits of the applicable performance specifications in 40 CFR 60, Appendix B are exceeded; and adjust continuous monitoring systems referenced by subsection (2) of this section whenever the twenty-four (24) hour calibration drift exceeds ten percent (10%) of the emission standard.

(8) Instrument span should be approximately two hundred percent (200%) of the expected instrument data display output corresponding to the emission standard for the source.

(9) Alternative procedures and requirements:

(A) Alternative locations for installing continuous monitoring systems or monitoring devices may be approved by the commissioner when the owner or operator can demonstrate that installation at alternative locations will enable accurate and representative measurements.

(B) Alternative procedures for performing calibration checks may be approved by the commissioner when the owner or operator can demonstrate that such alternate procedures will still result in meeting the specifications set forth in tables 1.1 for opacity, 2.1 for sulfur dioxide and nitrogen oxides, and 3.1 for oxygen and carbon dioxide, as contained in 40 CFR 60, Appendix B.

(C) Alternative continuous monitoring

systems that do not meet the spectral response requirements in 40 CFR 60, Performance Specification 1, Appendix B, but adequately demonstrate a definite and consistent relationship between their measurements and the opacity measurement of a system complying with the requirements in Performance Specification 1 may be approved by the commissioner. The commissioner may require that such demonstration be performed for each affected facility.

326 IAC 3-1-10 Minimum data reporting requirements; retention of records

Sec. 10. (a) Owners or operators of facilities required to install continuous monitoring systems shall submit a written report of excess emissions for each calendar quarter and the nature and cause of the excess emissions, if known. The averaging periods used for data reporting shall be six (6) minutes for opacity and three (3) hours for gaseous measurements. The required report shall include, as a minimum, the data stipulated in this rule (326 IAC 3-1).

(b) For opacity measurements, the summary shall consist of the magnitude in actual percent opacity of all six (6) minute averages of opacity greater than forty percent (40%) opacity for each hour of operation of the facility. Average values may be obtained by integration over six (6) minutes or by arithmeticallv averaging a minimum of four (4) equally spaced, instantaneous, opacity measurements per minute.

(c) For gaseous measurements the summary shall consist of emission averages, in units of the applicable standard for each three (3) hour period during which the applicable standard was exceeded.

(d) The date and time identifying each period during which the continuous monitoring system was inoperative, except for zero (0) and span checks, and the nature of system repair of adjustments shall be reported. The commissioner may require proof of continuous monitoring system performance whenever system repairs of adjustments have been made.

(e) When no excess emissions have occurred and the continuous monitoring system(s) has not been inoperative, repaired or adjusted, such information shall be included in the report.

(f) Owners or operators of affected facilities shall maintain a file of all information reported in the quarterly summaries, and all other data collected either by the continuous monitoring system or as necessary to convert monitoring data to the units of the applicable standard for a minimum of two (2) years from the date of collection of such data or submission of such summaries.

326 IAC 3-1-11 Reduction; conversion factors

Sec. 11. Owners or operators of affected facilities shall use the following procedures for converting monitoring data to units of the standard where necessary.

(1) For fossil fuel-fired steam generators the following procedures shall be used to convert gaseous emission monitoring data in parts per million (ppm) to pounds per million BTU where necessary.

(A) When the owner or operator of a fossil fuel-fired steam generator elects under 326 IAC 3-1-8(1) to measure oxygen in the flue gases, the measurements of the pollutant concentration and oxygen shall be on a dry basis and the following conversion procedure used:

$$E = CF \frac{(20.9)}{(20.9 - \%\ O_2)}$$

(B) When the owner or operator elects under 326 IAC 3-1-8(1) to measure carbon dioxide in the flue gases, the measurement of the pollutant concentration and the carbon dioxide concentration shall each be on a consistent basis (wet or dry) and the following conversion procedure used:

$$F = CF_c \frac{(100)}{(\%\ CO_2)}$$

(C) When the owner or operator elects under 326 IAC 3-1-8(1) to measure sulfur dioxide or nitrogen oxides in the flue gases, the measurement of the pollutant concentration and the sulfur dioxide and/or the nitrogen oxides concentration(s) shall each be on a wet basis and the following conversion procedure used except where wet scrubbers are employed or where moisture is otherwise added to the stack gases:

$$E = C_{ws}F_w \frac{(20.9)}{(20.9(1-B_{wa})-\%O_{2ws})}$$

(D) When the owner or operator elects under 325 IAC 3-1-8(1) to measure sulfur dioxide or nitrogen oxides in the flue gases, the measurement of the pollutant concentration and the sulfur dioxide and/or the nitrogen oxides concentration(s) shall each be on a wet basis and the following conversion procedure used where wet scrubbers or moisture is otherwise present in the stack gases, provided water vapor content of the stack gas is measured at least once every fifteen (15) minutes at the same point as the pollutant and oxygen measurements are made:

$$E = C_{ws}F \frac{(20.9)}{(20.9(1-B_{ws})-\%O_{2ws})}$$

(E) The values used in the equations under this section are derived as follows:

C_{ws} = pollutant concentration at stack conditions, g/wscm (grams/wet standard cubic meter), lb/wscm (pounds/wet standard cubic meter), determined by multiplying the average concentration (ppm) for each one (1) hour period by 4.15×10^{-5} Mg/wscm per ppm (2.59×10^{-9} M lb/wscm per ppm) where M is pollutant molecular weight, g/g-mole (lb/lb-mole).

M = 64.07 for sulfur dioxide and 46.01 for nitrogen oxides.

C = as above but measured in terms of pounds/ dry standard cubic meter (lb/dscm) or grams/ dry standard cubic meter (g/dscm).

F, F_c = a factor representing a ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted (F), and a factor representing a ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted (F_c), respectively. Values of F and Fc are given in 40 CFR 60, Section 60.45(f), as applicable.

F_w = a factor representing a ratio of the volume of wet flue gases generated to the calorific value of the fuel combusted. Values of F_w are:

(i) For anthracite coal as classified according to A.S.T.M. D388-66, F_w = 1.188 wscm/million calories (10580 wscf/million BTU).

(ii) For sub-bituminous and bituminous coal as classified according to A.S.T.M. D388-66, F_w = 1.200 wscm/million calories (10680 wscf/ million BTU).

(iii) For liquid fossil fuels including crude, residual, and distillate oils, F_w = 1.164 wscm/ million calories (10360 wscf/million BTU).

(iv) For gaseous fossil fuels: for natural gas, F_w = 1.196 wscm/million calories (10650) wscf/ million BTU; for propane, F_w = 1.150 wscm/ million calories (10240 wscf/million BTU); for butane, F_w = 1.172 wscm/million calories (10430 wscf/million BTU).

B_{wa} = proportion by volume of water vapor in the ambient air.

B_{ws} = proportion by volume of water vapor in the stack gas.

$\%O_2$, $\%CO_2$ = Oxygen or carbon dioxide volume (expressed as percent) determined with equipment specified under 326 IAC 3-1-8.

E = pollutant emission, lb/million BTU.

(2) For sulfuric acid plants the owner or operator shall:

(A) establish a conversion factor three (3) times daily according to the procedures of 40 CFR 60, Section 60.84(b);

(B) multiply the conversion factor by the average sulfur dioxide concentration in the flue gases to obtain average sulfur dioxide emissions in lb/ton; and

(C) report the average sulfur dioxide emission for each three (3) hour period in excess of the emission standard set forth in 326 IAC 7-1, in the quarterly summary.

(3) For nitric acid plants the owner or operator shall:

(A) establish a conversion factor according to the procedures of 40 CFR 60, Section 60.73(b);

(B) multiply the conversion factor by the average nitrogen oxides concentration in the flue gases to obtain nitrogen oxides emissions in lb/ton;

(C) report the average nitrogen oxides for each averaging period in excess of the emission standard set forth in 326 IAC 12, in the quarterly summary.

(4) Alternate data reporting and reduction procedures:

(A) Alternate procedures for computing emission averages that do not require integration of data may be approved by the commissioner if the owner or operator shows that his procedures are at least as accurate as those in this rule (326 IAC 3-1).

(B) Alternative methods of converting pollutant concentration measurements to units of the emission standard may be approved by the commissioner if the owner or operator shows that his procedures are at least as accurate as those in this rule (326 IAC 3-2).

Rule 2. Source Sampling Procedures

326 IAC 3-2-1 Applicability

Sec. 1. This rule (326 IAC 3-2) applies to any emissions testing performed in the state to determine compliance with applicable emission limits contained in this title (326 IAC), or for any other purpose requiring review and approval by the commissioner.

326 IAC 3-2-2 Federal test procedures; adoption

Sec. 2. Emissions tests subject to this rule (326 IAC 3-2) shall be conducted in accordance with the procedures and analysis methods specified in 40 CFR 60, Appendix A and 40 CFR 61, Appendix B. Such test methods, equipment, calibration requirements, and analysis must be strictly followed unless otherwise approved by the commissioner.

326 IAC 3-2-3 Privately conducted protocol tests; prior approval, form

Sec. 3. (a) When a test is to be performed by any person other than staff, a test protocol form shall be completed and received by the commissioner no later than thirty-five (35) days prior to the intended test date. Such test protocol shall be on a form approved by the commissioner. Any special or unique information relative to the scheduled test shall be included with the form.

(b) After evaluating the completed protocol form, the commissioner may:

(1) Inspect the test site.

(2) Require additional conditions, including, but not limited to the following:

(A) Reasonable modifications to the stack or duct to obtain acceptable test conditions.

(B) A pretest meeting to resolve an acceptable test protocol.

(C) Additional tests to allow for adverse conditions such as interferences, non-steady or cyclic processes,

(D) The keeping of process operating parameter records, operating logs or charts during the test,

(E) Conditions on control equipment operation to make it representative of future normal operation, or

(F) The recording of specified control equipment operating parameters during the test.

(c) If the commissioner requires modifications to the test methods, analytical methods, operational parameters or other matters included in the test protocol, or if a pretest meeting is required, the source operator and the testing firm shall be notified by letter or telephone at least twenty-five (25) days prior to the proposed test date. The source operator will receive notice of the acceptability of the test protocol from the commissioner within ten (10) days of its receipt. If the source operator or test firm desires to change any previously submitted procedures or conditions, the commissioner must be notified of such change at least twenty-five (25) days prior to intended test date, and such changes cannot be made unless approved by the commissioner prior to the test. Changes in the test protocol that result from emergency conditions must be approved by an authorized on-site staff member.

(d) The commissioner reserves the right to conduct any portion of the reference method tests. In such case, a twenty-five (25) day notice of proper test procedures will be given to the company and their testing representative.

(e) The source operator must notify the commissioner of the actual test date at least two (2) weeks prior to the date.

326 IAC 3-2-4 Required testing conditions; calibration of instruments

Sec. 4. (a) Staff may observe the field test procedures and plant operation during the test.

(b) All tests shall be conducted while the source is operating at between ninety-five (95%) to one hundred percent (100%) of its maximum operating capacity, or under other capacities or conditions specified and approved by the commissioner. For the purpose of this rule (326 IAC 3-2), maximum operating capacity means the maximum design capacity of the source or other maximum operating capacities agreed to by the source and the commissioner.

(c) Sources subject to 326 IAC 12, New Source Performance Standards, shall be tested under conditions as specified in the applicable provision therein.

(d) Calibration results of the various sampling components must be available for examination at the test site. The information must include dates, methods used, data and results. All components requiring calibration must be calibrated within sixty (60) days prior to the actual test date. Post test calibrations must be performed on the components within forty-five (45) days after the actual test date or before the equipments' next field use, whichever comes first. Components requiring calibration are listed in the federal test methods specified in 326 IAC 3-2-2. Calibration need not be done between tests when several facilities at one (1) location are tested in series, as long as the units are calibrated prior to the first test and after the last test in the series which is conducted at that site.

326 IAC 3-2-5 Test results; reports

Sec. 5. (a) All tests shall be reported to the commissioner in the form of a test report containing the following information (which can be kept confidential upon request):

(1) Certification by team leader and reviewer.

(2) Introduction, containing:

(A) date and type of tests;

(B) type of process and control equipment;

(C) plant name and location;

(D) purpose of test; and

(E) test participants and titles.

(3) Results summary, containing:

(A) tabulated data and results of each test run, process weight rate or heat input rate, the stack gas flow rate, the measured emissions given in units consistent with the applicable emission limits, and the visible emissions or average opacity readings; and

(B) allowable emission rate.

(4) Process information, including:

(A) description of process and control device;

(B) process flow diagram;

(C) maximum design capacities;

(D) fuel analysis and heat value for heat input rate determination;

(E) process and control equipment operating conditions during tests;

(F) discussion of variations from normal plant operations; and

(G) stack height, exit diameter, volumetric flow rate (acfm), exit temperature, and exit velocity.

(5) Sampling information, including

(A) description of sampling methods used;

(B) brief discussion of the analytical procedures with justification for any variance from standard procedures;

(C) specification of the number of sampling points, time per point, and total sampling time per run;

(D) cross sectional diagram showing sampling points, diagram showing stack dimensions, sampling location and distance from the nearest flow disturbance upstream and downstream of the sampling points; and

(E) sampling train diagram.

(6) Appendix, containing:

(A) sampling and analytical procedures;

(B) results and calculations: One (1) complete calculation using actual data for each type of test performed must be shown. Results must be stated in units consistent with the applicable emission limitation;

(C) raw production data signed by plant official;

(D) photocopies of all actual field data or original raw field data;

(E) laboratory report with chain of custody shown;

(F) copies of all calibration data;

(G) applicable regulations showing emission limitation; and

(H) copies of visible emissions observations or opacity monitor readings (for TSP tests).

(b) Unless previously agreed to in writing by the commissioner, all test reports must be received by the commissioner within forty-five (45) days of the completion of the testing.

326 IAC 3-2-6 Special testing procedures; particulate matter; sulfur dioxide; nitrogen oxide; volatile organic chemicals

Sec. 6. (a) Particulate matter tests shall be conducted in accordance with the following procedures:

(1) 40 CFR 60, Appendix A, Method 5, as in effect on December 2, 1981, or other procedures approved by the commissioner shall be used.

(2) Visible emissions (VE) evaluation

shall be performed in conjunction with a particulate emissions test by a qualified observer in accordance with the procedures contained in 326 IAC 5-1-4. VE readings shall be continuously recorded for at least thirty (30) minutes per hour of sampling time for each sampling repetition. A variance from this requirement may be granted by the on-site staff person for one (1) repetition only and provided that adverse conditions exist which would invalidate the VE readings. Sources equipped with continuous opacity monitors may submit the monitor's instantaneous or six (6) minute integrated readings during the sampling period, in lieu of performing VE observations; provided,

(A) The monitoring system meets the Performance Specifications Tests I as specified in 40 CFR 60, Appendix B as in effect on December 2, 1981, and

(B) The monitor readings submitted with the test include a zero (0) and span calibration check at the start and end of each test.

(3) At least three (3) repetitions of the test must be performed under identical source operating conditions unless otherwise allowed by the commissioner.

(4) During each of the repetitions, each sampling point shall be sampled for a minimum of two (2) minutes.

(5) The total test time per repetition shall be no less than sixty (60) minutes.

(6) The total sample volume per repetition shall be no less than thirty (30) dry standard cubic feed (dscf).

(7) The total particulate weight collected from the sampling nozzle, probe, cyclone (if used), filter holder (front half), filter and connecting glassware shall be reported. Particulate analysis of the impinger catch is not required unless specified by commissioner.

(b) Sulfur dioxide (SO_2) tests shall be conducted in accordance with the following procedures:

(1) 40 CFR 60, Appendix A, Method 6 or 40 CFR 60, Appendix A, Method 8, as in effect on December 2, 1981, or other procedures approved by the commissioner, shall be used.

(2) At least three (3) repetitions of two (2) samples, each of 40 CFR 60, Appendix A, Method 6, or three (3) repetitions of 40 CFR 60, Appendix A, Method 8, performed under identical source operating conditions, shall constitute a test.

(3) During each of the repetitions for 40 CFR 60, Appendix A, Method 8, each sampling point shall be sampled for a minimum of two (2) minutes.

(4) The total test time per repetition shall be as follows:

(A) 40 CFR 60, Appendix A, Method 6: a minimum of twenty (20) minutes per run with a thirty (30) minute interval between each run; or

(B) 40 CFR 60, Appendix A, Method 8: a minimum of sixty (60) minutes per run.

(5) The total sample volume per repetition under 40 CFR 60, Appendix A, Method 8, shall be no less than forty (40) dry standard cubic feet (dscf).

(c) Nitrogen oxide tests shall be conducted in accordance with the following procedures:

(1) 40 CFR 60, Appendix A, Method 7, as in effect on December 2, 1981, or other procedures approved by the commissioner, shall be used.

(2) At least three (3) repetitions of four (4) samples each shall constitute a test.

(d) Volatile organic compounds (VOC) emissions tests shall be conducted in accordance with the following procedures:

(1) 40 CFR 60, Appendix A, Method 25, as in effect on December 2, 1981, or other procedures approved by the commissioner, shall be used for the total nonmethane organic (TNMO) emissions.

(2) At least three (3) duplicate samples must be collected and analyzed.

(3) The total test time per repetition shall be a minimum of sixty (60) minutes.

326 IAC 3-2-7 Invalidity of nonconforming tests

Sec. 7. Any tests not meeting the requirements of this rule (326 IAC 3-2) are invalid for purposes of this rule.

326 IAC 3-2-8 Appeals

Sec. 8. A determination by the commissioner may be appealed in accordance with IC 13-1-1-4(f) and IC 4-21.5.

ARTICLE 4. BURNING REGULATIONS

Rule 1. Open Burning

326 IAC 4-1-1 Scope of rule

Sec. 1. The requirements of this rule (326 IAC 4-1) establish standards for the open burning of material which would result in emissions of regulated pollutants. This rule (326 IAC 4-1) applies everywhere in the state, except in areas where acts permitted by 326 IAC 4-1-3 or authorized by variance pursuant to 326 IAC 4-1-4 are prohibited by other state or local laws, regulations, or ordinances.

326 IAC 4-1-2 Prohibition against open burning

Sec. 2. No persons shall open burn any material except as provided in 326 IAC 4-1-3 or 326 IAC 4-1-4, or 326 IAC 4-1-5.

326 IAC 4-1-3 Exemptions

Sec. 3. (a) The following types of fires are permitted:

(1) Fires celebrating Twelfth Night Ceremonies.

(2) Fires celebrating school pep rallies.

(3) Fires celebrating scouting activities.

(4) Fires used for recreational and cooking purposes, i.e., camp fires.

(5) Residential burning; where residence contains four or fewer units. Burning shall be in a noncombustible container sufficiently vented to induce adequate primary combustion air with enclosed sides, a bottom, and a mesh covering with openings no larger than one-fourth inch (1/4") square. Burning is prohibited in apartment complexes and mobile home parks.

(6) Farm burning: wood products derived from the following farm maintenance operations:

(A) Burning of fence rows and fields or materials derived therefrom.

(B) Burning of natural growth derived from clearing a drainage ditch.

(C) Burning of limbs and prunings, but only if so diseased or infected as to present a contamination problem.

(7) Waste oil burning: where the waste oil has been collected in a properly constructed and located pit as prescribed in 310 IAC 7-1-37(A) of the Division of Oil and Gas, Department of Natural Resources. Each oil pit may be burned once every two (2) months and all the oil must be completely burned within thirty (30) minutes after ignition.

(8) Department of natural resources burning: in order to facilitate "prescribed" burning on DNR controlled properties for wildlife habitat maintenance, forestry purposes, and natural area management.

(9) United States Department of the Interior burning: in order to facilitate a National Park Service Fire Management Plan for the Indiana Dunes National Lakeshore.

(b) All exemptions under subsection (a)

of this section shall be subject to the following:

(1) Only wood products shall be burned unless otherwise stated above.

(2) Fires shall be attended at all times until completely extinguished.

(3) If fires create an nuisance or a fire hazard, they shall be extinguished.

(4) All residential, farm and waste oil burning shall occur during daylight hours during which the fires may be replenished, but only in such a manner that nearly all of the burning material is consumed by sunset.

(5) No burning shall be conducted during unfavorable meteorological conditions such as temperature inversions, high winds, air stagnation, etc.

326 IAC 4-1-4 Variances

Sec. 4. (a) Burning with prior approval of the commissioner or the commissioner's designated agent may be authorized for the following:

(1) Emergency burning of spilled petroleum products when all reasonable efforts to recover the spilled material have been made and failure to burn would result in an imminent fire hazard or water pollution problem.

(2) Burning of refuse consisting of material resulting from a natural disaster.

(3) Burning for the purpose of fire training.

(4) Burning of natural growth derived from a clearing operation, i.e., removal of natural growth for change in use of the land.

(5) Burning of highly explosive or other dangerous materials for which no alternative disposal method exists or where transportation of such materials is impossible.

(b) Burning not exempted by 326 IAC 4-1-3 may be permitted with prior receipt of a variance application and approval of the commissioner or the commissioner's designated agent.

326 IAC 4-1-5 Liability for fire

Sec. 5. Any person who allows the accumulation or existence of combustible material which constitutes or contributes to a fire causing air pollution may not refute liability for violation of this rule (326 IAC 4-1) on the basis that said fire was set by vandals, accidental, or an act of God.

Rule 2. Incinerators

326 IAC 4-2-1 Applicability of rule

Sec. 1. This rule (326 IAC 4-2) establishes standards for the use of incinerators which emit regulated pollutants. This rule (326 IAC 4-2) does not apply to incinerators in residential units consisting of four (4) or fewer families. All other incinerators are subject to this rule (326 IAC 4-2).

326 IAC 4-2-2 Stationary incinerators

Sec. 2. All stationary incinerators shall:

(1) Consist of primary and secondary chambers or the equivalent.

(2) Be equipped with a primary burner unless burning wood products.

(3) Comply with 326 IAC 5-1 and 326 IAC 2.

(4) Be maintained properly as specified by the manufacturer and approved by the commissioner or the commissioner's designated agent.

(5) Be operated according to the manufacturer's recommendations and only burn waste approved by the commissioner or its designated agent.

(6) Comply with other state and/or local rules or ordinances regarding installation and operation.

(7) Be operated so that emissions of hazardous material including, but not limited to, viable pathogenic bacteria, dangerous chemicals or gases, or noxious odors are prevented.

(8) Not emit particulate matter in excess of the following:

(A) Incinerators with a maximum refuse-burning capacity of two hundred (200) or more pounds per hour; 0.3 pounds of particulate matter per one thousand (1,000) pounds of dry exhaust gas at standard conditions corrected to fifty percent (50%) excess air.

(B) All other incinerators: 0.5 pounds of particulate matter per one thousand (1,000) pounds of dry exhaust gas at standard conditions corrected to fifty percent (50%) excess air.

(9) Not create a nuisance or a fire hazard. If any of the above result, the burning shall be terminated immediately.

326 IAC 4-2-3 Portable incinerators

Sec. 3. All portable incinerators shall be subject to the following conditions:

(1) Approval of the commissioner or its designated agent must be obtained prior to operation at a new project site.

(2) Only wood products shall be burned.

(3) Merchantable material may be salvaged where practicable.

(4) The local health department shall be notified prior to any burning.

(5) All burning shall be conducted under favorable meteorological conditions.

(6) Burning shall occur during daylight hours and all material shall be consumed by sunset.

(7) If burning creates an air pollution problem, a nuisance or a fire hazard, the burning shall be terminated immediately.

(8) The incinerator shall be maintained and operated according to the manufacturer's recommendations and in a manner approved by the commissioner or its designated agent.

(9) The installation and operation of such an apparatus shall comply with all other state and/or local rules or ordinances.

(10) A portable incinerator shall comply with both 326 IAC 5-1 and 326 IAC 2.

ARTICLE 5. OPACITY REGULATIONS

Rule 1. Opacity Limitations

326 IAC 5-1-1 Applicability of rule

Sec. 1. (a) This rule (326 IAC 5-1) shall apply to all visible emissions (not including condensed water vapor) emitted by or from any facility or source except those sources or facilities for which specific visible emission limitations are established by 326 IAC 11, 326 IAC 12, or 326 IAC 6.

(1) The requirements of 326 IAC 5-1-2(a)(1) shall apply to sources or facilities located in attainment areas for particulate matter, designated in 326 IAC 1-4.

(2) The requirements of 326 IAC 5-1-2(a)(2) shall apply to sources or facilities located in nonattainment areas for particulate matter as designated in 326 IAC 1-4.

326 IAC 5-1-2 Visible emission limitations

Sec. 2. (a) Visible emissions from any source or facility shall not exceed any of the following limitations. Unless otherwise stated, all visible emissions shall be observed in accordance with the procedures set forth in 326 IAC 5-1-4:

(1) Sources or facilities of visible emissions located in attainment areas for particulate matter shall meet the following limitations:

(A) Visible emissions shall not exceed an average of forty percent (40%) opacity in twenty-four (24) consecutive readings.

(B) Visible emissions shall not exceed sixty percent (60%) opacity for more than a cumulative total of fifteen (15) minutes (sixty (60) readings) in a six (6) hour period.

(2) Sources or facilities of visible emissions located in nonattainment areas shall meet the following limitations:

(A) Visible emissions shall not exceed, an average of thirty percent (30%) opacity in twenty-four (24) readings.

(B) Visible emissions shall not exceed sixty percent (60%) opacity for more than a cumulative total of fifteen (15) minutes (sixty (60) readings) in a six (6) hour period.

(3) Sources and facilities of visible emissions located in both attainment or nonattainment areas, for which an alternate visible emission limitation has been established pursuant to 326 IAC 5-1-5(b), shall comply with said limitations in lieu of the limitations set forth in subsection (a)(1) and (a)(2) of this section.

326 IAC 5-1-3 Temporary exemptions

Sec. 3. (a) Boiler startup and shutdown: When building a new fire in a boiler, or shutting down a boiler, visible emissions may exceed the applicable opacity limit established in 326 IAC 5-1-2(a); however, visible emissions shall not exceed an average of sixty percent (60%) opacity and emissions in excess of the applicable opacity limit shall not continue for more than ten (10) continuous minutes on one (1) occasion in any twenty-four (24) hour period.

