AL-TR-1992-0047

ARMSTRONG LABORATORY

COMPLIANCE TESTING OF GRISSOM AIR FORCE BASE CENTRAL HEATING PLANT COAL-FIRED BOILERS 3, 4, AND 5, GRISSOM AIR FORCE BASE, INDIANA

Ramon A. Cintron-Ocasio, Major, USAF, BSC

OCCUPATIONAL AND ENVIRONMENTAL
HEALTH DIRECTORATE
Brooks Air Force Base, TX 78235-5000

June 1992

Final Technical Report for Period 3-21 February 1992

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5000

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RAMON A. CINTRON-OCASIO, Maj, USAF, BSC
Chief, Air Quality and Hazardous Waste Branch

EDWARD F. MAHER, Col, USAF, BSC
Chief, Bioenvironmental Engineering Division

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A source emission testing for particulate matter and visible emissions was conducted on coal-fired boilers at the Grissom AFB Central Heating Plant during 3-21 February 1992 by the Air Quality Function of Armstrong Laboratory. The survey was conducted to determine compliance with regard to Indiana Administration Code, Title 325 Air Pollution Control Board, Article 5, Opacity Regulations, and Article 6, Particulate Regulations. All boilers were tested through the bypass stack. Results indicated that boilers 3 and 4 met applicable, visible, and particulate matter emissions standards. Boiler 5 exceeded the particulate standard.

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COMPLIANCE TESTING OF GRISSOM AIR FORCE BASE CENTRAL HEATING PLANT COAL-FIRED BOILERS 3, 4, AND 5, GRISSOM AIR FORCE BASE, INDIANA

INTRODUCTION

A source emission testing for particulate and visible emissions was conducted on coal-fired boilers 3, 4, and 5 at the Grissom Air Force Base Central Heating Plant from 3-21 February 1992 by personnel of the Air Quality Function of the Armstrong Laboratory, Bioenvironmental Engineering Division (AL/OEBQ). This survey was requested by 305th Combat Support Group/DE through Headquarters Strategic Air Command/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). A copy of this request is at Appendix A. Personnel involved with on-site testing are listed in Appendix B.

DISCUSSION

Background

On 7 November 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 Indiana Department of Environmental Management and 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.

On 18-23 November 1987, the Air Quality Function conducted a stationary source sampling survey for particulate emissions on coal-fired boilers 3 and 4 to determine how emissions compared with State regulations. Both boilers were tested through the bypass stack and scrubbers. Air emissions through the bypass stack were below the standard which was established as 0.80 lb/mmBtu. Boiler 3 emissions through the scrubber were above the standard while boiler 4 emissions through the scrubber were below the standard.

On 4-14 March 1988, a second stationary source sampling was conducted on coal-fired boilers 3 and 5. Boiler 3 was tested through scrubber A and results were below the emission standard of 0.80 lb/mmBtu. Boiler 5 emissions through scrubber A were below the emission standard of 0.60 lb/mmBtu. However, when

boiler 5 was tested through the bypass stack, results exceeded the 0.60 lb/mmBtu standard.

Another source sampling survey for particulate matter and visible emissions was conducted during 29 January 1989 - 15 February 1989 on coal-fired boilers 3, 4, and 5 by the Air Quality Function. Boiler 3 was tested through scrubber B, boiler 4 through scrubber A, and boiler 5 through scrubber B and the bypass. Results showed that boiler 3 emissions through scrubber B and boiler 4 emissions through scrubber A were below the emission standard of 0.80 lb/mmBtu. Boiler 5 emissions through scrubber B and the bypass stack were below the emission standard of 0.60 lb/mmBtu. All visible emissions were below applicable standards.

On 3-13 December 1990, source emission testing for particulate matter and visible emissions was conducted on coal-fired boilers 3, 4, and 5 by the Air Quality Function. All boilers were tested through the bypass only. Visible emissions were in compliance with opacity standards. However, all three boilers exceeded the particulate matter standards. These limits were established for boilers 3 and 4 as 0.47 lb/mmBtu when operating at 48 mmBtu/hr and for boiler 5 as 0.37 lb/mmBtu when operating at 78 mmBtu/hr. According to the State of Indiana, the emission limits specified during previous testing were erroneous and new standards were established.

On 14 February 1992, a second NOV was issued to Grissom AFB for violation of Article 6, Particulate Regulations (326 IAC 6-2). The NOV stated that boiler units 3 and 5 exceeded the allowable limit for particulate emissions.

Site Description

The Central Heating Plant operates a total of five boilers for steam production. Steam capacity for each boiler is presented in Table 1.

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 the 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 Company. The collector on both boiler 3 and 4 is a model 9VM-10 and consists of 36 9-in.

diameter cyclonic collectors operating in parallel. The collector on boiler 5 is a model 9VMU-10 and consists of 48 9-in. 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.

TABLE 1. GRISSOM AFB HEATING PLANT BOILERS INFORMATION

Boiler No./ Manufacturer	Steam Capacity (lb/hr)	(mmBtu/hr)	Year Installed	Fuel
1/Springfield Boiler Co	40,000	48	1955	oil
2/Springfield Boiler Co	40,000	48	1955	oil
3/Springfield Boiler Co	40,000	48	1955	coal
4/E. Keeler Co	40,000	48	1960	coal
5/Zurn Ind	65,000	78	1980	coal

The exhaust effluent from each boiler is ducted to a common breeching and can be routed to the wet-scrubber or 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. 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 73 ft above ground level. The bypass stack can be seen in Figure 1. A flue gas flow diagram is shown in Figure 2.

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 test shall be conducted in accordance with procedures and analysis methods specified in Title 40, Code of Federal Regulations, Part 60, Appendix A (1). 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 min (60 readings) in a 6-hr 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 min in any 60-min period.

Under 325 IAC 6, the maximum allowable particulate emission rate from combustion of fuel for indirect heating facilities (either existing and in operation or with permits to construct

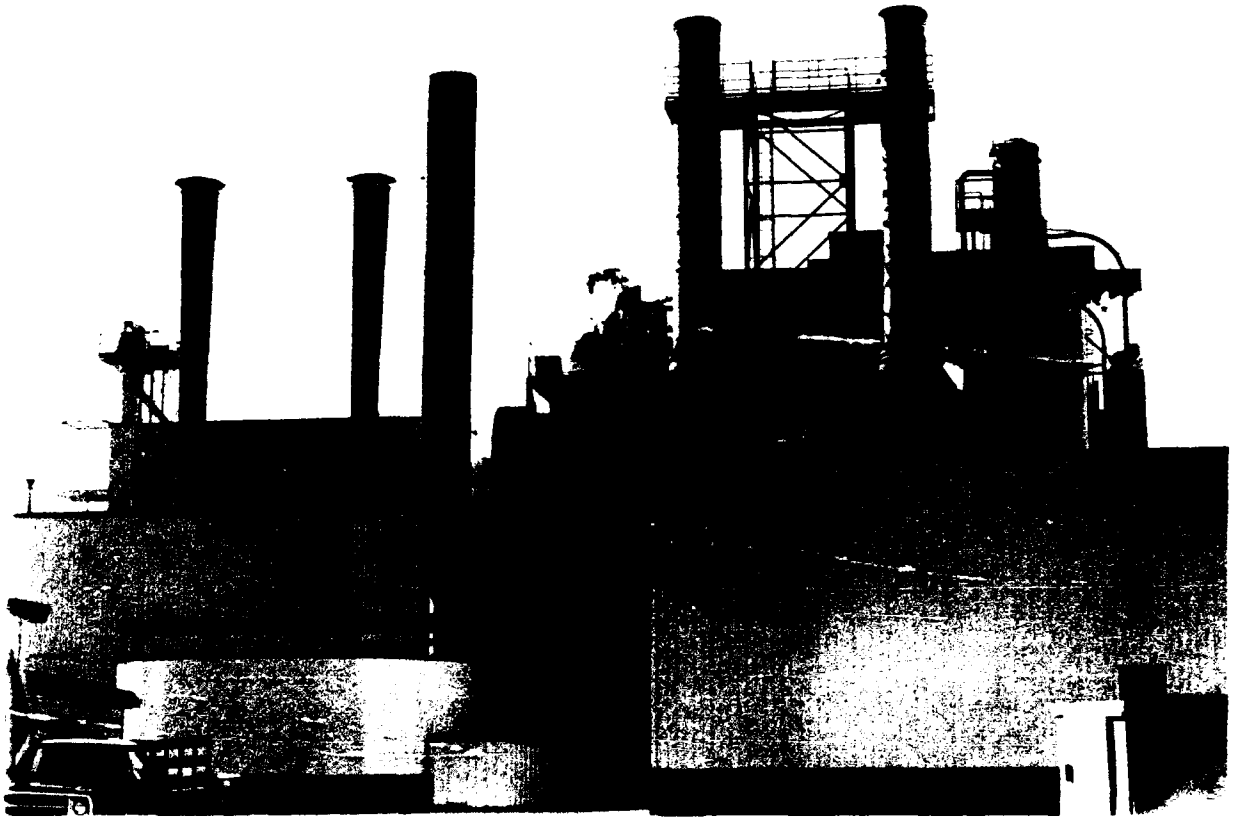

Figure 1. View of Scrubbers and Bypass Stack.

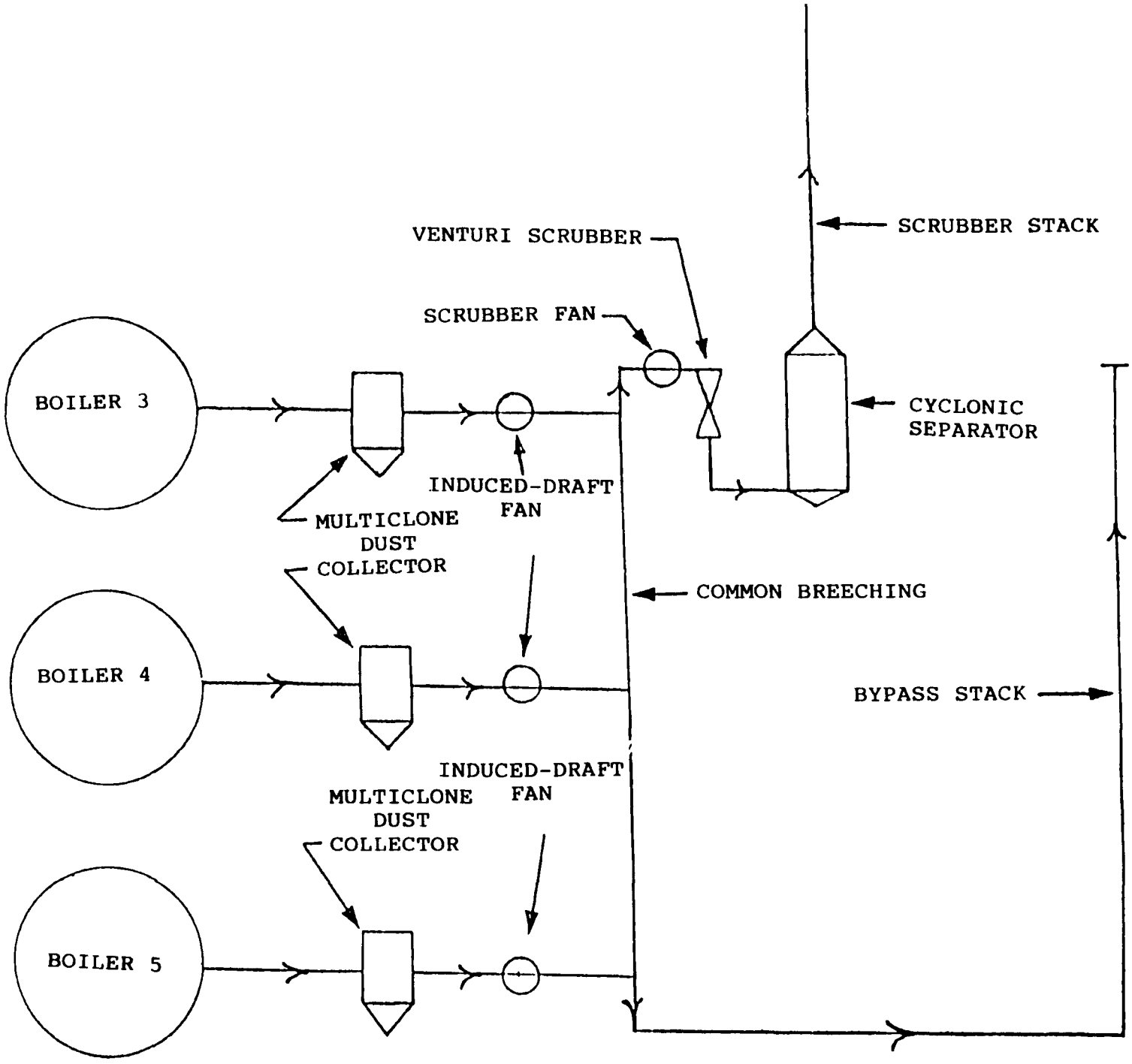

Figure 2. Flue Gas Flow Diagram.

prior to the effective date of 325 IAC 6, 26 September 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/mmBtu).

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.

N = Number of stacks in fuel burning operation.

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.

The limits on particulate emissions determined by the equation and values of the variables applicable to this facility are 0.52 lb/mmBtu for boilers 3 and 4 (operating prior to 8 June 1972) and 0.40 lb/mmBtu for boiler 5 (constructed after 8 June 1972). These standards apply when boilers 1 and 2 are operated at 36,000 lb/hr (43.2 mmBtu/hr), boilers 3 and 4 are operated at 34,000 lb/hr (40.8 mmBtu/hr) and boiler 5 is operated at 55,250 lb/hr (66.3 mmBtu/hr). State regulations are presented in Appendix C.

Sampling Methods and Procedures

Boilers 3, 4, and 5 were tested through the bypass stack. Coordination was made with plant personnel to try and operate boiler units 3 and 4 at 34,000 lb/hr of steam (40.8 mmBtu/hr) and boiler unit 5 at 55,250 lb/hr of steam (66.3 mmBtu/hr) during testing. One of the three runs which comprised a complete test included a soot blow. Soot blows are indicated on the field data sheets. Boiler operating logs for the test periods are provided in Appendix D. These logs indicate hourly steam output and coal usage. Laboratory results for the coal analysis are provided in Appendix E. Each coal sample represents an integrated sample collected over a particular 1-hr test run as noted on the analysis sheet.

The 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 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 min, and the sample time per traverse point was 5 min. The illustration showing port locations and sampling points is provided in Appendix F.

Prior to each emission test, a preliminary velocity pressure traverse was accomplished and cyclonic flow was determined (2). 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. The resulting flow angles in the bypass stack for boilers 3, 4, and 5 complied with the standard.

During each sample run, a flue gas sample for Orsat analysis (measures oxygen, and carbon dioxide for stack gas molecular determination and emissions correction) was taken. Orsat sampling and analysis equipment are shown in Figures 3 and 4. Flue gas moisture content, also needed for determination of gas molecular weight, was determined during particulate sampling.

Particulate samples were collected using the sampling train shown in Figure 5. Sampling results are shown in Appendixes G, H, and I. 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 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 10-in. 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 consisted of the following components.

1. First, third and fourth impingers: modified Greenburg-Smith type.

2. Second impinger: standard Greenburg-Smith was used as a condenser to collect stack gas moisture. The pumping and

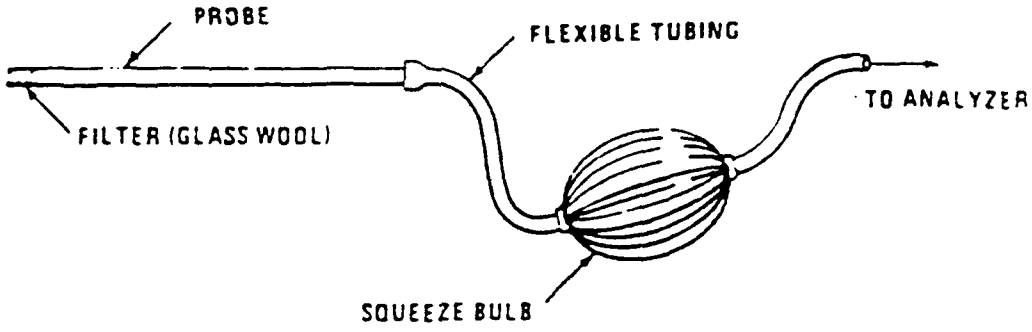

Figure 3. Orsat Sampling Train.

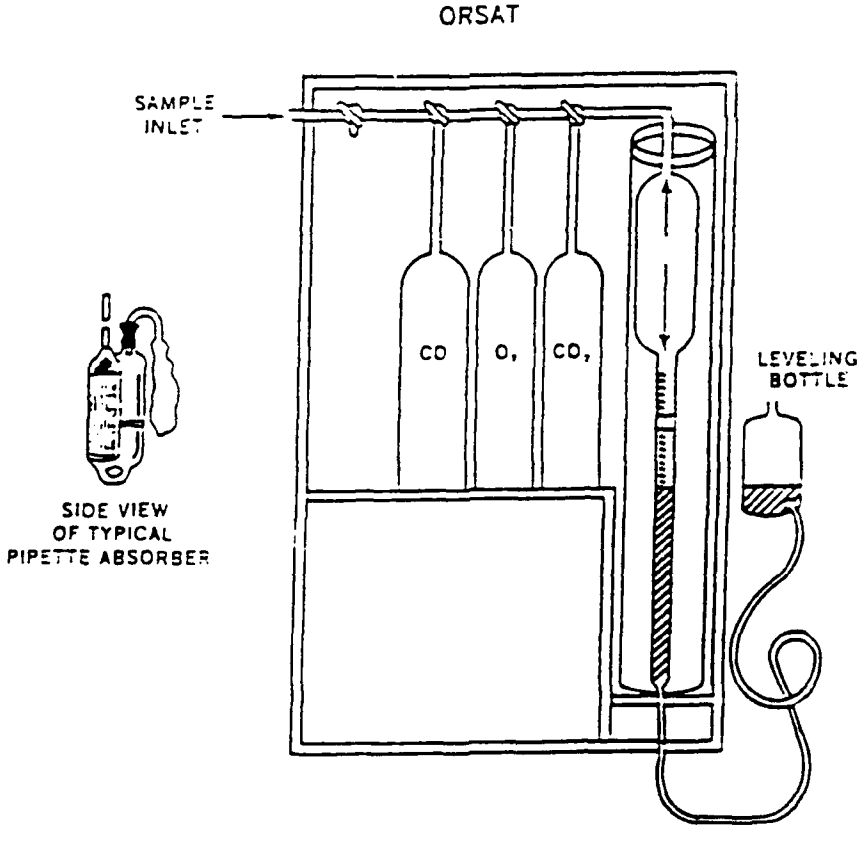

Figure 4. Orsat Apparatus.

