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ARMSTRONG LABORATORY

SOURCE EMISSION TESTING OF THE MEDICAL WASTE INCINERATOR, ANDREWS AIR FORCE BASE, MARYLAND

Robert J. O'Brien, Captain, USAF, BSC

OCCUPATIONAL AND ENVIRONMENTAL
HEALTH DIRECTORATE
Brooks Air Force Base, TX 78235-5114

December 1992

Final Technical Report for Period 8-9 July 1992

AIR FORCE MATERIEL COMMAND
BROOKS AIR FORCE BASE, TEXAS

NOTICES

Robert J. O'Brien

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13. ABSTRACT *(Maximum 200 words)*
Source emission testing for particulate matter and hydrogen chloride was conducted on the medical waste incinerator located at Bldg 1055, Andrews AFB MD. Compliance standards are found in Temporary Operating Permit No. 16-0655-2-0116N, issued by the State of Maryland on 20 October 1991. Test results indicate incinerator emissions are above the state standard for particulate matter and below the state standard for hydrogen chloride. Recommendations are made to reduce particulate emissions and to retest.

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SOURCE EMISSION TESTING OF THE MEDICAL WASTE INCINERATOR, ANDREWS AIR FORCE BASE, MARYLAND

INTRODUCTION

Background

On 8-9 Jul 92, source compliance testing for particulate matter and hydrogen chloride (HCl) emissions was conducted on the scrubber exhaust system of the medical waste incinerator (Bldg 1055) located adjacent to Malcolm Grow Medical Center, Andrews Air Force Base (AFB), MD. Testing was performed by the Air Quality Function of Armstrong Laboratory. This survey was requested by the Malcolm Grow Medical Center Facility Management Office (MGMC/SGG) to satisfy the State of Maryland operating permit requirements (Appendix A). Personnel involved with on-site testing are listed in Appendix B.

Site Description

The Andrews AFB medical waste incinerator is a Joy Energy Systems Model 480-E (Fig. 1). This incinerator consists of both a primary (lower) and secondary (upper) chamber. The primary chamber is equipped with an on/off natural gas burner and a manually adjusted underfire air blower. The secondary chamber is equipped with a modulating (high/low) natural gas burner. Additional combustion air required for the secondary chamber is supplied by a modulating flameport air blower, located between the primary and secondary chambers. The secondary chamber temperature serves as the control for both flameport air and the upper burner, while the primary chamber temperature controls the lower burner and underfire air. Loading of waste into the primary chamber is accomplished with the use of a hopper/hydraulic ram mechanical waste feed system. Continuous monitoring equipment for the incinerator consists of temperature-measuring thermocouples in both chambers and a draft pressure gauge in the primary chamber. The incinerator is currently utilized to burn Type 0 and infectious/pathological waste and has a design (rated) capacity of 385 pounds per hour (lb/hr) for this waste type.

To control the major pollutants (e.g., acid gases, particulate matter, etc.) found in the incinerator exhaust, the incinerator is equipped with an Airpol high energy venturi scrubber (Fig. 2). Absorption of hydrogen chloride and other acid gases is enhanced by the addition of caustic sodium hydroxide (NaOH) to the scrubber water. The scrubber liquid is recirculated through the venturi system with a specified amount bled off and replaced with fresh make-up liquid. An induced draft fan, located between the venturi and the stack, draws the incinerator exhaust through the scrubber system and forces it up the stack. A stainless steel impact (louver/baffle type) mist eliminator, located downstream of the venturi, helps control the amount of entrained water droplets carried over to the fan/stack. Continuous monitoring equipment for the venturi scrubber includes a draft gauge for measuring pressure drop, a thermocouple for measuring inlet temperature, a flow meter for measuring scrubber liquid flow rate, and a meter for measuring the pH of the liquid.

A schematic flow diagram of the entire incinerator/scrubber system is shown in Figure 3.