(b) Cleaning boilers: When removing ashes from the fuel bed or furnace in a boiler or blowing tubes, visible emissions may exceed the applicable opacity limit established in 326 IAC 5-1-2(a) however, visible emissions shall not exceed sixty percent (60%) opacity and visible emissions in excess of the applicable opacity limit shall not continue for more than five (5) continuous minutes on one (1) occasion in any sixty (60) minute period. Such emissions shall not be permitted on more than three (3) occasions in any twelve (12) hour period.

(c) Facilities not temporarily exempted by subsections (a) and (b) of this section may be granted special temporary exemptions by the commissioner of the same duration and type authorized therein provided that the facility proves to the satisfaction of the commissioner that said exemptions are needed and that during periods of startup and shutdown, owners and operators shall, to the extent practicable, maintain and operate any affected facility including air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the commissioner, which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures and inspection of the source.

(d) Sources or facilities not exempted through subsections (a), (b), or (c) of this section may also be granted special exemptions by the commissioner, provided that the source or facility owner or operator proves to the satisfaction of the commissioner that said exemption is justifiable. Said exemption(s) may be of longer duration and may apply to other types of facilities not provided for in subsections (a) or (b) of this section.

326 IAC 5-1-4 Compliance determination

Sec. 4. (a) Determination of visible emissions from sources or facilities to which this rule (326 IAC 5-1) applies may be made in accordance with subdivisions (1) or (2) below:

(1) Determination of visible emissions by means of a qualified observer shall be made according to the following:

(A) Position: The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun, if visible, oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the direction of the visible emissions (plume where applicable), and when observing opacity of emissions from rectangular outlets (e.g., monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one (1) plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).

(B) Field records: The observer shall record the name of the plant, emission location, type of facility, observer's name and affiliation, and the date on a field data sheet. Time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky conditions (presence and color of clouds), and visible emissions (plume where applicable) background are recorded on a field data sheet at the time opacity readings are initiated and completed.

(C) Observations: Opacity observations shall be made at the point of greatest opacity in that portion of the visible emissions, (plume where applicable) where condensed water vapor is not present. The observer shall not look continuously at the visible emissions, (plume where applicable) but instead shall observe the visible emissions, (plume where applicable) momentarily at fifteen (15) second intervals.

(D) Recording observations: Opacity observations shall be recorded to the nearest five percent (5%) at fifteen (15) second intervals on an observational record sheet. A minimum of twenty-four (24) observations shall be recorded. Each momentary observation shall be deemed to represent the average opacity of emissions for a fifteen (15) second period.

(E) Determination of opacity as an average of twenty-four (24) consecutive observations: Opacity shall be determined as an average of twenty-four (24) consecutive observations recorded at fifteen (15) second intervals. Divide the observations recorded on the record sheet into sets of twenty-four (24) consecutive observations. A set is composed of any twenty-four (24) consecutive observations. Sets need not be consecutive in time and in no case shall two (2) sets overlap. For each set of twenty-four (24) observations, calculate the average by summing the opacity of the twenty-four (24) observations and dividing this sum by twenty-four (24). Record the average opacity on a record sheet. For the purpose of determining an alternative visible emission limit in accordance with 326 IAC 5-1-5(b) following, an average of twenty-four (24) consecutive readings or more may be used to calculate the alternate visible emissions limit.

(F) Determination of opacity as a cumulative total of fifteen (15) minutes: For emissions from intermittent sources, opacity shall be determined in accordance with clause (A), (B), (C), and the first sentence of (D). Each momentary observation shall be deemed to represent the average opacity of emissions for a fifteen (15) second period. All readings greater than the specified limit in 326 IAC 5-1-2 shall be accumulated as fifteen (15) second segments for comparison with the limit.

(G) Attached steam plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

(H) Detached steam plumes: When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

(2) Determination of compliance with visible emission limitations established in this rule (326 IAC 5-1) may also be made in accordance with a source's or facility's continuous monitoring equipment, for any source or facility in compliance with the requirements of 326 IAC 3-1.

(b) If the compliance determination procedures set forth in subsections (a)(1) and (a)(2) of this section results in any conflict in visible emission readings, the determination made in accordance with subsection (a)(2) of this section shall prevail for the purpose of compliance, provided that it can be shown that the continuous monitor has met the performance specifications as set forth in the 40 CFR 60, specifically Performance Specification 1.

326 IAC 5-1-5 Violations

Sec. 5. (a) A violation of this rule (326 IAC 5-1) shall constitute prima facie evidence of a violation of other applicable particulate emission control regulations. A violation of any such rule may be refuted by a performance test conducted in accordance with subsection (b) of this section. Such test shall refute the mass emission violation only if the source is shown to be in compliance with the allowable mass emission limit. An exceedance of the allowable opacity emission limit will not be treated as a violation if, during the test described in subsection (b) of this section, the source demonstrates compliance with the allowable mass emission limit while simultaneously having visible emissions more than or equal to the reading at which the exceedance was originally observed.

(b) The owner or operator of a source or facility which believes it can operate in compliance with the applicable mass emission limitation, but exceeds the limits specified in 326 IAC 5-1-2, may submit a written petition to the commissioner requesting that an alternate opacity limitation be established pursuant to the following provisions. Additionally, if the commissioner has issued a notice of violation to an owner or operator of a source or facility for violation of the applicable opacity limitation, such owner or operator may, propose in notice of violation resolution, to disprove said violation by establishing an alternate opacity limit pursuant to the following provisions. This alternate limit shall be based upon a mass emission performance test conducted according to a method designated by the commissioner, and a visible emission test conducted simultaneously, according to 326 IAC 5-1-4. Where the commissioner determines there is no acceptable test method available, a request for an alternate visible emission limit shall be denied.

(1) The alternate emission limit shall be equal to that level of opacity at which the source or facility will be able, as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source or facility is meeting the mass emission limitation. However, the commissioner shall also reserve the right to determine the alternate visible emissions limit in the following manner:

(A) If a performance test of a source or facility demonstrates:

(i) that said source or facility is in compliance with the allowable mass emissions limit (as defined in 326 IAC 1-2) at the time that the test is done; and

(ii) simultaneously, said source's or facility's test demonstrates that the allowable opacity emission limit is being exceeded, then, the enforceable opacity limitation shall be equal to that level of opacity at which the source or facility will be able as indicated by the performance and opacity tests to meet the opacity standard at all times during which the source or facility is meeting the mass emission limitation.

(B) If a performance test of a source or facility demonstrates:

(i) that said source or facility is in compliance with the allowable mass emission limit, and the test mass emission rate is within ten percent (10%) of the allowable emissions limit for that source or facility; and

(ii) simultaneously, said source's or facility's test demonstrates that the opacity observed is below the allowable opacity emission limit, the enforceable opacity limitation shall be equal to that level of opacity at which the source or facility will be able, as indicated by the performance and opacity tests, to meet the opacity standard at all times during which the source or facility is meeting the mass emission limitation.

(C) If a performance test of a source or facility demonstrates:

(i) that said source or facility is in compliance with the allowable mass emission limit, and the test mass emission rate is less than ninety percent (90%) of the allowable emissions limit; and

(ii) simultaneously, said source's or facility's test demonstrates that the opacity observed is below the allowable opacity emission limit, the enforceable opacity limitation shall remain the existing allowable opacity emission limitation for that source or facility.

(2) Compliance with 326 IAC 6-1, 326 IAC 6-2, 326 IAC 6-3, and 326 IAC 11-1, and other applicable rules must be demonstrated by the performance test.

(3) The commissioner may require a performance test in any case where it is necessary to determine the compliance status for a facility. However, the commissioner will not request a performance test for any facility which is known to be in compliance with the allowable opacity limitation.

(4) All alternate visible emission limits shall be established on a source or facility-specific basis. No limitation for any facility or source shall be established by reference to a similar or identical facility or source.

(5) The owner or operator of the source or facility shall notify the commissioner at

least fifteen (15) days prior to conducting a test for the purposes of demonstrating an alternate visible emission limit.

(6) A staff member who is a qualified observer, approved by the commissioner or other consultant approved by the commissioner shall be present during any performance tests.

(7) The cost of the performance test shall be at the expense of the owner or operator.

(8) Any alternate visible emission limit established for any source or facility shall not become effective until said limitation is established in the applicable operating permit. Said limitation will be incorporated, by amendment, into the operating permit for said source or facility and submitted to the U.S. EPA as a SIP revision.

(9) Where a visible emission limitation is based upon a new source performance standard, any new limitation must comply with the provisions of said standard.

326 IAC 5-1-6 Compliance schedule

Sec. 6. Sources newly subject to more stringent limitations on August 27, 1980, by 326 IAC 5-1-2 shall comply with the compliance schedule of 326 IAC 6-1.

326 IAC 5-1-7 State implementation plan revisions

Sec. 7. Any exemptions given or provisions granted to this rule (326 IAC 5-1) by the commissioner under 326 IAC 5-1-3(c), 326 IAC 5-1-3(d), or 326 IAC 5-1-5(b), shall be submitted to the U.S. EPA as a SIP revision.

ARTICLE 6. PARTICULATE RULES

Rule 1. Nonattainment Area Limitations

326 IAC 6-1-1 Applicability of rule

Sec. 1. Sources or facilities specifically listed in 326 IAC 6-1-7 shall comply with the limitations contained therein. Sources or facilities that are (1) located in the nonattainment counties listed in 326 IAC 6-1-7, (2) but which sources or facilities are not specifically listed in 326 IAC 6-1-7, and (3) have the potential to emit one hundred (100) tons or more of particulate matter per year or have actual emissions of ten (10) tons or more of particulate matter per year, shall comply with the limitations of 326 IAC 6-1-2.

326 IAC 6-1-2 Particulate emission limitations; fuel combustion steam generators, asphalt concrete plant, grain elevators, foundaries, mineral aggregate operations; modification by commissioner

Sec. 2. (a) General sources: Facilities not limited by subsections (b) through (g) of this section shall not allow or permit discharge to the atmosphere of any gases which contain particulate matter in excess of 0.07 gram per dry standard cubic meter (g/dscm) (0.03 grain per dry standard cubic foot (dscf)). Where this limitation is more stringent than the applicable limitations of subsections (b) through (g) of this section, for facilities in existence prior to the applicability dates, or of a size not applicable to said subsections, emission limitations for those facilities shall be determined by the commissioner and will be established in accordance with the procedures set forth in subsection (h) of this section.

(b) Fuel combustion steam generators: No person shall operate a fossil fuel combustion steam generator (any furnace or boiler used in the process of burning solid, liquid, or gaseous fuel or any combination thereof for the purpose of producing steam by heat transfer) so as to discharge or cause to be discharged any gases unless such gases are limited to:

(1) A particulate matter content of no greater than 0.18 grams per million calories (0.10 pounds per million Btu) for solid fuel fired generators of greater than sixty-three million (63,000,000) kilocalories (kcal) per hour heat input (two hundred fifty (250) million Btu);

(2) A particulate matter content of no greater than 0.63 grams per million calories (0.35 pounds per million Btu) for solid fuel fired generators of equal to or greater than 6.3 but less than or equal to sixty-three million (63,000,000) kcal per hour heat input (twenty-five (25) but less than or equal to two hundred fifty (250) million Btu);

(3) A particulate matter content of no greater than 1.08 grams per million calories (0.6 pounds per million Btu) for solid fuel fired generators of less than 6.3 million kcal per hou heat input (twenty-five (25) million Btu);

(4) A particulate matter content of no greater than 0.27 grams per million kcal (0.15 pounds per million Btu) for all liquid fuel fired steam generators.

(5) A particulate matter content of no greater than .01 grains per dry standard cubic foot for all gaseous fuel-fired steam generators.

(c) Asphalt concrete plants: The requirements of this provision shall apply to any asphalt concrete plant (any facility used to manufacture asphalt concrete by heating and drying aggregate and mixing with asphalt cement). An asphalt concrete plant is deemed to consist only of the following: driers, systems for screening, handling, storing, and weighing hot aggregate; systems for loading, transferring, and storing mineral filler; systems for mixing asphalt concrete; and the loading, transfer, and storage systems associated with emission control systems.

(1) No person shall operate the affected facilities of an asphalt concrete plant which existed on or prior to June 11, 1973, so as to discharge or cause to be discharged into the atmosphere any gases unless such gases are limited to:

(A) A particulate matter content of no greater than 230 mg per dscm (0.10 grain per dscf).

(d) Grain Elevators: No person shall operate a grain elevator (a grain elevator is defined as any plant or installation at which grain is unloaded, handled, cleaned, dried, stored or loaded) without meeting the provisions of this subsection. Subdivision (1) of this subsection shall apply to any grain storage elevator located at any grain processing source which has a permanent grain storage capacity of thirty-five thousand two hundred (35,200) cubic meters (one (1) million U.S. bushels) and any grain terminal elevator which has a permanent grain storage capacity of eighty-eight thousand one hundred (88,100) cubic meters (two and one-half (2.5) million U.S. bushels). All grain elevators subject to this rule (326 IAC 6-1) shall comply with the requirements of subdivision (2) of this section.

(1) No owner or operator subject to the provisions of this subpart shall cause to be discharged into the atmosphere from any affected facility except a grain dryer any process emission unless such emissions are limited to a particulate matter content of no greater than 0.07 gram per dry standard cubic meter (dscm)(0.03 grain per dry standard cubic foot (dscf)) for said facilities for which construction or modification commenced prior to January 13, 1977.

(2) Grain elevators subject to this subdivision shall provide for good housekeeping and good maintenance procedures. Good housekeeping and maintenance is defined

Rule 2 Particulate Emission Limitations for Sources of Indirect Heating

326 IAC 6-2-1 Applicability

Sec. 1. This rule (326 IAC 6-2) establishes limitations for sources of indirect heating:

(a) Particulate emissions from the combustion of fuel for indirect heating from all facilities located in Lake, Porter, Marion, Boone, Hamilton, Hendricks, Johnson, Morgan, Shelby, and Hancock Counties which were existing and in operation or which received permit to construct prior to September 21, 1983, shall be limited by 326 IAC 6-2-2.

(b) Particulate emissions from the combustion of fuel for indirect heating from all facilities not specified in subsection (a) of this section which were existing and in operation or which received permits to construct prior to September 21, 1983 shall be limited by 326 IAC 6-2-3.

(c) Particulate emissions from the combustion of fuel for indirect heating from all facilities receiving permits to construct on or after September 21, 1983 shall be limited by 326 IAC 6-2-4.

(d) If any limitation established by this rule (326 IAC 6-2) is inconsistent with applicable limitations contained in 326 IAC 6-1, then the limitations contained in 326 IAC 6-1 prevail.

(e) If any limitation established by this rule (326 IAC 6-2) is inconsistent with applicable limitations contained in 326 IAC 12, New Source Performance Standards, then the limitations contained in 326 IAC 12 prevail.

(f) If any limitation established by this rule (326 IAC 6-2) is inconsistent with a limitation contained in a facility's construction or operation permit as issued pursuant to 326 IAC 2, Permit Review Regulations, then the limitations contained in the source's current permits prevail.

(g) If any limitation established by this rule (326 IAC 6-2) is inconsistent with a limitation required by 326 IAC 2, Permit Review Regulations, to prevent a violation of the ambient air quality standards set forth in 326 IAC-1-4, then the limitations required by 326 IAC 2 prevail.

(h) The addition of a new facility at a source does not affect the limitations of the existing facilities unless such changes in the limitations are required by the provisions of 326 IAC 2 or 326 IAC 6-1.

326 IAC 6-2-2 Emission limitations for facilities specified in 326 IAC 6-2-1(a)

Sec. 2. (a) Particulate emissions from existing indirect heating facilities located in the specified counties shall be limited by the following equation:

$$Pt = \frac{0.87}{Q^{0.16}}$$

Where:

Pt = Pounds of particulate matter emitted per million Btu (lb/mmBtu) heat input.

Q = Total source maximum operating capacity rating in million Btu per hour (mmBtu/hr) heat input. The maximum operating capacity rating is defined as the maximum capacity at which the facility is operated or the nameplate capacity, whichever is specified in the facility's operation permit application, except when some lower capacity is contained in the facility's operation permit, in which case, the capacity specified in the operation permit shall be used.

For Q less than 10 mmBtu/hr, Pt shall not exceed 0.6. For Q greater than or equal to 10,000 mmBtu/hr, Pt shall not exceed 0.2. Figure 1 may be used to estimate allowable emissions.

(b) The emission limitations for those indirect heating facilities which were existing and in operation on or before June 8, 1972, shall be calculated using the equation contained in subsection (a) of this section where: Q shall reflect the total source capacity on June 8, 1972. The resulting Pt is the emission limitation for each facility existing on that date and will not be affected by the addition of any subsequent facility. The particulate emissions from all of the facilities which were in existence on June 8, 1972, may be allocated in any way among these facilities provided that they will not result in a significantly greater air quality impact level at any receptor than that which would result if the particulate emissions from each of these facilities were limited to Pt; and provided that the emission limitations for each facility are specified in its operation permit. Significant impact levels are defined in 326 IAC 2-3(d).

(c) The emission limitations for those indirect heating facilities which began operation after June 8, 1972, and before September 21, 1983, and those facilities which receive permits to construct prior September 21, 1983 shall be calculated using the equation contained in subsection (a) of this section where: Q includes the capacity for the facility in question and the capacities for those facilities which were previously constructed or received prior permits to construct. The limitations for all previously permitted facilities do not change. The Q and Pt for each facility at a source which begins operation or receives a construction permit during this time period will be different.

326 IAC 6-2-3 Emission limitations for facilities specified in 326 IAC 6-2-1(b)

Sec. 3. (a) Particulate emissions from indirect heating facilities existing and in operation before September 21, 1983, shall be limited by the following equation:

$$Pt = \frac{C \times a \times h}{76.5 \times Q^{0.75} \times N^{0.25}}$$

Where:

C = Maximum ground level concentration with respect to distance from the point source at the "critical" wind speed for level terrain. This shall equal 50 migrograms per cubic meter (μ/m^3) for a period not to exceed a sixty (60) minute time period.

Pt = Pounds of particulate matter emitted per million Btu heat input (lb/mmBtu).

Q = Total source maximum operating capacity rating in million Btu per hour (mmBtu/hr) heat input. The maximum operating capacity rating is defined as the maximum capacity at which the facility is operated or the nameplate capacity, whichever is specified in the facility's operation permit application, except when some lower capacity is contained in the facility's operation permit; in which case, the capacity specified in the operation permit shall be used.

N = Number of stacks in fuel burning operation.

a = Plume rise factor which is used to make allowance for less than theoretical plume rise. The value 0.67 shall be used for Q less than or equal to 1,000 mmBtu/hr heat input. The value 0.8 shall be used for Q greater than 1,000 mmBtu/hr heat input.

h = Stack height in feet. If a number of stacks of different heights exist, the average stack height to represent "N" stacks shall be calculated by weighing each stack height with its particulate matter emission rate as follows:

$$h = \frac{\sum_{i=1}^{N} H_i \text{ X } pa_i \text{ X } Q}{\sum_{i=1}^{N} pa_i \text{ X } Q}$$

Where:

pa = the actual controlled emission rate in lb/mmBtu using the emission factor from AP-42 or stack test data. Stacks constructed after January 1, 1971, shall be credited with GEP stack height only. GEP stack height shall be calculated as specified in 326 IAC 1-7.

(b) The emission limitations for those indirect heating facilities which were existing and in operation on or before June 8, 1972, shall be calculated using the equation contained in subsection (a) of this section where: Q, N, and h shall include the parameters for all facilities in operation on June 8, 1972. The resulting Pt is the emission limitation for each facility existing on that date and will not be affected by the addition of any subsequent facility. The particulate emissions from all of the facilities which were in existence on June 8, 1972, may be allocated in any way among these facilities provided that they will not result in a significantly greater air quality impact level at any receptor than that which would result if the particulate emissions from each of these facilities were limited to Pt; and provided that the emission limitations for each facility are specified in its operation permit. Significant impact levels are defined in 326 IAC 2-3-2(d).

(c) The emission limitations for those indirect heating facilities which began operation after June 8, 1972, and before September 21, 1983, and those facilities which receive permits to construct prior to to September 21, 1983, shall be calculated using the equation contained in subsection (a) of this section where: Q, N, and h shall include the parameters for the facility in question and for those facilities which were previously constructed or received prior permits to construct. The limitations for all previously permitted facilities do not change. The Q, N, h, and Pt for each facility at a source which begins operation or receives a construction permit during this time period will be different.

(d) Particulate emissions from all facilities used for indirect heating purposes which were existing and in operation on or before June 8, 1972, shall in no case exceed 0.8 lb/mmBtu heat input.

(e) Particulate emissions from any facility used for indirect heating purposes which has 250 mmBtu/hr heat input or less and which began operation after June 8, 1972, shall in no case exceed 0.6 lb/mmBtu heat input.

326 IAC 6-2-4 Emission limitations for facilities specified in 326 IAC 6-2-1(c)

Sec. 4. (a) Particulate emissions from indirect heating facilities constructed after September 21, 1983 shall be limited by the following equation:

$$Pt = \frac{1.09}{Q^{0.26}}$$

Where:

Pt = Pounds of particulate matter emitted per million Btu (lb/mm Btu) heat input.

Q = Total source maximum operating capacity rating in million Btu per hour (mmBtu/hr) heat input. The maximum operating capacity rating is defined as the maximum capacity at which the facility is operated or the nameplate capacity, whichever is specified in the facility's permit application, except when some lower capacity is contained in the facility's operation permit; in which case, the capacity specified in the operation permit shall be used.

For Q less than 10 mmBtu/hr, Pt shall not exceed 0.6. for Q greater than or equal to 10,000 mmBtu/hr, Pt shall not exceed 0.1. Figure 2 may be used to estimate allowable emissions.

(b) As each new indirect heating facility is added to a plant Q will increase. As a result, the emission limitation for each progressively newer facility will be more stringent until the total plant capacity reaches 10,000 mmBtu/hr after which the emmission limit for each newer facility will be 0.1 lb/mmBtu heat input. The rated capacities for facilities regulated by 326 IAC 12, New Source Performance Standards, shall be included when calculating Q for subsequent facilities.

APPENDIX C

Plant Operating Logs

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13 FEB 89 **DAILY STEAM BOILER PLANT OPERATING LOG**

1. COMMAND: *Sac*

	TIME HOUR A	STEAM PRESS (PSIG) B	STEAM PRODUCED (1000 Pounds) C — BOILER NO. 1	C — 2	C — 3	C — 4	FUEL USED D (COAL – BTU/LB; OIL – BTU/GAL; GAS – BTU/1000CF) — BOILER NO. 1	D — 2	D — 3	D — 4	FLUE GAS E — O_2 OR CO_2 (Avg %) — BOILER NO. 1	E — 2	E — 3	E — 4	TEMP (359) — BOILER 1	TEMP — 2
FIRST SHIFT	0030	118	28,000	13,000	29,000		248	115			11.0	10.0	11.0		440	420
	0130	11[illegible]	28,000	13,000	26,000		248	115			[illegible]	[illegible]	[illegible]		440	420
	0230	[illegible]	27,000	[illegible]	29,000		239	115			10.5	[illegible]	[illegible]		440	420
	0330	[illegible]	27,000	10,000	24,000		248	88			11.0	9.5	10.5		440	420
	0430	[illegible]	27,000	[illegible]	33,000		239	97			10.5	9.5	11.5		440	[illegible]
	0530	116	27,000	11,000	32,000		239	97			10.5	10.0	11.0		440	420
	0630	116	30,000	13,000	32,000		265	115			11.0	10.5	11.5		440	420
	0730	116	20,000	14,000	32,000		257	124			10.5	10.5	11.5		440	420
	TOTAL	932	224,000	98,000	237,000		1983	866	26,333		86	81	89		3520	336[illegible]
	AVG.	117	28,000	12,250	29,625		248	108	3292		10.8	10.0	11.1		440	420
SECOND SHIFT	0830	120	25000	12000	34000		221	106			10.0	10.0	11.5		460	420
	0930	100	20000	10000	38000		177	88			10.0	10.0	11.0		460	40[illegible]
	1030	112	10000	12000	36000		168	106			11.0	10.0	12.0		460	40[illegible]
	1130	116	14000	10000	36000		142	88			11.0	10.0	11.5		460	37[illegible]
	1230	102	16000	10000	38000		168	88			11.0	10.0	12.0		460	37[illegible]
	1330	116	18000	10000	36000		159	88			11.0	10.0	12.0		440	34[illegible]
	1430	110	15000	10000	37000		159	88			10.0	10.0	12.0		440	36[illegible]
	1530	108	21000	14000	33000		186	124			10.5	10.5	11.5		440	42[illegible]
	TOTAL	884	153000	88000	288000		1354	779	32000		80.5	80.5	935		3620	308
	AVG.	111	19125	11000	36000		169	97	4000 *		10.1	10.1	11.7		453	386
THIRD SHIFT	1630	121	22000	13000	27000		195	115			10.0	10.0	11.5		440	420
	1730	123	23000	11000	26,000		204	97			10.5	10.0	11.5		440	410
	1830	116	23000	11000	28000		204	97			10.5	10.0	12.0		440	40[illegible]
	1930	119	22000	11000	29000		195	97			11.0	10.0	12.0		440	40[illegible]
	2030	114	25000	12000	26000		221	106			11.0	10.5	11.5		440	39[illegible]
	2130	112	24000	12000	27000		212	106			11.0	10.5	11.5		440	3[illegible]
	2230	120	24000	13000	26000		112	115			11.0	10.5	11.0		440	41[illegible]
	2330	118	23000	10000	26000		204	98			11.0	10.5	11.0		440	4[illegible]
	TOTAL	933	186000	93000	215000		1547	821	23889		86.0	82	92		3520	322
	AVG	117	23250	11625	26875		193	103	2986		10.8	10.3	11.5		440	403
DAILY	TOTAL	2749	563000	279000	740010		4884	2466	82222		253	244	275		10660	966
DAILY	AVG	115	23458	11625	30833		204	103	3426		10.5	10.2	11.4		444	40[illegible]

5. OPERATING DATA

	FIRST SHIFT #1	#2	#3	SECOND SHIFT #1	#2	#3	
A. STEAM FLOW FINAL (Integrator)	545439	756092	815000	547927	758386	819914	55[illegible]
B. STEAM FLOW START	541860	753670	810871	545439	756092	815000	54[illegible]
C. TOTAL STEAM PRODUCED	224,000	98,000	237,000	153000	88000	288000	186
D. LBS. STEAM PER UNIT OF FUEL							
E. SOOT BLOWN	0500	0455	0450			0924 + 1238	2010
F. BLOW DOWN	TIME: 0100	GALS. 264 + 420 = 684		TIME:	GALS. 0 + 420 = 420		TIME:
G. DEGREE DAY							
H. OPERATOR	RICHARD - BOSSARD - WITTENBRINK			DEWEES - RICHARDS - SCHERLO - BATES			McG[illegible]
I. FIREMAN				BONNER -			
J. TOTAL MANHOURS OPERATION	24			40			

13. REMARKS (Continue on reverse)

WC-GG-0025

ASHES - 0610 - 0710 = 420

OIL TRANSFER TO 9'7"

WC - GG - OA - 0810 "SEE NOT

ASHES - 1500 / 1600 > 420

HANGER 200 - 1355 8

DATE	SIGNATURE OF CHIEF OPERATING ENGINEER

AF FORM OCT 82 1458 PREVIOUS EDITION WILL BE USED.