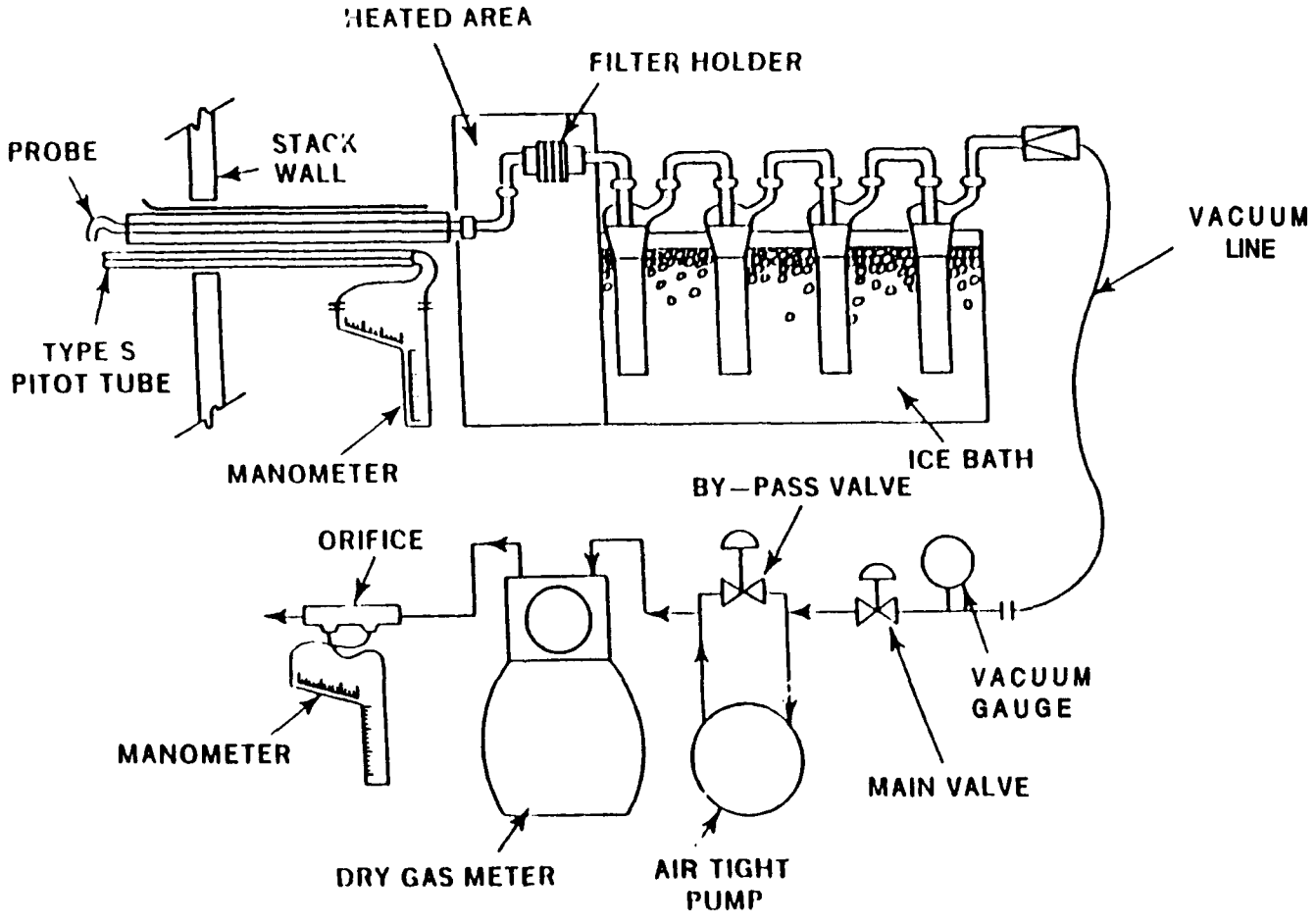

Figure 5. Particulate Sampling Train.

metering system was used to control and monitor the sample gas flow. Equipment calibration data is presented in Appendix J.

Particulate emissions calculations were done using "Source Test Calculation and Check Programs for the Hewlett-Packard 41 Calculators" (EPA-340/1-85-018) developed by the EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC (3). This is our standard method for calculating emissions data. Emission calculations from the EPA programs are found in Appendix K.

Visible emissions were determined during each sample run. Visible emissions results are presented in Appendixes G through I.

CONCLUSIONS

Visible emissions averaged less than 40% for all runs except for time periods where soot blows occurred. Soot blows did cause opacity to exceed 60% but not for more than a 5-min period.

Table 2 provides operating parameters for boilers 3, 4, and 5 during testing and the resultant particulate emission rates determined from these tests.

In summary, boilers 3 and 4 met the emission standard of 0.52 lb/mmBtu for particulate matter when operating at 34,000 lb/hr (40.8 mmBtu/hr) and boilers 1 and 2 operating at 36,000 lb/hr (43.2 mmBtu/hr).

Boiler 5 did not meet the emission standard for particulate matter.

RECOMMENDATIONS

Operate boiler units 3 and 4 at 34,000 lb/hr (40.8 mmBtu/hr) in order to meet the particulate matter standard.

We recommend that boiler 5 be fully evaluated and, if necessary, repaired. All aspects of the boiler, including operating conditions, control equipment, and maintenance should be considered.

After action is taken in boiler 5, you may request our services for another evaluation. Armstrong Laboratory will remain active in providing consultant and testing services to Grissom AFB with respect to the heating plant.

TABLE 2. GRISSOM AFB EMISSION SURVEY RESULTS

UNIT NO.	DATE	TIME	RUN NO.	STEAM FLOW (lb/hr)	COAL HEATING VALUE-Btu/lb	COAL lb/hr	% CO2 FLUE GAS	PM (lb/hr)	PM-12% CO2 (lb/mmBtu)	VISIBLE EMISSION
#3	13 FEB 92	0803	1x	34046	11551	3783	7.6%	16.64	0.60	24
#3	13 FEB 92	1027	2	33420	11346	3713	7.8%	11.88	0.43	19
#3	13 FEB 92	1254	3	33019	11181	3669	7.0%	12.86	0.53	21
								Average =	0.52	
#4	11 FEB 92	0842	1x	33714	11738	3746	8.7%	17.94	0.57	19
#4	11 FEB 92	1213	2	37070	12117	4119	9.2%	15.00	0.39	29
#4	11 FEB 92	1443	3	31902	12107	3545	8.9%	13.07	0.41	28
								Average =	0.46	
#5	20 FEB 92	1109	1	54583	11495	5869	10.1%	43.24	0.76	20
#5	20 FEB 92	1413	2x	54769	11078	5889	9.8%	51.42	0.97	29
#5	20 FEB 92	1701	3	54152	11085	5823	9.1%	49.20	1.01	27
								Average =	0.91	

x - Soot blow

REFERENCES

1. "Standards of Performance for New Stationary Sources," Title 40, Part 60, Code of Federal Regulations, July 1, 1989.

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 the Hewlett-Packard 41 Calculators. U.S. Environmental Protection Agency, EPA-340/1-85-018, Research Triangle Park, North Carolina, May 1987.

APPENDIX A

Letter of Request

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 305TH COMBAT SUPPORT GROUP (SAC)
GRISSOM AIR FORCE BASE INDIANA 46971-5000

REPLY TO ATTN OF: CC

27 SEP 1991

SUBJECT: Heat Plant Stack Emissions Testing

TO: 305 MEDSQ/CC
HQ SAC/SGPB
AL/OEB
IN TURN

1. Request the USAF Armstrong Laboratory conduct stack sampling of the Grissom AFB Heat Plant in February 1992. Particulate Matter emission and opacity tests for coal fired boilers 3, 4, and 5 through the by-pass stack is necessary to demonstrate compliance with Indiana Air Pollution Control Board rules. The December 1990 stack testing resulted in particulate matter emission noncompliance for all three boilers.

2. Since stack testing was conducted in December 1990, the controls project has been officially completed and the multiclone dust collector cones are being replaced. The new cones will be in place prior to February 1992.

3. Our point of contact is Ms Marlene Seneca, DSN 928-4579, 305 SPTG/DEV.

DANIEL W. GODDARD, Colonel, USAF
Commander

cc: HQ SAC/DEVC
305 AREFW/JA
305 SPTG/DEM

ALMA3 (18-17)

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APPENDIX B

Personnel Information

1. Armstrong Laboratory Test Team

Maj Ramon Cintron-Ocasio, Chief, Air Quality and Hazardous Waste
Capt Ronald Vaughn, Consultant, Environmental Quality
Capt Robert O'Brien, Consultant, Environmental Quality
TSgt Kurt Jagielski, Bioenvironmental Engineering Technician
Sgt Arturo Buendia, Bioenvironmental Engineering Technician

AL/OEBQ
Brooks AFB TX 78235-5000

Phone: DSN 240-3305
Commercial (512) 536-3305

2. Grissom AFB on-site representatives

Lt Ed Laferty	305 Strat Clinic/SGPB DSN 928-3017 Commercial (317) 689-3017
Lt Col John Peak	305 CSG/DE
Marlene Seneca	305 CSG/DEEV DSN 928-4592 Commercial (317) 689-4592
Smedley Graham Jim Williams	305 CES/DEMMHZ DSN 928-3253 Commercial (317) 689-3253

APPENDIX C

State Regulations

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 noncompliance 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 [Repealed]

Rule 1.1. Continuous Monitoring of Emissions

326 IAC 3-1.1-1 Applicability of rule; monitoring requirements for applicable pollutants

Sec. 1. (a) Facilities in the following categories shall continuously monitor and record emissions of air pollutants in accordance with this rule:

(1) Fossil fuel-fired steam generators of greater than two hundred fifty (250) million Btu per hour heat input capacity and, after January 1, 1992, of greater than one hundred (100) million Btu per hour heat input capacity shall be monitored for opacity, nitrogen oxide emissions, sulfur dioxide emissions, and oxygen or carbon dioxide as required in clauses (A) through (D) as follows:

(A) A continuous monitoring system for the measurement of opacity which meets the performance specifications of section 2 of this rule shall be installed, calibrated, operated, and maintained in accordance with the procedures of this rule by the owner or operator, except under one (1) of the following conditions:

(i) Gaseous fuel is the only fuel combusted.

(ii) Oil or a mixture of gas and oil are the only fuels combusted and the facility is able to comply with 326 IAC 5-1 and 326 IAC 6-2 without utilization of particulate matter collection equipment.

(iii) A facility owner or operator may petition the commissioner for an administrative waiver from these monitoring requirements if information available to such owner or operator, including facility annual capacity factors, use and proven efficiency of control equipment, emissions testing and self-monitoring, and control equipment operation and maintenance programs indicate that a continuous monitoring system is unnecessary to verify continuous compliance under normal facility operations. Such petition shall be submitted to the commissioner for approval by January 1, 1991. A waiver shall be effective upon written approval by the commissioner. If a facility owner or operator chooses to obtain a waiver by limiting a capacity factor, such capacity factor shall not become effective and enforceable against such facility owner or operator until the waiver is approved and effective. The commissioner shall not approve such waiver for fossil fuel-fired steam generators of greater than two hundred fifty (250) million Btu per hour heat input capacity without an enforceable permit condition limiting the annual capacity factor to less than thirty percent (30%). The commissioner may establish conditions in the approval of a waiver to assure compliance with the applicable opacity rule. Failure to continuously meet the requirements for obtaining a waiver or failure to comply with any condition contained in the approval of a waiver shall render void any

waiver issued.

(B) A continuous monitoring system for the measurement of sulfur dioxide which meets the performance specifications of section 2 of this rule shall be installed, calibrated, operated, and maintained if sulfur dioxide pollution control equipment has been installed or if such a monitor is needed to determine compliance with 326 IAC 12, a construction permit required under 326 IAC 2, or as provided under subsection (e).

(C) A continuous monitoring system for the measurement of nitrogen oxides which meets the performance specifications of section 2 of this rule shall be installed, calibrated, operated, and maintained if nitrogen oxide pollution control equipment has been installed or if such a monitor is needed to determine compliance with 326 IAC 12, a construction permit required under 326 IAC 2, or as provided under subsection (e).

(D) A continuous monitoring system for the measurement of the percent oxygen or carbon dioxide which meets the performance specifications of section 2 of this rule shall be installed, calibrated, operated, and maintained if measurements of oxygen or carbon dioxide in the flue gas are required to convert either sulfur dioxide or nitrogen oxide continuous monitoring data, or both, to units of the emission limitation for the particular facility.

(2) Sulfuric acid sources of greater than three hundred (300) tons per day acid production capacity shall install, calibrate, operate, and maintain a continuous monitoring system for the measurement of sulfur dioxide which meets the performance specifications of section 2 of this rule for each sulfuric acid producing facility within such source.

(3) 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 shall install, calibrate, operate, and maintain a continuous monitoring system for the measurement of opacity which meets the performance specifications of section 2 of this rule for each regenerator within such source.

(4) Upon a determination by the commissioner that a continuous monitoring system is necessary to determine continuous compliance with the applicable rules for opacity and that other methods of determining compliance have not been effective, a continuous monitoring system for the measurement of opacity shall be installed, calibrated, operated, and maintained in accordance with the procedures of this rule by a facility owner or operator. The continuous monitoring system shall be installed and in operation within one hundred eighty (180) days of notification of a final determination by the commissioner that such system is necessary.

(5) Upon a determination by the commissioner that a continuous monitoring system is necessary to determine continuous compliance for any facility required to obtain a construction permit pursuant to 326 IAC 2-2 or 326 IAC 2-3, such facility owner or operator shall install a continuous monitoring system as appropriate.

(b) Any facility which is subject to a new source performance standard, pursuant to 326 IAC 12 or 40 CFR 60*, shall comply with the monitoring and reporting requirements as specified for such new source performance standard and the requirements of this rule.

(c) Any data collected pursuant to the requirements of this rule may be used for determinations of compliance with the applicable limitations.

(d) The owner or operator of any facility not specified in subsection (a) may install, calibrate, operate, and maintain systems for the continuous monitoring of emissions. Any data collected and submitted to the department to determine compliance with the requirements of this title shall be collected and submitted pursuant to the requirements of this rule.

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

*Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of pertinent sections are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

326 IAC 3-1.1-2 Minimum performance and operating specifications

Sec. 2. Owners and operators of monitoring equipment installed to comply with this rule shall comply with the following performance specifications and operating requirements:

(1) The performance specifications set forth in 40 CFR 60, Appendix B*, shall be used to certify monitoring equipment installed pursuant to this rule, except that where reference is made to the "administrator" in 40 CFR 60, Appendix B, the term "commissioner" shall be inserted for the purposes of this rule, and where continuous emissions monitors were installed prior to March 1983 for measuring opacity, the performance specifications in 40 CFR 60, Appendix B, 1982 Edition*, shall apply.

(2) Cycling times include the total time a monitoring system requires to sample, analyze, and record an emission measurement including the following:

(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 monoxide, carbon dioxide, oxygen, hydrogen sulfide, total reduced sulfur, 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.

(3) When the effluents from two (2) or more affected facilities are combined before being released to the atmosphere, the owner or operator may either install a continuous opacity monitoring system on the combined effluent or install a continuous opacity monitoring system comprised of, and capable of combining the signals from, component transmissometers on each effluent stream and shall report the results on the combined effluent as required. When the effluents from two (2) or more affected facilities subject to the same emission standard, other than opacity, are combined before being released to the atmosphere, the owner or operator may report the results as required for each affected facility or for the combined effluent.

(4) Instrument full-scale response (upper limit of concentration measurement range) for all opacity monitoring systems shall be set at one hundred percent (100%) opacity if possible. In all cases, the manufacturer's procedures for calibration shall be followed and may result in an

upscale maximum response of less than one hundred percent (100%). The minimum instrument full-scale response for gaseous monitoring systems shall be set at two hundred percent (200%) of the expected instrument data display output corresponding to the emission limitation for the facility, unless a request for an alternate setting is submitted and approved by the commissioner.

(5) Locations for installing continuous monitoring systems or monitoring devices which vary from those locations provided under the performance specifications of 40 CFR 60, Appendix B may be approved by the commissioner when the owner or operator can demonstrate that installation at alternative locations will enable accurate and representative measurements.

(6) Owners or operators of affected facilities shall conduct continuous emission monitoring system performance evaluations, upon request of the commissioner, in order to demonstrate the continuing compliance of the continuous emission monitoring systems with performance specifications. For the purpose of this rule, a performance evaluation shall mean a quantitative and qualitative evaluation of the performance of the continuous emission monitor in terms of the accuracy, precision, reliability, representativeness, and comparability of the data acquired by the monitoring system. The commissioner may request owners or operators of affected facilities to conduct continuous emission monitoring system performance evaluations when the commissioner has reason to believe, based on review of monitoring data, quality assurance data, inspections, or other information, that the continuous emission monitoring system is malfunctioning or may be providing invalid data over an extended period. A written report containing the complete information of such performance evaluations shall be furnished to the department within forty-five (45) days after the test date. The department may conduct performance evaluations of the continuous emission monitoring systems at any time in order to verify the continued compliance of such systems with the performance specifications.

*Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of pertinent sections are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

326 IAC 3-1.1-3 Notification; record keeping; reporting

Sec. 3. (a) Owners or operators of facilities required to install continuous monitoring systems shall prepare a written report of excess emissions for each calendar quarter. The report shall include the operating time of the monitored facilities and a description of the nature and cause of the excess emissions, if known. The averaging periods used for data reporting for opacity measurements shall be six (6) minutes. The averaging periods used for data reporting for gaseous measurements shall be three (3) hour block periods ending at 03:00, 06:00, 09:00, 12:00, 15:00, 18:00, 21:00, and 24:00. The required report shall include, as a minimum, the data stipulated in this rule. The quarterly excess emissions report shall be submitted to the department within thirty (30) days following the end of each calendar quarter as follows:

(1) For opacity measurements, the excess emissions summary shall consist of each six (6) minute average of opacity greater than the applicable capacity limit. For continuous periods of exceedance, the summary shall consist of beginning time, ending time, and the magnitude of the highest six (6) minute opacity average during the period. Average values may be obtained by integration over six (6) minutes or by arithmetically averaging a minimum of six (6) equally spaced, instantaneous, opacity measurements per minute.

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

(3) The date and time identifying each period during which the continuous monitoring system was inoperative or malfunctioning, except for zero (0) and span checks, and the nature of system repair or adjustments shall be reported.

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

(b) When a malfunction of any monitoring system lasts more than one (1) day, the department shall be notified as soon as practicable but in no event later than two (2) business days after the beginning of such occurrence. Information of the scope and expected duration of the malfunction shall be provided.

(c) Owners or operators shall maintain a file of all measurements, all continuous monitoring system evaluations, calibration checks, adjustments, and maintenance performed on these systems, and all other data collected either by the continuous monitoring system or as necessary to convert monitoring data to units of the applicable emission limitation, recorded in a permanent form suitable for inspection. The file shall be retained for a period of two (2) years following the date of such measurements, maintenance, reports, and records.

(d) Owners or operators shall provide written notification to the department as so as practicable but not less than two (2) weeks prior to the following dates:

(1) The anticipated date for conducting the performance specifications tests or performance evaluations of the continuous emission monitoring systems, as required by the commissioner under Section 2(6) of this rule.