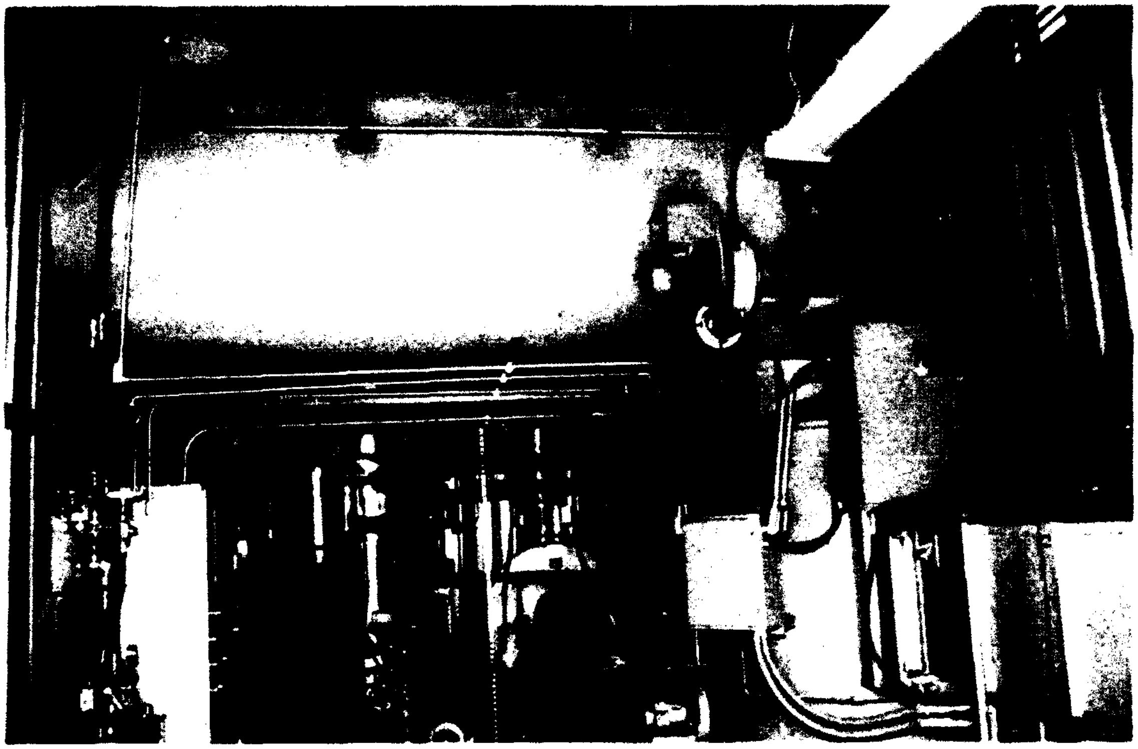

Figure 1. View of Medical Waste Incinerator.

Applicable Standards and Guidelines

The emission standards and operating requirements for the incinerator are stated in Temporary Operating Permit No. 16-0655-2-0116N, issued by the State of Maryland on 20 Oct 91. Although this permit has a 28 Feb 92 expiration date, a verbal extension was granted by the State of Maryland in Dec 91 to allow for the correction of mechanical problems prior to stack testing. The entire permit is found in Appendix C and the major provisions are summarized below:

1. Each waste charge shall be timed and weighed to monitor the hourly burn rate.

2. The weight of each charge may not exceed one-fifth of the rated hourly burn. The time interval between two succeeding charges may not be less than the time (T) in minutes determined as follows:

$$T = 60 \times [\text{charge} / (\text{hour burn rate})]$$

3. Auxiliary burners shall be used to raise the temperature in the primary chamber to be greater than 1400 degrees Fahrenheit (°F) and the secondary chamber to be greater than 1700 °F prior to charging any infectious waste. The temperature in the secondary chamber shall be at least 150 °F higher than the primary chamber.