DAILY STEAM BOILER PLANT OPERATING LOG

1. COMMAND	2. BASE AND LOCATION	3. BUILDING NO. AND NAME	4. DATE
Sac	Grissom [illegible]	[illegible]	14 FEB 87

Fuel used (D): COAL – BTU/LB; OIL – BTU/GAL; GAS – BTU/1000CF

Flue gas (E): O_2 or CO_2 (Are %); Temp (Degrees) 50 31 35 40

Shift	A Time Hour	B Steam Press (PSIG)	C Steam Produced (1000 Pounds) Boiler 1	Boiler 2	Boiler 3 (#5)	Boiler 4	D Fuel Used Boiler 1	Boiler 2	Boiler 3 (#5)	Boiler 4	E O_2 or CO_2 Boiler 1	Boiler 2	Boiler 3 (#5)	Boiler 4	E Temp Boiler 1	Boiler 2	Boiler 3 (#5)	Boiler 4
First shift	[illegible]	116	[illegible]	11000	38400	23000	212	97			10.5	9.5	10.5	10.5	440	340	520	510
	0130	116	24000	11000		23000	212	18			10.5	10.0		11.0	440	400		520
	[illegible]	116	25000	2500		27000	208	75			11.0	9.5		10.5	440	380		530
	[illegible]	116	23000	9000		26000	204	80			11.0	9.5		11.0	440	282		520
	[illegible]	116	24000	10000		25000	212	58			11.0	10.0		11.0	440	[illegible]		[illegible]
	[illegible]	117	23000	10000		25300	208	82			10.5	10.0		11.0	440	370		[illegible]
	[illegible]	116	24000	10000		26000	212	86			10.5	10.0		10.5	440	360		510
	[illegible]	120	23000	9500		28000	204	84			10.5	10.0		11.0	440	370		[illegible]
	TOTAL	933	189000	78000	38400	202500	1672	622		21822	85.5	78.5	10.5	86.5	3520	3030		4130
	AVG.	117	23625	9750	38400	25312	209	84		2728	10.7	9.2	10.5	10.8	440	379		516
Second shift	[illegible]	106	16000	16000		38000	89	89			10.0	10.0		11.5	440	360		540
	0930	106	22000	16600		38000	195	142			10.5	[illegible]		12.0	460	420		500
	1030	110	10000	16000		18500	89	124			10.5	10.5		12.1	450	410		460
	1120	112	10000	15000		3820	29	133			10.0	10.5		12.1	450	440		450
	1230	116	10000	15000		28000	59	[illegible]			10.0	[illegible]		12.2	440	440		440
	1330	110	8000	12000		38500	71	106			11.0	10.5		12.2	440	420		450
	[illegible]	114	7600	11000		38000	71	89			16.0	16.0		12.2	440	390		450
	[illegible]	113	8000	14000		32000	71	124			10.0	10.0		11.5	440	420		460
	TOTAL	887	86000	106000		298750	761	938		33194	81.0	82.5		95.8	3580	3320	520	3760
	AVG.	111	10750	13250		37344	95	117	*	4149	10.1	10.3		12.0	448	415	520	470
Third shift	1630	11[illegible]	15000	12000		33000	133	115			10.0	10.0		11.5	440	420		500
	1730	118	16000	12000		30000	142	106			10.5	10.0		11.5	440	420		500
	1830	118	16000	12000		31000	142	106			10.5	10.0		11.5	440	420		500
	1930	118	16000	12000		31000	142	106			10.5	10.0		11.0	440	420		[illegible]
	2030	114	17000	12000		30000	150	106			11.0	10.5		11.0	440	420		500
	2130	114	17000	13000		32000	150	116			11.0	10.5		11.5	440	420		500
	2230	119	18000	13000		31000	159	116			11.0	10.6		11.5	440	410		500
	2330	116	15000			31000	132							11.5				500
	TOTAL	918	130000	87000	38400	248000	1150	771		27556	79.5	71.5		91	3080	2930		4000
	AVG.	116	16250	12429	38400	31000	144	110		3444	10.6	10.2		11.3	440	418		500
Daily	TOTAL	2738	405000	271000	38400	750250	3583	2391	4129	82632	211	235	10.5	273	10180	9280	520	[illegible]
	AVG.	115	16875	11783	38400	31260	149	100	4129	3443	10.5	10.1		11.4	443	403	520	494

Shift	A Time Hour	F Fuel Oil Press (PSIG)	Fuel Oil Temp (°F)	G Feedwater Heater Press (PSIG)	Feedwater Heater Temp (°F)	H Feedwater Flow Start	Stop	Gals	I Make Up Water Flow Start	Stop	Gals	J Condensate Return Temp	K Feedwater Pump Pressures Suct	Disch	L Outside Temperature (°F)
First shift	[illegible]			8	216			[illegible]	5056	5122	662	165		[illegible]	36
	0130			x	216			6767		5214	920	165		[illegible]	[illegible]
	[illegible]			x	216			7106		5271	670	165		[illegible]	[illegible]
	[illegible]			8	216			6900		5272	920	165		[illegible]	[illegible]
	[illegible]			8	216			7106		5454	210	165		[illegible]	[illegible]
	[illegible]			8	216			7106		5517	630	165		[illegible]	[illegible]
	[illegible]			8	216			7229		[illegible]	740	165		[illegible]	[illegible]
	[illegible]			8	216			7229		5679	880	165		205	36
	TOTAL			64	1728			56637			1201	1320		1640	267
	AVG.			8	216			7080			150	165		[illegible]	36
Second shift	[illegible]			8	219			6985	5679	5765	[illegible]	160		205	26
	0930			8	219			9157		5801	[illegible]	160		205	26
	1030			8	218			7534		5850	790	175		205	50
	1120			8	215			7615		5948	680	175		205	52
	1230			8	[illegible]			7590		6087	790	175		205	20
	1330			8	[illegible]			6988		6125	1010	170		205	50
	[illegible]			8	215			6747		6220	920	165		205	52
	[illegible]			8	212			6506		6322	1000	150		205	54
	TOTAL			64	1744			59127			6200	1340		1640	380
	AVG.			8	218			7391			775	168		205	48
Third shift	1630			8	218			7229	6326	6412	970	160		205	45
	1730			8	216			6989		6515	990	160		205	40
	1830			8	218			7108		6596	110	160		205	40
	1930			[illegible]	218			7108		6669	730	160		205	40
	2030			8	217			7108		6739	690	160		205	39
	2130			8	218			7470		6837	990	160		205	31
	2230			8	218			7470		6931	940	160		205	36
	2330			8	218			10169		6965	340	160		205	37
	TOTAL			64	1744			60621			3920	1280		1640	319
	AVG.			8	218			7581			490	160		205	40
Daily	TOTAL			192	5216			176465			4321	3940		4120	985
	AVG.			8	217			7353			180	164		205	41

5. OPERATING DATA -85 85 435 -85 38102

	First shift			Second shift			Third shift			Total
	#1	#5	#4							271000
a Steam flow final (integrator)	554090	762[illegible]	329720	[illegible]578	765109	[illegible]	557651	767322	348[illegible]	750250
b Steam flow start	550[illegible]	760801	85[illegible]	554010	762[illegible]	[illegible]	5557[illegible]	76[illegible]	29[illegible]	405000
c Total steam produced	189000	78000	202500	86000	106000	[illegible]	130000	87000	247000	1464600
d Lbs steam per unit of fuel							#1 #2 #4			
e Soot blown	0430	[illegible]	1752			1535-57	2050-2058			
f Blow down	Time: [illegible]	Gals: 2029		Time:	Gals: [illegible]		Time:	Gals: 2530		776[illegible]
g Degree day										
h Operator	[illegible]			[illegible]			Mr Gouch + Mr McGowan + [illegible]			
i Fireman	[illegible]			[illegible]			[illegible]			
j Total manhours operation	24			45			40			112

k. Remarks: DONT BLOW ANY BOILERS TODAY.

[illegible] 200 [illegible] [illegible] 0305 [illegible] 1610

[illegible] 1400 210 1500 210

5. Plant combustion efficiency (Percent) 85.84 — #1 84.5% #5 85.7% #4 85.5%	11. Makeup water (Percent) 62% 2.4 C/O
7. Plant BTU output (Millions) 1466.[illegible]	12. Total fuel used 43.4 TONS
8. Plant BTU input (Millions) 1,995[illegible]	Coal lbs 86,761
9. Overall efficiency (Percent) [illegible]	Oil gals 5785
10. Plant manhours [illegible] 43.[illegible]	Gas mcf [illegible]

Date | Signature of chief operating engineer [illegible]

AF Form 1458 Previous edition will be used

12 FEB. 89

DAILY STEAM BOILER PLANT OPERATING LOG

1. COMMAND: SAC

Shift	TIME HOUR (A)	STEAM PRESS (PSIG) (B)	STEAM PRODUCED (1000 Pounds) (C) Boiler 1	Boiler 2	Boiler 3	Boiler 5	FUEL USED (D) Coal – BTU/LB, Oil – BTU/GAL, Gas – BTU/1000CF Boiler 1	Boiler 2	Boiler 3	Boiler 5	FLUE GAS (E) O_2 or CO_2 (Avg %) Boiler 1	Boiler 2	Boiler 3	Boiler 5	TEMP 331 Boiler 1	25 Boiler 2
FIRST SHIFT	0030	120	14000	7000		57600	124	62			10.0	9.5		11.0	440	34
	0130	104	22000			64000	195				10.5			11.0	440	
	0230	112	23000			59200	203				10.5			11.5	440	
	0330	98	24000			67200	212				11.0			10.5	440	
	0430	116	22000	7000		64000	195	62			10.5	9.5		11.0	440	32
	0530	114	15000	6000		67200	133	53			10.0	9.5		11.5	440	33
	0630	118	14000	8000		65600	124	71			10.5	9.5		11.0	440	33
	0730	112	13000	8000		67200	115	71			10.0	9.5		11.0	440	33
	TOTAL	900	147000	36000		512 000	1301	318		55054	83.0	47.5		88.5	3520	165
	AVG.	113	18375	7200		64000	163	64		6882	10.4	9.5		11.1	440	33
SECOND SHIFT	0830	112	14000	7200		64500	124	64			10.5	10.0		12.5	440	34
	0930	110	14000	7200		64000	124	64			10.5	10.0		12.5	440	34
	1030	114	8000	8000		65600	71	71			10.0	10.0		12.5	440	34
	1130	113	8000	8000		63000	71	71			10.0	10.0		12.5	420	34
	1230	124	8000	8000		64000	71	71			10.0	10.0		13.0	420	34
	1330	110	—	—		64000	—	—			—	—		13.0	—	—
	1430	116	8000	—		62800	71	—			10.0	—		12.5	420	—
	1530	116	8000	8000		62800	71	71			10.0	10.0		13.0	440	34
	TOTAL	915	68000	46400		510700	602	441		54914	71.0	60.0		101.5	3020	204
	AVG.	114	9714	7733		63838	86	69	*	6864	10.1	10.0		12.7	431	34
THIRD SHIFT	1630	116	4000	7000		54400	25	62			10.0	10.0		12.5	440	30
	1730	114	15000	7000		48000	133	62			10.0	10.0		12.5	440	30
	1830	118	19000	—		52800	168	—			11.0	—		12.5	440	—
	1930	118	19000	—		56000	168	—			10.5	—		12.5	440	—
	2030	118	22000	4000	8000	40000	203	35			10.5	9.5	9.0	12.0	440	30
	2120	119	26000	11000	23000	25600	230	97			11.0	10.0	10.5	9.5	440	24
	2230	119	28000	14000	30000		248	124			11.0	10.0	11.0		440	42
	2330	120	35000	14000	33000		265	124			11.0	10.0	11.0		440	42
	TOTAL	942	164000	57000	94000	276800	1450	574	10444	29763	84	59.5	40.5	71.5	3520	208
	AVG	118	20500	9500	23500	46133	181	84	2611	4961	10.5	9.9	10.1	11.9	440	34
DAILY	TOTAL	2757	379000	139400	94000	1299500	3353	1233	10444	139731	238	167	40.5	261.8	10060	57
	AVG.	115	15792	8200	23500	54068	140	73	2611	6351	9.9	9.8	10.1	11.9	419	37

OPERATING DATA

	FIRST SHIFT #1	#2	#5	SECOND SHIFT #1	#2	#5	#1
A. STEAM FLOW FINAL (Integrator)	538527	752906	979344	539340	752949	985725	5418
B. STEAM FLOW START	535965	752906	973054	538527	752906	979344	5393
C. TOTAL STEAM PRODUCED	147000	36000	512000	68000	46400	510700	1640
D. LBS. STEAM PER UNIT OF FUEL							
E. SOOT BLOWN		0200			1000		2145
F. BLOW DOWN	TIME: 0100	GALS. 352+490=842		TIME: 0900	GALS. 352+1260−105=1720		TIME
G. DEGREE DAY							
H. OPERATOR	(McPHEARSON) GASPARD WITTENBERG			Williams, DEWEES, BEIMLER, (ECKHARDT)			Fa
I. FIREMAN				DINGFELDT, HODGSON			
J. TOTAL MANHOURS OPERATION	24			48			

13. REMARKS (Continue on reverse)

First shift:
WC-GG-DA-0015
ASHES 0420-0530=490
OIL TRANSFER TO 9'3".
HANGER 200 OPEN 0735-0745

Second shift:
WC-GG-DA-0820
ASHES-0820 > 1260
1120
1545 > 105
1600

W
As
B
B

DATE | SIGNATURE OF CHIEF OPERATING ENGINEER

AF FORM 1458 OCT 82 PREVIOUS EDITION WILL BE USED.

FR.

10 FEB 89 **DAILY STEAM BOILER PLANT OPERATING LOG**

1. COMMAND SAC

TIME HOUR A	STEAM PRESS (PSIG) B	STEAM PRODUCED (1000 Pounds) C BOILER NO. 1	2	3	5	FUEL USED D (COAL – BTU/LB; OIL – BTU/GAL; GAS – BTU/1000CF) BOILER NO. 1	2	3	5	FLUE GAS E O_2 OR CO_2 (Avg %) BOILER NO. 1	2	3	5	TEMP 352 BOILER 1	2
FIRST SHIFT															
0030	118	27000	8000		59200	239	71			10.5	10.0		10.5	440	36
0130	118	27000	10000		56000	239	88			10.0	10.0		10.0	440	36
0230	118	28000	10000		52800	248	88			10.0	10.5		10.5	440	36
0330	118	27000	10000		56000	239	88			10.0	10.5		10.0	440	36
0430	118	27000	9000		57000	239	80			10.5	10.5		10.0	420	34
0530	118	26500	8000		56800	234	71			10.5	10.5		10.0	430	35
0630	118	25000	8000		62400	221	71			10.5	10.5		10.0	430	35
0730	114	22000	8000		63500	195	71			10.0	10.0		10.0	420	34
TOTAL	940	204500	71000		463700	1854	628		49860	82.0	82.5		81.0	3460	282
AVG.	117	26187	8875		57962	232	78		6233	10.2	10.3		10.1	432	352
SECOND SHIFT															
0830	116	17500	8000		64000	155	71			12.0	11.5		12.6	400	35
0930	114	16000	8000		64000	142	71			12.0	11.5		14.2	400	35
1030	112		8000		64000		71				11.5		14.1		35
1130	111	11000	10000		64000	97	88			11.0	11.5		14.0	380	38
1230	108	17000			64000	150				11.5			14.2	400	
1330	111	18000			64000	159				12.0			14.2	400	
1430	106	18000			64000	159				12.0			14.0	400	
1530	118	11000			64000	97				12.0			14.0	400	
TOTAL	896	108500	34000		512000	959	301		55054	82.5	46.0		111.3	2760	143
AVG.	112	13563	8500		64000	137	75		6882	11.8	11.5		13.9	394	35
THIRD SHIFT															
1630	74	40000	26000		27000	354	230			11.0	11.0		10.0	[illegible]	52
1730	98	36000	23000		41600	319	204			11.5	10.5		11.5	440	[illegible]
1830	116	32000	8000		48000	283	71			11.0	10.5		11.5	480	42
1930	120	31000	10000		48000	274	89			12.0	11.0		11.0	420	42
2030	123	25000	8000		48000	221	71			11.5	10.0		11.5	480	42
2130	114	26000	8000		48000	230	71			11.5	10.0		11.5	480	42
2230	120	28000	8000		52800	248	71			11.5	10.0		12.0	480	42
2330	121	26000	8000		52800	230	71			11.5	10.0		11.5	480	42
TOTAL	876	244000	99000		366400	2159	878		39398	91.5	83.0		90.5	3840	34
AVG.	110	30500	12375		45800	270	110		4925	11.4	10.4		11.3	480	43
DAILY TOTAL	2712	562000	204000		1342100	4972	1807		144312	256	211.5		282.8	10460	77
DAILY AVG.	113	24435	10200		55921	216	90		6013	11.1	10.6		11.9	437	38

5. OPERATING DATA -85 -85

	FIRST SHIFT #1	#2	#5	SECOND SHIFT #1	#2	#5	
A. STEAM FLOW FINAL (Integrator)	522924.	750338	944799	524984	750695	951472	52
B. STEAM FLOW START	519417	749321	938869	522924	750338	944799	524
C. TOTAL STEAM PRODUCED	209500	71000.	463700	108500	34000	512000	244
D. LBS. STEAM PER UNIT OF FUEL							
E. SOOT BLOWN	0415	0420	0425	1230	1240	1245	20
F. BLOW DOWN	TIME: 0100	GALS. 352+420=772		TIME: 0900	GALS. 484+420=904		TIME:
G. DEGREE DAY							
H. OPERATOR	McPhearson Gaspard			Williams Scheble Cater, Bauer			Good
I. FIREMAN				Erdmeat Richards			
J. TOTAL MANHOURS OPERATION	16			48			

13. REMARKS (Continue on reverse)

WC-GG-DA-0015
Ashes 0305 - 0325 = 140
0610 - 0650 = 280 > 420

WC-GG-DA-0810
Ashes = 0830 - 0900 = 210
Ashes = 1530 - 1600 = 210

W

Blowdown #3 - 420 ... to the middle of Glass.
Header 200 opened at 0814 to 0830

DATE	SIGNATURE OF CHIEF OPERATING ENGINEER

AF FORM OCT 82 1458 PREVIOUS EDITION WILL BE USED.

APPENDIX D

Coal Analysis

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The laboratory data sheets were not suitable for reproduction; therefore, the coal analysis results are presented in the following table.

BOILER #	RUN #	STACK ID*	AS RECEIVED BTU/LB VALUE
3	1	SCB	11209
3	2	SCB	11281
3	3	SCB	11316
4	1	SCA	11433
4	2	SCA	11369
4	3	SCA	11365
5	1	SCB	11794
5	2	SCB	11463
5	3	SCB	11995
5	1	BP	11339
5	2	BP	11359
5	3	BP	11344

* SCA = SCRUBBER A
SCB = SCRUBBER B
BP = BYPASS

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APPENDIX E

Boiler 3, Scrubber B Field Data

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DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: SCRUBBER B Stack diameter at ports: 5.0 (ft)

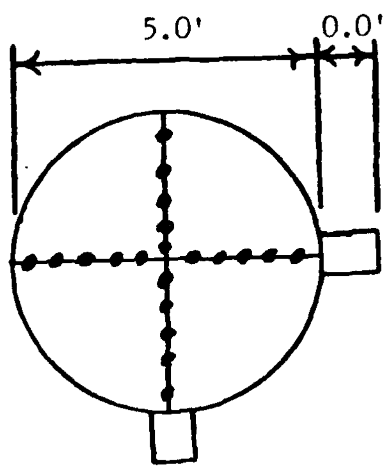
Distance A (ft) 7.0 (duct diameters) 1.4

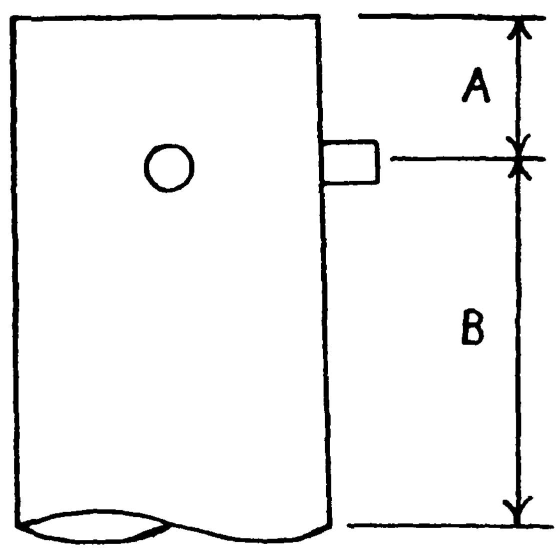
Recommended number of traverse points as determined by distance A: 20

Distance B (ft) 28 (duct diameters) 5.6

Recommended number of traverse points as determined by distance B: 20

Number of traverse points used: 20





PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE GRISSOM	PLANT CENTRAL HEAT PLANT
DATE 13 FEB 89	SAMPLING TEAM
SOURCE TYPE AND MAKE	
SOURCE NUMBER BOIL #3 SCRUBBER B	INSIDE STACK DIAMETER 60 Inches
RELATED CAPACITY	TYPE FUEL
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER 0 Inches	
NUMBER OF TRAVERSES 2	NUMBER OF POINTS/TRAVERSE 10

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

POINT	PERCENT OF DIAMETER	DISTANCE FROM INSIDE WALL (Inches)	TOTAL DISTANCE FROM OUTSIDE OF NIPPLE TO SAMPLING POINT (Inches)
1			1.5
2			4.9
3			8.8
4			13.6
5			20.5
6			39.5
7			46.4
8			51.2
9			55.1
10			58.5

OEHL FORM 15 APR 78

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE: GRISSOM AFB	DATE: 13 FEB 89
BOILER NUMBER: ~~###~~ #3, SCRUBBER B	
INSIDE STACK DIAMETER: 60	Inches
STATION PRESSURE: 28.975	In Hg
STACK STATIC PRESSURE: .16	In H20
SAMPLING TEAM	

TRAVERSE POINT NUMBER	VELOCITY HEAD, Vp IN H20	$\sqrt{V_p}$ CYCLONIC α	STACK TEMPERATURE (°F)
1	.16	23 21	108
2	.16	23 22	108
3	.16	23 20	108
4	.16	10 11	109
5	.17	0 5	108
6	.23	8 6	108
7	.23	10 10	109
8	.26	15 12	108
9	.26	20 19	108
10	.275	18 20	108
		AVG = 15°	
FPS = 27			
Ts = 108			
NOZ DIA = .3221			
AVERAGE			

FORM

START 10:13 1058 STOP 1128

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER BOILER 3
#1 Scrubber B

DATE
13 Feb 89

PLANT

BASE
Grissom AFB

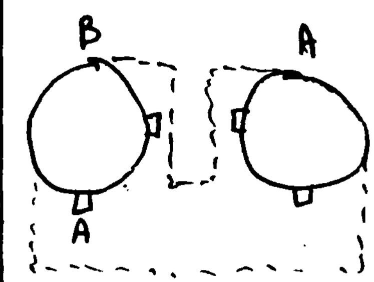
SAMPLE BOX NUMBER
Nutech #1

METER BOX NUMBER
Nutech #1

Qw/Qm

Co

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good
Preleak 15" Hg good
15" Hg good
Postleak 15 Hg good

Static ΔP = -.16

AMBIENT TEMP °F

STATION PRESS 28.975 in Hg

HEATER BOX TEMP 248 ± 25 °F

PROBE HEATER SETTING 190

PROBE LENGTH 72 in

NOZZLE AREA (A) .320 sq ft

Cp .84

DRY GAS FRACTION (Fd)