(2) The anticipated date for planned relocation of a certified monitor or for replacement of a certified monitor with a noncertified monitor.

326 IAC 3-1.1-4 Standard operating procedures

Sec. 4. (a) The owner or operator of each affected facility under section 1 of this rule or 326 IAC 12, who is required to monitor emissions on a continuous basis, shall submit to the department, by April 1, 1992, complete written continuous emissions monitoring standard operating procedures (SOP). In addition, any revision to the SOP shall be submitted to the department. At a minimum, the SOP shall describe complete step-by-step procedures and operations as follows:

(1) Calibration procedures shall include calibration error limits and linearity, calibration gas type as applicable, quality, and traceability to the National Bureau of Standards, calibration frequency, criteria for recalibration, and analysis procedures to periodically verify the accuracy of span and calibration standards.

(2) Operation procedures shall include

daily procedures, quantifying and recording daily zero (0), measuring low level (average measurement concentration) and high level drift which meets the requirements of 40 CFR 60, Appendix B, Performance Specification 2, Section 4.2*, and other operating parameter checks indicating correct operational status.

(3) Preventive maintenance procedures shall include those procedures taken to ensure continuous operation and to minimize malfunctions.

(4) Quality control and quality assurance procedures shall include calibration and span and zero (0) drift criteria, excessive drift criteria, corrective action for excessive drift, precision and accuracy audits, corrective action for accuracy audits failure, data validity criteria, participation in interlaboratory performance audits, and data recording and calculation audits.

(5) Record keeping and reporting procedures shall include data chain of custody, reporting of instrument precision and accuracy, and reporting of emissions data.

(b) The commissioner may require a performance evaluation pursuant to section 2(6) of this rule or an emissions test pursuant to 326 IAC 3-2.1 if a facility owner or operator fails to submit a SOP or submits a SOP which fails to take into account the factors provided under subsection (a).

*Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of pertinent sections are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

326 IAC 3-1.1-5 Conversion factors

Sec. 5. (a) 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 (lbs./MMBtu) where necessary.

(A) When the owner or operator of a fossil fuel-fired steam generator elects under this rule to measure oxygen (O_2) 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 this rule to measure carbon dioxide (CO_2) in the flue gases, the measurement of the pollutant concentration and the CO_2 concentraiton 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 this rule 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 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 this rule 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 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 in grams per wet standard cubic meter (g/wscm) or pounds per wet standard cubic meter (lbs/wscm), determined by multiplying the average concentration in parts per million (ppm) for each one (1) hour period by 4.15×10^{-5} M g/wscm per ppm or 2.59×10^{-9} M lbs/wscm per ppm, where M is pollutant molecular weight in grams per gram-mole (g/g-mole) or pounds per pound-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 per dry standard cubic meter (lbs/dscm) or grams per 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 F_c are given in 40 CFR 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 ASTM D388-88, "Standard Specification for Classification of Coals by Rank"*, F_w = 1.188 wscm per million calories (10,580 wscf per million Btu).

(ii) For subbituminous and bituminous coal as classified according to ASTM D388-88, F_w = 1.200 wscm per million calories (10,680 wscf per million Btu).

(iii) For liquid fossil fuels including crude, residual, and distillate oils, F_w = 1.164 wscm per million calories (10,360 wscf per million Btu).

(iv) For gaseous fossil fuels:

(AA) for natural gas, F_w = 1.196 wscm per million calories (10,650 wscf per million Btu);

(BB) for propane, F_w = 1.150 wscm per million calories (10,240 wscf per million Btu).

(CC) for butane, F_w = 1.172 wscm per

million calories (10,430 wscf per 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 this rule.

E = pollutant emission, lbs/MMBtu.

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

(A) establish a conversion factor three (3) times daily according to the procedures of 40 CFR 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 pounds per ton (lbs/ton); and

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

(b) Alternate procedures for computing emission averages that do not require integration of data or 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 the alternate procedures are at least as accurate as those in this rule.

* Copies of the American Society for Testing and Materials (ASTM) procedures referenced may be obtained from ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103 (phone (215) 299-5462). Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of ASTM procedures or pertinent sections of the CFR are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

Rule 2.1 Source Sampling Procedures

326 IAC 3-2.1-1 Applicability; test procedures

Sec. 1. This rule applies to any facility emissions testing performed to determine compliance with applicable emission limitations contained in this title, or for any other purpose requiring review and approval by the commissioner. Emission tests subject to this rule shall be conducted in accordance with any applicable procedures and analysis methods specified in 40 CFR 61, Appendix A and 40 CFR 61, Appendix B *, unless alternative procedures and methods are approved by the commissioner.

* Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of pertinent sections are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

326 IAC 3-2.1-2 Source test protocols

Sec. 2. (a) When an emissions test is to be performed by any person other than the department, a test protocol form shall be completed and submitted to the department 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 or shall contain information equivalent to that required on the form approved by the commissioner.

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

(1) inspect the test site; or

(2) require additional conditions, including, but not limited to:

(A) reasonable modifications to the stack or duct to obtain acceptable test conditions;

(B) additional tests to allow for adverse conditions such as interferences, nonsteady or cyclic processes;

(C) the keeping of process operating parameter records, operating logs, or charts during the test;

(D) conditions on control equipment operation to make the operation of control equipment representative of normal operation; and

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

(c) If the department requires modification to the test methods, analytical methods, operational parameters, or other matters included in the test protocol, the source operator and the testing firm shall be notified by letter or telephone at least twenty-one (21) days prior to the proposed test date. If the source operator or test firm desires to change any previously submitted procedures or conditions, the department shall be notified of such change as soon as practicable prior to the intended test date, and such changes shall not be made unless approved by the commissioner prior to the test. Reasonable changes in the test protocol that result from emergency conditions during the test shall be approved by the department before the test may proceed if a department staff person is available at the test site. Otherwise, post-test approval may be granted based on reasonable changes resulting from emergency or reasonably unforeseeable conditions during the test.

(d) The department reserves the right to conduct any portion of the reference method tests utilizing equipment supplied by the department. Notice of acceptable test procedures shall be given to the source and its testing representative.

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

326 IAC 3-2.1-3 Emission testing

Sec. 3. (a) Department staff may observe the field test procedures and source operation during the test.

(b) All emission tests shall be conducted while the facility being tested is operating at ninety-five percent (95%) to one hundred percent (100%) of its permitted operating capacity and under conditions representative of normal operations or under other capacities or conditions specified and approved by the commissioner. For the purpose of this rule, capacity means the design capacity of the facility or other operating capacities agreed to by the source and the department.

(c) Facilities subject to 326 IAC 12, New Source Performance Standards, shall be tested under conditions as specified in the applicable provision for that facility in 40 CFR 60*.

(d) Calibration results of the various sampling components shall be available for examination at the test site. The information shall include dates, methods used, data, and results. All components requiring calibration shall be calibrated within sixty (60) days prior to the actual test date. Post-test calibrations shall be per-

formed on the components within forty-five (45) days after the actual test date. Components requiring calibration are listed in the federal test methods specified in this rule.

(e) The department may perform or require the performance of audits of equipment or procedures associated with the test series up to the time of the actual performance of the test, between test runs, or following the test series.

(f) The original or photocopies of the raw field data generated during the test series shall be provided to the department observer upon request, if such request may be reasonably met under the existing circumstances.

*Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of pertinent sections are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

326 IAC 3-2.1-4 Reporting

Sec. 4. (a) All emission tests for which a protocol was submitted pursuant to section 2 of this rule shall be reported to the department in the form of a test report containing the following information:

(1) The reported testing methods and results certified as true, accurate, and in compliance with this rule by the person responsible for conducting the emissions test.

(2) A description of the facility or facilities being tested, the date and type of tests conducted, the type of process and control equipment utilized, the source name and location, the purpose of the tests, and the test participants and their titles.

(3) The tabulated data and results of the process weight rate or heat input rate, the referenced or derived conversion factors, the stack gas flow rate, the measured emissions given in units consistent with the applicable emission limitations, the visible emissions observations or six (6) minute average continuous opacity monitor readings, and the average value of emissions from any continuous gaseous emissions monitoring system in units consistent with the applicable emission limitations, if applicable to the pollutant being tested.

(4) A description of process and control devices, a process flow diagram, maximum design capacities, a fuel analysis and heat value for heat input rate determinations, process and control equipment operating conditions, a discussion of variations from normal plant operations, and stack height, exit diameter, volumetric flow rate (cubic feet per minute), exit temperature, and exit velocity.

(5) A description of sampling methods used, a brief discussion of the analytical procedures with justifications for any variance from reference method procedures, a specification of the number of sampling points, time per point, and total sampling time per run, a cross-sectional diagram showing sampling points, a diagram showing stack dimensions, sampling location and distance from the nearest flow disturbance upstream and downstream of the sampling points, and a diagram of the sampling train.

(6) The sampling and analytical procedures utilized, results and calculations in units consistent with the applicable emission limitation with one (1) complete calculation using actual data for each type of test performed, raw production data signed by the source official, photocopies of all actual field data, a laboratory report with the chain of custody shown, copies of all calibration data, applicable rules and regulations showing emission limitations, for particulate matter tests, copies of visible emissions evaluations or opacity monitor readings, and, for gaseous pollutant tests, copies of any continuous gaseous emissions monitoring system readings.

(b) All emission test reports must be received by the department within forty-five (45) days of the completion of the testing. An extension may be granted by the commissioner, if the source submits to the department a reasonable written explanation for the requested extension within five (5) days prior to the end of the initial forty-five (45) day period.

326 IAC 3-2.1-5 Specific testing procedures; particulate matter; sulfur dioxide; nitrogen oxides; volatile organic compounds

Sec. 5. (a) Particulate matter tests shall be conducted in accordance with the following procedures:

(1) 40 CFR 60, Appendix A, Method 5, 5A, 5B, 5C, 5D, 5E, or 5F*, as applicable, or other procedures approved by the commissioner, shall be used.

(2) Visible emissions (VE) evaluations 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 waiver from this requirement may be granted by the on-site department staff person provided that adverse conditions exist which would invalidate the VE readings. Facilities equipped with continuous opacity monitors may submit the instantaneous or six (6) minute integrated readings of such monitors during the sampling period, in lieu of performing VE evaluations, provided:

(A) the monitoring system meets the performance specifications as specified in 40 CFR 60, Appendix B*; and

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

(3) At least three (3) repetitions of the test shall be performed under consistent facility operating conditions, unless otherwise allowed by the commissioner. In addition, for boiler emissions testing, at least one (1) of the three (3) repetitions shall be conducted during a normal sootblowing cycle which is consistent with frequency and duration normally experienced.

(4) Only those fuels representative of fuel quality during normal operations shall be combusted.

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

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

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

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

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

(1) 40 CFR 60, Appendix A, Method 6, 6A, or 6C, or 8*, as applicable, or other procedures approved by the commissioner, shall be used.

(2) At least three (3) repetitions of the (2) samples, each of 40 CFR 60, Appendix A, Method 6, 6A, or 6C, or three (3) repetitions of 40 CFR 60, Appendix A, Method 8, performed under identical facility operating conditions, shall constitute a test. For boiler emissions testing, only those fuels representative of fuel quality during normal operations shall be combusted.

(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:

(A) 40 CFR 60, Appendix A, Method 6, 6A, or 6C: 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, 7A, 7B, 7C, or 7D, as applicable, 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*, or other procedures approved by the commissioner, shall be used for the total nonmethane organic emissions.

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

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

*Copies of the Code of Federal Regulations (CFR) referenced may be obtained from the Government Printing Office, Washington, D.C. 20402. Copies of pertinent sections are also available from the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

Rule 3. Fuel Sampling and Analysis Procedures

326 IAC 3-3-1 Applicability

Sec. 1. This rule applies to any fuel sampling and analysis performed after February 15, 1992, to determine compliance with the emission limitations specified in 326 IAC 7.

326 IAC 3-3-2 Coal sampling and analysis methods

Sec. 2. (a) Owners or operators of coal sampling systems for sources with total coal-fired capacity greater than or equal to one thousand five hundred (1,500) million Btu per hour actual heat input shall follow procedures specified in ASTM D2234-89, "Standard Methods for Collection of a Gross Sample of Coal"*, unless otherwise provided in section 3 of this rule. The coal sampling system shall also meet the following requirements:

(1) The coal sample acquisition point shall be at a location where representative samples of the total coal flow to be combusted by the facility or facilities may be obtained. A single as-bunkered sampling station may be used to represent the coal to be combusted by multiple facilities using the same stockpile feed system.

(2) The increment collection method shall be I-A-1, I-B-1, or I-C-1 under Table 1, ASTM D2234-89.

(3) The opening of the sampling device shall be at least two and one-half (2.5) times the top-size of the coal and not less than one and one-quarter (1.25) inches.

(4) The sampling device shall have sufficient capacity to completely retain or entirely pass the increment without loss or spillage.

(5) The velocity with which the cross-stream cutting instrument travels through the stream shall not exceed eighteen (18) inches per second. This velocity requirement shall not apply to a swing arm sampler or to a sampler whose cutter opening is perpendicular to the stream of coal. Owners or operators of all coal sampling systems shall detail the proper operating procedures in the standard operating procedures document required under section 5 of this rule.

(6) Increments obtained during the sampling period shall be protected from changes in composition to maintain the integrity of constituent characteristics required to convert sample sulfur content to units of the applicable emission standard.

(7) A comparison of weight or volume of collected sample with that of the total flow of coal shall be conducted at a minimum of once every two (2) weeks to assure a constant sampling ratio is maintained for increments composited into a sample representing a single twenty-four (24) hour period.

(8) A routine inspection of the sampling system shall be established to meet requirements and guidelines specified in ASTM D4702-87, "Guide for Inspecting Mechanical Coal Sampling Systems that Use Cross-Cut Sample Cutters for Conformance with Current ASTM Methods"*.

(9) Composite samples shall be collected for analysis at a minimum of once per twenty-four (24) hour period.

(b) Owners or operators of coal sampling systems for sources with total coal-fired capacity between one hundred (100) and one thousand five hundred (1,500) million Btu per hour actual heat input shall either comply with requirements specified in subsection (a), section 3 of this rule, or shall meet the following minimum requirements:

(1) The coal sample acquisition point shall be at a location where representative samples of the total coal flow to be combusted by the facility or facilities may be obtained. A single as-bunkered or as-burned sampling station may be used to represent the coal to be combusted by multiple facilities using the same stockpile feed system.

(2) Coal shall be sampled at least three (3) times per day and at least once per eight (8) hour period.

(3) Minimum sample size shall be five hundred (500) grams.

(4) Samples shall be composited and analyzed at the end of each calendar month.

(c) Coal samples shall be prepared for analysis in accordance with procedures specified in ASTM D2013-86, "Standard Method of Preparing Coal Samples for Analysis"*. The preparation of samples shall meet the following requirements:

(1) Samples shall be prepared in accordance with Procedure A or Procedure B, ASTM D2013-86.

(2) Sample preparation shall be checked at weekly intervals by performing a split sample of the twenty-four (24) hour composite sample and preparing and analyzing these two (2) identically.

(d) The heat content of coal samples shall be determined in accordance with procedures specified in ASTM D2015-85, "Standard Test Method for Gross Calorific Value of Solid Fuel by the Adiabatic Bomb Calorimeter", or ASTM D3286-85,

"Standard Test Method for Gross Calorific Value of Coal and Coke by the Isothermal Jacket Bomb Calorimeter"*. The restandardization requirements in Section 11 of both methods shall be followed. Precision requirements for repeatability shall be verified per Section 16.1.1 of both methods at a minimum of once per week.

(e) The sulfur content of coal samples shall be determined in accordance with procedures specified in ASTM D3177-84, "Standard Test Methods for Total Sulfur in the Analysis Sample of Coal and Coke", or ASTM D4239-85, "Standard Test Methods for Sulfur in the Analysis Sample of Coal and Coke Using High Temperature Tube Furnace Combustion Methods"*. Precision requirements for repeatability shall be verified per Section 13, ASTM D3177-84, or Section 18, ASTM D4239-85, at a minimum of once per week. The laboratory that performs the analysis shall participate in an interlab audit program using coal samples supplied by the department.

(f) Compliance with the provisions of this section is required by February 15, 1992, unless a source owner or operator demonstrates that modifications to the coal sampling and analysis procedures at a source are necessary to meet the requirements of this section. The commissioner may extend such compliance date to no later than December 31, 1992.

*Copies of the American Society for Testing and Materials (ASTM) procedures referenced may be obtained from ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103 (phone (215) 299-5462). Copies are also available at the Department of Environmental Management, Office of Air Management, 105 South Meridian Street, Indianapolis, Indiana 46225.

326 IAC 3-3-3 Alternative coal sampling and analysis

Sec. 3. (a) As an alternative to coal sampling and analysis procedures in section 2 of this rule, a source owner or operator may use manual or other non-ASTM automatic sampling and analysis procedures upon a demonstration, submitted to the commissioner for approval, that such procedures provide sulfur dioxide emission estimates representative either of estimates based on coal sampling and analysis procedures per section 2 of this rule or of continuous emissions monitoring. The demonstration may consist of one (1) or more of the following methods:

(1) A source owner or operator may submit documentation of procedures and results of a stopped-belt bias test or other comparisons between a sampling system meeting the requirements of section 2 of this rule and those methods and procedures proposed by the source owner or operator. A stopped-belt bias test and a sampling system meeting the requirements of section 2 of this rule shall be considered reference method systems. A comparison shall utilize a series of at least twenty-five (25) reference method system samples paired with nonreference method system samples and analyzed for the percent of sulfur content to determine the presence of significant systemic error. The detection of significant systemic error shall be based on the application of a statistical test (t-test) to determine if there is a difference between the reference and nonreference systems at the ninety-five percent (95%) confidence level, according to the following formula:

$$t = \frac{\bar{d} \setminus n}{Sd}$$

where:

t = calculated t value

d = average difference between paired data

Sd = standard deviation of the differences

n = number of paired data sets

The calculated t value is compared to the t value in the standard statistical t tables at the ninety-five percent (95%) probability and the appropriate degrees of freedom (n — 1). If the calculated t value is greater than or equal to the table t, then the systems are not comparable. Certain coals with low variability may detect an small bias, which may be acceptable as decided on a case-by-case basis. The above method tests for positive and negative bias. Provisions for testing only for a negative bias that would cause a source to report less than actual values may be acceptable if supported by statistical tests. Upon request, the department shall provide written guidance to a source owner or operator as to the procedures to be followed in conducting this comparison.

(2) Other procedures may be acceptable if submitted to the commissioner for approval.

(b) The demonstration provided in subsection (a)(1) or (a)(2) shall be repeated upon any significant change to the coal sampling procedures or upon notification by the commissioner that a new demonstration is necessary. If the commissioner has reason to doubt that the alternative sampling and analysis procedures are comparable to methods and procedures provided in section 2 of this rule, based on inspections, monitoring, quality assurance data, or other information, the commissioner may notify the owner or operator that the demonstration shall be repeated. Written notification of the request shall be made to the source owner or operator allowing at least sixty (60) days to schedule the demonstration.