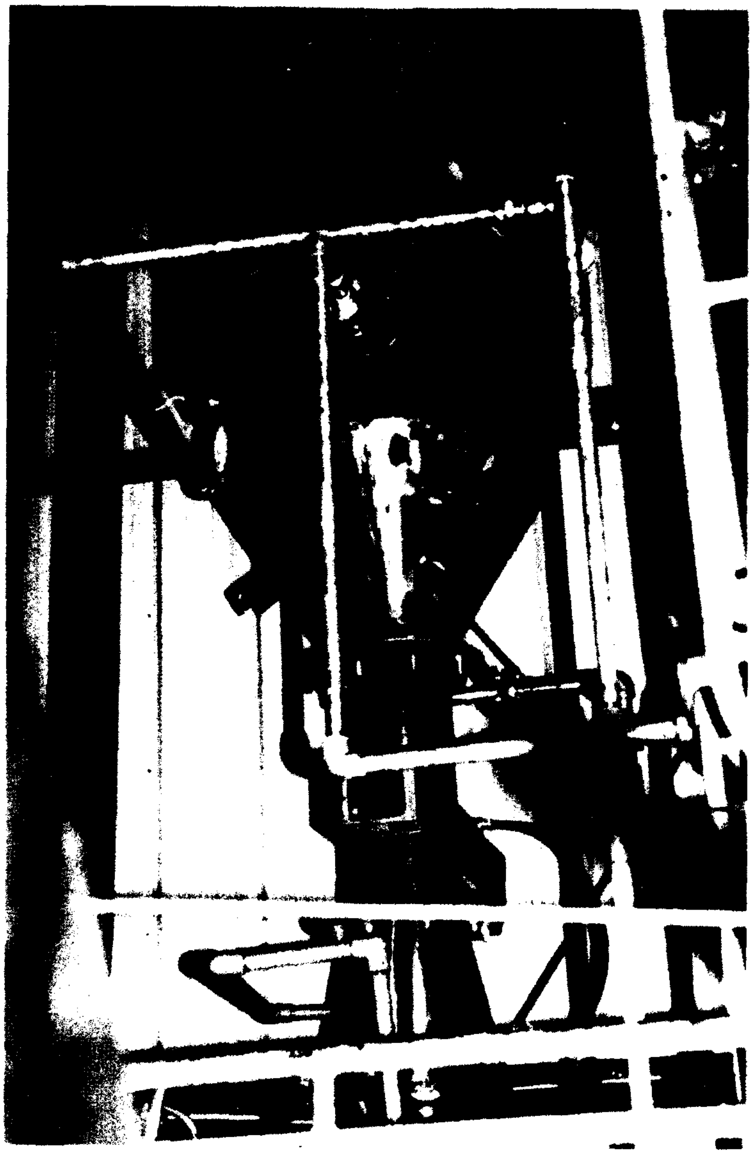

Figure 2. View of High Energy Venturi Scrubber.