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (in H2O)~~	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp) B	ORIFICE DIFF. PRESS. (H) F	GAS SAMPLE VOLUME 536.129	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	SAMPLE BOX TEMP #3 (°F)	IMPINGER OUTLET TEMP #4 (°F)
1	0	3.0	108		.095	.99	~~530.342~~	87		85	247	48
2	3	4.6	106		.22	2.31		89		86	251	48
3	6	4.8	105		.21	2.22		91		87	250	50
4	9	4.8	106		.21	2.22		94		87	250	52
5	12	4.9	108		.22	2.32		96		88	252	54
6	15	5.1	108		.24	2.54		98		89	251	55
7	18	5.3	107		.25	2.66		100		90	248	57
8	21	5.3	108		.25	2.65		101		90	245	59
9	24	5.6	107		.245	2.61		101		91	247	60
10	27	5.9	108		.26	2.77		102		92	244	59
	30 stop						552.780					
1	0	4.3	106		.18	1.91	552.960	94		92	243	47
2	3	4.5	105		.175	1.87		98		93	241	47
3	6	4.4	108		.17	1.81		100		93	243	48
4	9	4.6	107		.175	1.87		102		94	244	50
5	12	5.0	107		.20	2.20		104		95	243	51
6	15	5.4	108		.25	2.60		105		96	242	52
7	18	6.0	107		.245	2.63		106		97	241	52
8	21	6.0	107		.25	2.69		107		97	243	53
9	24	6.6	107		.28	3.01		106		97	241	54
10	27	6.9	107		.28	3.02		107		98	242	56
	30 stop						575.218					21.6510

Ts = 107 Tm = 96 ΔH = 2.36 PSTS = 11.1156 Total ft³ #1 = #2 = 22.2580 43.9090

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	13 FEB 89	One

BUILDING NUMBER	SOURCE NUMBER
Power Plant	Boiler 3 Scrubber B

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.3451	.2918	0.0533
ACETONE WASHINGS *(Probe, Front Half Filter)*	~~96.6805~~ 96.6805	96.6641	~~0.0164~~ .0164
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		.0697 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	243.0	200.0	43.0
IMPINGER 2 *(H20)*	211.0	200.0	11.0
IMPINGER 3 *(Dry)*	1.5	0.0	1.5
IMPINGER 4 *(Silica Gel)*	208.4	200.0	8.4
	Total Weight of Water Collected		63.9 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	4.4	4.4	4.4		4.4
VOL % O_2	14.4	14.4	14.2		14.3
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

START 12:08 12:38 1243 STOP 1:13 Soot blow

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: #2 Boil. 3 Scrubber B

DATE: 13 Feb 89

PLANT:

BASE: Grissom AFB

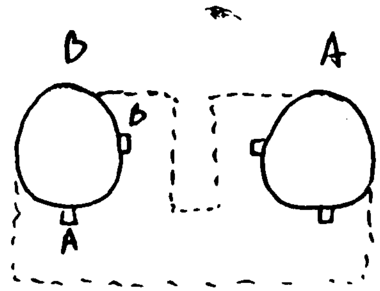
SAMPLE BOX NUMBER: Nutech #1

METER BOX NUMBER: Nutech #1

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good
Preleak 15" Hg good
Postleak 15" Hg good
SOOT BLOW

Static ΔP ≈ -.16

AMBIENT TEMP: °F

STATION PRESS: 28.975 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 72 in

NOZZLE AREA (A): .328 sq ft

Cp: .84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp) B	ORIFICE DIFF. PRESS. (H) F	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #2 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #? (°F)	SAMPLE BOX TEMP #3 (°F)	IMPINGER OUTLET TEMP #4 (°F)
1	0	4.2	106	.	.22	2.35	* 515.549	98		96	242	42
2	3	4.3	104	.	.225	2.42		100		98	244	43
3	6	4.5	105	.	.215	2.35		103		98	244	45
4	9	4.5	106	.	.215	2.32		105		99	243	46
5	12	4.5	106	.	.23	2.40		106		99	244	48
6	15	4.6	107	.	.22	2.37		107		100	244	50
7	18	4.9	107	.	.24	2.59		108		100	244	51
8	21	4.9	108	.	.24	2.59		109		101	241	53
9	24	4.9	109	.	.225	2.43		109		101	242	55
10	27	4.8	111	.	.20	2.15	* 598.260	110		101	241	56
	30 stop						*					
1	0	4.0	105	.	.18	1.95	* 598.260	105		102	241	50
2	3	4.0	108	.	.165	1.78		107		102	242	52
3	6	4.0	110	.	.145	1.56		108		102	241	53
4	9	4.1	109	.	.155	1.67		109		102	240	53
5	12	4.9	108	.	.195	2.11		110		103	241	54
6	15	5.5	109	.	.235	2.55		112		103	243	54
7	18	5.6	108	.	.23	2.50		112		103	242	54
8	21	5.9	109	.	.235	2.55		112		104	241	55
9	24	6.4	108	.	.26	2.82		112		104	240	56
10	27	6.4	109		.26	2.82		112		104	242	56
	30 stop						* 620.080					

Ts 108 Tm 104 ΔH -2.3 ΔPsts 11.002 Total FP 44.5310

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	13 FEB 89	Two

BUILDING NUMBER	SOURCE NUMBER
Power Plant	Boiler 3 Scrubber B

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.3423	.2906	0.0517
ACETONE WASHINGS *(Probe, Front Half Filter)*	98.7417 98.7417	98.7350	.0067
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		.0584 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	242.0	200.0	42.0
IMPINGER 2 *(H20)*	216.0	200.0	16.0
IMPINGER 3 *(Dry)*	2.5	0.0	2.5
IMPINGER 4 *(Silica Gel)*	211.5	200.0	11.5
	Total Weight of Water Collected		72.0 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	4.2	4.2	4.2		4.2
VOL % O_2	13.6	13.6	13.6		13.6
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

START 1:47 2:22 STOP 2:52
2:17

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: #3 Coil 3 Scrubber B

DATE: 13 Feb 89

PLANT:

BASE: Grissom AFB

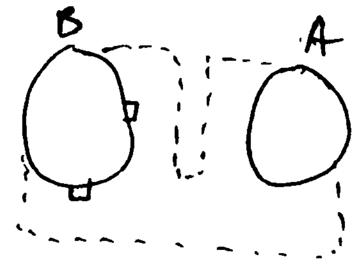
SAMPLE BOX NUMBER: Nutech #1

METER BOX NUMBER: Nutech #1

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

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

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot - good
Preleak - 15" Hg Good
Post leak - 15" Hg Good

Static ΔP = .16

AMBIENT TEMP: °F

STATION PRESS: 28.975 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 72 in

NOZZLE AREA (A): .320 sq ft

Cp: .84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE~~ Vac (in H2O)	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	B VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	#3 SAMPLE BOX TEMP (°F)	#4 IMPINGER OUTLET TEMP (°F)
1	0	7.0	105		.21	2.26	*620.418	100		100	235	41
2	3	7.0	108		.215	2.31		102		100	236	41
3	6	7.0	109		.215	2.30		103		100	237	41
4	9	7.1	108		.21	2.26		105		101	237	43
5	12	8.0	109		.22	2.37		106		101	238	45
6	15	8.9	108		.24	2.59		107		101	239	45
7	18	9.0	109		.23	2.48		107		101	239	47
8	21	9.1	109		.235	2.53		107		101	239	48
9	24	9.9	111		.225	2.41		107		101	239	49
10	27	9.1	110		.195	2.09	*642.885	106		101	239	50
	30 stop											
1	0	8.6	108		.185	1.98	*642.886	102		100	239	46
2	3	8.2	108		.17	1.83		104		100	240	47
3	6	7.9	109		.155	1.66		105		100	239	48
4	9	8.4	109		.17	1.83		107		100	241	48
5	12	9.1	109		.19	2.05		108		101	239	48
6	15	11.4	110		.23	2.48		109		101	239	48
7	18	11.2	109		.22	2.48		109		101	242	48
8	21	12.0	109		.235	2.53		109		101	241	50
9	24	13.9	110		.275	2.46		109		101	240	51
10	27	14.1	110		.23	3.01	*664.897	109		101	241	52
	30 stop											

OEHL FORM MAY 78 18 Tm = 103 Ts = 109 ΔH = 2.32 √PSTS 11.0489 Total ft³ 44.4790

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	13 FEB 89	THREE

BUILDING NUMBER	SOURCE NUMBER
POWER PLANT	BOILER 3 SCRUBBER B

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.3681	.2909	0.0772
ACETONE WASHINGS *(Probe, Front Half Filter)*	103.5373 103.5373	103.5278	0.0095
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		.0867 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	253.0	200.0	53.0
IMPINGER 2 *(H20)*	210.0	200.0	10.0
IMPINGER 3 *(Dry)*	0	0.0	0
IMPINGER 4 *(Silica Gel)*	208.0	200.0	8
	Total Weight of Water Collected		71.0 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	4.0	4.0	4.0		4.0
VOL % O_2	14.0	14.0	13.8		13.9
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

VISIBLE EMISSION OBSERVATION FORM

No. Run # 1

COMPANY NAME: Grissom AFB Heating Plant

STREET ADDRESS: Bldg 223

CITY: Grissom AFB | STATE: In | ZIP: 46971

PHONE (KEY CONTACT): | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Boiler #3 | OPERATING MODE: 95-100%

CONTROL EQUIPMENT: Scrubber B (wet) | OPERATING MODE:

DESCRIBE EMISSION POINT: Fiberglass stack 60" diameter

HEIGHT ABOVE GROUND LEVEL: 95'

HEIGHT RELATIVE TO OBSERVER: Start 95' End ✓

DISTANCE FROM OBSERVER: Start 300' End ✓

DIRECTION FROM OBSERVER: Start NW End ✓

DESCRIBE EMISSIONS: Start Looping End

EMISSION COLOR: Start ? End ✓

IF WATER DROPLET PLUME: Attached ☑ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 100 End ✓

DESCRIBE PLUME BACKGROUND: Start Stratus Layer End ✓

BACKGROUND COLOR: Start Gray End ✓

SKY CONDITIONS: Start OVC End ✓

WIND SPEED: Start 20 mph End ✓

WIND DIRECTION: Start SW End ✓

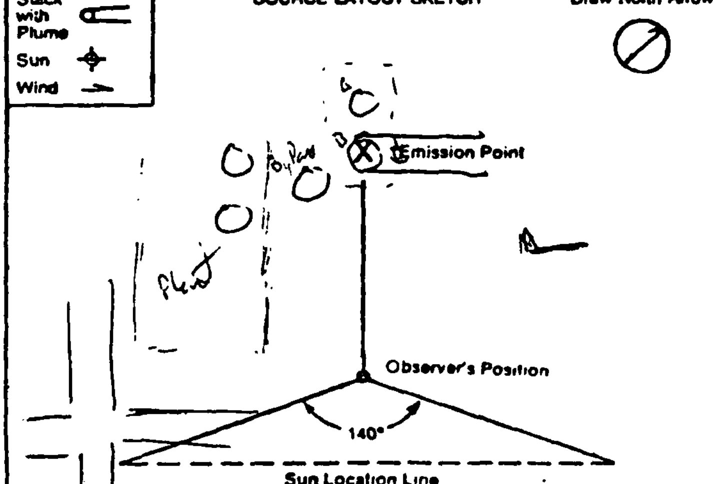
AMBIENT TEMP: Start 34 End ✓

WET BULB TEMP:

RH, percent: 90%

SOURCE LAYOUT SKETCH — Draw North Arrow

Stack with Plume — Sun — Wind



ADDITIONAL INFORMATION:

OBSERVATION DATE: 13 Feb 89 | START TIME: 1106 | END TIME: 1112

MIN \ SEC	0	15	30	45	COMMENTS
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT): Paul T. Scott

OBSERVER'S SIGNATURE: Paul T Scott | DATE: 13 Feb 89

ORGANIZATION: USAFOEHL/ECQ

CERTIFIED BY: Texas Air Control Board | DATE: 16 Sept 88

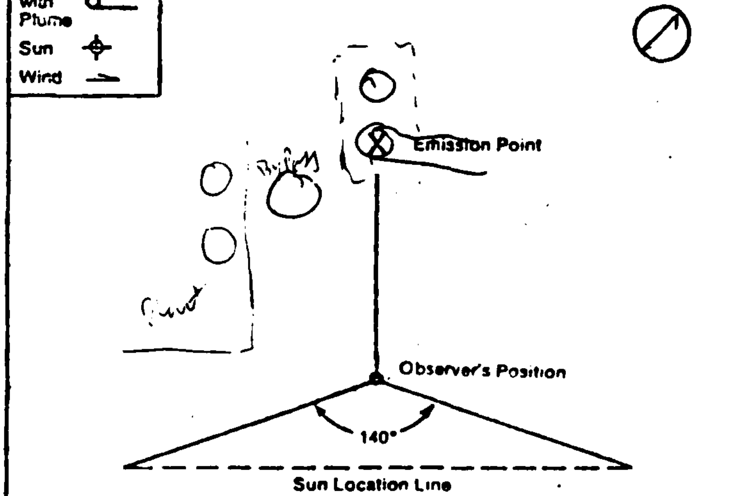
VISIBLE EMISSION OBSERVATION FORM

No. TWO

COMPANY NAME	Grissom Heating Plant
STREET ADDRESS	Bldg 223
CITY	Grissom AFB
STATE	In
ZIP	46971
PHONE (KEY CONTACT)	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Boiler #3
OPERATING MODE	95-100%
CONTROL EQUIPMENT	Wet Scrubber #3
OPERATING MODE	✓
DESCRIBE EMISSION POINT	Fiberglass stack 60" diameter
HEIGHT ABOVE GROUND LEVEL	95'
HEIGHT RELATIVE TO OBSERVER	Start 95' End ✓
DISTANCE FROM OBSERVER	Start 300' End ✓
DIRECTION FROM OBSERVER	Start NW End ✓
DESCRIBE EMISSIONS	Start Lofting End Fumigating
EMISSION COLOR	Start N/A End
IF WATER DROPLET PLUME	Attached ✓ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	Start 100' End ✓
DESCRIBE PLUME BACKGROUND	Start Gray Sky STRATUS End ✓
BACKGROUND COLOR	Start Gray End ✓
SKY CONDITIONS	Start OVC End ✓
WIND SPEED	Start 10 End ✓
WIND DIRECTION	Start SW End ✓
AMBIENT TEMP	Start 35 End ✓
WET BULB TEMP	
RH, percent	95

SOURCE LAYOUT SKETCH — Draw North Arrow

Stack with Plume — Sun — Wind



ADDITIONAL INFORMATION

55

OBSERVATION DATE	START TIME	END TIME
13 Feb	1235	1250

MIN \ SEC	0	15	30	45	COMMENTS
1	Ø	Ø	Ø	Ø	
2	Ø	Ø	Ø	Ø	
3	Ø	Ø	Ø	Ø	
4	Ø	Ø	Ø	Ø	soot blow at 1239
5	Ø	Ø	Ø	Ø	
6	Ø	Ø	Ø	5	
7	5	5	Ø	Ø	
8	Ø	Ø	Ø	Ø	
9	Ø	Ø	Ø	Ø	
10	Ø	Ø	Ø	Ø	
11	Ø	Ø	Ø	Ø	
12	Ø	Ø	Ø	Ø	
13	Ø	Ø	Ø	Ø	
14	Ø	Ø	Ø	Ø	
15	Ø	Ø	Ø	Ø	
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

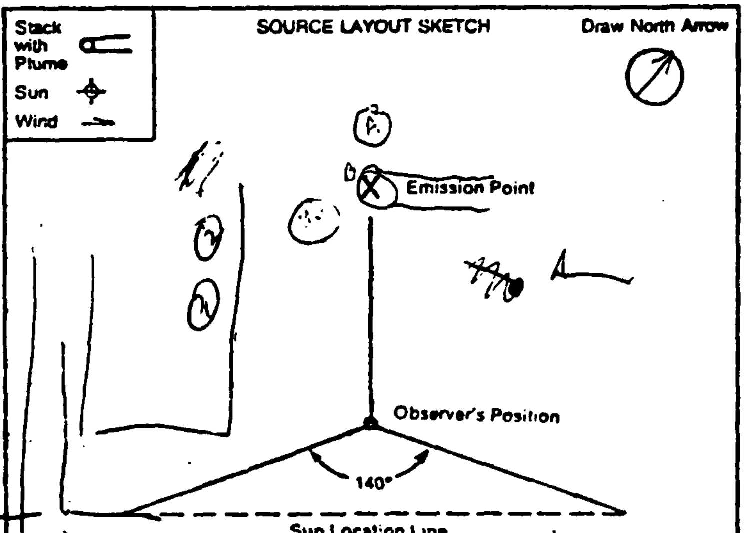
OBSERVER'S NAME (PRINT)	Paul T. Scott
OBSERVER'S SIGNATURE	Paul T Scott
DATE	13 Feb 89
ORGANIZATION	USAFOEHL/ECQ
CERTIFIED BY	Texas Air Control Board
DATE	16 Sept 89

VISIBLE EMISSION OBSERVATION FORM

No. THREE

COMPANY NAME	Grissom Heating Plant
STREET ADDRESS	Bldg 223
CITY	Grissom AFB
STATE	In
ZIP	46971
PHONE (KEY CONTACT)	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Coal-Fired Boiler #3
OPERATING MODE	95-100%
CONTROL EQUIPMENT	Wet Scrubber B
OPERATING MODE	
DESCRIBE EMISSION POINT	Fiberglass stack 60" diameter
HEIGHT ABOVE GROUND LEVEL	95'
HEIGHT RELATIVE TO OBSERVER	Start 95 End ✓
DISTANCE FROM OBSERVER	Start 300' End ✓
DIRECTION FROM OBSERVER	Start NW End ✓
DESCRIBE EMISSIONS	Start lofting End ✓
EMISSION COLOR	Start grey brown End ✓
IF WATER DROPLET PLUME	Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	Start 100' End ✓
DESCRIBE PLUME BACKGROUND	Start Clouds-Stratus End ✓
BACKGROUND COLOR	Start Gray End ✓
SKY CONDITIONS	Start OVC End ✓
WIND SPEED	Start 10 End ✓
WIND DIRECTION	Start SW End ✓
AMBIENT TEMP	Start 36 End ✓
WET BULB TEMP	
RH, percent	95

SOURCE LAYOUT SKETCH



ADDITIONAL INFORMATION

56

OBSERVATION DATE	START TIME	END TIME
13 Feb 89	1433	1439

MIN \ SEC	0	15	30	45	COMMENTS
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7					
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29					
30					

OBSERVER'S NAME (PRINT): Paul T. Scott

OBSERVER'S SIGNATURE: Paul T Scott — DATE: 13 Feb 89

ORGANIZATION: USAF OEHL/ECQ

CERTIFIED BY: Texas Air Control Board — DATE: 16 Sep 89

APPENDIX F

Boiler 4, Scrubber A Field Data

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DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: SCRUBBER A   Stack diameter at ports: 5.0 (ft)

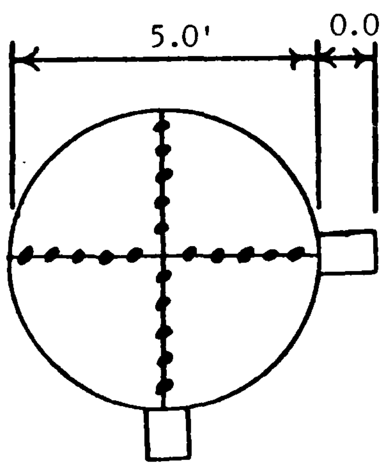
Distance A (ft) 7.0   (duct diameters) 1.4

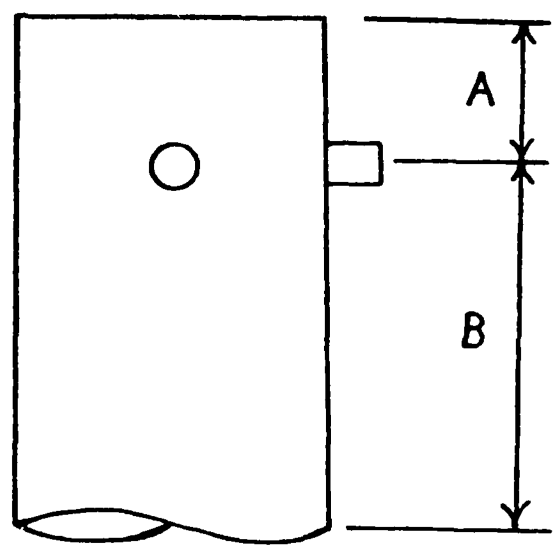
Recommended number of traverse points as determined by distance A: 20

Distance B (ft) 28   (duct diameters) 5.6

Recommended number of traverse points as determined by distance B: 20

Number of traverse points used: 20





PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE	PLANT
GRISSOM AFB	GRISSOM AFB CENTRAL HEAT PLANT
DATE: 14 FEB 89	SAMPLING TEAM
SOURCE TYPE AND MAKE: COAL FIRED BOILER	
SOURCE NUMBER: BOILER #4	INSIDE STACK DIAMETER: SCRUBBER A - 60" Inches
RELATED CAPACITY	TYPE FUEL
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER Inches	
NUMBER OF TRAVERSES: 2	NUMBER OF POINTS/TRAVERSE: 10

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

POINT	PERCENT OF DIAMETER	DISTANCE FROM INSIDE WALL *(Inches)*	TOTAL DISTANCE FROM OUTSIDE OF NIPPLE TO SAMPLING POINT *(Inches)*
1			1.5
2			4.9
3			8.8
4			13.6
5			20.5
6			39.5
7			46.4
8			51.2
9			55.1
10			58.5

OEHL FORM APR 78 15

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

BASE GRISSOM AFB	DATE 14 FEB 79
BOILER NUMBER #4 SCRUBBER A	
INSIDE STACK DIAMETER 60	Inches
STATION PRESSURE 29.381	In Hg
STACK STATIC PRESSURE -.29	In H20
SAMPLING TEAM	

TRAVERSE POINT NUMBER	VELOCITY HEAD, Vp IN H20	CYCLONIC $\sqrt{V_p}$ α	STACK TEMPERATURE (0F)
1	.19	25 23	102
2	.21	20 22	102
3	.22	14 15	102
4	.27	5 7	106
5	.30	5 5	102
6	.38	5 5	103
7	.43	10 9	102
8	.37	10 11	102
9	.33	18 17	102
10	.25	25 25	102
		AVG = 14°	
FPS = 32			
Ts = 103			
NOZZLE DIA = 0.2899			
AVERAGE			

OEHL FORM APR 78 16

0

START 0944 10:14 1021 STOP 1051 2203

PARTICULATE SAMPLING DATA SHEET

$\Delta H = 2.07$

RUN NUMBER: #1, Boiler 4, Scrubber A

DATE: 14 Feb 89 Happy Valentines Day

PLANT:

BASE: Grissom AFB

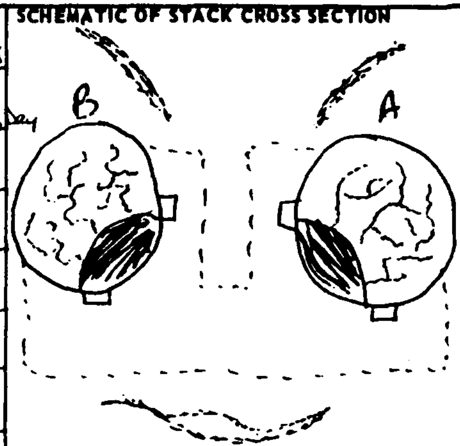
SAMPLE BOX NUMBER: Nutech #2

METER BOX NUMBER: Nutech #1

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$$°R = °F + 460$$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good

Preleak ck 15" Hg good

Postleak ck 19" Hg good

Static $\Delta P = -.29$

AMBIENT TEMP: °F

STATION PRESS: 29.381 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 96 in

NOZZLE AREA (A): .303 sq ft

Cp: .84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	VAC STATIC PRESSURE (in H20)	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	B VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	SAMPLE BOX TEMP #3 (°F)	IMPINGER OUTLET TEMP #4 (°F)
1	0	3.8	97		.105	.94	*665.254	90		88	241	33
2	3	4.6	96		.145	1.30		91		89	246	24
3	6	5.9	91		.2	1.81		94		89	246	34
4	9	6.4	88		.225	2.05		96		90	247	33
5	12	8.1	85		.30	2.76		98		91	249	35
6	15	13.8	89		.48	4.39		100		91	249	39
7	18	17.5	91		.55	5.03		101		92	250	45
8	21	17.8	93		.63	5.74		102		92	249	48
9	24	17.9	93		.58	5.29 ok		102		93	248	48
10	27	17.9	95		.47	4.27	*689.511	101		93	245	51
	30 stop											
1	0	8.9 8.1	90		.26	2.37	*689.512	95		93	247	49
2	3	11.0 9.4	90		.315	2.88		98		94	242	50
3	6	10.0 9.0	95		.305	2.80		99		94	244	53
4	9	10.1	95		.355	3.23		101		94	243	54
5	12	11.5	95		.385	3.50		102		94	243	55
6	15	11.2	95		.375	3.42		104		95	244	57
7	18	8.8	95		.285	2.60		105		95	244	59
8	21	7.5	94		.245	2.24		105		96	241	57
9	24	6.9	94		.22	2.01		105		96	241	55
10	27	6.0	93		.18	1.65	*713.648	106		96	240	54
	30 stop											

$T_m = 96$ $T_s = 93$ $\Delta H = 3.01$ $\sqrt{\Delta P}$ STS = 13.19 Total $Ft^3 = 42.3930$

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	14 Feb 89	One

BUILDING NUMBER	SOURCE NUMBER
Power Plant	Boiler 4 Scrubber A

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.3149	.2898	0.0251
ACETONE WASHINGS *(Probe, Front Half Filter)*	100.0882	100.0520	0.0362
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0613 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	230.0	200.0	30.0
IMPINGER 2 *(H20)*	212.0	200.0	12.0
IMPINGER 3 *(Dry)*	2.5	0.0	2.5
IMPINGER 4 *(Silica Gel)*	214.1	200.0	14.1
	Total Weight of Water Collected		58.6 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	3.0	3.0	3.0		3.0
VOL % O_2	17.6	17.6	17.6		17.6
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

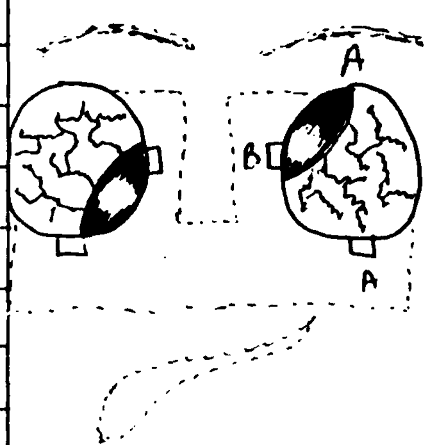
AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