326 IAC 3-3-4 Fuel oil sampling; analysis methods

Sec. 4. (a) Sampling and analysis of the sulfur content of fuel oil shall be performed in accordance with the following ASTM procedures*:

(1) Collection of fuel oil samples shall be conducted according to:

(A) ASTM D4057-83, "Standard Practice for Manual Sampling of Petroleum and Petroleum Products"; or

(B) ASTM D4177-82, "Standard Method for Automatic Sampling of Petroleum and Petroleum Products".

(2) Determination of sulfur content shall be conducted according to:

(A) ASTM D129-84, "Standard Test Method for Sulfur in Petroleum Products (General Bomb Method)";

(B) ASTM D1266-87, "Standard Test Method for Sulfur in Petroleum Products (Lamp Method)";

(C) ASTM D1552-83, "Standard Test Method for Sulfur in Petroleum Products (High-Temperature Method)"; or

(D) ASTM D2622-87, "Standard Test Method for Sulfur in Petroleum Products (X-Ray Spectrographic Method)".

(3) Determination of heat content shall be conducted according to ASTM D240-85, "Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter".

(b) An owner or operator may, with the prior approval of the commissioner, modify the procedures specified in subsection (a), use alternate equivalent procedures, or rely upon equivalent sampling and anal-

Rule 2. Incinerators

326 IAC 4-2-1 Applicability of rule

Sec. 2. All incinerators shall:

lishes 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 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;

(5) Be operated according to the manufacturer's recommendations and only burn waste approved by the commissioner;

(6) Comply with other state and, or local rules or ordinances regarding installation and operation of incinerators;

(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:

(A) Incinerators with a maximum refuse-burning capacity of two hundred (200) or more pounds per hour: three-tenths (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; or

(B) All other incinerators: five-tenths (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; and

(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

[Repealed]

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 ex-

emptions 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 hour 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 .03 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 as those practices which would be followed by a prudent management in controlling, regulating, and maintaining clean and safe conditions of buildings, conditions and grounds. In particular, these practices are required to minimize the opportunity for particulate matter to become airborne and leave the property.

(A) Good housekeeping practices shall be conducted in the following areas of operations:

(i) Areas to be swept and maintained clean in appearance shall include at a minimum: general grounds, yard and other open areas; floors decks, hopper areas, loading areas, dust collectors, and all such areas of dust or waste concentrations; and grain driers with respect to accumulated particulate matter.

(ii) Cleanings or other collected waste material shall be handled and disposed of in such a manner that the area does not generate fugitive dust.

(iii) Dust from driveways, access roads, and other areas of travel shall be controlled.

(iv) Accidental spills and other accumulations shall be cleaned up as soon as possible but no later than completion of the day's operation.

(B) Good equipment maintenance will be those procedures which eliminate or minimize emissions from equipment or a system caused by:

(i) Malfunctions.

(ii) Breakdowns.

(iii) Improper adjustment.

(iv) Operation above rated or designed capacity.

(v) Not following designed operating specifications.

(vi) Lack of good preventive maintenance care.

(vii) Lack of critical and proper spare replacement parts on hand.

(viii) Lack of properly trained and experienced personnel.

(C) To insure the above good housekeeping and maintenance procedures, emissions from the affected areas, operations, equipment and systems shall not exceed twenty percent (20%) opacity as determined pursuant to 326 IAC 5-1.

(e) Foundries: Grey iron foundries shall be limited by the provisions of this subsection.

(1) No owner or operator of a grey iron foundry shall cause, allow or permit from

Rule 2 Participate 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 micrograms 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:

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

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.

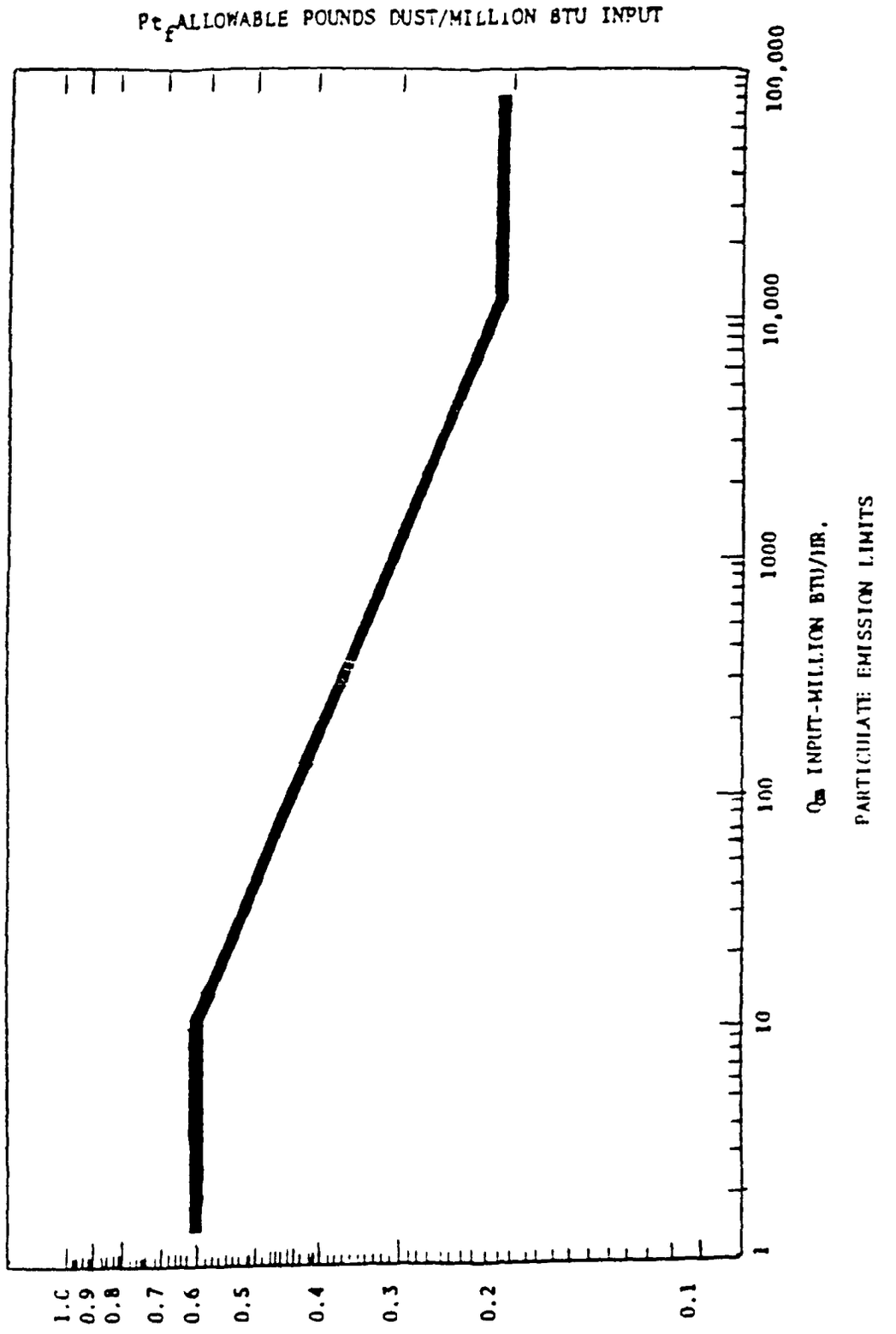
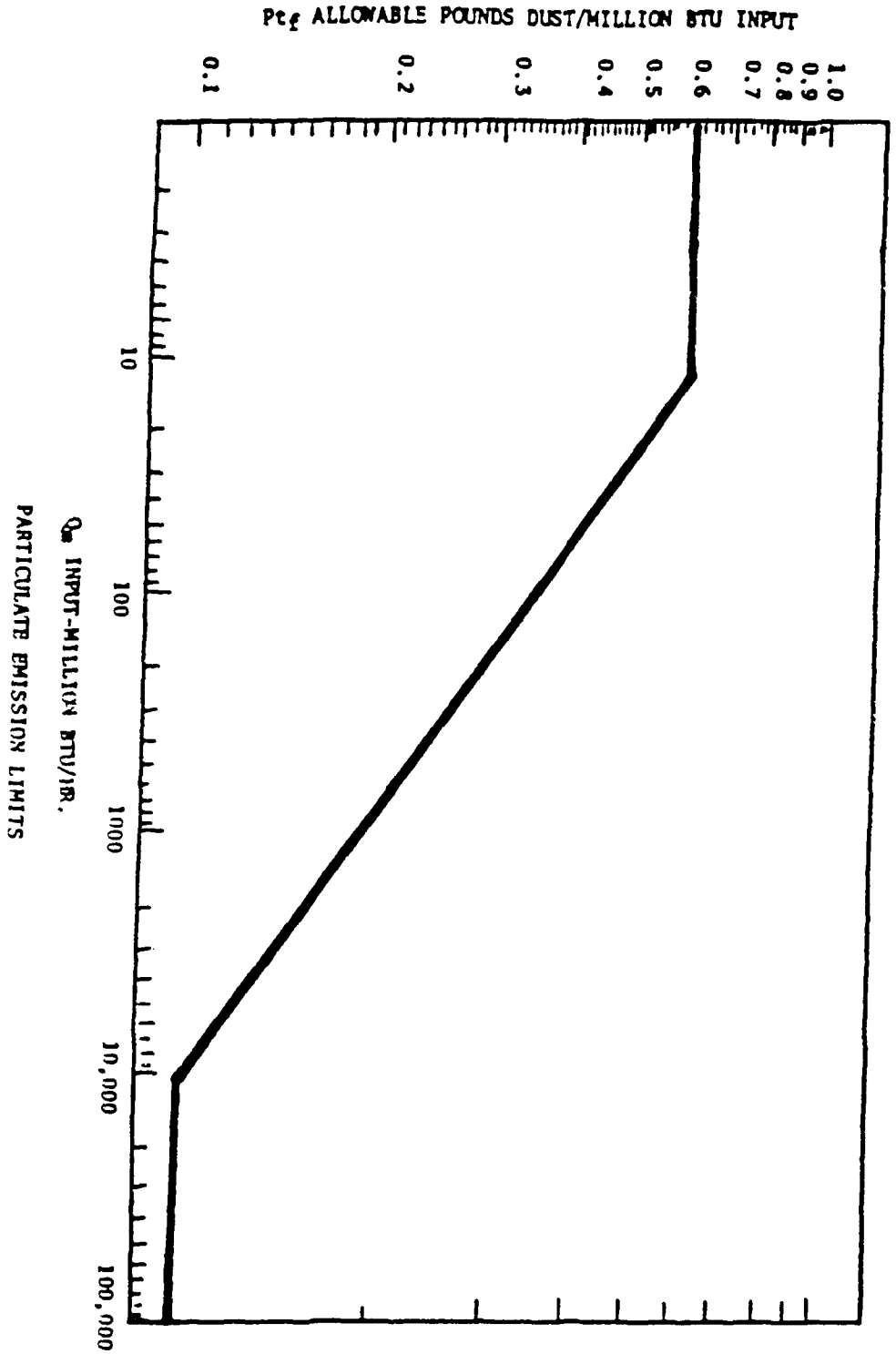


FIGURE 1

PARTICULATE EMISSION LIMITS


Pt_E ALLOWABLE POUNDS DUST/MILLION BTU INPUT
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
10
100
1000
10,000
100,000
Q_in INPUT-MILLION BTU/HR.
PARTICULATE EMISSION LIMITS

APPENDIX D

Plant Operating Logs

UNIT # 3

3 Feb 92

TIME	STEAM FLOW	COAL PPH
0100	23200	2,578
0200	22147	2,460
0300	21604	2,400
0400	22038	2,449
0500	21947	2,439
0600	23236	2,582
0700	29360	3,262
0800	34046	3,783
0900	32695	3,633
1000	33420	3,713
1100	33023	3,669
1200	33019	3,669
1300	32420	3,602
1400	32272	3,586
1500	32527	3,614
1600	33865	3,763
1700	34070	3,786
1800	34050	3,783
1900	33605	3,734
2000	33498	3,722
2100	33602	3,734
2200	33745	3,749
2300	33333	3,704
2400	21910	2,434

SMEDLEY A. GRAHAM WS-10 DAFC.
PLANT FOREMAN

JAMES R. WILLIAMS WS-07
ASSISTANT FOREMAN

UNIT # 4

2/13 [illegible]

TIME	STEAM FLOW	COAL PPH
0100	17414	1,935
0200	18431	2,048
0300	19212	2,135
0400	19552	2,172
0500	19081	2,120
0600	12913	1,435
0700	10901	1,211
0800	16620	1,845
0900	33714	3,746
1000	37900	4,211
1100	38488	4,276
1200	37070	4,119
1300	35101	3,900
1400	31902	3,545
1500	30390	3,377
1600	27406	3,045
1700	27557	3,062
1800	26972	2,997
1900	26797	2,977
2000	27037	3,004
2100	26967	2,996
2200	27341	3,038
2300	26693	2,966
2400	18143	2,016

SMEDLEY A. GRAHAM WS-10 DAFC.
PLANT FOREMAN.

JAMES R. WILLIAMS WS-07
ASSISTANT FOREMAN

BOILER #5

TIME	STEAM FLOW	COAL PPH	20 Feb 92
0100	56314	6,055	
0200	56384	6,063	
0300	57005	6,130	
0400	56218	6,045	
0500	55676	5,987	
0600	55711	5,990	
0700	56305	6,054	
0800	55074	5,922	
0900	55505	5,968	
1000	54821	5,894	
1100	54587	5,869	
1200	54339	5,843	
1300	53878	5,793	
1400	54769	5,889	
1500	53060	5,705	
1600	54066	5,814	
1700	54152	5,823	
1800	55162	5,931	
1900	54466	5,856	
2000	51852	5,575	
2100	53481	5,745	
2200	54560	5,867	
2300	56662	60934	
2400	59112	6,356	

SHEDLEY A. GRAHAM WS-10 DAFC.
PLANT FOREMAN

JAMES R. WILLIAMS WS-07
ASSISTANT FOREMAN

APPENDIX E

Coal Analysis

Branch Code 44

Lab. No 31415

Date Rec'd 02/22/92

Date Sampled --------

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

SAMPLE IDENTIFICATION

CAN #4467
BOILER #3
RUN #1
02/13/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
As Rec'd	10.73	7.30	30.77	51.20	11551	0.75
Dry Basis	-----	8.18	34.47	57.35	12939	0.84
M-A-Free					14092	

Respectfully Submitted, Mark M. Smith

MARK M. SMITH

Branch Code 44

Lab. No. 31414

Date Rec'd 02/22/92

Date Sampled --------

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

SAMPLE IDENTIFICATION

CAN #2819
BOILER #3
RUN #2
02/13/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
As Rec'd.	11.13	7.36	30.03	51.48	11346	0.89
Dry Basis	-----	8.28	33.79	57.93	12767	1.01
M-A-Free					13920	

Respectfully Submitted,

Mark M. Smith

MARK M. SMITH

nch Code 44

No 31413

e Rec'd 02/22/92

e Sampled --------

npled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

AMPLE IDENTIFICATION

CAN #4120
BOILER #3
RUN #3
02/13/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
s Rec'd	11.89	7.66	29.42	51.03	11181	0.83
ry Basis	-----	8.69	33.39	57.92	12690	0.94
-A-Free					13898	

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK NOT VALID IF ALTERED

Respectfully Submitted, Mark M. Smith

MARK M. SMITH

Branch Code 44

Lab. No. 412

Date Rec'd 02/22/92

Date Sampled --------

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

SAMPLE IDENTIFICATION

CAN #2030
BOILER #4
RUN #1
02/11/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	BTU/LB	% Sulfur
As Rec'd.	8.36	7.75	30.50	53.39	11738	0.66
Dry Basis	-----	8.46	33.28	58.26	12808	0.72
M-A-Free					13992	

Respectfully Submitted,

Mark M. Smith

MARK M. SMITH

Branch Code 44

Lab. No 31411

Date Rec'd 02/22/92

Date Sampled --------

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

SAMPLE IDENTIFICATION

CAN #1284
BOILER #4
RUN #2
02/11/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
As Rec'd	6.07	8.00	32.05	53.88	12117	0.90
Dry Basis	-----	8.52	34.12	57.36	12900	0.95
M-A-Free					14101	

Respectfully Submitted, Mark M. Smith

44

MARK M. SMITH

nch Code 44

. No. 31410

e Rec'd 02/22/92

e Sampled --------

npled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

AMPLE IDENTIFICATION

CAN #4606
BOILER #4
RUN #3
02/11/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB	% Sulfur
Rec'd.	5.81	8.06	32.03	54.10	12107	0.95
y Basis	-----	8.56	34.00	57.44	12854	1.01
A-Free					14057	

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Respectfully Submitted, Mark M. Smith

MARK M. SMITH

inch Code 44

No 31418

e Rec'd 02/22/92

e Sampled --------

mpled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

AMPLE IDENTIFICATION

CAN #1756
BOILER #5
RUN #1
02/20/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
Rec'd	13.15	7.12	32.19	47.54	11495	0.61
y Basis	-----	8.20	37.07	54.73	13235	0.70
A-Free					14417	

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Respectfully Submitted,

MARK M. SMITH

Branch Code 44

Lab No 31417

Date Rec'd 02/22/92

Date Sampled --------

Sampled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

SAMPLE IDENTIFICATION

CAN #4234
BOILER #5
RUN #2
02/20/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
As Rec'd.	14.45	7.74	29.37	48.44	11078	0.74
Dry Basis	-----	9.05	34.33	56.62	12949	0.87
M-A-Free					14238	

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Respectfully Submitted,

MARK M. SMITH

nch Code 44

No 31416

e Rec'd 02/22/92

e Sampled --------

npled By YOURSELVES

STANDARD LABORATORIES, INC.