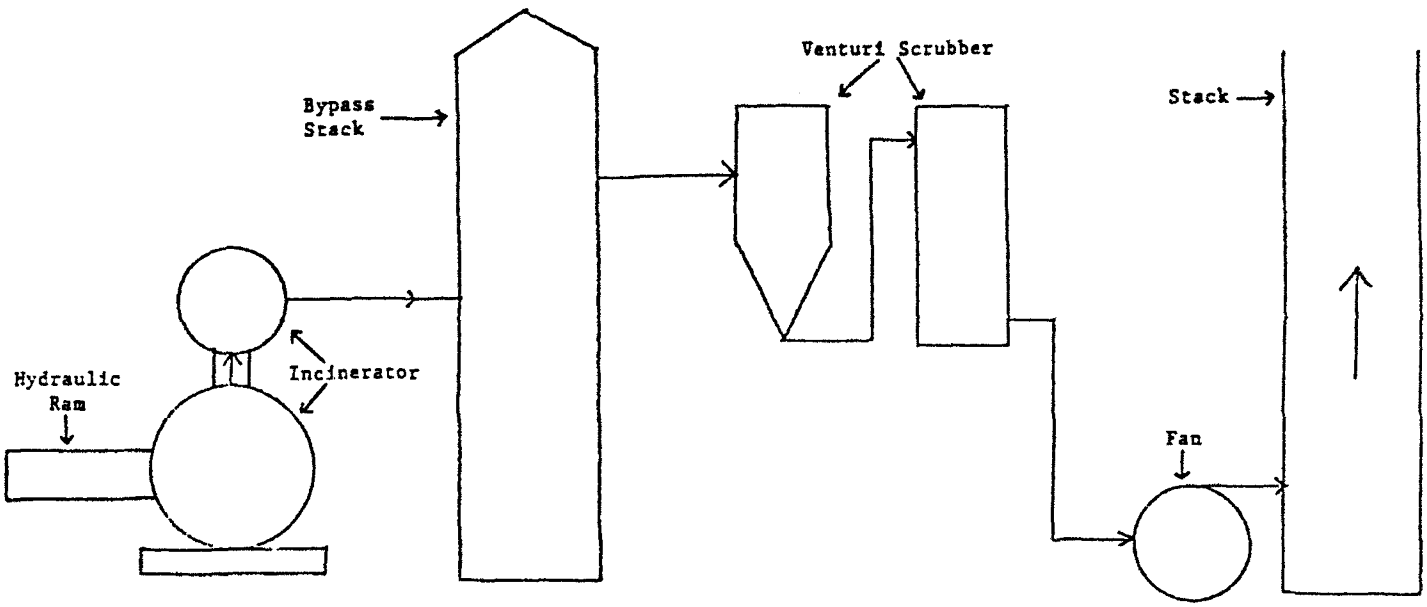

Figure 3. Schematic Flow Diagram of the Incinerator/Scrubber System.

4. Before the temporary permit to operate expires, stack emission tests shall be conducted to demonstrate compliance with the following:

a. At least a 90% reduction of HCl gas unless the HCl concentration in the exhaust gas is less than 50 parts per million (ppm) by volume corrected to 7% oxygen (O_2).

b. Particulate matter emissions standard of 0.03 grains per standard cubic foot of dry gas corrected to 12% carbon dioxide (CO_2).

5. The following parameters shall be continuously monitored and recorded:

a. Temperatures at the outlets of the primary and secondary chambers of the incinerator and the inlets of the venturi caustic scrubber; and

b. The pH and flow rate of the scrubbing solution.

METHODS AND MATERIALS

Sampling and analysis were conducted in accordance with Environmental Protection Agency (EPA) Methods 1 through 5 and 26. These methods are found in Appendix A to Title 40, Code of Federal Regulations, Part 60 (1).

The incinerator/scrubber system has a circular stack with three existing sampling ports, two of which are accessible for sampling. The port holes are located on the same horizontal plane, 90 degrees apart. During sampling, the port holes were 8.33 ft downstream from the nearest flow disturbance. Although not measured, the port holes were estimated to be greater than 12 ft upstream of the nearest flow disturbance. With an inside diameter of 1.29 ft, the sampling points during testing were between six and seven duct diameters downstream and greater than nine duct diameters upstream of the nearest flow disturbance. Based on this information and the type of sampling required, a total of 16 traverse points were used to collect a representative sample. Three sampling runs, 60 minutes each, were conducted and the results averaged to determine final emission values.

Prior to the first sample run on the stack, cyclonic flow was determined by using the Type S pitot tube and measuring the stack gas rotational angle at each point along the center traverse. Flow conditions are considered acceptable when the arithmetic mean average of the rotational angles is 20 degrees or less. As a precautionary measure, a flow straightening vane was installed in the stack prior to the cyclonic flow check. Measurements taken with the straightening vane in place showed the stack air flow to be within acceptable limits. A preliminary velocity pressure traverse, using the same Type S pitot tube, was also accomplished at this time.

A grab sample for Orsat analysis (measures O_2 and CO_2 for stack gas molecular weight determination) was taken during each sampling run. Orsat sampling and analysis equipment are shown in Figures 4 and 5. Flue gas moisture content, which is also required for determination of flue gas molecular weight, was obtained during particulate/chloride sampling.