START 11:24 11:54 STOP 1229

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER	#2 Boiler 4, Scrubber A
DATE	14 Feb 89
PLANT	
BASE	Grissom AFB
SAMPLE BOX NUMBER	Nutech #1
METER BOX NUMBER	Nutech #1
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot – good
Preleak ck 15" Hg good
Postleak ck 18" Hg good

Static ΔP = -.29

AMBIENT TEMP	°F
STATION PRESS	29.381 in Hg
HEATER BOX TEMP	248 ± 25 °F
PROBE HEATER SETTING	190
PROBE LENGTH	96 in
NOZZLE AREA (A)	.303 sq ft
Cp	.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE~~ (in H2O)	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD B (Vp)	ORIFICE DIFF. PRESS. F (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	SAMPLE BOX TEMP #3 (°F)	IMPINGER OUTLET TEMP #4 (°F)
1	0	5.1	93		.185	1.68	*714.255	94		94	235	34
2	3	6.0	92		.22	2.00		95		94	236	34
3	6	6.8	90		.235	2.15		96		94	237	35
4	9	7.8	86		.27	2.49		99		94	239	39
5	12	8.8	92		.32	2.92		100		94	238	43
6	15	14.1	91		.475	4.35		101		94	239	47
7	18	17.9	92		.56	5.13 4.1		102		95	240	51
8	21	17.9	94		.57	5.20 4.1		102		95	240	61
9	24	17.9	96		.645	5.86 4.7		102		95	239	63
10	27	17.9	96		.52	4.13	*740.079	102		95	240	62
X	30 stop	X	X	X	X	X	X	X	X	X	X	X
1	0	11.0	92		.35	3.19	*740.079	98		95	239	52
2	3	12.9	96		.39	3.54		100		95	241	53
3	6	13.2	97		.39	3.55		104		96	240	54
4	9	13.9	98		.40	3.64		105		96	239	56
5	12	12.1	98		.41	3.73		107		96	241	58
6	15	8.9	99		.29	2.64		107		97	243	59
7	18	7.2	99		.245	2.23		108		98	243	58
8	21	6.8	100		.225	2.05		109		98	242	56
9	24	6.8	97		.22	2.01		109		98	243	55
10	27	6.1	99		.195	1.78	*764.675	110		99	242	54
	30 stop											

OEHL FORM 18 MAY 78

Tm = 99 Ts = 95 ΔH = 3.24 √ΔPs Ts = 13.8003 Total ft³ = 50.42

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
GRISSOM AFB	14 FEB 89	TWO

BUILDING NUMBER	SOURCE NUMBER
POWER PLANT	BOILER 4 SCRUBBER A

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3143	.2889	0.0254
ACETONE WASHINGS *(Probe, Front Half Filter)*	102.2120	102.2047	0.0073
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0327 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	232.0	200.0	32.0
IMPINGER 2 *(H20)*	212.0	200.0	12.0
IMPINGER 3 *(Dry)*	2.0	0.0	2.0
IMPINGER 4 *(Silica Gel)*	216.1	200.0	16.1
	Total Weight of Water Collected		62.1 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.8	2.8	2.8		2.8
VOL % O_2	15.4	15.4	15.2		15.3
VOL % CO					
VOL % N_2					

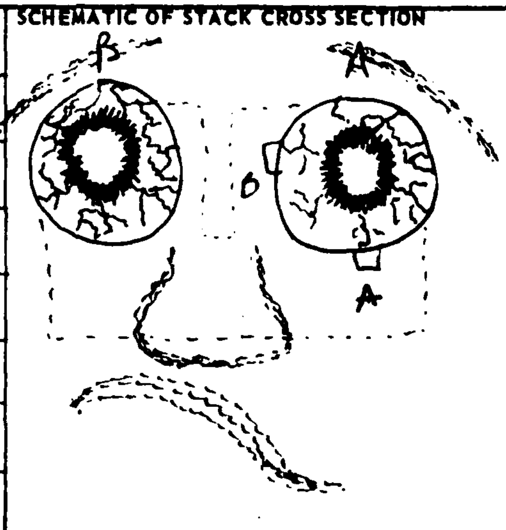
Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

START 1:14 1:44 1:48 2:18 STOP 2:22

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 13 Boiler 4, Scrubber A	SCHEMATIC OF STACK CROSS SECTION	EQUATIONS	AMBIENT TEMP: °F
DATE: 14 Feb 89		$^oR = ^oF + 460$	STATION PRESS: 29.381 in Hg
PLANT:		$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$	HEATER BOX TEMP: 248 ± 25 °F
BASE: Grissom AFB		Pitot good	PROBE HEATER SETTING: 190
SAMPLE BOX NUMBER: Nutech A1		Preleak ck 15" Hg good	PROBE LENGTH: 96 in
METER BOX NUMBER: Nutech #1		Postleak ck 15" Hg good	NOZZLE AREA (A): .303 sq ft
Qw/Qm:		SOOT BLOW	Cp: .84
Co:		~~Static~~ ΔP = .29	DRY GAS FRACTION (Fd):
		771.576	



TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (in H2O)~~ VAC	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	β VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	#3 SAMPLE BOX TEMP (°F)	#4 IMPINGER OUTLET TEMP (°F)
1	0	3.9	90		.22	2.02	* 769.257	92		96	237	41
2	3	4.0	93		.235	2.15		100		97	239	41
3	6	4.5	96		.265	2.41		102		97	240	44
4	9	4.9	99		.29	2.63		103		98	240	45
5	12	5.0	99		.33	3.00		105		98	241	48
6	15	6.5	100		.475	4.31		106		98	241	50
7	18	7.0	100		.545	4.95		107		98	241	54
8	21	8.1	103		.615	5.57		109		99	242	59
9	24	7.9	101		.595	5.42		110		100	241	62
10	27	6.9	100		.485	4.43	794.652	11[illegible]		100	242	66
	30 stop						*					
1	0	3.1	90		.38	3.52	* 794.655	105		101	240	47
2	3	3.1	86		.37	3.46		108		101	240	46
3	6	3.2	95		.42	3.87		109		101	242	43
4	9	3.2	101		.42	3.84		111		102	241	42
5	12	3.1	101		.405	3.70		112		102	242	41
6	15	3.0	101		.3	2.73 ~~[illegible]~~		113		103	242	41
7	18	4.2	99		.235	2.16		114		103	241	42
8	21	4.4	102		.24	2.19		109		103	243	43
9	24	4.7	100		.26	2.38		110		103	243	44
10	27	4.8	98		.245	2.26		112		104	242	46
	30 stop						* 819.507					

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
GRISSOM AFB	14 FEB 89	THREE

BUILDING NUMBER	SOURCE NUMBER
POWER PLANT	BOILER 4 SCRUBBER A

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3132	.2875	0.0257
ACETONE WASHINGS *(Probe, Front Half Filter)*	105.3842	105.3784	0.0058
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0315 ~~0.0358~~ gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	209.0 ~~[illegible]~~	200.0	9.0 ~~[illegible]~~
IMPINGER 2 *(H20)*	224.0	200.0	24.0
IMPINGER 3 *(Dry)*	10.0	0.0	10.0
IMPINGER 4 *(Silica Gel)*	210.7	200.0	10.7
	Total Weight of Water Collected		53.7 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.2	2.2	2.2		2.2
VOL % O_2	15.4	15.4	15.4		15.4
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE Grissom AFB	DATE 14 Feb 89
BOILER NUMBER #4	
INSIDE STACK DIAMETER 60"	Inches
STATION PRESSURE 29.381	In Hg
STACK STATIC PRESSURE -.29	In H20
SAMPLING TEAM	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	~~$\sqrt{V_p}$~~ α	STACK TEMPERATURE (°F)
1	.19	25	102
2	.21	20	102
3	.22	14	102
4	.27	5	106
5	.30	5	102
6	.38	5	103
7	.43	10	102
8	.37	10	102
9	.33	18	102
10	.25	25	102
FSP = 32			
Ts = 103			
Nossle Dia = .2899			
	AVERAGE		

OEHL FORM APR 78 16

VISIBLE EMISSION OBSERVATION FORM

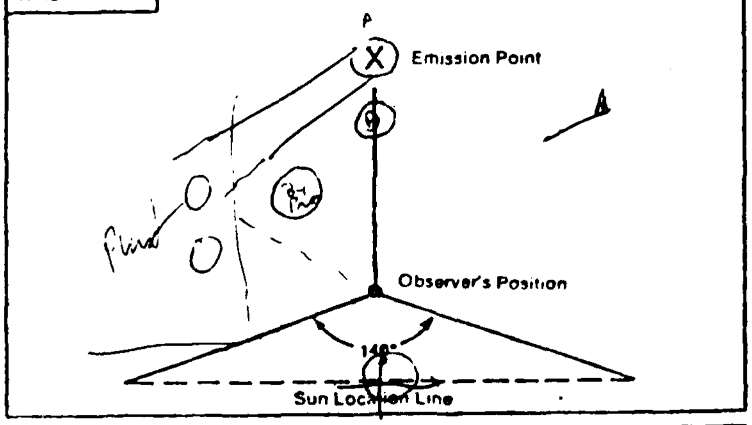
No. Run #1

COMPANY NAME	Grissom AFB Heating Plant
STREET ADDRESS	Bldg 223
CITY	Grissom AFB
STATE	In
ZIP	46971
PHONE (KEY CONTACT)	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Coal Fired Boiler 4
OPERATING MODE	95-100%
CONTROL EQUIPMENT	Wet Scrubber A
OPERATING MODE	
DESCRIBE EMISSION POINT	Fiber Glass Stack 60" diameter
HEIGHT ABOVE GROUND LEVEL	95
HEIGHT RELATIVE TO OBSERVER	Start 95 End ✓
DISTANCE FROM OBSERVER	Start 300 End
DIRECTION FROM OBSERVER	Start NW End ✓
DESCRIBE EMISSIONS	Start Lofting End ✓
EMISSION COLOR	Start N/A End
IF WATER DROPLET PLUME	Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	Start 150 End ✓
DESCRIBE PLUME BACKGROUND	Start Sky End ✓
BACKGROUND COLOR	Start Blue End ✓
SKY CONDITIONS	Start Sct End ✓
WIND SPEED	Start 5 End ✓
WIND DIRECTION	Start NNW End —
AMBIENT TEMP	Start 35 End ✓
WET BULB TEMP	
RH, percent	65

SOURCE LAYOUT SKETCH

Draw North Arrow

Stack with Plume
Sun
Wind



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
14 Feb 89	1026	1032

MIN \ SEC	0	15	30	45	COMMENTS
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7					
8					
9					
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30					

OBSERVER'S NAME (PRINT)	Paul T. Scott
OBSERVER'S SIGNATURE	Paul T. Scott
DATE	14 Feb 89
ORGANIZATION	USAF OEHL/ECQ
CERTIFIED BY	Texas Air Control Board
DATE	16 Sept 88

VISIBLE EMISSION OBSERVATION FORM

No. TWØ

COMPANY NAME: Grissom AFB Heating

STREET ADDRESS: Bldg 223

CITY: Grissom AFB | STATE: In | ZIP: 46971

PHONE (KEY CONTACT): | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Coal-Fired Boiler #4 | OPERATING MODE: 95-100%

CONTROL EQUIPMENT: Wet Scrubber A | OPERATING MODE:

DESCRIBE EMISSION POINT: Fiberglass stack 60' diameter

HEIGHT ABOVE GROUND LEVEL: 95' | HEIGHT RELATIVE TO OBSERVER: Start 95' End ✓

DISTANCE FROM OBSERVER: Start 300' End ✓ | DIRECTION FROM OBSERVER: Start NNW End ✓

DESCRIBE EMISSIONS: Start Lofting End ✓

EMISSION COLOR: Start N/A End ✓ | IF WATER DROPLET PLUME: Attached ☐ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 100' End ✓

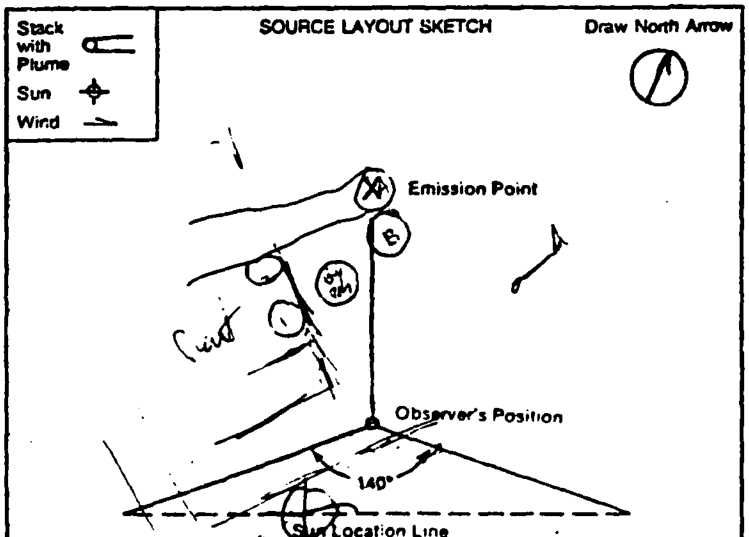
DESCRIBE PLUME BACKGROUND: Start SKY End ✓

BACKGROUND COLOR: Start Blue/White End ✓ | SKY CONDITIONS: Start BKN CI End ✓

WIND SPEED: Start 5 End ✓ | WIND DIRECTION: Start NNE End ✓

AMBIENT TEMP: Start 39 End ✓ | WET BULB TEMP: | RH, percent: 65

SOURCE LAYOUT SKETCH — Draw North Arrow



ADDITIONAL INFORMATION

70

OBSERVATION DATE: 14 Feb 88 | START TIME: 1212 | END TIME: 1218

MIN \ SEC	0	15	30	45	COMMENTS
1	Ø	Ø	Ø	Ø	
2	Ø	Ø	Ø	Ø	
3	Ø	Ø	Ø	Ø	
4	Ø	Ø	Ø	Ø	
5	Ø	Ø	Ø	Ø	
6	Ø	Ø	Ø	Ø	
7					
8					
9					
10					
11					
12					
13					
14					
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25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT): Paul T. Scott

OBSERVER'S SIGNATURE: Paul T. Scott | DATE: 14 Feb 88

ORGANIZATION: USAF OEHL/ECQ

CERTIFIED BY: Texas Air Control Board | DATE: 16 Sept 87

VISIBLE EMISSION OBSERVATION FORM

No. THREE

COMPANY NAME: Grissom AFB Heating Plant

STREET ADDRESS: Bld 227

CITY: Grissom AFB | **STATE:** IN | **ZIP:**

PHONE (KEY CONTACT): | **SOURCE ID NUMBER:**

PROCESS EQUIPMENT: Coal Fired Boiler #4 | **OPERATING MODE:** 95-100%

CONTROL EQUIPMENT: Wet Scrubber A | **OPERATING MODE:**

DESCRIBE EMISSION POINT: Fiberglass Stack 60' diamt

HEIGHT ABOVE GROUND LEVEL: 95 | **HEIGHT RELATIVE TO OBSERVER:** Start 95 End ✓

DISTANCE FROM OBSERVER: Start 350' End ✓ | **DIRECTION FROM OBSERVER:** Start N End ✓

DESCRIBE EMISSIONS: Start Lofting End ✓

EMISSION COLOR: Start Gray End ✓ | **IF WATER DROPLET PLUME:** Attached ☐ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 100' End ✓

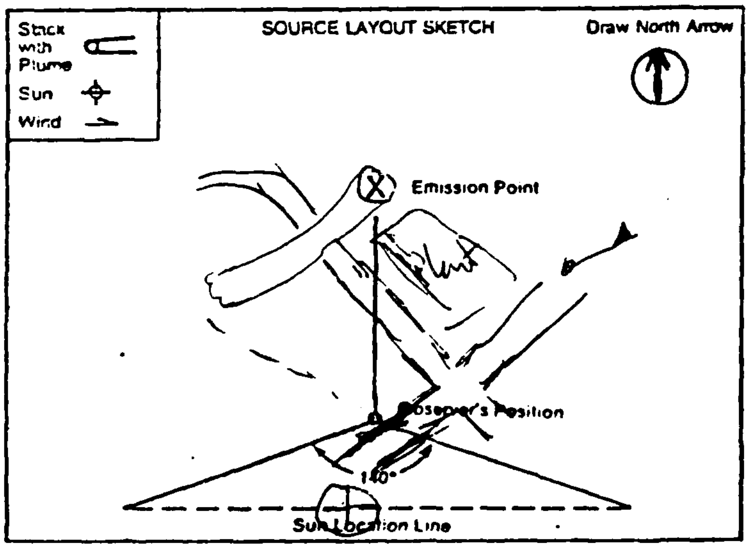
DESCRIBE PLUME BACKGROUND: Start SKY End ✓

BACKGROUND COLOR: Start Blue End ✓ | **SKY CONDITIONS:** Start SCT End ✓

WIND SPEED: Start 5 End ✓ | **WIND DIRECTION:** Start NE End

AMBIENT TEMP: Start 39 End ✓ | **WET BULB TEMP:** N/A | **RH, percent:** 65

SOURCE LAYOUT SKETCH



ADDITIONAL INFORMATION

71

OBSERVATION DATE: 14 Feb 89 | **START TIME:** 1337 | **END TIME:** 1349

MIN \ SEC	0	15	30	45	COMMENTS
1	0	0	0	0	
2	0	0	0	0	Soot blow at 1338:3
3	5	5	5	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	
7	0	0	0	0	
8	0	0	0	0	
9	0	0	0	0	
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT): Paul T. Scott

OBSERVER'S SIGNATURE: Paul T Scott | **DATE:** 14 Feb 8[illegible]

ORGANIZATION: USAFOEHL

CERTIFIED BY: Texas Air Control Board | **DATE:** 16 Sept 8[illegible]

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APPENDIX G

Boiler 5, Scrubber B Field Data

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DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: SCRUBBER B **Stack diameter at ports:** 5.0 **(ft)**

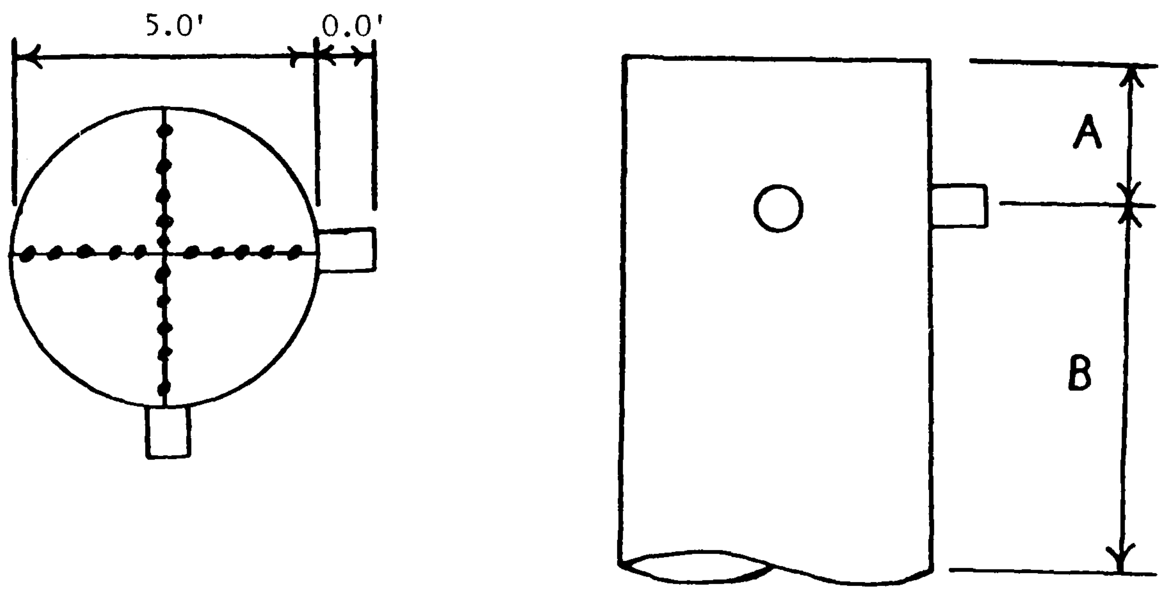
Distance A (ft) 7.0 **(duct diameters)** 1.4

Recommended number of traverse points as determined by distance A: 20

Distance B (ft) 28 **(duct diameters)** 5.6

Recommended number of traverse points as determined by distance B: 20

Number of traverse points used: 20



PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE GRISSOM	PLANT CENTRAL HEAT PLANT
DATE 10 FEB 89	SAMPLING TEAM
SOURCE TYPE AND MAKE	
SOURCE NUMBER	INSIDE STACK DIAMETER 60 Inches
RELATED CAPACITY	TYPE FUEL
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER 0 Inches	
NUMBER OF TRAVERSES 2	NUMBER OF POINTS/TRAVERSE 10

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

POINT	PERCENT OF DIAMETER	DISTANCE FROM INSIDE WALL *(Inches)*	TOTAL DISTANCE FROM OUTSIDE OF NIPPLE TO SAMPLING POINT *(Inches)*
1			1.5
2			4.9
3			8.8
4			13.6
5			20.5
6			39.5
7			46.4
8			51.2
9			55.1
10			58.5

OEHL FORM APR 78 15

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

BASE: GRISSOM	DATE: 10 FEB 89
BOILER NUMBER: #5 SCRUBBER B	
INSIDE STACK DIAMETER: 60	Inches
STATION PRESSURE: 29.455	In Hg
STACK STATIC PRESSURE: -.19	In H20
SAMPLING TEAM:	

TRAVERSE POINT NUMBER	VELOCITY HEAD, Vp IN H20	$\sqrt{V_p}$	STACK TEMPERATURE (^{0}F)
1	.14	23 22	112
2	.145	24 22	113
3	.15	24 23	114
4	.16	12 10	114
5	.195	5 10	114
6	.23	5 6	114
7	.24	8 7	113
8	.24	14 9	113
9	.27	19 18	113
10	.26	21 20	113
		AVG = 15	
FAS = 21			
T_S = 113			
NOZ DIA = .325			
	AVERAGE		

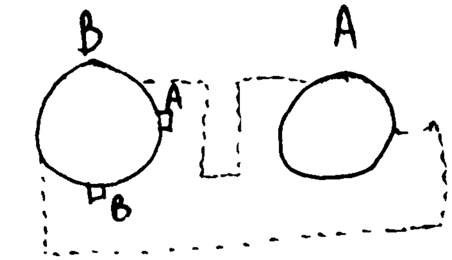
OEHL FORM 16 APR 78

Sheet   START 0946 1017   1020   STOP 10:52

PARTICULATE SAMPLING DATA SHEET

ΔH@ = 2.07

RUN NUMBER 5 #1 Batch Scrubber B	SCHEMATIC OF STACK CROSS SECTION	EQUATIONS	AMBIENT TEMP °F
DATE 10 Feb 89		$°R = °F + 460$	STATION PRESS 29.455 in Hg
PLANT		$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$	HEATER BOX TEMP 248 ± 25 °F
BASE Grissom			PROBE HEATER SETTING 190
SAMPLE BOX NUMBER Nutech #1		Pitot good	PROBE LENGTH 72 in
METER BOX NUMBER Nutech #1		Preleak ch 18" Hg good Post leak ch 17.5" Hg good	NOZZLE AREA (A) .320 sq ft
Qw/Qm		SOOT BLOW	Cp .84
Co		Static ΔP = -.19	DRY GAS FRACTION (Fd)



TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (in H20)~~	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	B VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	SAMPLE BOX TEMP #3 (°F)	IMPINGER OUTLET TEMP #4 (°F)
1	0	7.6	111		.23	2.39	*316.901	87		86	245	44
2	3	8.0	111		.24	2.49		87		86	249	49
3	6	8.0	109		.23	2.41		89		87	249	50
4	9	8.1	109		.225	2.36		91		87	257	51
5	12	9.5	109		.245	2.57		93		88	259	51
6	15	9.8	110		.24	2.52		95		88	260	50
7	18	10.8	107		.26	2.75		96		89	261	48
8	21	12.4	108		.27	2.85		97		89	262	50
9	24	12.8	111		.27	2.84		98		90	264	52
10	27	11.2	113		.22	2.31	*238.835	98		90	265	55
~~X~~	30 STOP											
1	0	9.0	110		.19	2.00	*238.836	95		91	265	49
2	3	8.9	115		.17	1.78		98		92	266	52
3	6	8.9	112		.17	1.78		101		93	266	52
4	9	9.4	119		.18	1.88		102		93	265	51
5	12	9.9	120		.20	2.09		103		94	266	51
6	15	13.9	132		.27	2.77		105		95	267	52
7	18	14.8	148		.27	2.71		106		96	264	54
8	21	15.1	123		.27	2.82		107		96	265	55
9	24	17.0	121		.30	3.15		107		97	268	55
10	27	17.1	119		.29	3.06	*260.392	107		98	268	55
	30 STOP											

OEHL FORM 18 $\bar{T}_m$ = 95 $\bar{T}_s$ = 116   ΔH = 2.48   ΣDSTS = 11.6471   Total Ft³ = 43.4910

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
GRISSOM IND	1Ø FEB 89	ONE

BUILDING NUMBER	SOURCE NUMBER
POWER PLANT	BOILER 5 SCRUBBER B

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	~~0.4057~~ 0.4045	~~0.2848~~ Ø.[illegible] 0.2855	0.119Ø ~~0.1202~~
ACETONE WASHINGS *(Probe, Front Half Filter)*	100.0622 ~~100.0638~~	1ØØ.Ø497	0.0125 ~~0.0141~~
BACK HALF *(If needed)*	—	—	—
	Total Weight of Particulates Collected		0.1315 ~~0.1343~~ gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	246.5	200.0	46.5
IMPINGER 2 *(H20)*	217.Ø	200.0	17.Ø
IMPINGER 3 *(Dry)*	7.5	0.0	7.5
IMPINGER 4 *(Silica Gel)*	210.6	200g	10.6
	Total Weight of Water Collected		71.6 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	7.2	7.3	7.2		7.2
VOL % O_2	11.8	11.8	12.Ø		11.9
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE

START: 1217
1247

STOP: 1:19

PARTICULATE SAMPLING DATA SHEET $\Delta H_a = 2.07$

RUN NUMBER Boil 5
#2 SCRUBBER B

DATE
10 Feb 89

PLANT

BASE
Grissom AFB

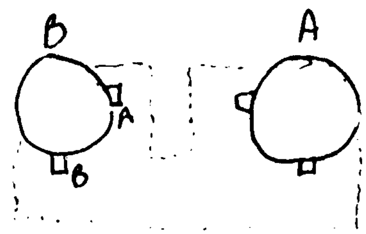
SAMPLE BOX NUMBER
Nutech #1

METER BOX NUMBER
Nutech #1

Qw/Qm

Co

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$^oR = ^oF + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good
Preleak ck 15" Hg good
Postleak ck 15" Hg good

Static ΔP = -.19

AMBIENT TEMP °F

STATION PRESS ~~29.46~~ 29.455 in Hg

HEATER BOX TEMP 248 ± 25 °F

PROBE HEATER SETTING 190

PROBE LENGTH 72 in

NOZZLE ~~AREA (A)~~ DIA .320 sq ft

Cp .84

DRY GAS FRACTION (Fd)

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	VAC ~~STATIC PRESSURE~~ (in/H2O)	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	B VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	#3 SAMPLE BOX TEMP (°F)	#4 IMPINGER OUTLET TEMP (°F)
1	0	4.0	113		.23	2.43	* 260.672	98		97	266	49
2	3	4.4	113		.245	2.60		101		98	268	51
3	6	4.5	101		.23	2.50		104		99	269	52
4	9	4.8	100		.235	2.57		106		100	268	52
5	12	5.0	100		.245	2.68		108		100	268	52
6	15	5.2	98		.26	2.86		110		101	270	51
7	18	5.5	100		.25	2.74		110		101	271	52
8	21	6.0	101		.26	2.85		112		102	269	57
9	24	6.1	101		.255	2.79		112		102	270	64
10	27	5.8	102		.215	2.39	* 283.885	112		103	270	67
X	X	X	X	X	X	X		X	X	X	X	X
1	0	5.3	106		.2	2.17	* 283.885	109		103	255	66
2	3	5.3	104		.19	2.07		110		103	252	67
3	6	5.2	107		.18	1.96		112		104	248	67
4	9	5.2	111		.18	1.95		113		104	241	63
5	12	6.0	116		.21	2.25		113		105	240	58
6	15	6.9	116		.27	2.90		115		105	240	55
7	18	6.9	112		.25	2.71		115		105	243	53
8	21	7.5	113		.27	2.92		114		106	239	51
9	24	8.0	112		.3	3.24		113		105	243	50
10	27	8.9	112		.32	3.46	* 306.754	113		106	242	51
	30 stop											

Time 80

OEHL FORM 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
GRISSOM IND	18 FEB 89	TWO

BUILDING NUMBER	SOURCE NUMBER
POWER PLANT	BOILER ~~3~~ 5 SCRUBBER B

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.363~~4~~ 3	0.2883	0.0750 ~~0.0756~~
ACETONE WASHINGS *(Probe, Front Half Filter)*	102. ~~2194~~ ~~2020~~ 2174	102.2020	0.0154 ~~0.0174~~
BACK HALF *(If needed)*		—	—
	Total Weight of Particulates Collected		0.0904 ~~0.0930~~ gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	237.0	200.0	37.0
IMPINGER 2 *(H20)*	218.0	200.0	18.0
IMPINGER 3 *(Dry)*	5.5	0.0	5.5
IMPINGER 4 *(Silica Gel)*	213.8	200.0g	13.8
	Total Weight of Water Collected		74.3 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	6.3	6.2	6.1		6.2
VOL % O_2	11.5	11.6	11.7		11.6
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

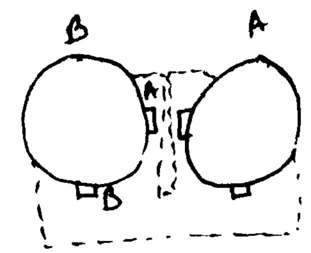
START: 2:17 2:50 STOP:
2:48

PARTICULATE SAMPLING DATA SHEET

$\Delta H_{@} = 2.07$

RUN NUMBER	Boiler 5 #3 Scrubber B
DATE	10 Feb 89
PLANT	
BASE	Grissom AFB
SAMPLE BOX NUMBER	Nutech #1
METER BOX NUMBER	Nutech #1
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$^{o}R = {^{o}F} + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot ck good
Preleak ck 16" Hg good
Postleak ck 18" Hg good

Static ΔP = -.19

AMBIENT TEMP	°F
STATION PRESS	~~29.46~~ 29.455 in Hg
HEATER BOX TEMP	248. ±25 °F
PROBE HEATER SETTING	190
PROBE LENGTH	72 in
NOZZLE ~~AREA (A)~~ DIA	.320 sq ft
Cp	.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	VAC ~~STATIC~~ PRESSURE (in H2O)	STACK TEMP (°F) #1	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp) 6	ORIFICE DIFF. PRESS. (H) F	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F) #6	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F) #7	SAMPLE BOX TEMP (°F) #3	IMPINGER OUTLET TEMP (°F) #4
1	0	8.1	104		.225	2.44	* 307.442	103		102	246	32
2	3	9.0	98		.23	2.52		104		102	252	41
3	6	9.0	101		.22	2.40		106		102	255	45
4	9	9.0	105		.23	2.50		108		102	255	49
5	12	10.1	106		.245	2.66		109		103	257	51
6	15	10.2	107		.24	2.60		110		103	255	52
7	18	10.2	107		.24	2.60		110		103	254	52
8	21	11.5	110		.26	2.81		111		103	253	54
9	24	11.8	112		.26	2.80		111		103	255	56
10	27	10.4	112		.23	2.48		111		103	254	58
							* 330.106					
1	0	7.6	103		.15	1.63	* 330.107	107		102	254	51
2	3	8.1	109		.17	1.83		107		102	255	51
3	6	8.2	112		.17	1.82		107		102	255	51
4	9	8.3	117		.17	1.81		108		102	254	52
5	12	10.3	121		.21	2.22		107		102	254	53
6	15	12.9	122		.26	2.74		108		102	255	55
7	18	1[illegible]0	121		.26	2.75		108		102	255	56
8	21	[illegible]	122		.27	2.85		108		102	255	58
9	24	[illegible]	121		.3	3.17		108		102	253	59
10	27	[illegible]	124		.3	3.15		108		102	253	62
	30 stop						* 352.097					

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
GRISSOM IND	1 FEB 89	THREE

BUILDING NUMBER	SOURCE NUMBER
POWER PLANT	BOILER 5 SCRUBBER B

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3544 ~~0.3554~~	0.2868	0.0676 ~~0.0686~~
ACETONE WASHINGS *(Probe, Front Half Filter)*	105.3931 ~~105.3947~~	105.3753	0.0178 ~~0.0194~~
BACK HALF *(If needed)*	—	—	
	Total Weight of Particulates Collected		0.0854 ~~0.0880~~ gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	245.5	200.0	45.5
IMPINGER 2 *(H20)*	216.0	200.0	16.0
IMPINGER 3 *(Dry)*	5.5	0.0	5.5
IMPINGER 4 *(Silica Gel)*	212.7	200.0g	12.7
	Total Weight of Water Collected		79.7 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	6.0	6.0	6.0		6.0
VOL % O_2	11.4	11.4	11.4		11.4
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

Run #1

VISIBLE EMISSION OBSERVATION FORM

No. Run # 1

COMPANY NAME: Grissom Power Plant

STREET ADDRESS: Bldg # 223

CITY: Grissom AFB | STATE: In | ZIP: 46971

PHONE (KEY CONTACT):

SOURCE ID NUMBER:

PROCESS EQUIPMENT: Coal Fired Boiler | OPERATING MODE: 75-100%

CONTROL EQUIPMENT: Wet Scrubber [illegible] | OPERATING MODE:

DESCRIBE EMISSION POINT: [illegible] Stack

HEIGHT ABOVE GROUND LEVEL: 95 ft

HEIGHT RELATIVE TO OBSERVER: Start 95 ft End

DISTANCE FROM OBSERVER: Start ~210 ft End

DIRECTION FROM OBSERVER: Start NW End

DESCRIBE EMISSIONS: Start [illegible] End

EMISSION COLOR: Start [illegible] End

IF WATER DROPLET PLUME: Attached ☑ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start [illegible] End

DESCRIBE PLUME BACKGROUND: Start Sky End

BACKGROUND COLOR: Start Blue End

SKY CONDITIONS: Start Clr End

WIND SPEED: Start 10 End

WIND DIRECTION: Start 270 End

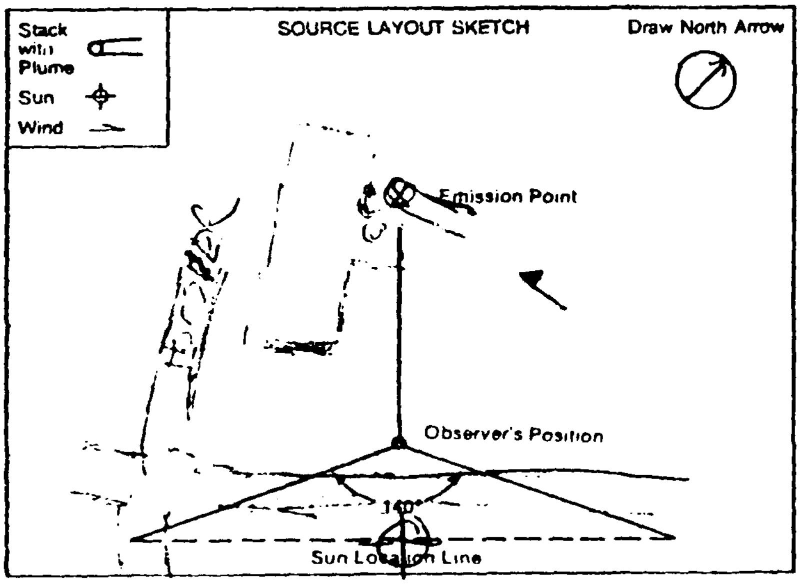
AMBIENT TEMP: Start 18 End

WET BULB TEMP: N/A

RH, percent: 55

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE: 10 Jun 87 | START TIME: 1032 | END TIME: 1044

MIN \ SEC	0	15	30	45	COMMENTS
1	0	0	0	0	
2	0	0	0	0	
3	0	0	0	0	
4	0	0	0	0	
5	0	0	0	0	
6	0	0	0	0	soot blow
7	0	0	0	0	start 1035
8	0	0	0	0	soot blow time
9	0	0	0	0	at 1041
10	0	0	0	0	
11	0	0	0	0	
12	0	0	0	0	
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT): [illegible] T. Scott

OBSERVER'S SIGNATURE: [illegible] | DATE: 10 [illegible]

ORGANIZATION: [illegible]

CERTIFIED BY: Texas Air Control Board / Eastern Technical | DATE: 16 Sep 8[illegible]

CONTINUED ON [illegible]

Run #2

VISIBLE EMISSION OBSERVATION FORM

No. Run #2

COMPANY NAME	Grissom Power Plant
STREET ADDRESS	Bldg #223
CITY	Grissom AFB
STATE	IN
ZIP	46971
PHONE (KEY CONTACT)	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Coal-Fired Boiler
OPERATING MODE	95-100%
CONTROL EQUIPMENT	Wet Scrubber B
OPERATING MODE	
DESCRIBE EMISSION POINT	Fiberglass stack 60" diameter
HEIGHT ABOVE GROUND LEVEL	95 ft
HEIGHT RELATIVE TO OBSERVER	Start 95 ft End ✓
DISTANCE FROM OBSERVER	Start 300 ft End
DIRECTION FROM OBSERVER	Start NNW End ✓
DESCRIBE EMISSIONS	Start lofting End ✓
EMISSION COLOR	Start Nil End
IF WATER DROPLET PLUME	Attached ☑ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	Start 100' End ✓
DESCRIBE PLUME BACKGROUND	Start Sky End ✓
BACKGROUND COLOR	Start Blue End ✓
SKY CONDITIONS	Start Clr End
WIND SPEED	Start 10 End ✓
WIND DIRECTION	Start SW End
AMBIENT TEMP	Start 20 End ✓
WET BULB TEMP	
RH, percent	50

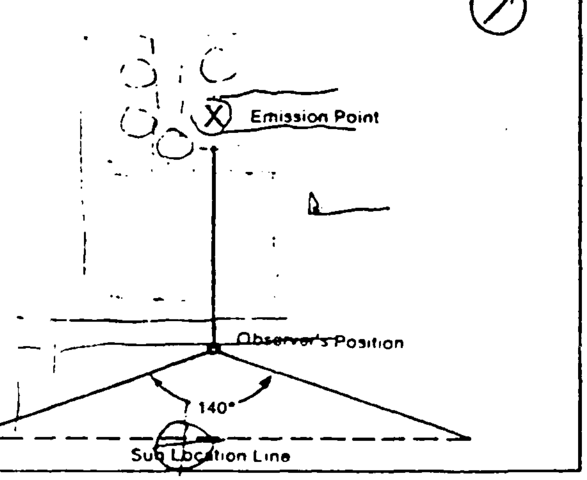
SOURCE LAYOUT SKETCH

Draw North Arrow

Stack with Plume

Sun

Wind



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
10 Feb 89	1218	1230

MIN \ SEC	0	15	30	45	COMMENTS
1	Ø	Ø	Ø	Ø	
2	Ø	Ø	Ø	Ø	
3	Ø	Ø	Ø	Ø	
4	Ø	Ø	Ø	Ø	
5	Ø	Ø	Ø	Ø	
6	Ø	Ø	Ø	Ø	
7	Ø	Ø	Ø	Ø	
8	Ø	Ø	Ø	Ø	
9	Ø	Ø	Ø	Ø	
10	Ø	Ø	Ø	Ø	
11	Ø	Ø	Ø	Ø	
12	Ø	Ø	Ø	Ø	
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)	Paul T. Scott
OBSERVER'S SIGNATURE	Paul T Scott
DATE	10 Feb 89
ORGANIZATION	USAFOEHL/ECQ
CERTIFIED BY	Texas Air Control Board
DATE	16 Sept 88

Run #3

VISIBLE EMISSION OBSERVATION FORM

No. Run #3

COMPANY NAME: Grissom AFB Power Plant

STREET ADDRESS: Bldg #223

CITY: Grissom AFB | STATE: IN | ZIP: 46971

PHONE (KEY CONTACT): | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Coal-Fired Boiler | OPERATING MODE: 95-100%

CONTROL EQUIPMENT: Wet Scrubber | OPERATING MODE:

DESCRIBE EMISSION POINT: Fiberglass Stack 60" diameter

HEIGHT ABOVE GROUND LEVEL: 95 | HEIGHT RELATIVE TO OBSERVER: Start 95 End ✓

DISTANCE FROM OBSERVER: Start 300' End ✓ | DIRECTION FROM OBSERVER: Start N End ✓

DESCRIBE EMISSIONS: Start Lofting - Steam End ✓

EMISSION COLOR: Start N/A End | IF WATER DROPLET PLUME: Attached ☒ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 100' End ✓

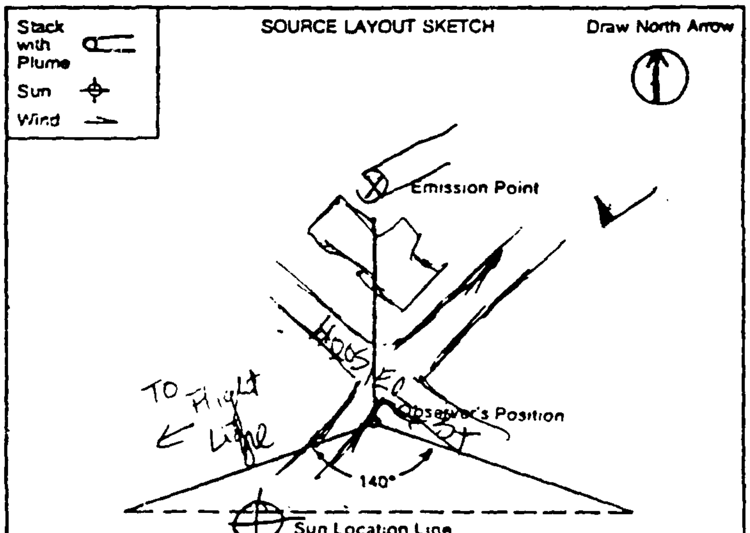
DESCRIBE PLUME BACKGROUND: Start ~~[illegible]~~ Sky End ✓

BACKGROUND COLOR: Start Blue End ✓ | SKY CONDITIONS: Start End

WIND SPEED: Start 10 End ✓ | WIND DIRECTION: Start SW End

AMBIENT TEMP: Start 20 End | WET BULB TEMP: | RH, percent: 50

SOURCE LAYOUT SKETCH — Draw North Arrow



ADDITIONAL INFORMATION:

86

OBSERVATION DATE: 10 Feb 89 | START TIME: 1459 | END TIME: 1513

MIN \ SEC	0	15	30	45	COMMENTS
1	Ø	Ø	Ø	Ø	
2	Ø	Ø	Ø	Ø	
3	Ø	Ø	Ø	Ø	
4	Ø	Ø	Ø	Ø	
5	Ø	Ø	Ø	Ø	
6	Ø	Ø	Ø	Ø	
7	Ø	Ø	Ø	Ø	
8	Ø	Ø	Ø	Ø	
9	Ø	Ø	Ø	Ø	
10	Ø	Ø	Ø	Ø	
11	Ø	Ø	Ø	Ø	
12	Ø	Ø	Ø	Ø	
13					
14					
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24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT): Paul T. Scott

OBSERVER'S SIGNATURE: Paul T Scott | DATE: 10 Feb 89

ORGANIZATION: OEHL / ECQ

CERTIFIED BY: Texas Air Control Board | DATE: 16 Sept 88

APPENDIX H

Boiler 5, Bypass Stack Field Data

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DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: BYPASS Stack diameter at ports: 5.5 (ft)

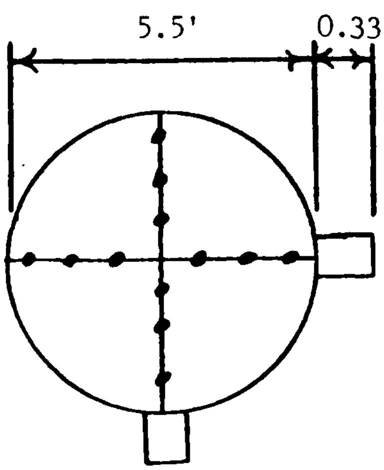
Distance A (ft) 11.5 (duct diameters) 2.1

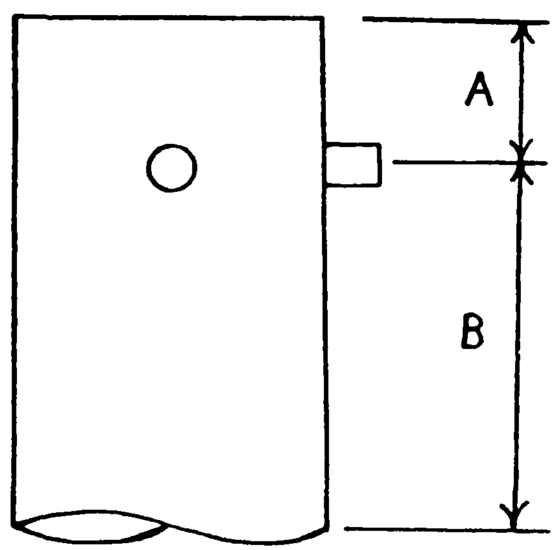
Recommended number of traverse points as determined by distance A: 12

Distance B (ft) 39.5 (duct diameters) 7.2

Recommended number of traverse points as determined by distance B: 12

Number of traverse points used: 12





PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE Grissom	PLANT Power Plant
DATE 3 Feb 89	SAMPLING TEAM OEHL
SOURCE TYPE AND MAKE Bypass Stack	
SOURCE NUMBER	INSIDE STACK DIAMETER 66 Inches
RELATED CAPACITY	TYPE FUEL COAL
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER 4.00 Inches	
NUMBER OF TRAVERSES 2	NUMBER OF POINTS/TRAVERSE 6

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

POINT	PERCENT OF DIAMETER	DISTANCE FROM INSIDE WALL *(Inches)*	TOTAL DISTANCE FROM OUTSIDE OF NIPPLE TO SAMPLING POINT *(Inches)*
1			6.9
2			13.7
3			23.5
4			50.5
5			60.3
6			67.1
			Assu H_2O - 6%
			MW=29

OEHL FORM 15

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE: Grissom AFB, In	DATE: Feb 89
BOILER NUMBER: By-Pass Stack	
INSIDE STACK DIAMETER: 66.Ø	Inches
STATION PRESSURE: 29.617	In Hg
STACK STATIC PRESSURE: -.16	In H20
SAMPLING TEAM: OEHL/ECQ	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	~~$\sqrt{V_p}$~~ α	STACK TEMPERATURE (°F)
1	.05	Ø Ø	300
2	.09	5 4	300
3	.13	~~17~~ 11	306
4	.15	4 7	308
5	.15	1Ø 12	308
6	.13	Ø Ø	309
		Avg ~~4.5~~ 5.0	
			PPS - 23
			T_s - 305
			Θ = .3929
AVERAGE			

OEHL FORM 16 APR 78

START 10:11 1041 1047 STOP

PARTICULATE SAMPLING DATA SHEET

$\Delta\alpha$ = 2.07

RUN NUMBER: #1 Bo... 5 ByPass

DATE: 12 Feb 89

PLANT:

BASE: Grissom AFB

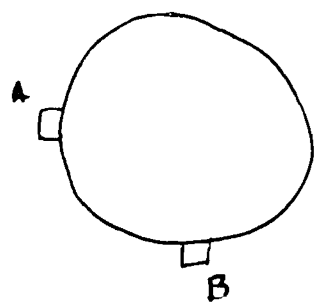
SAMPLE BOX NUMBER: Nutech #1

METER BOX NUMBER: Nutech #1

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good

Pre leak test 15" Hg good

Post leak test [18" Hg good]

18" Hg good

Static Δp = -.18

AMBIENT TEMP: °F

STATION PRESS: 29.410 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 96 in

NOZZLE AREA (A): .395 sq ft

Cp: .84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (In H20)~~ VAC	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	B VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	#3 SAMPLE BOX TEMP (°F)	#4 IMPINGER OUTLET TEMP (°F)
1	0	4.8	309		.06	1.08	* 416.~~305~~ 315	49		47	236	49
2	5	6.0	306		.07	1.26		48		47	238	52
3	10	7.5	303		.075	1.35		51		47	239	55
4	15	11.5	304		.10	1.81		52		48	241	56
5	20	14.8	305		.10	1.81		54		48	240	62
6	25	160	306		.10	1.8		54		48	241	66
	30 stop						* 433.032					
1	0	13.1	295		.06	1.10	* 433.035	51		49	232	51
(1:50) 2	5	17.3	293		.085	1.56		52		49	235	47
CF at 11:1 3	10 0	(11:16) 6.8	260		.10	1.806	* 439.416	50		49	235	52
4	15 5	6.2	289		.08	1.48	* 440.005	52		49	232	47
5	20 10	6.2	283		.065	1.21		54		50	230	47
6	25 15	(11:31) 6.2	280		.065	1.22		55		49	235	49
	30 stop 20						* 451.140					

$\overline{Tm}$ = ~~52~~ ~~53~~ 50 $\overline{Ts}$ = ~~302~~ 296 $\overline{\Delta H}$ = 1.46 $\overline{\sqrt{P_s T_s}}$ = 7.7391

Total Ft³ = #1 = 23.~~1010~~ 0980
#2 = 11.1850
~~34.2260~~
34.2830

OEHL FORM 18 MAY 78

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	12 FEB 89	ONE ~~[illegible]~~

BUILDING NUMBER	SOURCE NUMBER
Power Plant	Boiler 5 Bypass

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER #1	.4596	Ø.2898 ~~[illegible]~~	0.1698
ACETONE WASHINGS *(Probe, Front Half Filter)*	95.6105	95.5190	0.0915
~~BACK HALF (if needed)~~ Filter #2	.3820	Ø.2945	0.0875
	Total Weight of Particulates Collected		0.3488 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	232.5	200.0	32.5 ~~[illegible]~~
IMPINGER 2 *(H20)*	212.0	200.0	12.0
IMPINGER 3 *(Dry)*	0	0.0	0
IMPINGER 4 *(Silica Gel)*	206.Ø	200.0	6.0
	Total Weight of Water Collected		50.5 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	9.0	9.0	9.0		9.0
VOL % O_2	9.2	9.2	9.2		9.2
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

START 12:20 1:05 STOP
12:50 1:35

PARTICULATE SAMPLING DATA SHEET

$\Delta a = 2.07$

RUN NUMBER: #2 Boiler 5 ByPass

DATE: 12 Feb 89

PLANT:

BASE: Grissom AFB

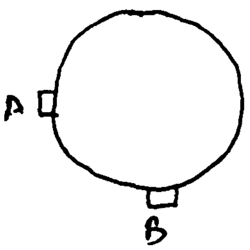
SAMPLE BOX NUMBER: Nutech #1

METER BOX NUMBER: Nutech #1

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good 15" Hg good
Preleak ck 15" Hg good
Postleak ck $\boxed{18" \text{ Hg good}}$
15" Hg good

Static ΔP = -.12

AMBIENT TEMP: °F

STATION PRESS: 29.~~345~~ 46 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 96 in