305 CSG/DEMPH
BLDG. 223 - HEAT PLANT
ATTN: MR. JIM WILLIAMS
GRISSOM AFB, IN 46971-5320

AMPLE IDENTIFICATION

CAN #4997
BOILER #5
RUN #3
02/20/92

	% Moisture	% Ash	% Volatile	% Fixed Carbon	B.T.U./LB.	% Sulfur
; Rec'd.	16.62	6.34	33.87	43.17	11085	1.34
y Basis	-----	7.61	40.62	51.77	13295	1.61
-A-Free					14390	

FOR YOUR PROTECTION THIS DOCUMENT HAS BEEN PRINTED ON CONTROLLED PAPER STOCK. NOT VALID IF ALTERED

Respectfully Submitted, Mark M. Smith

MARK M. SMITH

APPENDIX F

Port Locations and Sampling Points

DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

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

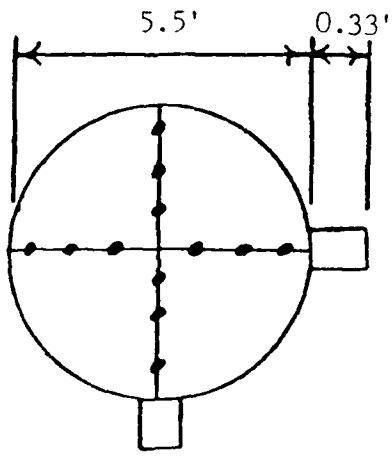
Distance A (ft) 11.5 (duct diameters) 2.1

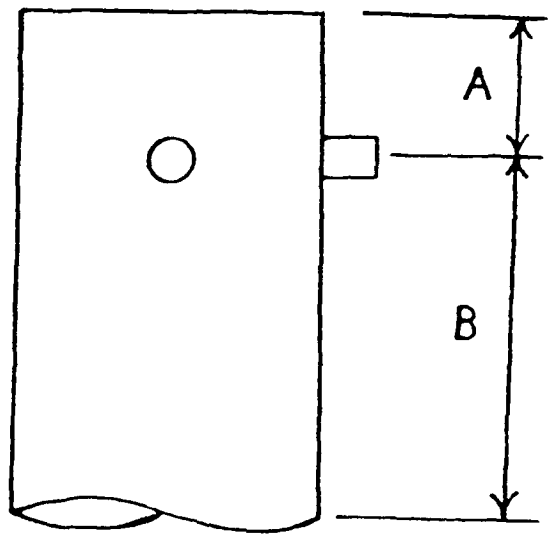
Recommended number of traverse points as determined by distance A: 12

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





APPENDIX G

Boiler 3 *Field Data*

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	13 Feb 92	1 (one)

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg # 223	Boiler #3

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.6228	0.2887	0.3341
ACETONE WASHINGS *(Probe, Front Half Filter)*	103.5788	2I 103.4908	0.0880
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.4221 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	228	200	28
IMPINGER 2 *(H20)*	209	200	9
IMPINGER 3 *(Dry)*	< 1	—	.5
IMPINGER 4 *(Silica Gel)*	208.2	200	8.2
	Total Weight of Water Collected		45.7 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	7.6	7.6	7.7		7.6
VOL % O_2	12.1	12.2	12.2		12.2
VOL % CO					
VOL % N_2					

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

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB	13 Feb 92	2

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler #3

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.5365	.2860	0.2505
ACETONE WASHINGS (Probe, Front Half Filter)	100.3229	100.2643	0.0586
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.3091 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	226	200	26
IMPINGER 2 (H20)	205	200	5
IMPINGER 3 (Dry)	<1	—	0.5
IMPINGER 4 (Silica Gel)	206.9	200	6.9
	Total Weight of Water Collected		38.4 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	7.7	7.8	7.8		7.8
VOL % O_2	12.1	12.2	12.2		12.2
VOL % CO					
VOL % N_2					

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

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	13 Feb 92	3

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler #3

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.5435	.2875	0.2560
ACETONE WASHINGS *(Probe, Front Half Filter)*	97.6241	8 97.5608	0.0633
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.3193 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	214	200	14
IMPINGER 2 *(H20)*	210	200	10
IMPINGER 3 *(Dry)*	0	–	–
IMPINGER 4 *(Silica Gel)*	209.7	200	9.7
	Total Weight of Water Collected		33.7 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	7.0	7.0	7.0		7.0
VOL % O_2	13.1	13.0	13.0		13.0
VOL % CO					
VOL % N_2					

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

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1 — Boiler 3, 85% capacity

DATE: 13 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

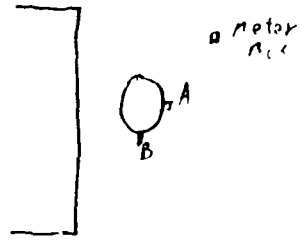
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



Values used

MWd = 29.9 %H2O = 5.5

EQUATIONS

$°R = °F + 460$

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

pre pitot check - OK

pre Train check at 15 inHg - OK

Post Train check at 7 inHg - OK

post pitot check - OK

static pressure = -0.125

ΔHe = 1.451 Y = 1.004

AMBIENT TEMP: 30 °F

STATION PRESS: 29.083 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 248 ± 25 °F

PROBE LENGTH: 8 ft

NOZZLE AREA (A) dia: 0.496 in²

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (0805)	2.1	115		0.013	0.73	365.047	43		43	241	34
2	5	3.1	170		0.028	1.43		42		43	248	35
3	10	3.2	268		0.032	1.42		45		43	254	35
4	15	3.8	287		0.035	1.52		47		43	264	34
5	20	3.4	289		0.031	1.34		48		43	253	34
6	25	3.5	283		0.025	1.09		48		42	258	35
	30						382.535					
1 B	30 (0846)	3.5	90		0.018	1.05		42		41	257	33
2	35	4.0	150		0.025	1.31		45		41	257	34
3	40	4.5	262		0.032	1.43		46		41	257	35
4	45	5.1	280		0.039	1.70		47		41	256	36
5	50	5.1	282		0.038	1.65		47		41	254	35
6	55	5.0	277		0.030	1.32		48		41	256	36
	60						401.009					
			Ts = 229			ΔH = 1.33			Tm = 44			
					VPST = 4437							
						Total Vol = 35.962						

OEHL FORM 18 MAY 78

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2 — Boiler 3 85% capacity

DATE: 13 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

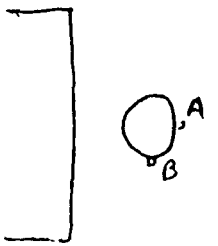
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



values used
MWJ = 29.9
% H_2O = 5.5

EQUATIONS

$°R = °F + 460$

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

pre pitot check - ok
pre Train check at 15 in Hg - ok
post Train check at 6 in Hg - ok
post pitot check - ok

static pressure = -0.125
$\Delta H@$ = 1.951 Y_d = 1.004

AMBIENT TEMP: 32 °F

STATION PRESS: 29.083 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 248 ± 25 °F

PROBE LENGTH: 8 FT

NOZZLE AREA: d.a 0.446 ~~sq ft~~

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1027)	2.5	96		0.016	0.93	401.202	41		40	252	35
2	5	2.5	165		0.018	0.93		45		41	258	36
3	10	2.5	254		0.018	0.82		49		43	269	36
4	15	3.0	282		0.025	1.10		51		44	247	36
5	20	2.2	285		0.015	0.66		57		47	227	38
6	25	1.5	284		0.005	0.22		61		51	249	37
	30						415.342					
1 B	30 (1110)	2.1	85		0.010	0.61	415.342	59		56	246	36
2	35	2.7	166		0.015	0.80		62		57	224	37
3	40	3.0	265		0.029	1.06		64		59	238	37
4	45	3.8	281		0.03	1.35		64		59	260	38
5	50	4.0	286		0.032	1.43		65		59	272	39
6	55	3.4	284		0.025	1.13		66		60	265	39
	60						431.583					
			$\overline{Ts}$ = 227			ΔH = 0.92			$\overline{Tm}$ = 57			
				$\sqrt{\Delta P}\overline{Ts}$ = 3.5733								
						Total V_{m1} = 30.381						

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 3 — Boiler 3 85% capacity

DATE: 13 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

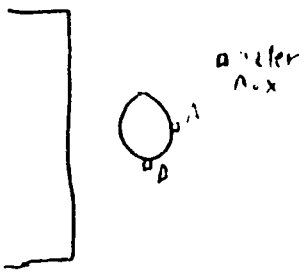
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



values used
MWd = 29.4 — 1, 11, 0 = 5.5

EQUATIONS

$°R = °F + 460$

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

pre pitot check - ok

pre Train check at 15 in Hg - ok

post Train check at 8.5 in Hg - ok

post pitot check - ok

static pressure = -0.125

ΔHe = 1.951 — Y = 1.004

AMBIENT TEMP: 35 °F

STATION PRESS: 29.083 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 248 ± 25 °F

PROBE LENGTH: 8 ~~ft~~ in

NOZZLE AREA (~~A~~) dia: 0.446 ~~in sq ft~~

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	VAC STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1254)	2.9	80		0.01	0.60	432.187	44		44	251	40
2	5	4.0	140		0.02	1.09		48		44	255	39
3	10	5.6	261		0.03	1.36		50		49	254	38
4	15	6.5	287		0.038	1.67		53		44	256	38
5	20	5.9	287		0.030	1.31		55		49	260	40
6	25	5.2	285		0.025	1.10		55		49	255	40
	30						444.102					
1 B	30 (1330)	4.3	103		0.015	0.87	444.102	50		49	256	36
2	35	6.5	170		0.028	1.45		51		44	250	36
3	40	7.0	263		0.035	1.54		53		49	252	36
4	45	7.2	282		0.036	1.54		54		49	256	37
5	50	7.0	288		0.038	1.66		54		48	259	37
6	55	6.6	285		0.028	1.24		54		48	253	38
	60						467.566					
		$\bar{T}_s$ =	227		ΔH =	1.29		$\bar{T}m$ =	51			
				$\sqrt{Ts}$ =	4.3341							
						Total Vol =	35.379					

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VISIBLE EMISSION OBSERVATION FORM

No. 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: 85%
CONTROL EQUIPMENT: By-Pass | OPERATING MODE: —

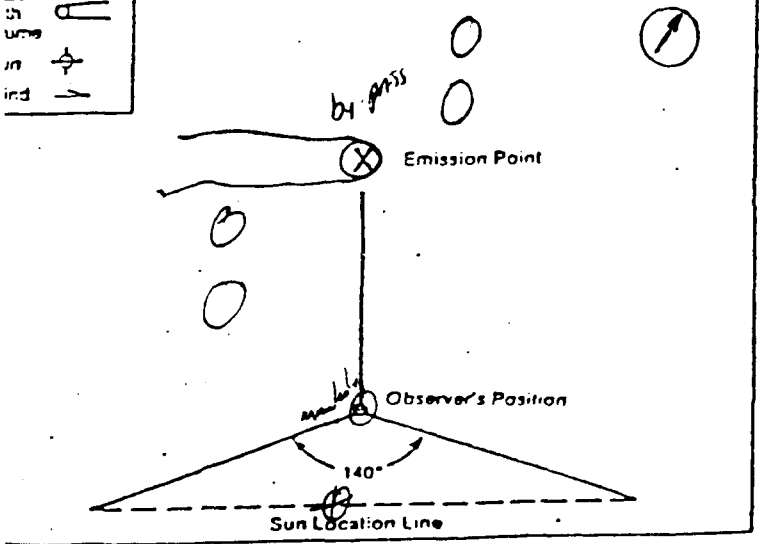
DESCRIBE EMISSION POINT: Steel Stack

HEIGHT ABOVE GROUND LEVEL: 100 | HEIGHT RELATIVE TO OBSERVER: Start 100 End
DISTANCE FROM OBSERVER: Start 150 End | DIRECTION FROM OBSERVER: Start NW End

DESCRIBE EMISSIONS: Start Lt Haze End
EMISSION COLOR: Start gray End | IF WATER DROPLET PLUME: Attached ☐ — Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start End

DESCRIBE PLUME BACKGROUND: Start sky End
BACKGROUND COLOR: Start gray End | SKY CONDITIONS: Start Overcast End
WIND SPEED: Start 7 End | WIND DIRECTION: Start NE End
AMBIENT TEMP: Start 28 End | WET BULB TEMP | RH, percent: 80

SOURCE LAYOUT SKETCH — Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
13 Feb 92	0804	0834

SEC / MIN	0	15	30	45	COMMENTS
1	15	20	20	20	
2	20	20	20	20	
3	20	20	20	20	
4	15	15	20	20	
5	15	20	20	20	
6	25	20	20	20	
7	20	20	20	20	
8	15	20	15	15	
9	15	15	15	20	
10	20	15	15	15	
11	15	15	20	20	
12	20	20	20	20	
13	20	15	20	20	
14	20	15	20	20	
15	20	15	20	15	
16	20	20	20	20	
17	15	15	20	20	
18	25	20	25	20	
19	40	60	40	30	Soot Blow (0822)
20	20	25	20	20	
21	15	20	20	20	
22	25	20	20	20	
23	20	20	15	15	
24	20	20	25	30	
25	30	25	30	30	
26	20	15	15	20	
27	15	15	15	15	
28	15	15	15	15	
29	15	15	20	15	
30	20	20	15	20	

OBSERVER'S NAME (PRINT): Ramon A. Cintron-Ocasio
OBSERVER'S SIGNATURE: [signature] | DATE: 13 Feb 92
ORGANIZATION: Armstrong Lab/OEBQ
CERTIFIED BY: Texas Air Control Board | DATE: 14 Oct 91

VISIBLE EMISSION OBSERVATION FORM

No. 2

COMPANY NAME: Grissom AFB

STREET ADDRESS: Bldg #223

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

PHONE (KEY CONTACT): | SOURCE ID NUMBER:

PROCESS EQUIPMENT: Boiler #3 | OPERATING MODE: 85%

CONTROL EQUIPMENT: None | OPERATING MODE: —

DESCRIBE EMISSION POINT: Steel Stack

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

DISTANCE FROM OBSERVER: Start 150' End | DIRECTION FROM OBSERVER: Start NW End

DESCRIBE EMISSIONS: Start Ic-Wht End

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

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2' above stack End

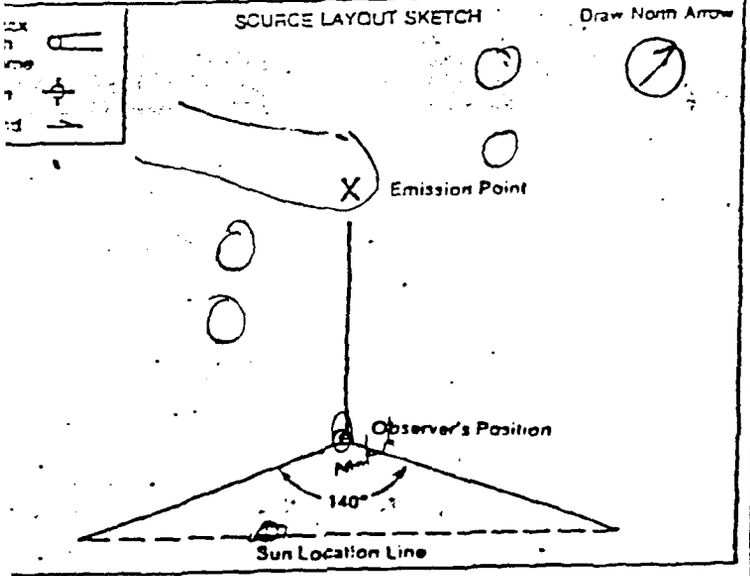
DESCRIBE PLUME BACKGROUND: Start Sky End

BACKGROUND COLOR: Start gray End | SKY CONDITIONS: Start overcast End

WIND SPEED: Start 1 End | WIND DIRECTION: Start E End

AMBIENT TEMP: Start 28 End | WET BULB TEMP: | RH, percent: 86

SOURCE LAYOUT SKETCH — Draw North Arrow



OBSERVATION DATE: 13 Feb 92 | START TIME: 1030 | END TIME: 1100

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

OBSERVER'S NAME (PRINT): Ramon A. Cintron-Quasio

OBSERVER'S SIGNATURE: [signature] | DATE: 13 Feb 92

ORGANIZATION: Armstrong Lab/OEBQ

CERTIFIED BY: Texas Air Control Board | DATE: 18 Oct 92

ADDITIONAL INFORMATION

VISIBLE EMISSION OBSERVATION FORM

No. 3

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: 85%

CONTROL EQUIPMENT: None | OPERATING MODE: —

DESCRIBE EMISSION POINT: By-pass - Stack

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

DISTANCE FROM OBSERVER: Start 200 End | DIRECTION FROM OBSERVER: Start North End

DESCRIBE EMISSIONS: Start Fanning End

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

POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2' above stack End

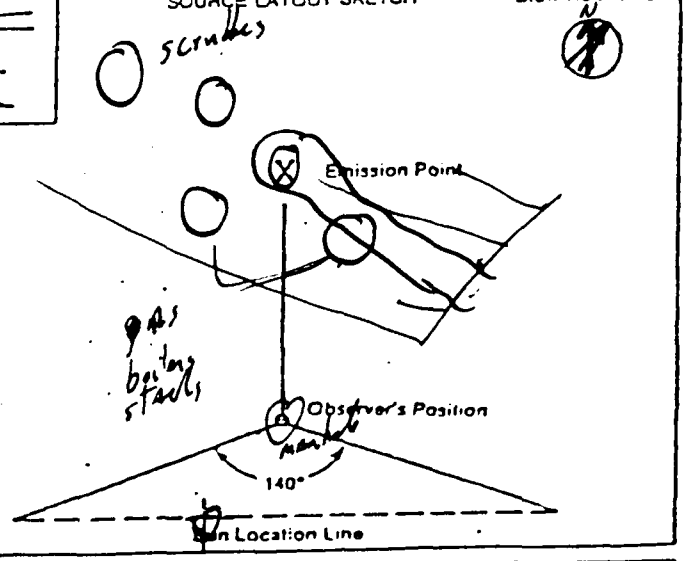
DESCRIBE PLUME BACKGROUND: Start Sky End

BACKGROUND COLOR: Start gray End | SKY CONDITIONS: Start overcast End

WIND SPEED: Start 1 kt End | WIND DIRECTION: Start NW End

AMBIENT TEMP: Start 33 End | WET BULB TEMP | RH, percent

SOURCE LAYOUT SKETCH — Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE: 13 Feb 92 | START TIME: 1300 | END TIME: 1330

SEC / MIN	0	15	30	45	COMMENTS
1	15	20	20	20	Steam mixed
2	15	20	20	20	from other stacks
3	15	20	20	20	mixed with bypass
4	20	20	20	20	smoke and
5	20	25	20	25	interfered with
6	25	30	30	25	opacity reading
7	20	20	25	20	
8	20	20	20	20	
9	20	20	20	20	
10	20	20	20	20	
11	20	20	20	20	
12	25	20	20	20	
13	15	15	15	20	
14	15	15	20	20	
15	20	20	20	20	
16	20	20	20	20	
17	20	20	20	20	
18	20	20	20	20	
19	20	20	20	20	
20	20	20	20	20	
21	20	20	20	20	
22	20	20	15	20	
23	20	15	15	15	
24	15	15	15	15	
25	15	15	20	15	
26	20	15	20	20	
27	20	15	20	15	
28	15	20	20	15	
29	15	15	20	15	
30	20	20	15	15	

OBSERVER'S NAME (PRINT): Ramon A. Cintron-Rosado

OBSERVER'S SIGNATURE: Ramon A. Cintron | DATE: 13 Feb 92

ORGANIZATION: Armstrong Lab/OEBQ

CERTIFIED BY: Texas Air Control Board | DATE: 15 Oct 91

APPENDIX H

Boiler 4 Field Data

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	11 Feb 92	1

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler 4 (85E)

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.6527	0,2910	0.3617
ACETONE WASHINGS (Probe, Front & Half Filter)	105.6981	~~100.2543~~ 2P 105.6033	0.0948
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.4565 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	226	200	26
IMPINGER 2 (H20)	212	200	12
IMPINGER 3 (Dry)	< 1	—	1
IMPINGER 4 (Silica Gel)	208.9	200	8.9
— — —	Total Weight of Water Collected		47.9 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	8.7	8.6	8.7		8.7
VOL % O_2	11.2	11.2	11.2		11.2
VOL % CO					
VOL % N_2					

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

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AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	11 Feb 92	2

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler 4

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	.6104	0.2886	0.3218
ACETONE WASHINGS (Probe, Front Half Filter)	94.5858	~~3I~~ 94.5230 ~~103.4900~~	0.0628
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.3846 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	237	200	37
IMPINGER 2 (H20)	208	200	8
IMPINGER 3 (Dry)	0	—	0
IMPINGER 4 (Silica Gel)	208.4	8.4	8.4
— — —	Total Weight of Water Collected		53.4 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	9.3	9.1	9.1		9.2
VOL % O_2	10.7	10.8	10.7		10.7
VOL % CO					
VOL % N_2					-

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

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	11 Feb 92	3

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler 4

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.5630	0.2877	0.2753
ACETONE WASHINGS (Probe, Front Half Filter)	98.5278	ITF 98.4662 ~~103.6894~~	0.0616
BACK HALF (if needed)			
	Total Weight of Particulates Collected		0.3369 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	239	200	39
IMPINGER 2 (H20)	206	200	6
IMPINGER 3 (Dry)	21	—	1
IMPINGER 4 (Silica Gel)	208.9	200	8.9
—	Total Weight of Water Collected		54.9 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	8.9	9.0	8.8		8.9
VOL % O_2	10.9	10.8	10.9		10.9
VOL % CO					
VOL % N_2					

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

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1 — Boiler 4 55% capacity

DATE: 11 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

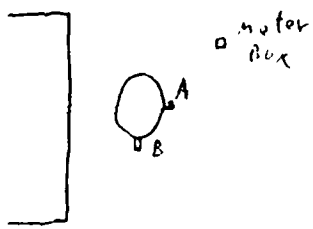
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



Values used

Mwd = 29.9 % H_2O = 5.5

EQUATIONS

$°R = °F + 460$

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

pre pitot check - ok

pre Train check at 15 in Hg - ok

post pitot check - ok

post Train check at 10 in Hg - ok

static pressure = -0.108

$\Delta H@$ = 1.951 $\Delta\gamma$ = 1.004

AMBIENT TEMP: 36 °F

STATION PRESS: 30.23 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 248 ± 25 °F

PROBE LENGTH: 8 ft

NOZZLE AREA (A): 0.496 sq ft

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H_2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (0842)	2.9	90		0.018	1.64	250.471	43		43	252	33
2	5	3.8	190		0.032	1.57		45		44	264	36
3	10	4.6	307		0.035	1.46		48		46	270	37
4	15	4.8	327		0.042	1.71		51		48	273	39
5	20	5.1	329		0.042	1.71		52		45	273	39
6	25	5.0	323		0.032	1.31		53		45	244	40
	30						269.303					
1 B	30 (0919)	4.0	100		0.015	0.86	269.303	46		45	254	36
2	35	5.1	199		0.028	1.36		49		45	241	37
3	40	5.4	294		0.035	1.48		51		45	254	38
4	45	7.0	318		0.042	1.74		53		46	266	39
5	50	8.0	322		0.045	1.85		54		46	272	40
6	55	8.1	318		0.040	1.66		54		46	228	42
	60						288.160					
			$\bar{T}s$ =	260		$\bar{\Delta H}$ = 1.48			$\bar{T}m$ =	47		
					$\sqrt{\Delta P}\bar{T}s$ = 4.9146							
						Total Vol =	37.689					

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2 — Boiler 4, 85% capacity

DATE: 11 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

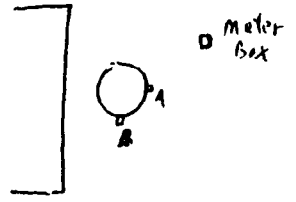
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

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

pre pitot check - ok

pre Train check at 15 in Hg - ok

post Train check at 10 in Hg - ok

post pitot check - ok

values used

MWJ = 29.9 % H_2O = 5.5

static pressure = -0.108

$\Delta H@$ = 1.951 Y_i = 1.004

AMBIENT TEMP: 37 °F

STATION PRESS: 30.23 in Hg

HEATER BOX TEMP: 249 ± 25 °F

PROBE HEATER SETTING: 248 ± 25

PROBE LENGTH: 8 Ft

NOZZLE AREA (A): 0.496 sq ft

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1213)	1.9	90		0.022	1.27	270.065	43		43	240	34
2	5	2.1	275		0.030	1.30		46		44	249	35
3	10	2.5	303		0.035	1.46		50		45	256	35
4	15	3.0	323		0.040	1.64		52		45	262	37
5	20	3.1	326		0.038	1.56		53		46	257	38
6	25	3.7	319		0.032	1.32		52		46	249	38
	30						308.588					
1 B	30 (1251)	3.2	140		0.015	0.86	308.588	49		47	250	38
2	35	3.9	190		0.020	0.99		52		48	249	38
3	40	5.0	304		0.032	1.35		54		48	241	39
4	45	5.8	320		0.038	1.58		55		49	245	39
5	50	6.0	324		0.035	1.45		56		49	247	40
6	55	6.8	320		0.035	1.46		57		50	248	40
	60						326.132					
		$\bar{T}_s$ =	267			$\bar{\Delta H}$ = 1.35		$\bar{T}_m$ =	49			
				$\sqrt{\bar{T}_s}$ =	4.7308							
						Total V_i = 36.069						

OEHL FORM MAY 78 18

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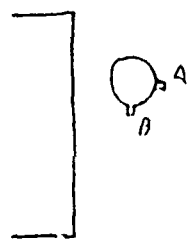
PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 3 — Boiler 4, 85% capacity
DATE: 11 Feb 92
PLANT: Heating Plant
BASE: Grissom AFB
SAMPLE BOX NUMBER:
METER BOX NUMBER: 3
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION



Values used
MWd = 29.9 %H2O = 5.5

EQUATIONS

$°R = °F + 460$

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

Pre pitot check — ok
pre Train check at 15 in Hg — ok
Post pitot check — ok
Post Train check at 11 in Hg — ok

static pressure = −0.108
ΔH@ = 1.951 Yi = 1.004

AMBIENT TEMP: 38 °F
STATION PRESS: 30.23 in Hg
HEATER BOX TEMP: 248 ± 25 °F
PROBE HEATER SETTING: 248 ± 25
PROBE LENGTH: 8 ft
NOZZLE AREA (A): 0.496 sq ft
Cp: 0.84
DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1443)	2.4	170		0.019	0.97	326.376	41		41	233	35
2	5	3.1	250		0.031	1.41		43		42	243	36
3	10	4.0	319		0.038	1.58		47		43	251	36
4	15	4.9	324		0.038	1.56		50		43	261	36
5	20	5.1	331		0.035	1.44		50		43	257	36
6	25	5.5	321		0.029	1.21		51		44	252	36
	30						344.440					
1 B	30 (1541)	5.0	127		0.016	0.88	344.440	43		43	241	34
2	35	6.8	180		0.025	1.26		45		43	241	34
3	40	8.0	308		0.035	1.48		48		44	241	35
4	45	9.5	225		0.040	1.66		50		44	241	38
5	50	10.4	331		0.040	1.63		51		44	240	40
6	55	11.3	326		0.038	1.58		52		45	243	40
	60						362.704					
			$\bar{T}_s$ = 276		$\overline{\Delta H}$ = 1.39			$\bar{T}_m$ =	45			
				$\overline{\sqrt{\Delta P}T_s}$ = 4.8359								
						Total vol =	36.328					

OEHL FORM 18 MAY 78

29.374

VISIBLE EMISSION OBSERVATION FORM

No. 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 #4 | OPERATING MODE: 85%
CONTROL EQUIPMENT: Nor | OPERATING MODE: —

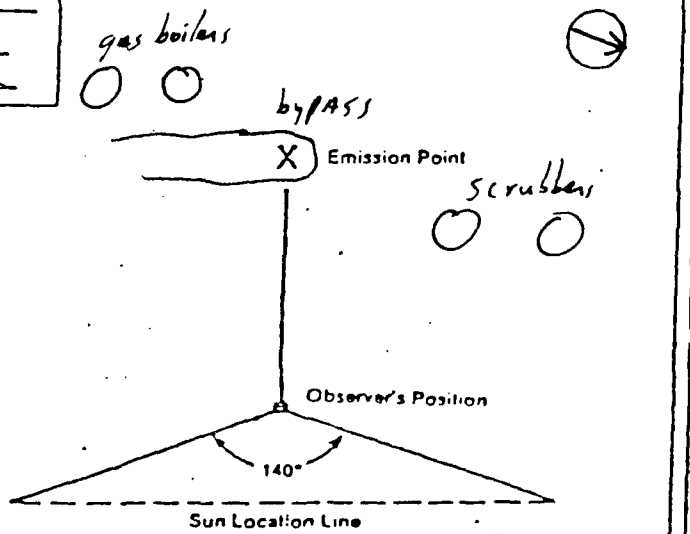
DESCRIBE EMISSION POINT: By pass stack
HEIGHT ABOVE GROUND LEVEL: 100' | HEIGHT RELATIVE TO OBSERVER: Start 100' End
DISTANCE FROM OBSERVER: Start 250' End | DIRECTION FROM OBSERVER: Start west End

DESCRIBE EMISSIONS: Start End
EMISSION COLOR: Start gray End | IF WATER DROPLET PLUME: Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2 fet abow stack End

DESCRIBE PLUME BACKGROUND: Start sky End
BACKGROUND COLOR: Start gray End | SKY CONDITIONS: Start overcast End
WIND SPEED: Start 7 Knots End | WIND DIRECTION: Start 310 (NW) End
AMBIENT TEMP: Start 35 End | WET BULB TEMP: | RH, percent: 94%

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH — Draw North Arrow



OBSERVATION DATE: 11 Feb 92 | START TIME: 0844 | END TIME: 0914

SEC / MIN	0	15	30	45	COMMENTS
1	15	15	20	20	
2	15	15	15	15	
3	15	15	15	15	
4	10	15	15	15	
5	20	15	15	15	
6	15	15	15	15	
7	10	15	15	10	
8	10	15	15	15	
9	15	10	15	10	
10	10	10	10	10	
11	10	10	10	10	
12	15	10	10	15	
13	10	15	10	15	
14	15	15	15	10	
15	15	10	10	10	
16	10	10	10	10	
17	15	15	15	10	
18	15	15	15	20	
19	10	15	15	10	
20	10	15	20	15	
21	15	10	10	10	
22	10	25	55	60	Soot Blow
23	40	35	20	15	
24	10	10	10	10	
25	15	10	10	10	
26	10	10	10	10	
27	15	15	15	10	
28	15	10	15	10	
29	15	15	15	10	
30	15	10	10	10	

OBSERVER'S NAME (PRINT): Ramon A. Clinton - Ocasio
OBSERVER'S SIGNATURE: Ramon A Clinton | DATE: 11 Feb 92
ORGANIZATION: Armstrong Laboratory / OEBQ
CERTIFIED BY: Texas Air Control Board | DATE: 18 Oct 91

ADDITIONAL INFORMATION

VISIBLE EMISSION OBSERVATION FORM

No. 2

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 #4	OPERATING MODE: 85%
CONTROL EQUIPMENT: None	OPERATING MODE: —

DESCRIBE EMISSION POINT: Bypass stack	
HEIGHT ABOVE GROUND LEVEL: 100'	HEIGHT RELATIVE TO OBSERVER: Start 100' End
DISTANCE FROM OBSERVER: Start 150' End	DIRECTION FROM OBSERVER: Start Northwest End

DESCRIBE EMISSIONS: Start	End
EMISSION COLOR: Start gray End	IF WATER DROPLET PLUME: Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2' above stack	End

DESCRIBE PLUME BACKGROUND: Start	End
BACKGROUND COLOR: Start gray End	SKY CONDITIONS: Start overcast End
WIND SPEED: Start 5 Knots End	WIND DIRECTION: Start North End
AMBIENT TEMP: Start 38 End	WET BULB TEMP / RH, percent: 96%

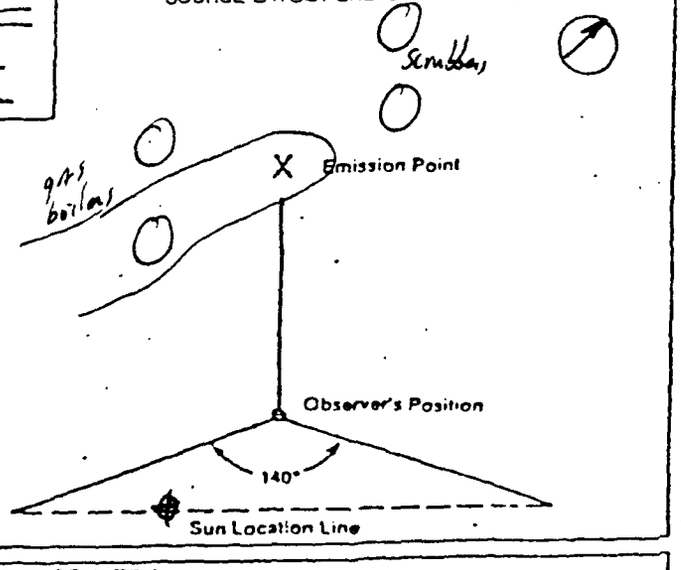
SOURCE LAYOUT SKETCH

Draw North Arrow

Stack with Plume

Sun

Wind



OBSERVATION DATE	START TIME	END TIME
11 Feb 92	1214	1254

SEC / MIN	0	15	30	45	COMMENTS
1	20	20	20	25	
2	25	30	25	30	
3	25	20	15	15	
4	10	10	15	15	
5	15	20	20	20	
6	20	20	25	20	
7	20	20	20	25	
8	20	20	15	20	
9	20	20	25	20	
10	25	25	20	25	
11	20	25	20	25	
12	20	25	25	25	
13	20	25	25	25	
14	20	20	20	20	
15	25	20	20	20	
16	25	20	25	25	
17	30	25	20	20	
18	20	20	15	15	
19	20	20	15	20	
20	20	20	20	20	
21	30	35	30	30	
22	25	20	25	25	
23	20	20	30	30	
24	35	40	25	25	
25	20	20	20	15	
26	20	20	20	20	
27	40	35	30	35	
28	30	25	35	40	
29	40	35	35	30	
30	30	35	35	40	

OBSERVER'S NAME (PRINT): Ramon A. Cintron-Ocasio	
OBSERVER'S SIGNATURE: Ramon A. Cintron	DATE: 11 Feb 92
ORGANIZATION: Armstrong Laboratory/OEBQ	
CERTIFIED BY: Texas Air Control Board	DATE: 18 Oct 91

ADDITIONAL INFORMATION

VISIBLE EMISSION OBSERVATION FORM

No. 3

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 #4 | OPERATING MODE: 85%
CONTROL EQUIPMENT: None | OPERATING MODE: —

DESCRIBE EMISSION POINT: By-pass Stack

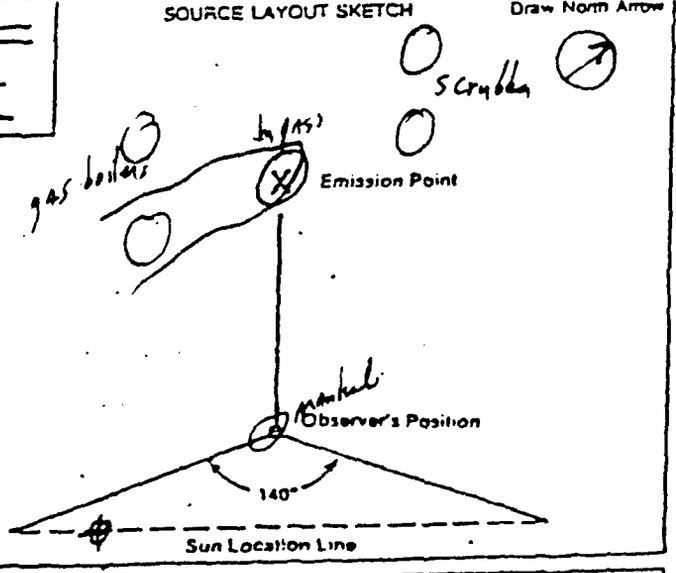
HEIGHT ABOVE GROUND LEVEL: 100' | HEIGHT RELATIVE TO OBSERVER: Start 100' End
DISTANCE FROM OBSERVER: Start 150' End | DIRECTION FROM OBSERVER: Start NW End

DESCRIBE EMISSIONS: Start End
EMISSION COLOR: Start gray End | IF WATER DROPLET PLUME: Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2' above stack End

DESCRIBE PLUME BACKGROUND: Start sky End
BACKGROUND COLOR: Start gray End | SKY CONDITIONS: Start overcast End
WIND SPEED: Start 11 gusts End | WIND DIRECTION: Start North End
AMBIENT TEMP: Start 35 End | WET BULB TEMP: | RH, percent: 86

Stack with Plume
Sun
Wind

SOURCE LAYOUT SKETCH — Draw North Arrow



OBSERVATION DATE	START TIME	END TIME
11 Feb 92	1440	1510

SEC / MIN	0	15	30	45	COMMENTS
1	15	20	15	10	
2	15	10	15	15	
3	15	10	15	15	
4	15	10	15	15	
5	10	10	10	10	
6	10	15	10	10	
7	10	10	10	5	
8	5	5	5	5	
9	10	10	10	15	
10	15	15	15	20	
11	20	20	20	20	
12	20	20	20	20	
13	15	20	15	20	
14	15	10	15	20	
15	20	15	15	15	
16	10	5	5	10	
17	10	15	15	20	
18	10	20	15	10	
19	10	15	15	20	
20	15	15	20	20	
21	20	20	15	20	
22	15	15	15	15	
23	20	20	20	20	
24	25	25	30	20	
25	20	15	20	25	
26	30	35	25	20	
27	25	20	20	25	
28	25	25	30	35	
29	40	50	50	30	
30	30	30	30	25	

OBSERVER'S NAME (PRINT): Ramon A. Clayton-Ocasio
OBSERVER'S SIGNATURE: | DATE: 11 Feb 92
ORGANIZATION: Armstrong Laboratory / OEBQ
CERTIFIED BY: Texas Air Control Board | DATE: 18 Oct 91

ADDITIONAL INFORMATION

APPENDIX I

Boiler 5 Field Data

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	20 Feb 92	1

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler #5 - 85%

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.5972	0.2861	0.3111
ACETONE WASHINGS (Probe, Front Half Filter)	94.8151	94.4824	0.3327
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.6438 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	232	200	32
IMPINGER 2 (H20)	206	200	6
IMPINGER 3 (Dry)	0	-	0
IMPINGER 4 (Silica Gel)	206.7	200	6.7
	Total Weight of Water Collected		44.7 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	10.0	10.2	10.0		10.1
VOL % O_2	9.8	9.7	9.8		9.8
VOL % CO					
VOL % N_2					