NOZZLE AREA (A): .3~~95~~ sq ft

Cp: .84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE~~ (in H20)	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	B VELOCITY HEAD (Vp)	F ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	#3 SAMPLE BOX TEMP (°F)	#4 IMPINGER OUTLET TEMP (°F)
1	0	4.0	299		.04	.73	*451.664	51		49	233	47
2	5	6.5	298		.07	1.28		53		50	235	46
3	10	8.8	285		.075	1.40		57		51	238	44
4	15	10.1	281		.085	1.60		58		52	238	42
5	20	15.4	292		.09	1.67		58		52	238	57
6	25	17.5	296		.09	1.66		58		53	239	64
	30 STOP						*467.731					
X	X	X	X	X	X	X	X	X	X	X	X	X
1	0	4.2	290		.05	.43	*469.892	59		55	234	51
2	5	6.6	288		.08	1.5		62		57	238	47
3	10	8.0	280		.09	1.72		66		59	242	42
4	15	7.9	270		.075	1.46		68		60	246	32
5	20	7.2	250		.06	1.20		69		61	246	26
6	25	7.1	242		.05	1.01		69		62	249	22
	30 STOP						*486.026					
								7.2127				
	$\overline{Tm}$ = 58		$\overline{Ts}$ = 281		ΔH = 1.36		$\sqrt{PSTS}$ = ~~7.2127~~			Total ft³ =	#1	16.0670
											#2	16.1340
												32.2010

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, In	12 Feb 89	TWO

BUILDING NUMBER	SOURCE NUMBER
Bldg 223 - Power Plant	Boiler #5 By Pass

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER A	.4402	0.2941 ~~0.2941~~	0.1461
ACETONE WASHINGS *(Probe, Front Half Filter)*	105.13568 ~~9698~~	105.0880	0.0470
~~BACK HALF (if needed)~~ Filter B	.4202	0.2910	0.1292
	Total Weight of Particulates Collected		0.3223 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	229.5	200.0	29.5
IMPINGER 2 *(H20)*	216.00	200.0	16.0
IMPINGER 3 *(Dry)*	2.0	0.0	2.0
IMPINGER 4 *(Silica Gel)*	211.2	200.0	11.2
	Total Weight of Water Collected		gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	10.6	10.6	10.6		10.6
VOL % O_2	7.6	7.8	7.8		7.7
VOL % CO					
VOL % N_2					

Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

START 2:22 2:50 3:06 3:36 STOP

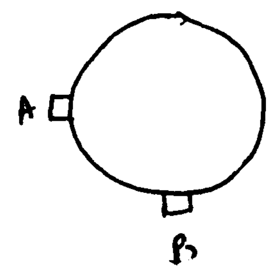
Soot blow

PARTICULATE SAMPLING DATA SHEET

$\Delta a = 2.07$

RUN NUMBER	#3 Blr 5 ByPass
DATE	12 Feb 89
PLANT	
BASE	Grissom AFB
SAMPLE BOX NUMBER	Nuteck #1
METER BOX NUMBER	Nutech #1
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION



SOOT B-OW

EQUATIONS

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

$$H = \left[\frac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \frac{Tm}{Ts} \cdot Vp$$

Pitot good

Preleak ch ~~15" Hg~~ $\boxed{15"}$ good

Postleak ch 16" Hg good

#2 filter $\boxed{15"}$ good

SOOT BLOW

Static ΔP = -.12

AMBIENT TEMP	°F
STATION PRESS	~~29.245~~ 29.410 in Hg
HEATER BOX TEMP	248 ± 25 °F
PROBE HEATER SETTING	190
PROBE LENGTH	96 in
NOZZLE AREA (A)	.395 sq ft
Cp	.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	~~STATIC PRESSURE (in H20)~~ VAC	STACK TEMP #1 (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD B (Vp)	ORIFICE DIFF. PRESS. F (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN #6 (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT #7 (°F)	SAMPLE BOX TEMP #3 (°F)	IMPINGER OUTLET TEMP #4 (°F)
1	0	4.1	275	,	.05	.97	*487.036	68	[illegible]	68	238	48
2	5	6.0	269	,	.06	1.18		70		69	246	36
3	10	8.0	278	,	.075	1.46		72		69	242	40
4	15	11.0	287	,	.09	1.74		74		70	242	46
5	20	14.6	294	,	.095	1.82		74		70	242	55
6	25	15.0	299	,	.085	1.61		74		71	244	62
	30 stop						*504.083					
1	0	5.1	275	,	.07	1.31	*505.110	73		72	234	49
2	5	6.1	274	,	.085	1.67		75		73	242	44
3	10	7.0	278	,	.09	1.77		78		73	243	44
4	15	6.5	279	,	.07	1.38		80		74	244	44
5	20	6.9	281	,	.075	1.47		80		75	242	44
6	25	7.0	277	,	.06	1.19		81		75	245	44
	30 stop						*522.560					

$\overline{Tm}$ = 73 $\overline{Ts}$ = 281 $\overline{\Delta H}$ = 1.47 $\overline{\sqrt{PSTS}}$ = 7.4441 Total Ft³ = #1 17.0470 #2 17.4500 34.4970

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	12 FEB 89	THREE

BUILDING NUMBER	SOURCE NUMBER
Power Plant	Boiler 5 Bypass

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER A	.4529	0.2859	0.1670
ACETONE WASHINGS (Probe, Front Half Filter)	105.9698	105.8062	0.1636
Filter ~~BACK HALF~~ (If needed) B	.4661	0.2913	0.1748
	Total Weight of Particulates Collected		0.5054 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	240.0	200.0	40.0
IMPINGER 2 (H20)	210.0	200.0	10.0
IMPINGER 3 (Dry)	0	0.0	0
IMPINGER 4 (Silica Gel)	207.0	200.0	7
	Total Weight of Water Collected		57.0 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	7.4	7.4	7.4		7.4
VOL % O_2	10.4	10.4	10.2		10.3
VOL % CO					
VOL % N_2					

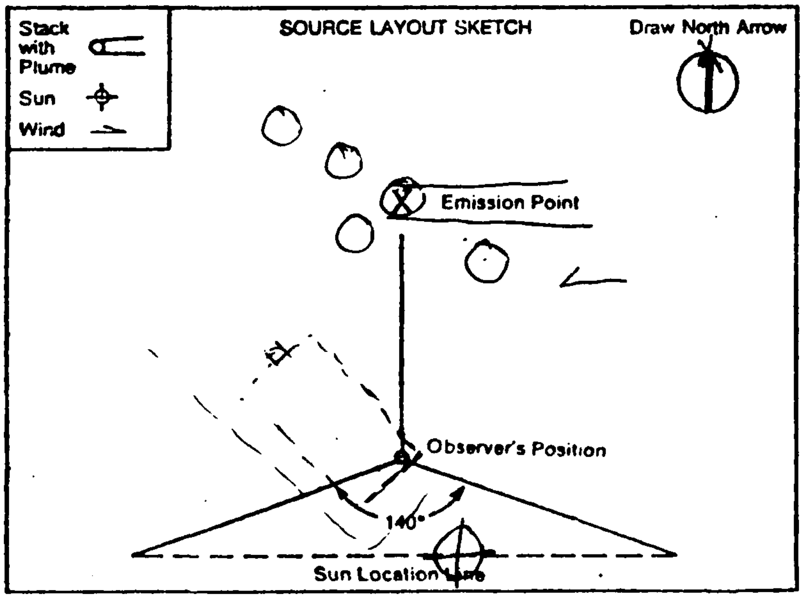
Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

VISIBLE EMISSION OBSERVATION FORM

No. ONE

COMPANY NAME	Grissom AFB Power Plant
STREET ADDRESS	Bldg 223
CITY	Grissom AFB
STATE	IN
ZIP	46971
PHONE (KEY CONTACT)	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Boiler # 5
OPERATING MODE	95-100 %
CONTROL EQUIPMENT	None - By Pass
OPERATING MODE	—
DESCRIBE EMISSION POINT	Steel stack 66" diameter
HEIGHT ABOVE GROUND LEVEL	100 ft +
HEIGHT RELATIVE TO OBSERVER	Start 8' End ✓
DISTANCE FROM OBSERVER	Start 40' End ✓
DIRECTION FROM OBSERVER	Start N End ✓
DESCRIBE EMISSIONS	Start Lofting End ✓
EMISSION COLOR	Start Brown End
IF WATER DROPLET PLUME	Attached ☐ 20' Detached ☑
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	Start 5' End ✓
DESCRIBE PLUME BACKGROUND	Start Sky End ✓
BACKGROUND COLOR	Start Blue End ✓
SKY CONDITIONS	Start CLR End ✓
WIND SPEED	Start 5 End
WIND DIRECTION	Start W End ✓
AMBIENT TEMP	Start 28 End ✓
WET BULB TEMP	N/A
RH, percent	45



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
12 Feb 89	1018	

MIN \ SEC	0	15	30	45	COMMENTS
1	5	5	5	5	
2	5	10	10	10	
3	10	5	5	5	
4	5	5	10	5	
5	5	10	15	15	
6	10	10	10	10	
7	5	5	5	5	
8	5	5	5	5	
9	10	10	5	5	
10	5	5	5	5	
11	10	10	5	5	
12	5	10	10	5	
13	10	5	5	5	
14	5	5	5	10	
15	5	10	10	10	
16	5	10	5	0	
17	0	5	5	5	
18	5	5	10	5	
19	0	0	0	0	
20	5	10	10	5	
21	5	5	5	5	
22	5	5	5	5	
23	5	0	0	0	
24	0	0	5	5	
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)	Paul T. Scott
OBSERVER'S SIGNATURE	Paul T Scott
DATE	12 Feb
ORGANIZATION	USAF OEHL/ECQ
CERTIFIED BY	Texas Air Control Board
DATE	16 Sept

VISIBLE EMISSION OBSERVATION FORM

No. TWO

COMPANY NAME: Grissom AFB Heating Plant

STREET ADDRESS: Bldg 223

CITY: Grissom AFB | STATE: In | ZIP: 46971

PHONE (KEY CONTACT): | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Boiler #5 | OPERATING MODE: 95-100%

CONTROL EQUIPMENT: None - ByPass | OPERATING MODE:

DESCRIBE EMISSION POINT: steel stack 66" diameter

HEIGHT ABOVE GROUND LEVEL: 100 ft | HEIGHT RELATIVE TO OBSERVER: Start 8' End

DISTANCE FROM OBSERVER: Start 40' End ✓ | DIRECTION FROM OBSERVER: Start N End ✓

DESCRIBE EMISSIONS: Start Buoyant/Lofting End ✓

EMISSION COLOR: Start Brown End ✓ | IF WATER DROPLET PLUME: Attached ☐ Detached ☐

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 5' End ✓

DESCRIBE PLUME BACKGROUND: Start SKY End ✓

BACKGROUND COLOR: Start Blue End ✓ | SKY CONDITIONS: Start CLR End ✓

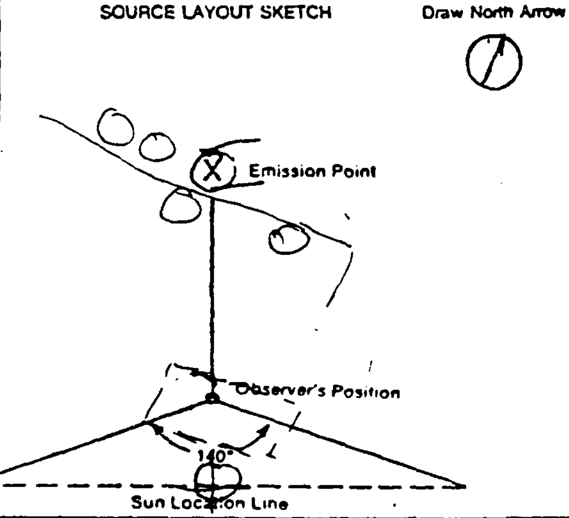
WIND SPEED: Start <5 End | WIND DIRECTION: Start WSW End

AMBIENT TEMP: Start 29 End ✓ | WET BULB TEMP: N/A | RH, percent: 45

SOURCE LAYOUT SKETCH

Stack with Plume ⊂ | Sun ⊕ | Wind →

Draw North Arrow



ADDITIONAL INFORMATION

99

OBSERVATION DATE: 12 Feb 89 | START TIME: 1322 | END TIME: 1332

MIN \ SEC	0	15	30	45	COMMENTS
1	10	5	5	5	
2	5	5	5	5	
3	0	5	10	10	
4	30	25	20	20	
5	30	30	30	15	
6	20	25	10	15	
7	5	5	0	5	
8	5	5	0	5	
9	10	15	20	5	
10	5	5	10	10	
11					
12					
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30					

OBSERVER'S NAME (PRINT): Paul T. Scott

OBSERVER'S SIGNATURE: Paul T. Scott | DATE: 12 Feb 89

ORGANIZATION: USAFOEHL/ECQ

CERTIFIED BY: Texas Air Control Board | DATE: 16 Sept 88

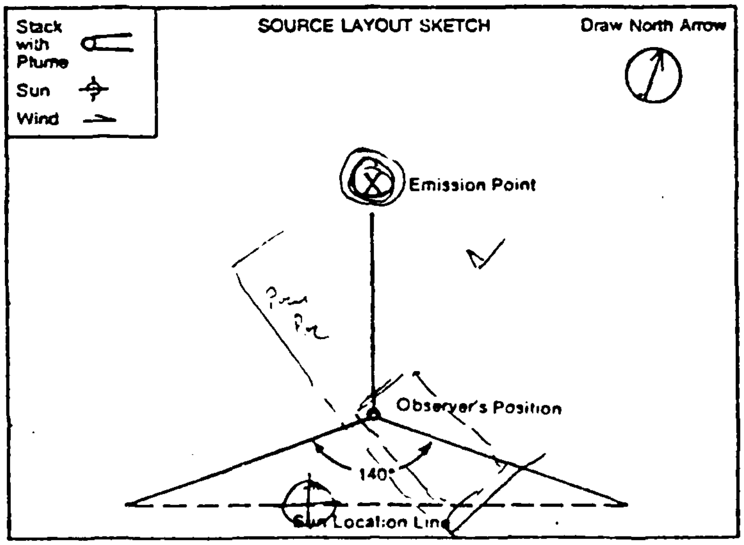
VISIBLE EMISSION OBSERVATION FORM

No. THREE

COMPANY NAME	Grissom AFB Heating Plant
STREET ADDRESS	Bldg 223
CITY	Grissom AFB
STATE	In
ZIP	46971
PHONE (KEY CONTACT)	
SOURCE ID NUMBER	
PROCESS EQUIPMENT	Boiler #5
OPERATING MODE	95-100%
CONTROL EQUIPMENT	None - ByPass
OPERATING MODE	
DESCRIBE EMISSION POINT	Steel stack 66" diameter
HEIGHT ABOVE GROUND LEVEL	100 ft
HEIGHT RELATIVE TO OBSERVER	Start 8' End ✓
DISTANCE FROM OBSERVER	Start 40' End ✓
DIRECTION FROM OBSERVER	Start N End ✓
DESCRIBE EMISSIONS	Start Buoyant End Looping
EMISSION COLOR	Start Brown End ✓
IF WATER DROPLET PLUME	Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED	Start 5' End ✓
DESCRIBE PLUME BACKGROUND	Start ~~[illegible]~~ Sky End ~~[illegible]~~ ✓
BACKGROUND COLOR	Start Blue End ✓
SKY CONDITIONS	Start CLR End ✓
WIND SPEED	Start CALM End <5
WIND DIRECTION	Start VAR End SW
AMBIENT TEMP	Start 39 End ✓
WET BULB TEMP	N/A
RH, percent	45

SOURCE LAYOUT SKETCH

Draw North Arrow



ADDITIONAL INFORMATION

100

OBSERVATION DATE	START TIME	END TIME
12 Feb 89	1519	1538

MIN \ SEC	0	15	30	45	COMMENTS
1	5	5	5	15	
2	20	10	5	10	
3	20	10	5	5	
4	5	10	10	15	
5	15	15	15	15	
6	10	5	10	15	
7	20	25	20	20	
8	20	15	15	10	
9	10	5	10	10	
10	15	25	20	30	soot blow at 1528:45
11	60	60	60	30	
12	40	50	60	60	
13	30	25	50	30	
14	20	25	25	15	
15	15	15	10	15	
16	10	10	15	10	
17	10	10	5	5	
18	5	5	5	5	
19	5	5	5	10	
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

OBSERVER'S NAME (PRINT)	Paul T. Scott
OBSERVER'S SIGNATURE	Paul T Scott
DATE	12 Feb 89
ORGANIZATION	USAFOEHL/ECQ
CERTIFIED BY	Texas Air Control Board
DATE	16 Sep 88

APPENDIX I

Calibration Data

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NOZZLE CALIBRATION DATA FORM

Date 10 Feb 89 Calibrated by MAJ Garrison

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
	.320	.319	.320	.001	.320

where:

[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$(0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

NOZZLE CALIBRATION DATA FORM

Date Feb 89 Calibrated by Garrison

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
H4	.377	.377	.377	.001	.377
12 7-6-89	.394	.395	.395	.0001	.395

where:

[a]$D_{1,2,3}$, = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq (0.10$ mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

Quality Assurance Handbook M5-2.6

NOZZLE CALIBRATION DATA FORM

Date 14 Feb 89 Calibrated by Garrison Major

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
	.302	.303	.304	.002	.303

where:

[a] $D_{1,2,3,}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$ (0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

TYPE S PITOT TUBE INSPECTION DATA FORM

#6A

Pitot tube assembly level? ✓ yes ______ no

Pitot tube openings damaged? ______ yes (explain below) ✓ no

α_1 = 1 ° (<10°), α_2 = 2 ° (<10°), β_1 = 2 ° (<5°),
β_2 = 3 ° (<5°)

(1.1875)

γ = 4 °, θ = 0 °, A = 13/16 ~~cm~~ (in.)

0.125

z = A sin γ = 0.0828 ~~cm~~ (in.); <0.32 cm (<1/8 in.),
w = A sin θ = 0.0 ~~cm~~ (in.); <.08 cm (<1/32 in.)
0.0313

P_A 19/32 (0.5938) ~~cm~~ (in.) P_b 19/32 (0.5938) ~~cm~~ (in.)

D_t = 0.375 cm (in.)

Comments: CONSTRUCTED IAW 40 CFR 60, APP A, METH 2, FIG 2.2. ASSIGNED BASELINE COEFFICIENT = 0.84

Calibration required? ______ yes ✓ no

Quality Assurance Handbook M2-1.7

TYPE S PITOT TUBE INSPECTION DATA FORM

#8A

Pitot tube assembly level? ✓ yes ______ no

Pitot tube openings damaged? ______ yes (explain below) ✓ no

α_1 = 1 ° (<10°), α_2 = 2 ° (<10°), β_1 = ∅ ° (<5°),

β_2 = 2 ° (<5°)

γ = 1 °, θ = 1 °, A = 15/16 (0.938) cm (in.)

z = A sin γ = 0.0164 cm (in.); <0.32 cm (<1/8 in.), 0.1250

w = A sin θ = 0.0164 cm (in.); <.08 cm (<1/32 in.) 0.0313

P_A 15/32 (0.469) cm (in.) P_b 15/32 (0.469) cm (in.)

D_t = 3/8 (.375) cm (in.)

Comments: CONSTRUCTED IAW 40CFR60, APP A, METH 2, FIG 2.2 ASSIGNED BASELINE COEFFICIENT = 0.84

Calibration required? ______ yes ✓ no

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 21 Nov 88 Meter box number Nutch #2

Barometric pressure, P_b = 30.Ø2 in. Hg Calibrated by Scott & Vaughn

VAC	Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter Inlet (t_{d_i}), °F	Temperature: Dry gas meter Outlet (t_{d_o}), °F	Temperature: Dry gas meter Avg[a] (t_d), °F	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
4.Ø	0.5	5	5.Ø57	75 75 535	77 82	75 77	537.75	12.4Ø	Ø.9926	1.73
4.Ø	1.0	5	5.Ø31	76 76 536	84 89	77 8Ø	542.5	9.14	1.ØØ34	1.87
4.Ø	1.5	10	1Ø.1Ø1	77 77 537	9Ø 96	81 84	547.75	15.35	1.ØØ61	1.97
4.Ø	2.0	10	1Ø.23Ø	78 78 538	97 99	85 87	552.Ø	13.45	Ø.9981	2.00
4.Ø	3.0	10	1Ø.17Ø	78 78 538	1ØØ 1Ø3	87 89	554.75	1Ø.92	1.ØØ65	1.97
4.Ø	4.0	10	1Ø.191	78 78 538	1Ø3 1Ø5	89 91	557.Ø	9.35	1.ØØ61	1.92
								Avg	1.ØØ2	1.91

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w\ P_b(t_d + 460)}{V_d(P_b + \frac{\Delta H}{13.6})\ (t_w + 460)}$	$\Delta H@_i = \frac{0.0317\ \Delta H}{P_b\ (t_d + 460)} \left[\frac{(t_w + 460)\ \theta}{V_w}\right]^2$
0.5	0.0368	$\frac{(5)(30.02)(537.75)}{(5.057)(30.02+\frac{.5}{13.6})(535)}$	$\frac{(.0317)(.5)}{(30.02)(537.75)}\left(\frac{(535)(12.4)}{(5)}\right)^2$
1.0	0.0737	$\frac{(5)(30.02)(542.5)}{(5.031)(30.02+\frac{1}{13.6})(536)}$	$\frac{(.0317)(1.0)}{(30.02)(542.5)}\left[\frac{(536)(9.14)}{5}\right]^2$
1.5	0.110	$\frac{(10)(30.02)(547.75)}{(10.101)(30.02+\frac{1.5}{13.6})(537)}$	$\frac{(.0317)(1.5)}{(30.02)(547.75)}\left[\frac{(537)(15.35)}{10}\right]^2$
2.0	0.147	$\frac{(10)(30.02)(552)}{(10.23)(30.02+\frac{2.0}{13.6})(538)}$	$\frac{(.0317)(2.0)}{(30.02)(552)}\left[\frac{(538)(13.45)}{10}\right]^2$
3.0	0.221	$\frac{(10)(30.02)(554.75)}{(10.17)(30.02+\frac{3}{13.6})(538)}$	$\frac{(.0317)(3.0)}{(30.02)(554.75)}\left[\frac{(538)(10.92)}{10}\right]^2$
4.0	0.294	$\frac{(10)(30.02)(557)}{(10.19)(30.02+\frac{4}{13.6})(538)}$	$\frac{(.0317)(4.0)}{(30.02)(557)}\left[\frac{(538)(9.35)}{10}\right]^2$

[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)

PRETEST FOR GRISSOM AFB

Test number Post Date 18 Nov 88 Meter box number Nutech #1 Plant Offutt

Barometric pressure, P_b = 29.82 in. Hg Dry gas meter number Rockwell Pretest Y 1.077

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (Θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
.9	10	9.152	81 85 543	85 543	77 79 538	540.5	20.95	4	1.085	$\frac{(10)(29.82)(540.5)}{(9.152)(29.82+\frac{.9}{13.6})(543)}$
.9	10	9.214	85 87 546	85 89 547	79 84 541.5	544.25	20.18	4	1.079	$\frac{(10)(29.82)(544.25)}{(9.214)(29.886)(546)}$
.9	10	9.272	87 88 547.5	89 90 549.5	84 85 544.5	547.0	20.10	4	1.075	$\frac{(10)(29.82)(547.0)}{(9.272)(29.886)(547.5)}$
									Y = 1.080	

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

where

1.02315 ← 1.077 → 1.13085

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, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °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}, °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 ±0.05Y. .05385

P_b = Barometric pressure, in. Hg.

Θ = Time of calibration run, min.

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number ________ Date 22 Feb 89 Meter box number one-Nutech Plant Post Offutt/CAISSON

Barometric pressure, P_b = 29.740 in. Hg Dry gas meter number standard Pretest Y 1.077

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
2.5	10	9.280	77 77 537°R	81 86 543.5	71 75 533.0	538.25	12.33	8.0	1.074	$\frac{(10)(29.74)(538.25)}{(9.280)(29.74 + \frac{2.5}{13.6})(537)}$
2.5	10	9.306	77 77 537R	86 89 547.5	75 79 536.5	542.00	12.31	8.0	1.078	$\frac{(10)(29.74)(542)}{(9.306)(29.9238)(537)}$
2.5	10	9.343	77 77 537R	89 93 551.0	79 83 541.0	546.00	12.32	8.0	1.082	$\frac{(10)(29.74)(546)}{(9.343)(29.9238)(537)}$
									Y = 1.078	

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

where

$[1.077 \pm .0539] \Rightarrow 1.0231 \leftrightarrow 1.1309$

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, °F.

t_{d_i} = Temperature of the inlet gas of the dry gas meter, °F.

t_{d_o} = Temperature of the outlet gas of the dry gas meter, °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}, °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.

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

NUTECH #2

Date 3 JAN 89 Thermocouple number INLET/OUTLET

Ambient temperature 26 °C Barometric pressure ______ in. Hg

Calibrator GARRISON SCOTT Reference: mercury-in-glass ASTM 63F

other ______

Reference point number	Source[a] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[b] ≤ °C *
INLET				
-	HOT WATER BATH	43.5	43	.5
-	ROOM TEMP	26	26	0
OUTLET				
-	HOT WATER BATH	43.5	42	1
-	ROOM TEMP	26	26.5	.5

[a]Type of calibration system used.