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

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	20 Feb 92	2

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler #5 - 85%

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.6560	0.2908	0.3652
ACETONE WASHINGS (Probe, Front Half Filter)	102.7217	⑤ 102.3179	0.4038
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.7690 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	232	200	32
IMPINGER 2 (H20)	206	200	6
IMPINGER 3 (Dry)	0	0	0
IMPINGER 4 (Silica Gel)	207.4	200	7.4
	Total Weight of Water Collected		45.7 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	9.8	9.8	9.8		9.8
VOL % O_2	10.2	10.2	10.2		10.2
VOL % CO					
VOL % N_2					

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

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Grissom AFB, IN	20 Feb 92	3

BUILDING NUMBER	SOURCE NUMBER
Heating Plant - Bldg #223	Boiler #5 - 85%

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.6244	0.2845	0.3399
ACETONE WASHINGS (Probe, Front Half Filter)	95.2193	⑦ 94.8270	0.3923
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.7322 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	232	200	32
IMPINGER 2 (H20)	202	200	2
IMPINGER 3 (Dry)	0	0	0
IMPINGER 4 (Silica Gel)	206.9	200	6.9
	Total Weight of Water Collected		40.9 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	9.2	9.0	9.0		9.1
VOL % O_2	10.8	10.8	10.8		10.8
VOL % CO					
VOL % N_2					

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

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1 — Boiler 5 — 85% capacity

DATE: 20 Feb 92

PLANT: Heating plant

BASE: Grissom AFB

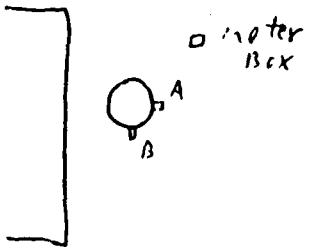
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



values used

M_{wd} = 30.0 $\%H_2O$ = 6.0

EQUATIONS

$°R \approx °F + 460$

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

Pre pitot check - ok

Pre Train check at 5.5 in H_g - OK

Post pitot check - ok

Post Train check at 5 in H_g - ok

static pressure = -0.135

ΔHe = 1.951 Y_i = 1.004

AMBIENT TEMP: 39 °F

STATION PRESS: 29.339 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 248 ± 25

PROBE LENGTH: 8 Ft

NOZZLE ~~AREA (A)~~ d.a: 0.378 in

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1109)	1.4	174		0.032	0.55	694.476	44		44	234	39
2	5	2.9	250		0.070	1.07		45		44	242	39
3	10	3.0	280		0.075	1.10		49		45	244	39
4	15	3.1	287		0.080	1.17		51		45	244	39
5	20	3.1	282		0.075	1.09		52		45	253	39
6	25	3.0	282		0.075	0.81		52		46	256	39
	30						709.798					
1 B	30 (1146)	2.8	186		0.070	0.67	709.798	47		45	243	39
2	35	3.1	247		0.055	0.85		44		45	241	39
3	40	3.8	281		0.071	1.04		50		46	240	40
4	45	4.0	288		0.080	1.17		52		46	246	40
5	50	4.2	293		0.080	1.16		53		47	247	41
6	55	4.1	293		0.075	1.09		53		47	245	40
	60						725.326					
		$\overline{Ts}$ =	263			$\overline{\Delta H}$ = 0.98		$\overline{Tm}$ =	48			
				$\overline{\sqrt{Ts}\,Ts}$ =	6.850							
						Total vol =	30.85					

OEHL FORM MAY 78 18

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2 — Boilers 5 55% capac

DATE: 20 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

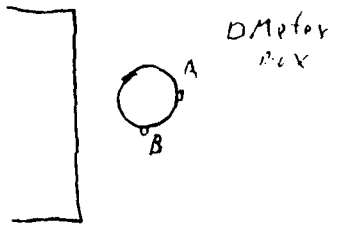
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



Values used

M_d = 30.0 % H_2O = 6.0

EQUATIONS

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

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

pre pitot check - OK

pre Train check at 10.5 in/g - OK

post pitot check - OK

post Train check at 6 in Hg - OK

static pressure = -0.135

ΔHe = 1.951 Y_i = 1.004

AMBIENT TEMP: 39 °F

STATION PRESS: 29.33 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 245 ± 25 °F

PROBE LENGTH: 8 ft

NOZZLE ~~AREA (A)~~ dia: 0.378 in

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1413)	2.1	165		0.042	0.72	715.822	42		41	223	38
2	5	2.5	224		0.055	0.86		44		42	232	39
3	10	3.0	268		0.070	1.04		47		43	236	39
4	15	3.1	286		0.081	1.18		49		44	239	39
5	20	3.4	287		0.085	1.23		51		44	247	40
6	25	3.1	282		0.060	0.88		52		45	243	40
	30											
1 B	30 (1455)	2.5	226		0.040	0.63	741.364	45		44	234	37
2	35	3.0	243		0.050	0.77		48		43	235	37
3	40	3.1	274		0.062	0.92		50		46	235	39
4	45	3.4	285		0.079	1.16		51		46	236	39
5	50	4.0	287		0.082	1.20		52		46	237	39
6	55	4.1	284		0.075	1.10		54		47	232	40
	60						756.686					
		$\overline{Ts}$ =	260		ΔH = 0.97			$\overline{Tm}$ =	47			
				$\sqrt{Ts}$ = 6.8100		Total V_i = 30.864						

OEHL FORM MAY 78 18

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 3 — Boiler 5 — 85% capac

DATE: 20 Feb 92

PLANT: Heating Plant

BASE: Grissom AFB

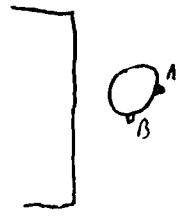
SAMPLE BOX NUMBER:

METER BOX NUMBER: 3

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



values used

MW_d = 30.0 — % H2O = 6.0

EQUATIONS

°R = °F + 460

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

pre pitot check - ok

pre train check at 16 in Hg - ok

static pressure = -0.13

ΔH@ = 1.951 — Y_i = 1.004

AMBIENT TEMP: 40 °F

STATION PRESS: 29.33 in Hg

HEATER BOX TEMP: 248 ± 25 °F

PROBE HEATER SETTING: 248 ± 25

PROBE LENGTH: 8 Ft

NOZZLE ~~AREA (A)~~ dia: 0.378 in

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O)	STACK TEMP (°F)	STACK TEMP (Ts) (°R)	VELOCITY HEAD (Vp)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP AVG (Tm) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1 A	0 (1701)	2.0	150		0.045	0.74	756.900	43		41	223	40
2	5	2.1	263		0.061	0.91		45		43	224	40
3	10	2.2	281		0.068	0.94		47		43	230	41
4	15	2.9	282		0.080	1.17		49		43	230	41
5	20	3.0	285		0.075	1.09		50		44	226	41
6	25	3.0	281		0.065	0.95		50		44	226	42
	30						772.459					
1 B	30 (1749)	2.9	190		0.070	0.67	772.459	45		44	228	39
2	35	3.0	260		0.055	0.83		48		44	235	39
3	40	3.5	274		0.065	0.96		49		44	232	40
4	45	4.0	282		0.072	1.05		50		44	225	39
5	50	4.1	284		0.075	1.10		51		45	223	40
6	55	4.2	280		0.070	1.03		51		45	227	41
	60						787.668					
			Ts = 259			ΔH = 0.96			Tm = 46			
					√Ps·Ts = 6.781							
						Total Vol =	30.768					

OEHL FORM MAY 78 18

77

VISIBLE EMISSION OBSERVATION FORM

No. 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 #5	OPERATING MODE: 85 %
CONTROL EQUIPMENT: None	OPERATING MODE: —

DESCRIBE EMISSION POINT: Steel Stack - by pass

HEIGHT ABOVE GROUND LEVEL: 100'	HEIGHT RELATIVE TO OBSERVER: Start 100' End
DISTANCE FROM OBSERVER: Start 150' End	DIRECTION FROM OBSERVER: Start NE End

DESCRIBE EMISSIONS: Start fanning End	
EMISSION COLOR: Start gray End	IF WATER DROPLET PLUME: Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start Two feet above stack End	

DESCRIBE PLUME BACKGROUND: Start sky End	
BACKGROUND COLOR: Start gray End	SKY CONDITIONS: Start overcast End
WIND SPEED: Start 10 Knots End	WIND DIRECTION: Start SW End
AMBIENT TEMP: Start 39 End	WET BULB TEMP: / RH, percent:

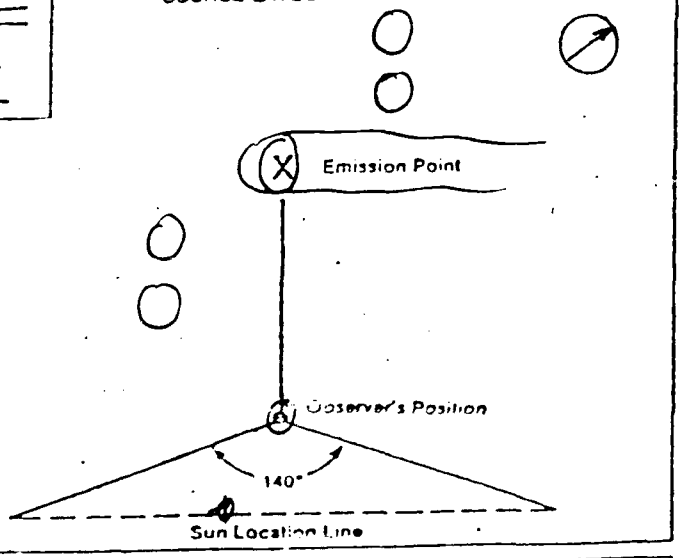
SOURCE LAYOUT SKETCH

Draw North Arrow

Stack with Plume

Sun

Wind



ADDITIONAL INFORMATION

OBSERVATION DATE	START TIME	END TIME
20 Feb 92	1110	1140

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

OBSERVER'S NAME (PRINT): Ramon A Cintron-Ocasio	
OBSERVER'S SIGNATURE: Ramon A Cintron	DATE: 20 Feb 92
ORGANIZATION: Arastrong Lab / OEBQ	
CERTIFIED BY: Texas Air Control Board	DATE: 15 Oct 91

VISIBLE EMISSION OBSERVATION FORM

No. 2

COMPANY NAME: Grissom AFB - Heating Plant
STREET ADDRESS: Bldg #223
CITY: Grissom AFB | STATE: IN | ZIP: 46971
PHONE (KEY CONTACT) | SOURCE ID NUMBER

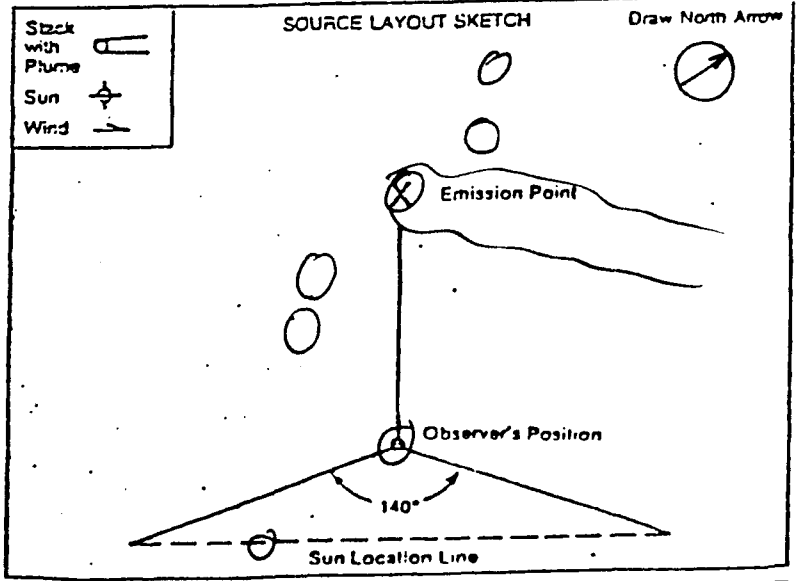
PROCESS EQUIPMENT: Boiler #5 | OPERATING MODE: 85%
CONTROL EQUIPMENT: None | OPERATING MODE: —

DESCRIBE EMISSION POINT: Steel stack - by pass
HEIGHT ABOVE GROUND LEVEL: 100' | HEIGHT RELATIVE TO OBSERVER: Start 100' End
DISTANCE FROM OBSERVER: Start 1320' End | DIRECTION FROM OBSERVER: Start NW End

DESCRIBE EMISSIONS: Start Fanning End
EMISSION COLOR: Start gray End | IF WATER DROPLET PLUME: Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2' Above stack End

DESCRIBE PLUME BACKGROUND: Start sky End
BACKGROUND COLOR: Start gray End | SKY CONDITIONS: Start overcast End
WIND SPEED: Start 15 End | WIND DIRECTION: Start SW End
AMBIENT TEMP: Start 39 End | WET BULB TEMP | RH, percent

SOURCE LAYOUT SKETCH — Draw North Arrow



ADDITIONAL INFORMATION

OBSERVATION DATE: 20 Feb 92 | START TIME: 1415 | END TIME: 1445

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

OBSERVER'S NAME (PRINT): Ramon A. Cintron-Ocasio
OBSERVER'S SIGNATURE: [signature] | DATE: 20 Feb 92
ORGANIZATION: Armstrong Laboratory/OEBQ
CERTIFIED BY: Texas Air Control Board | DATE: 18 Oct 91

VISIBLE EMISSION OBSERVATION FORM

No. 3

COMPANY NAME: Grissom AFB - Heating Plant		
STREET ADDRESS: Bldg #223		
CITY: Grissom AFB	STATE: IN	ZIP: 46911
PHONE (KEY CONTACT):	SOURCE ID NUMBER:	

PROCESS EQUIPMENT: Boiler #5	OPERATING MODE: 85%
CONTROL EQUIPMENT: None	OPERATING MODE: —

DESCRIBE EMISSION POINT: Steel Stack - by pass	
HEIGHT ABOVE GROUND LEVEL: 100	HEIGHT RELATIVE TO OBSERVER: Start 100 End
DISTANCE FROM OBSERVER: Start 300' End	DIRECTION FROM OBSERVER: Start Northeast End

DESCRIBE EMISSIONS: Start Fannes End	
EMISSION COLOR: Start gray End	IF WATER DROPLET PLUME: Attached ☐ Detached ☐
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: Start 2' above stack End	

DESCRIBE PLUME BACKGROUND: Start Sky End —		
BACKGROUND COLOR: Start gray End	SKY CONDITIONS: Start overcast End	
WIND SPEED: Start 15 knots End	WIND DIRECTION: Start SW End	
AMBIENT TEMP: Start 40 End	WET BULB TEMP	RH, percent

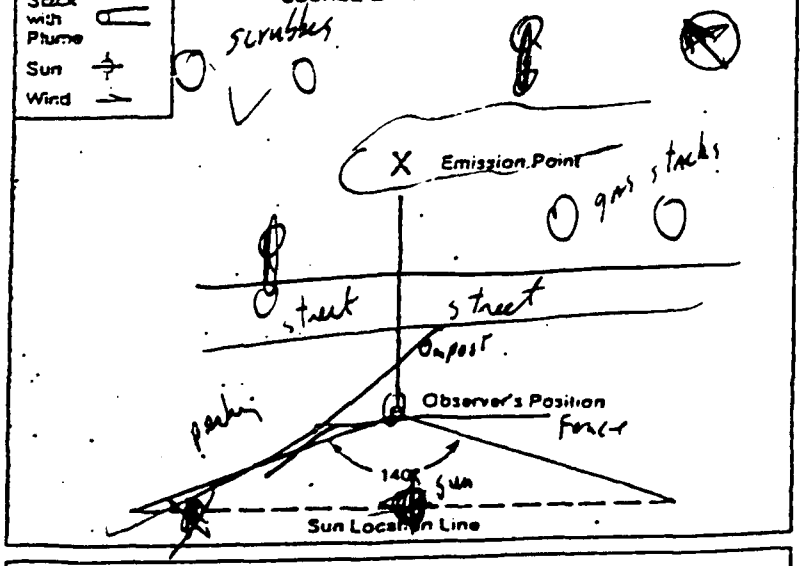
SOURCE LAYOUT SKETCH

Draw North Arrow

Stack with Plume

Sun

Wind



ADDITIONAL INFORMATION:

OBSERVATION DATE	START TIME	END TIME
20 Feb 97	1705	1735

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

OBSERVER'S NAME (PRINT): Ramon A. Cintron - Ocasio	
OBSERVER'S SIGNATURE: Ramon A. Cintron	DATE: 20 Feb 92
ORGANIZATION: Armstrong Laboratory / OEBQ	
CERTIFIED BY: Texas Air Control Board	DATE: 18 Oct 91

APPENDIX J

Calibration Data

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 6 Nov 91 Meter box number 3

Barometric pressure, P_b = 29.313 in. Hg Calibrated by Vaughn / O'Brien

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
0.5	5	5.015	69 71 → 70	70 74 → 72	68 70 → 69	70.5	12.88	0.997	1.90
1.0	5	5.013	72 73 → 72.5	77 81 → 79	71 73 → 72	75.5	9.079	1.001	1.888
1.5	10	10.042	75 74 → 74.5	82 87 → 84.5	74 78 → 76	80.25	15.179	1.003	1.976
2.0	10	10.086	75 75 → 75	88 93 → 90.5	78 81 → 79.5	85.0	13.163	1.005	1.945
3.0	10	10.103	75 74 → 74.5	93 96 → 94.5	81 84 → 82.5	88.5	10.789	1.003	1.967
4.0	10	10.122	74 74 → 74	96 94 → 95	84 86 → 85	90	9.459	1.007	2.007
							Avg	1.004	1.951

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	$Y_i = \frac{(5)(29.313)(70.5+460)}{(5.015)(29.313+\frac{.5}{13.6})(70+460)}$	$\Delta H@_i = \frac{(0.0317)(.5)}{29.313(70.5+460)}\left[\frac{(70+460)(12.88)}{5}\right]^2$
1.0	0.0737	$Y_i = \frac{(5)(29.313)(75.5+460)}{(5.013)(29.313+\frac{1.0}{13.6})(75.5+460)}$	$\Delta H@_i = \frac{(0.0317)(1.0)}{29.313(75.5+460)}\left[\frac{(75.5+460)(9.079)}{5}\right]^2$
1.5	0.110	$Y_i = \frac{(10)(29.313)(80.25+460)}{(10.042)(29.313+\frac{1.5}{13.6})(74.5+460)}$	$\Delta H@_i = \frac{0.0317(1.5)}{29.313(80.25+460)}\left[\frac{(74.5+460)(15.179)}{10}\right]^2$
2.0	0.147	$Y_i = \frac{(10)(29.313)(85+460)}{(10.086)(29.313+\frac{2.0}{13.6})(75+460)}$	$\Delta H@_i = \frac{0.0317(2.0)}{29.313(85+460)}\left[\frac{(75+460)(13.163)}{10}\right]^2$
3.0	0.221	$Y_i = \frac{(10)(29.313)(88.5+460)}{(10.103)(29.313+\frac{3.0}{13.6})(74.5+460)}$	$\Delta H@_i = \frac{0.0317(3.0)}{29.313(88.5+460)}\left[\frac{(74.5+460)(10.789)}{10}\right]^2$
4.0	0.294	$Y_i = \frac{(10)(29.313)(90+460)}{(10.122)(29.313+\frac{4.0}{13.6})(74+460)}$	$\Delta H@_i = \frac{0.0317(4.0)}{29.313(90+460)}\left[\frac{(74+460)(9.459)}{10}\right]^2$

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

Quality Assurance Handbook M4-2.3A (front side)

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test numbers _____ Date 13 Jan 92 Meter box number 3 Plant _____

Barometric pressure, P_b = 29.085 in. Hg Dry gas meter number _____ Pretest Y 1.004

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 (t_d), °F [a]	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$ (θ)
1.3	10	9.989	72/72 72	81/86 83.5	75/78 76.5	80.0	15.91	11.9	1.0128	
1.3	10	10.038	72/72 72	87/88 87.5	79/81 80	83.75	16.03	11.9	1.0149	
1.3	10	10.098	72/72 72	88/89 88.5	82/83 82.5	85.5	16.10	11.9	1.0121	
									Y = 1.0133	

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

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

P_b = Barometric pressure, in. Hg.

θ = Time of calibration run, min.

APPENDIX K

EPA Computer Program Emissions Calculations

```
XROM "METH 5"
RUN NUMBER
ONE, BOILER 3, 13 FEB 92
                    RUN
METER BOX Y?
        1.0040      RUN
DELTA H?
        1.7300      RUN
BAR PRESS ?
       29.0830      RUN
METER VOL ?
       35.9620      RUN
MTR TEMP F?
       44.0000      RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
        0.0000      RUN
STATIC HOH IN ?
        -.1250      RUN
STACK TEMP.
      229.0000      RUN
ML. WATER ?
       45.7000      RUN
IMP. % HOH = 5.5

% HOH=5.5
% CO2?
        7.6000      RUN
% OXYGEN?
       12.2000      RUN
% CO ?
        0.0000      RUN
MOL WT OTHER?
                    RUN
MWd =29.70
MW WET=29.06
SQRT PSTS ?
        4.4371      RUN
TIME MIN ?
       60.0000      RUN
NOZZLE DIA ?
         .4960      RUN
STK DIA INCH ?
       66.0000      RUN
* VOL MTR STD = 36.891
  STK PRES ABS = 29.07
  VOL HOH GAS = 2.15
  % MOISTURE = 5.51
  MOL DRY GAS = 0.945
  % NITROGEN = 80.20
  MOL WT DRY = 29.70
  MOL WT WET = 29.06
  VELOCITY FPS = 10.96
  STACK AREA = 23.76
  STACK ACFM = 15,627.
* STACK DSCFM = 10,995.
  % ISOKINETIC = 99.07


END OF FIELD DATA
```

```
XROM "METH 5"
RUN NUMBER
TWO, BOILER 3, 13 FEB 92
                    RUN
METER BOX Y?
        1.0040      RUN
DELTA H?
         .9200      RUN
BAR PRESS ?
       29.0830      RUN
METER VOL ?
       30.3810      RUN
MTR TEMP F?
       54.0000      RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
        0.0000      RUN
STATIC HOH IN ?
        -.1250      RUN
STACK TEMP.
      227.0000      RUN
ML. WATER ?
       38.4000      RUN
IMP. % HOH = 5.6

% HOH=5.6
% CO2?
        7.7000      RUN
% OXYGEN?
       12.2000      RUN
% CO ?
        0.0000      RUN
MOL WT OTHER?
                    RUN
MWd =29.72
MW WET=29.06
SQRT PSTS ?
        3.5733      RUN
TIME MIN ?
       60.0000      RUN
NOZZLE DIA ?
         .4960      RUN
STK DIA INCH ?
       66.0000      RUN
* VOL MTR STD = 30.528
  STK PRES ABS = 29.07
  VOL HOH GAS = 1.81
  % MOISTURE = 5.59
  MOL DRY GAS = 0.941
  % NITROGEN = 80.10
  MOL WT DRY = 29.72
  MOL WT WET = 29.06
  VELOCITY FPS = 8.83
  STACK AREA = 23.76
  STACK ACFM = 12,583.
* STACK DSCFM = 8,872.
  % ISOKINETIC = 101.60


END OF FIELD DATA
```

```
XROM "METH 5"
RUN NUMBER
THREE, BOILER 3
 13 FEB 92
                    RUN
METER BOX Y?
        1.0040      RUN
DELTA H?
        1.2900      RUN
BAR PRESS ?
       29.0830      RUN
METER VOL ?
       35.3790      RUN
MTR TEMP F?
       51.0000      RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
        0.0000      RUN
STATIC HOH IN ?
        -.1250      RUN
STACK TEMP.
      227.0000      RUN
ML. WATER ?
       33.7000      RUN
IMP. % HOH = 4.2

% HOH=4.2
% CO2
        7.0000      RUN
% OXYGEN?
       13.0000      RUN
% CO ?
        0.0000      RUN
MOL WT OTHER?
MWd =29.64          RUN
MW WET=29.15


SQRT PSTS ?
        4.3341      RUN
TIME MIN ?
       60.0000      RUN
NOZZLE DIA ?
         .4960      RUN
STK DIA INCH ?
       66.0000      RUN

* VOL MTR STD = 35.792
  STK PRES ABS = 29.07
  VOL HOH GAS = 1.59
  % MOISTURE = 4.24
  MOL DRY GAS = 0.958
  % NITROGEN = 80.00
  MOL WT DRY = 29.64
  MOL WT WET = 29.15
  VELOCITY FPS = 10.69
  STACK AREA = 23.76
  STACK ACFM = 15,241.
* STACK DSCFM = 10,899.
  % ISOKINETIC = 96.96
END OF FIELD DATA
```

```
XROM "MASSFLO"

RUN NUMBER
          1.0000    RUN

VOL MTR STD ?
         36.8910    RUN
STACK DSCFM ?
     10,995.0000    RUN
FRONT 1/2 MG ?
        422.1000    RUN
BACK 1/2 MG ?
                    RUN


F  GR/DSCF = 0.1766
F  MG/MMM = 404.0563
F  LB/HR = 16.6406
F  KG/HR = 7.5482
```

```
XROM "MASSFLO"

RUN NUMBER
          2.0000    RUN

VOL MTR STD ?
         30.5230    RUN
STACK DSCFM ?
      8,872.0000    RUN
FRONT 1/2 MG ?
        309.1000    RUN
BACK 1/2 MG ?
                    RUN


F  GR/DSCF = 0.1563
F  MG/MMM = 357.5569
F  LB/HR = 11.8823
F  KG/HR = 5.3898
```

```
XROM "MASSFLO"

RUN NUMBER
          3.0000    RUN

VOL MTR STD ?
         35.7920    RUN
STACK DSCFM ?
     10,899.0000    RUN
FRONT 1/2 MG ?
        319.3000    RUN
BACK 1/2 MG ?
                    RUN


F  GR/DSCF = 0.1377
F  MG/MMM = 315.0358
F  LB/HR = 12.8611
F  KG/HR = 5.8338
```

```
          XROM "METH 5"
RUN NUMBER
BOILER 4, RUN 1
                    RUN
METER BOX Y?
          1.0040    RUN
DELTA H?
          1.4800    RUN
BAR PRESS ?
         30.2300    RUN
METER VOL ?
         37.6690    RUN
MTR TEMP F?
         47.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.1080    RUN
STACK TEMP.
        260.0000    RUN
ML. WATER ?
         47.9000    RUN
IMP. % HOH = 5.3

% HOH=5.3
% CO2?
          9.7000    RUN
% OXYGEN?
         11.2000    RUN
% CO ?
                    RUN
MOL WT OTHER?
MWd =29.84          RUN
MW WET=29.21
SQRT PSTS ?
          4.9146    RUN
TIME MIN ?
         60.0000    RUN
NOZZLE DIA ?
           .4960    RUN
STK DIA INCH ?
         66.0000    RUN

* VOL MTR STD = 39.959
  STK PRES ABS = 30.22
  VOL HOH GAS = 2.25
  % MOISTURE = 5.34
  MOL DRY GAS = 0.947
  % NITROGEN = 80.10
  MOL WT DRY = 29.84
  MOL WT WET = 29.21
  VELOCITY FPS = 11.88
  STACK AREA = 23.76
  STACK ACFM = 16,933.
* STACK DSCFM = 11,873.
  % ISOKINETIC =  99.37

END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
BOILER 4, RUN 2
                    RUN
METER BOX Y?
          1.0040    RUN
DELTA H?
          1.3500    RUN
BAR PRESS ?
         30.2300    RUN
METER VOL ?
         36.0670    RUN
MTR TEMP F?
         49.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.1080    RUN
STACK TEMP.
        267.0000    RUN
ML. WATER ?
         53.4000    RUN
IMP. % HOH = 6.2

% HOH=6.2
% CO2?
          9.2000    RUN
% OXYGEN?
         10.7000    RUN
% CO ?
                    RUN
MOL WT OTHER?
MWd =29.90          RUN
MW WET=29.16
SQRT PSTS ?
          4.7303    RUN
TIME MIN ?
         60.0000    RUN
NOZZLE DIA ?
           .4960    RUN
STK DIA INCH ?
         66.0000    RUN

* VOL MTR STD = 38.077
  STK PRES ABS = 30.22
  VOL HOH GAS = 2.51
  % MOISTURE = 6.19
  MOL DRY GAS = 0.938
  % NITROGEN = 80.10
  MOL WT DRY = 29.90
  MOL WT WET = 29.16
  VELOCITY FPS = 11.44
  STACK AREA = 23.76
  STACK ACFM = 16,31?.
* STACK DSCFM = 11,226.
  % ISOKINETIC =  100.15

END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
BOILER 4, RUN 3
                    RUN
METER BOX Y?
          1.0040    RUN
DELTA H?
          1.3900    RUN
BAR PRESS ?
         30.2300    RUN
METER VOL ?
         36.3280    RUN
MTR TEMP F?
         45.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.1080    RUN
STACK TEMP.
        276.0000    RUN
ML. WATER ?
         54.9000    RUN
IMP. % HOH = 6.3

% HOH=6.3
% CO2?
          8.9000    RUN
% OXYGEN?
         10.9000    RUN
% CO ?
                    RUN
MOL WT OTHER?
MWd =29.86          RUN
MW WET=29.12
SQRT PSTS ?
          4.8359    RUN
TIME MIN ?
         60.0000    RUN
NOZZLE DIA ?
           .4960    RUN
STK DIA INCH ?
         66.0000    RUN

* VOL MTR STD = 38.660
  STK PRES ABS = 30.22
  VOL HOH GAS = 2.58
  % MOISTURE = 6.27
  MOL DRY GAS = 0.937
  % NITROGEN = 80.20
  MOL WT DRY = 29.86
  MOL WT WET = 29.12
  VELOCITY FPS = 11.71
  STACK AREA = 23.76
  STACK ACFM = 16,688.
* STACK DSCFM = 11,335.
  % ISOKINETIC = 100.71

END OF FIELD DATA
```

XROM "MASSFLO"

RUN NUMBER
BOILER 4, RUN 1 F

VOL MTR STD ?
[illegible] RUN

STACK DSCFM ?
11,673.00 RUN

FRONT 1/2 MG ?
456.50 RUN

BACK 1/2 MG ?
0.00 F

F GR/DSCF = 0.[illegible]
F MG/MMM = 403.47
F LB/HR = 17.94
F KG/HR = 8.14

XROM "MASSFLO"

RUN NUMBER
BOILER 4, RUN 2

RUN

VOL MTR STD ?
36.077 RUN

STACK DSCFM ?
11,226.00 RUN

FRONT 1/2 MG ?
384.60 RUN

BACK 1/2 MG ?
0.60 RUN

F GR/DSCF = 0.16
F MG/MMM = 356.69
F LB/HR = 15.00
F KG/HR = 6.80

XROM "MASSFLO"

RUN NUMBER
BOILER 4, RUN 3 RUN

VOL MTR STD ?
38.66 RUN

STACK DSCFM ?
11,335.00 RUN

FRONT 1/2 MG ?
336.90 RUN

BACK 1/2 MG ?
0.00 RUN

F GR/DSCF = 0.13
F MG/MMM = 307.74
F LB/HR = 13.07
F KG/HR = 5.93

```
        XROM "METH 5"
RUN NUMBER
ONE, BOILER 5, 20 FEB 92
                        RUN
METER BOX Y?
          1.0040        RUN
DELTA H?
           .9800        RUN
BAR PRESS ?
         29.3390        RUN
METER VOL ?
         30.8500        RUN
MTR TEMP F?
         48.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
          0.0000        RUN
STATIC HOH IN ?
          -.1350        RUN
STACK TEMP.
        263.0000        RUN
ML. WATER ?
         44.7000        RUN
IMP. % HOH = 6.2

% HOH=6.2
% CO2?
         10.1000        RUN
% OXYGEN?
          9.8000        RUN
% CO ?
          0.0000        RUN
MOL WT OTHER?
MWd =30.01              RUN
MW WET=29.26
SQRT PSTS ?
          6.2502        RUN
TIME MIN ?
         60.0000        RUN
NOZZLE DIA ?
           .3780        RUN
STK DIA INCH ?
         66.0000        RUN

* VOL MTR STD = 31.645
  STK PRES ABS = 29.33
  VOL HOH GAS = 2.10
  % MOISTURE = 6.22
  MOL DRY GAS = 0.938
  % NITROGEN = 80.10
  MOL WT DRY = 30.01
  MOL WT WET = 29.26
  VELOCITY FPS = 16.79
  STACK AREA = 23.76
  STACK ACFM = 23,938.
* STACK DSCFM = 16,068.
  % ISOKINETIC =  100.13

END OF FIELD DATA
```

```
        XROM "METH 5"
RUN NUMBER
TWO, BOILER 5, 20 FEB 92
                        RUN
METER BOX Y?
          1.0040        RUN
DELTA H?
           .9700        RUN
BAR PRESS ?
         29.3390        RUN
METER VOL ?
         30.8640        RUN
MTR TEMP F?
         47.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
          0.0000        RUN
STATIC HOH IN ?
          -.1350        RUN
STACK TEMP.
        260.0000        RUN
ML. WATER ?
         45.4000        RUN
IMP. % HOH = 6.3

% HOH=6.3
% CO2?
          9.8000        RUN
% OXYGEN?
         10.2000        RUN
% CO ?
          0.0000        RUN
MOL WT OTHER?
MWd =29.98              RUN
MW WET=29.22
SQRT PSTS ?
          6.8100        RUN
TIME MIN ?
         60.0000        RUN
NOZZLE DIA ?
           .3780        RUN
STK DIA INCH ?
         66.0000        RUN

* VOL MTR STD = 31.721
  STK PRES ABS = 29.33
  VOL HOH GAS = 2.14
  % MOISTURE = 6.31
  MOL DRY GAS = 0.937
  % NITROGEN = 80.00
  MOL WT DRY = 29.98
  MOL WT WET = 29.22
  VELOCITY FPS = 16.71
  STACK AREA = 23.76
  STACK ACFM = 23,813.
* STACK DSCFM = 16,038.
  % ISOKINETIC =  100.56

END OF FIELD DATA
```

```
        XROM "METH 5"
RUN NUMBER
THREE, BOILER 5
 20 FEB 92
                        RUN
METER BOX Y?
          1.0040        RUN
DELTA H?
           .9600        RUN
BAR PRESS ?
         29.3390        RUN
METER VOL ?
         30.7630        RUN
MTR TEMP F?
         46.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
          0.0000        RUN
STATIC HOH IN ?
          -.1350        RUN
STACK TEMP.
        259.0000        RUN
ML. WATER ?
         40.9000        RUN
IMP. % HOH = 5.7

% HOH=5.7
% CO2?
          9.1000        RUN
% OXYGEN?
         10.8000        RUN
% CO ?
          0.0000        RUN
MOL WT OTHER?
MWd =29.89              RUN
MW WET=29.21
SQRT PSTS ?
          6.7816        RUN
TIME MIN ?
         60.0000        RUN
NOZZLE DIA ?
           .3780        RUN
STK DIA INCH ?
         66.0000        RUN

* VOL MTR STD = 31.684
  STK PRES ABS = 29.33
  VOL HOH GAS = 1.93
  % MOISTURE = 5.73
  MOL DRY GAS = 0.943
  % NITROGEN = 80.10
  MOL WT DRY = 29.89
  MOL WT WET = 29.21
  VELOCITY FPS = 16.64
  STACK AREA = 23.76
  STACK ACFM = 23,719.
* STACK DSCFM = 16,096.
  % ISOKINETIC =  100.08

END OF FIELD DATA
```

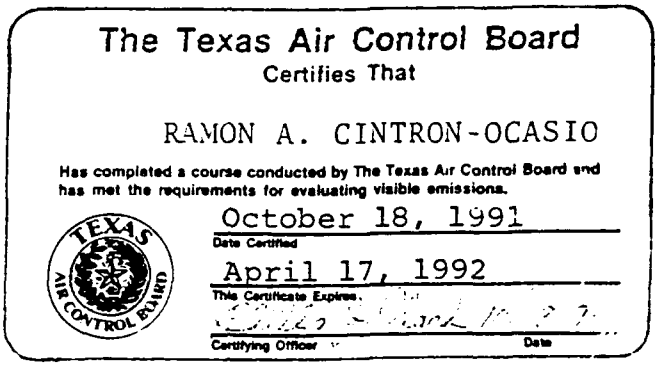
```
        XFOM "MASSFLO

RUN NUMBER
          1.0000    RUN

VOL MTR STD ?
         31.6450    RUN
STACK DSCFM ?
      16,068.0000   RUN
FRONT 1/2 MG ?
        643.0000    RUN
BACK 1/2 MG ?
                    RUN

F  GR/DSCF = 0.3140
F  MG/MMM = 718.4438
F  LB/HR = 43.2400
F  KG/HR = 19.6177
```

```
        XFOM "MASSFLO

RUN NUMBER
          2.0000    RUN

VOL MTR STD ?
         31.7210    RUN
STACK DSCFM ?
      16,038.0000   RUN
FRONT 1/2 MG ?
        769.0000    RUN
BACK 1/2 MG ?
                    RUN

F  GR/DSCF = 0.3741
F  MG/MMM = 856.1037
F  LB/HR = 51.4230
F  KG/HR = 23.3282
```

```
        XFOM "MASSFLO

RUN NUMBER
          3.0000    RUN

VOL MTR STD ?
         31.6840    RUN
STACK DSCFM ?
      16,096.0000   RUN
FRONT 1/2 MG ?
        732.2000    RUN
BACK 1/2 MG ?
                    RUN

F  GR/DSCF = 0.3566
F  MG/MMM = 816.0977
F  LB/HR = 49.2024
F  KG/HR = 22.3182
```

APPENDIX L

EPA Method 9 Certification



The Texas Air Control Board

Certifies That

RAMON A. CINTRON-OCASIO

Has completed a course conducted by The Texas Air Control Board and has met the requirements for evaluating visible emissions.

October 18, 1991
Date Certified

April 17, 1992
This Certificate Expires

Certifying Officer — Date

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