[b] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

Quality Assurance Handbook M5-2.5

* MUST BE WITHIN 3°C OF REFERENCE

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 20 19 OCT 88 Thermocouple number IMPINGER D1

Ambient temperature 26 °C Barometric pressure 29.232 29.175 in. Hg

Calibrator GARRISON/SCOTT Reference: mercury-in-glass NBS

other ____________

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
0	ICE BATH	0	0	—
—	ROOM TEMP	25.5	26.1	0.6

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c] $\left[\dfrac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date ~~19~~ 20 OCT 88 Thermocouple number IMPINGER D2

Ambient temperature 26° °C Barometric pressure ~~29.175~~ 29.232 in. Hg

Calibrator GARRISON/SCOTT Reference: mercury-in-glass NBS

other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
0	ICE BATH	0	0	—
—	ROOM TEMP	26.0	26.6	0.6

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c]$\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

IMPINGER

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19/20 OCT 88 Thermocouple number D3

Ambient temperature 26 °C Barometric pressure 29.232/ 29.175 in. Hg

Calibrator GARRISON/ SCOTT Reference: mercury-in-glass NBS

other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
C	ICE BATH	0	0.6	0.6
—	ROOM TEMP	25.8	25.6	0.2

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c]$\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19/20 OCT 88 Thermocouple number IMPINGER DY

Ambient temperature 26 °C Barometric pressure 29.232 29.175 in. Hg

Calibrator GARRISON/SCOTT Reference: mercury-in-glass NBS

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
0	ICE BATH	0	0.6	0.6
—	ROOM TEMP	25.5	25.6	0.1

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

IMPINGER

Date 19 Oct 88 Thermocouple number D5

Ambient temperature 26 °C Barometric pressure ~~29.175~~ 29.232 in. Hg

Calibrator GARRISON/SCOTT Reference: mercury-in-glass NBS

other ______

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
0	ICE BATH	0	0.6	0.6
—	ROOM TEMP	26	25.5	0.5

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

$$^{c}\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$$

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19/20 Oct 88 Thermocouple number IMPINGER D6

Ambient temperature 26 °C Barometric pressure 29.232 / 29.175 in. Hg

Calibrator GARRISON/ SCOTT Reference: mercury-in-glass NBS

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C *
0	ICE BATH	0	0.6	0.6
—	ROOM TEMP	26	25.5	0.5

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19/20 Oct 88 Thermocouple number IMPINGER D7

Ambient temperature 26 °C Barometric pressure 29.232/ 29.175 in. Hg

Calibrator GARRISON/ SCOTT Reference: mercury-in-glass NBS

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] ~~%~~ °C*
0	ICE BATH	0	0.6	0.6
—	ROOM TEMP	26	25.5	0.5

[a]Every 30°C (50°F) for each reference point.

[b]Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%.$

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK SENSOR CALIBRATION: 19-20 Oct 88

SENSOR #	REFERENCE TEMPERATURE (deg K) X axis	TEST TEMPERATURE (deg K) Y axis
P1	273.30	273.60
	371.90	373.60
	447.00	450.20

Regression Output:

Constant		-4.30
Std Err of Y Est		0.20
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.02	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.29%

SENSOR #	REFERENCE TEMPERATURE (deg K) X axis	TEST TEMPERATURE (deg K) Y axis
P2	273.30	273.60
	371.80	373.60
	447.60	450.80

Regression Output:

Constant		-4.27
Std Err of Y Est		0.11
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.02	
Std Err of Coef.	0.00	

[illegible]ation @ 2000 F(1093.3 K) = 1.25%

SENSOR #	REFERENCE TEMPERATURE (deg K) X axis	TEST TEMPERATURE (deg K) Y axis
P3	273.30	274.10
	371.90	374.10
	447.60	450.80

Regression Output:

Constant		-2.96
Std Err of Y Est		0.03
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.01	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.11%

SENSOR #	REFERENCE TEMPERATURE (deg K) X axis	TEST TEMPERATURE (deg K) Y axis
P4	273.30	273.60
	371.80	373.60
	447.60	450.80

Regression Output:

Constant		-4.27
Std Err of Y Est		0.11
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.02	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.27%

P5	273.30	274.10	
	371.90	373.60	
	447.60	450.80	

Regression Output:

Constant		-3.03
Std Err of Y Est		0.37
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.01	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.08%

P6	273.30	273.30	
	371.90	373.60	
	447.60	450.80	

Regression Output:

Constant		-5.03
Std Err of Y Est		0.09
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.02	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.37%

P7	273.30	273.30	
	371.90	373.60	
	447.60	450.80	

Regression Output:

Constant		-5.03
Std Err of Y Est		0.09
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.02	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.37%

P8	273.60	273.60	
	371.80	373.00	
	449.40	452.40	

Regression Output:

Constant		-4.75
Std Err of Y Est		0.39
R Squared		1.00
No. of Observations		3.00
Degrees of Freedom		1.00
X Coefficient(s)	1.02	
Std Err of Coef.	0.00	

% Deviation @ 2000 F(1093.3 K) = 1.25%

APPENDIX J

EPA Computer Program Emissions Calculations

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XROM "METH 5"
RUN NUMBER
B3 R1 SCR: B
RUN
METER BOX Y?
1.0770 RUN
DELTA H?
2.3500 RUN
BAR PRESS ?
28.9750 RUN
METER VOL ?
43.9090 RUN
MTR TEMP F?
96.0000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
RUN
STATIC HOH IN
-.1660 RUN
STACK TEMP.
107.0000 RUN
ML. WATER ?
63.9000 RUN
SAT % = 8.2

IMP. % HOH = 6.4

% HOH=6.4

% CO2?
4.4000 RUN
% OXYGEN?
14.3000 RUN
% CO ?
RUN
MOL WT OTHER?
RUN

MWd =29.28
MW WET=28.55

SQRT PSTS ?
11.1156 RUN
TIME MIN ?
60.0000 RUN
NOZZLE DIA ?
.3200 RUN
STK DIA INCH ?
60.0000 RUN

* VOL MTR STD = 43.749
STK PRES ABS = 28.96
VOL HOH GAS = 3.01
% MOISTURE = 6.43
MOL DRY GAS = 0.936
% NITROGEN = 81.30
MOL WT DRY = 29.28
MOL WT WET = 28.55
VELOCITY FPS = 27.76
STACK AREA = 19.63
STACK ACFM = 32,702.
* STACK DSCFM = 27,583.
% ISOKINETIC = 92.99

XROM "METH 5"
RUN NUMBER
B3 R2 SCR: B
RUN
METER BOX Y?
1.0770 RUN
DELTA H?
2.3100 RUN
BAR PRESS ?
28.9750 RUN
METER VOL ?
44.5310 RUN
MTR TEMP F?
104.0000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
RUN
STATIC HOH IN ?
-.1600 RUN
STACK TEMP.
108.0000 RUN
ML. WATER ?
72.0000 RUN
SAT % = 8.4

IMP. % HOH = 7.2

% HOH=7.2

% CO2?
4.2000 RUN
% OXYGEN?
13.6000 RUN
% CO ?
RUN
MOL WT OTHER?
RUN

MWd =29.22
MW WET=28.41

SQRT PSTS ?
11.0021 RUN
TIME MIN ?
60.0000 RUN
NOZZLE DIA ?
.3200 RUN
STK DIA INCH ?
60.0000 RUN

* VOL MTR STD = 43.735
STK PRES ABS = 28.96
VOL HOH GAS = 3.39
% MOISTURE = 7.19
MOL DRY GAS = 0.928
% NITROGEN = 82.20
MOL WT DRY = 29.22
MOL WT WET = 28.41
VELOCITY FPS = 27.54
STACK AREA = 19.63
STACK ACFM = 32,449.
* STACK DSCFM = 27,099.
% ISOKINETIC = 94.62

XROM "METH 5"
RUN NUMBER
B3 R3 SCR: B
RUN
METER BOX Y?
1.0770 RUN
DELTA H?
2.3200 RUN
BAR PRESS ?
28.9750 RUN
METER VOL ?
44.4790 RUN
MTR TEMP F?
103.0000 RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
RUN
STATIC HOH IN ?
-.1600 RUN
STACK TEMP.
109.0000 RUN
ML. WATER ?
71.0000 RUN
SAT % = 8.7

IMP. % HOH = 7.1

% HOH=7.1

% CO2?
4.0000 RUN
% OXYGEN?
13.9000 RUN
% CO ?
RUN
MOL WT OTHER?
RUN

MWd =29.20
MW WET=28.40

SQRT PSTS ?
11.0489 RUN
TIME MIN ?
60.0000 RUN
NOZZLE DIA ?
.3200 RUN
STK DIA INCH ?
60.0000 RUN

* VOL MTR STD = 43.763
STK PRES ABS = 28.96
VOL HOH GAS = 3.34
% MOISTURE = 7.09
MOL DRY GAS = 0.929
% NITROGEN = 82.10
MOL WT DRY = 29.20
MOL WT WET = 28.40
VELOCITY FPS = 27.66
STACK AREA = 19.63
STACK ACFM = 32,591.
* STACK DSCFM = 27,199.
% ISOKINETIC = 94.33

```
          XROM "MASSFLO"

RUN NUMBER
B3 R1 SCR: B
                        RUN

VOL MTR STD ?
          43.7490     RUN
STACK DSCFM ?
      27,583.0000     RUN
FRONT 1/2 MG ?
          69.7000     RUN
BACK 1/2 MG ?
           0.0000     RUN


F  GR/DSCF = 0.0246
F  MG/MMM = 56.2615
F  LB/HR = 5.8128
F  KG/HR = 2.6367

          XROM "MASSFLO"

RUN NUMBER
B3 R2 SCR: B
                        RUN

VOL MTR STD ?
          43.7350     RUN
STACK DSCFM ?
      27,099.0000     RUN
FRONT 1/2 MG ?
          58.4000     RUN
BACK 1/2 MG ?
           0.0000     RUN


F  GR/DSCF = 0.0206
F  MG/MMM = 47.1553
F  LB/HR = 4.7865
F  KG/HR = 2.1711

          XROM "MASSFLO"

RUN NUMBER
B3 R3 SCR: B
                        RUN

VOL MTR STD ?
          43.7630     RUN
STACK DSCFM ?
      27,199.0000     RUN
FRONT 1/2 MG ?
            .0000     CLX
          86.7000     RUN
BACK 1/2 MG ?
           0.0000     RUN


F  GR/DSCF = 0.0306
F  MG/MMM = 69.9615
F  LB/HR = 7.1276
F  KG/HR = 3.2331
```

```
XROM "METH 5"
RUN NUMBER
B4 R1 SCR: A
                    RUN
METER BOX Y?
      1.0770        RUN
DELTA H?
      3.0100        RUN
BAR PRESS ?
     29.3810        RUN
METER VOL ?
     48.3930        RUN
MTR TEMP F?
     96.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
      -.2900        RUN
STACK TEMP.
     93.0000        RUN
ML. WATER ?
     58.6000        RUN
SAT % = 5.3


IMP. % HOH = 5.3

% HOH=5.3


% CO2?
      3.0000        RUN
% OXYGEN?
     17.6000        RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.18
MW WET=28.59


SQRT PSTS ?
     13.1919        RUN
TIME MIN ?
     60.0000        RUN
NOZZLE DIA ?
       .3030        RUN
STK DIA INCH ?
     60.0000        RUN

* VOL MTR STD = 48.969
  STK PRES ABS = 29.36
  VOL HOH GAS = 2.76
  % MOISTURE = 5.31
  MOL DRY GAS = 0.947
  % NITROGEN = 79.40
  MOL WT DRY = 29.18
  MOL WT WET = 28.59
  VELOCITY FPS = 32.70
  STACK AREA = 19.63
  STACK ACFM = 38,521.
* STACK DSCFM = 34,175.
  % ISOKINETIC =  93.70
```

```
XROM "METH 5"
RUN NUMBER
B4 R2 SCR: A
                    RUN
METER BOX Y?
      1.0770        RUN
DELTA H?
      3.2400        RUN
BAR PRESS ?
     29.3810        RUN
METER VOL ?
     50.4200        RUN
MTR TEMP F?
     99.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
      -.2900        RUN
STACK TEMP.
     95.0000        RUN
ML. WATER ?
     62.1000        RUN
SAT % = 5.6


IMP. % HOH = 5.4

% HOH=5.4


% CO2?
      2.8000        RUN
% OXYGEN?
     15.3000        RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.06
MW WET=28.46


SQRT PSTS ?
     13.8003        RUN
TIME MIN ?
     60.0000        RUN
NOZZLE DIA ?
       .3030        RUN
STK DIA INCH ?
     60.0000        RUN

* VOL MTR STD = 50.775
  STK PRES ABS = 29.36
  VOL HOH GAS = 2.92
  % MOISTURE = 5.44
  MOL DRY GAS = 0.946
  % NITROGEN = 81.90
  MOL WT DRY = 29.06
  MOL WT WET = 28.46
  VELOCITY FPS = 34.29
  STACK AREA = 19.63
  STACK ACFM = 40,391.
* STACK DSCFM = 35,654.
  % ISOKINETIC =  93.12
```

```
XROM "METH 5"
RUN NUMBER
B4 R3 SCR: A
                    RUN
METER BOX Y?
      1.0770        RUN
DELTA H?
      3.3500        RUN
BAR PRESS ?
     29.3810        RUN
METER VOL ?
     50.2570        RUN
MTR TEMP F?
    104.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
      -.2900        RUN
STACK TEMP.
     98.0000        RUN
ML. WATER ?
     53.7000        RUN
SAT % = 6.2


IMP. % HOH = 4.8

% HOH=4.8


% CO2?
      2.2000        RUN
% OXYGEN?
     15.4000        RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =28.97
MW WET=28.44


SQRT PSTS ?
     14.1079        RUN
TIME MIN ?
     60.0000        RUN
NOZZLE DIA ?
       .3030        RUN
STK DIA INCH ?
     60.0000        RUN

* VOL MTR STD = 50.176
  STK PRES ABS = 29.36
  VOL HOH GAS = 2.53
  % MOISTURE = 4.80
  MOL DRY GAS = 0.952
  % NITROGEN = 82.40
  MOL WT DRY = 28.97
  MOL WT WET = 28.44
  VELOCITY FPS = 35.06
  STACK AREA = 19.63
  STACK ACFM = 41,303.
* STACK DSCFM = 36,511.
  % ISOKINETIC =  89.86
```

```
XROM "MASSFLO"

RUN NUMBER
B4 R1 SCR: A
                    RUN

VOL MTR STD ?
          48.9690   RUN
STACK DSCFM ?
      34,175.0000   RUN
FRONT 1/2 MG ?
          61.3000   RUN
BACK 1/2 MG ?
           0.0000   RUN


F  GR/DSCF = 0.0193
F  MG/MMM = 44.2065
F  LB/HR = 5.6588
F  KG/HR = 2.5668

XROM "MASSFLO"

RUN NUMBER
B4 R2 SCR: A
                    RUN

VOL MTR STD ?
          50.7750   RUN
STACK DSCFM ?
      35,654.0000   RUN
FRONT 1/2 MG ?
          32.7000   RUN
BACK 1/2 MG ?
           0.0000   RUN


F  GR/DSCF = 0.0099
F  MG/MMM = 22.7428
F  LB/HR = 3.0373
F  KG/HR = 1.3777

XROM "MASSFLO"

RUN NUMBER
B4 R3 SCR: A
                    RUN

VOL MTR STD ?
          50.1760   RUN
STACK DSCFM ?
      36,511.0000   RUN
FRONT 1/2 MG ?
          31.5000   RUN
BACK 1/2 MG ?
           0.0000   RUN


F  GR/DSCF = 0.0097
F  MG/MMM = 22.1698
F  LB/HR = 3.0319
F  KG/HR = 1.3753
```

```
RUN NUMBER
B5 R1 SCR: B
                    RUN
METER BOX Y?
         1.0770     RUN
DELTA H?
         2.4800     RUN
BAR PRESS ?
        29.4550     RUN
METER VOL ?
        43.4910     RUN
MTR TEMP F?
        95.0000     RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
         -.1900     RUN
STACK TEMP.
       116.0000     RUN
ML. WATER ?
        71.6000     RUN
SAT % = 10.4


IMP. % HOH = 7.1

% HOH=7.1
% CO2?
         7.2000     RUN
% OXYGEN?
        11.9000     RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.63
MW WET=28.80


SQRT PSTS ?
        11.6471     RUN
TIME MIN ?
        60.0000     RUN
NOZZLE DIA ?
          .3200     RUN
STK DIA INCH ?
        60.0000     RUN

* VOL MTR STD = 44.140
  STK PRES ABS = 29.44
  VOL HOH GAS = 3.37
  % MOISTURE = 7.09
  MOL DRY GAS = 0.929
  % NITROGEN = 80.90
  MOL WT DRY = 29.63
  MOL WT WET = 28.80
  VELOCITY FPS = 28.72
  STACK AREA = 19.63
  STACK ACFM = 33,837.
* STACK DSCFM = 28,356.
  % ISOKINETIC =   91.26
```

```
RUN NUMBER
B5 R2 SCR: B
                    RUN
METER BOX Y?
         1.0770     RUN
DELTA H?
         2.6000     RUN
BAR PRESS ?
        29.4550     RUN
METER VOL ?
        46.0820     RUN
MTR TEMP F?
       106.0000     RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
         -.1900     RUN
STACK TEMP.
       107.0000     RUN
ML. WATER ?
        74.3000     RUN
SAT % = 8.1


IMP. % HOH = 7.1

% HOH=7.1
% CO2?
         6.2000     RUN
% OXYGEN?
        11.6000     RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.46
MW WET=28.64


SQRT PSTS ?
        11.6253     RUN
TIME MIN ?
        60.0000     RUN
NOZZLE DIA ?
          .3200     RUN
STK DIA INCH ?
        60.0000     RUN

* VOL MTR STD = 45.874
  STK PRES ABS = 29.44
  VOL HOH GAS = 3.50
  % MOISTURE = 7.08
  MOL DRY GAS = 0.929
  % NITROGEN = 82.20
  MOL WT DRY = 29.46
  MOL WT WET = 28.64
  VELOCITY FPS = 28.75
  STACK AREA = 19.63
  STACK ACFM = 33,867.
* STACK DSCFM = 28,835.
  % ISOKINETIC =   93.27
```

```
RUN NUMBER
B5 R3 SCR: B
                    RUN
METER BOX Y?
         1.0770     RUN
DELTA H?
         2.4900     RUN
BAR PRESS ?
        29.4550     RUN
METER VOL ?
        44.6550     RUN
MTR TEMP F?
       105.0000     RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
         -.1900     RUN
STACK TEMP.
       112.0000     RUN
ML. WATER ?
        79.7000     RUN
SAT % = 9.3


IMP. % HOH = 7.8

% HOH=7.8
% CO2?
         6.0000     RUN
% OXYGEN?
        11.4000     RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.42
MW WET=28.53


SQRT PSTS ?
        11.4725     RUN
TIME MIN ?
        60.0000     RUN
NOZZLE DIA ?
          .3200     RUN
STK DIA INCH ?
        60.0000     RUN

* VOL MTR STD = 44.520
  STK PRES ABS = 29.44
  VOL HOH GAS = 3.75
  % MOISTURE = 7.77
  MOL DRY GAS = 0.922
  % NITROGEN = 82.60
  MOL WT DRY = 29.42
  MOL WT WET = 28.53
  VELOCITY FPS = 28.43
  STACK AREA = 19.63
  STACK ACFM = 33,490.
* STACK DSCFM = 28,055.
  % ISOKINETIC =   93.04
```

```
XROM "MASSFLO"

RUN NUMBER
B5 R1 SCR: B
                    RUN

VOL MTR STD ?
          44.1400    RUN
STACK DSCFM ?
      28,356.0000    RUN
FRONT 1/2 MG ?
         131.5000    RUN
BACK 1/2 MG ?
           0.0000    RUN


F  GR/DSCF = 0.0460
F  MG/MMM = 105.2060
F  LB/HR = 11.1742
F  KG/HR = 5.0686

XROM "MASSFLO"

RUN NUMBER
B5 R1 SCR: B
                    RUN

VOL MTR STD ?
          45.8740    RUN
STACK DSCFM ?
      28,835.0000    RUN
FRONT 1/2 MG ?
          90.4000    RUN
BACK 1/2 MG ?
           0.0000    RUN


F  GR/DSCF = 0.0304
F  MG/MMM = 69.5903
F  LB/HR = 7.5162
F  KG/HR = 3.4094

XROM "MASSFLO"

RUN NUMBER
B5 R3 SCR: B
                    RUN

VOL MTR STD ?
          44.5200    RUN
STACK DSCFM ?
      28,055.0000    RUN
FRONT 1/2 MG ?
          85.4000    RUN
BACK 1/2 MG ?
           0.0000    RUN


F  GR/DSCF = 0.0296
F  MG/MMM = 67.7407
F  LB/HR = 7.1185
F  KG/HR = 3.2290
```

```
XROM "MASSFLO"

RUN NUMBER
B5 R1 BP
                         RUN

VOL MTR STD ?
            37.7110    RUN
STACK DSCFM ?
       17,484.0000    RUN
FRONT 1/2 MG ?
           348.8000    RUN
BACK 1/2 MG ?
             0.0000    RUN


F  GR/DSCF = 0.1427
F  MG/MMM = 326.6295
F  LB/HR = 21.3908
F  KG/HR = 9.7029

XROM "MASSFLO"

RUN NUMBER
B5 R2 BP
                         RUN

VOL MTR STD ?
            34.8650    RUN
STACK DSCFM ?
       16,370.0000    RUN
FRONT 1/2 MG ?
           322.3000    RUN
BACK 1/2 MG ?
             0.0000    RUN


F  GR/DSCF = 0.1427
F  MG/MMM = 326.4507
F  LB/HR = 20.0169
F  KG/HR = 9.0797

XROM "MASSFLO"

RUN NUMBER
B5 R3 BP
                         RUN

VOL MTR STD ?
            36.3100    RUN
STACK DSCFM ?
       17,075.0000    RUN
FRONT 1/2 MG ?
           505.4000    RUN
BACK 1/2 MG ?
             0.0000    RUN


F  GR/DSCF = 0.2148
F  MG/MMM = 491.5366
F  LB/HR = 31.4375
F  KG/HR = 14.2600
```

```
           XROM "METH 5"
RUN NUMBER
B5 R1 BP
                    RUN
METER BOX Y?
           1.0770   RUN
DELTA H?
           1.4600   RUN
BAR PRESS ?
          29.4100   RUN
METER VOL ?
          34.2830   RUN
MTR TEMP F?
          50.0000   RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
           -.1200   RUN
STACK TEMP.
         296.0000   RUN
ML. WATER ?
          50.5000   RUN
IMP. % HOH = 5.9

% HOH=5.9


% CO2?
           9.0000   RUN
% OXYGEN?
           9.2000   RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.81
MW WET=29.11


SQRT PSTS ?
           7.7[illegible]1   RUN
TIME MIN ?
          60.0000   RUN
NOZZLE DIA ?
            .3950   RUN
STK DIA INCH ?
          66.0000   RUN

* VOL MTR STD = 37.711
  STK PRES ABS = 29.40
  VOL HOH GAS = 2.38
  % MOISTURE = 5.93
  MOL DRY GAS = 0.941
  % NITROGEN = 81.80
  MOL WT DRY = 29.81
  MOL WT WET = 29.11
  VELOCITY FPS = 19.00
  STACK AREA = 23.76
  STACK ACFM = 27,081.
* STACK DSCFM = 17,484.
  % ISOKINETIC =  100.42
```

```
           XROM "METH 5"
RUN NUMBER
B5 R2 BP
                    RUN
METER BOX Y?
           1.0770   RUN
DELTA H?
           1.3600   RUN
BAR PRESS ?
          29.4100   RUN
METER VOL ?
          32.2010   RUN
MTR TEMP F?
          58.0000   RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
           -.1200   RUN
STACK TEMP.
         281.0000   RUN
ML. WATER ?
          58.7000   RUN
IMP. % HOH = 7.3

% HOH=7.3


% CO2?
          10.6000   RUN
% OXYGEN?
           7.7000   RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =30.00
MW WET=29.12


SQRT PSTS ?
           7.2127   RUN
TIME MIN ?
          60.0000   RUN
NOZZLE DIA ?
            .3950   RUN
STK DIA INCH ?
          66.0000   RUN

* VOL MTR STD = 34.865
  STK PRES ABS = 29.40
  VOL HOH GAS = 2.76
  % MOISTURE = 7.34
  MOL DRY GAS = 0.927
  % NITROGEN = 81.70
  MOL WT DRY = 30.00
  MOL WT WET = 29.12
  VELOCITY FPS = 17.70
  STACK AREA = 23.76
  STACK ACFM = 25,233.
* STACK DSCFM = 16,370.
  % ISOKINETIC =  99.16
```

```
           XROM "METH 5"
RUN NUMBER
B5 R3 BP
                    RUN
METER BOX Y?
           1.0770   RUN
DELTA H?
           1.4700   RUN
BAR PRESS ?
          29.4100   RUN
METER VOL ?
          34.4970   RUN
MTR TEMP F?
          73.0000   RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
           -.1200   RUN
STACK TEMP.
         281.0000   RUN
ML. WATER ?
          57.0000   RUN
IMP. % HOH = 6.9

% HOH=6.9


% CO2?
           7.4000   RUN
% OXYGEN?
          10.3000   RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.60
MW WET=28.80


SQRT PSTS ?
           7.4441   RUN
TIME MIN ?
          60.0000   RUN
NOZZLE DIA ?
            .3950   RUN
STK DIA INCH ?
          66.0000   RUN

* VOL MTR STD = 36.310
  STK PRES ABS = 29.40
  VOL HOH GAS = 2.68
  % MOISTURE = 6.88
  MOL DRY GAS = 0.931
  % NITROGEN = 82.30
  MOL WT DRY = 29.60
  MOL WT WET = 28.80
  VELOCITY FPS = 18.37
  STACK AREA = 23.76
  STACK ACFM = 26,188.
* STACK DSCFM = 17,075.
  % ISOKINETIC =  99.01
```

APPENDIX K

EPA Method 9 Certification

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The Texas Air Control Board

Certifies That

PAUL T. SCOTT

Has completed a course conducted by The Texas Air Control Board and has met the requirements for evaluating visible emissions.

March 17, 1989
Date Certified

September 15, 1989
This Certificate Expires

[illegible]
Certifying Officer   Date

This is a recertification; initial certification was Sept 1988.

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