Particulate and chloride samples were collected using the sampling train shown in Figure 6. The train consisted of a button-hook probe nozzle, heated glass-lined probe, heated glass-fiber filter, impingers, and a pumping and metering device. The probe nozzle was sized prior to the sample run so that the gas stream could be sampled isokinetically (i.e., the velocity at the nozzle tip was the same as the stack gas velocity at each point sampled). Flue gas velocity pressure was measured at the nozzle tip using a Type S pitot tube connected to a 10-in. inclined-vertical manometer. Type K thermocouples were used to measure flue gas as well as sampling train temperatures. The probe liner was heated to minimize moisture condensation. The heated filter was used to collect particulates. The impinger train consisted of five glass impingers in series and was used as both a condenser (to collect stack gas moisture) and an absorber (to collect chlorides for subsequent hydrogen chloride determination). The first, second, fourth, and fifth impingers were of modified Greenburg-Smith design while the third impinger was a standard Greenburg-Smith type. The contents of each impinger were adjusted for HCl sampling in accordance with EPA Method 26. The first impinger was empty, the second and third impingers each contained 100 milliters (ml) of 0.1 N sulfuric acid (H_2SO_4), the fourth impinger contained 100 ml of 0.1 N sodium hydroxide (NaOH), and the fifth impinger contained 200 grams (g) of silica gel. Although not shown in Figure 6, the first impinger was added as a "knockout" impinger because of the hign moisture content of the stack gas. The pumping and metering system was used to control and monitor the sample gas flow rate. Equipment calibration data are presented in Appendix D (2).

Following sampling and volumetric determination, the contents of impingers 1, 2, and 3 (along with the glassware rinse water) were combined and submitted to the Armstrong Laboratory Analytical Division for chloride analysis by ion chromatography. The results of this analysis are found in Appendix E. Example calculations for HCl determination are found in Appendix F.

Front half particulate matter (material collected on sampling train surfaces up to and including the filter) was determined for compliance purposes according to the procedures specified in EPA Method 5. Field data from particulate sampling is presented in Appendix G. Emission calculations were accomplished using the "Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators" developed by the EPA Office of Air Quality Planning and Standards (3). Resulting emission calculations are presented in Appendix F.

Visible emission (opacity) readings were performed by State of Maryland regulatory personnel.

RESULTS AND DISCUSSION

All three valid sample runs were obtained on 9 Jul 92. A sample run performed on 8 Jul 92 was disregarded due to liquid transfer within the impinger train, a result of high moisture levels in the stack gas. To compensate for the high moisture content, a "knockout" impinger was added to the impinger train and the amount of liquid in impingers 2, 3, and 4 was lowered from 200 ml to 100 ml.

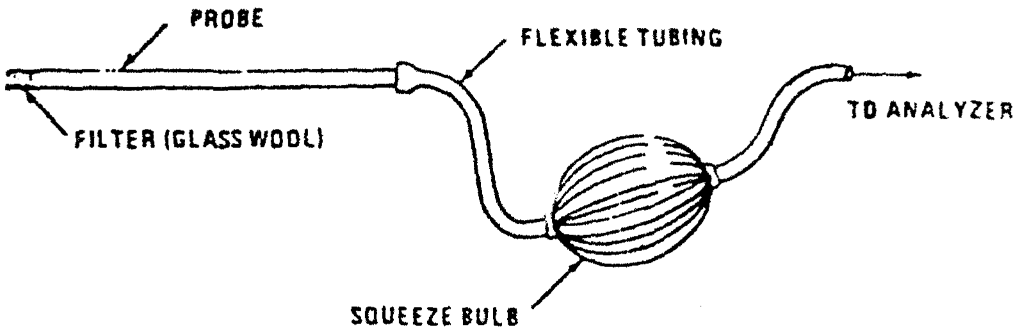

Figure 4. Orsat Grab Sampling Train.

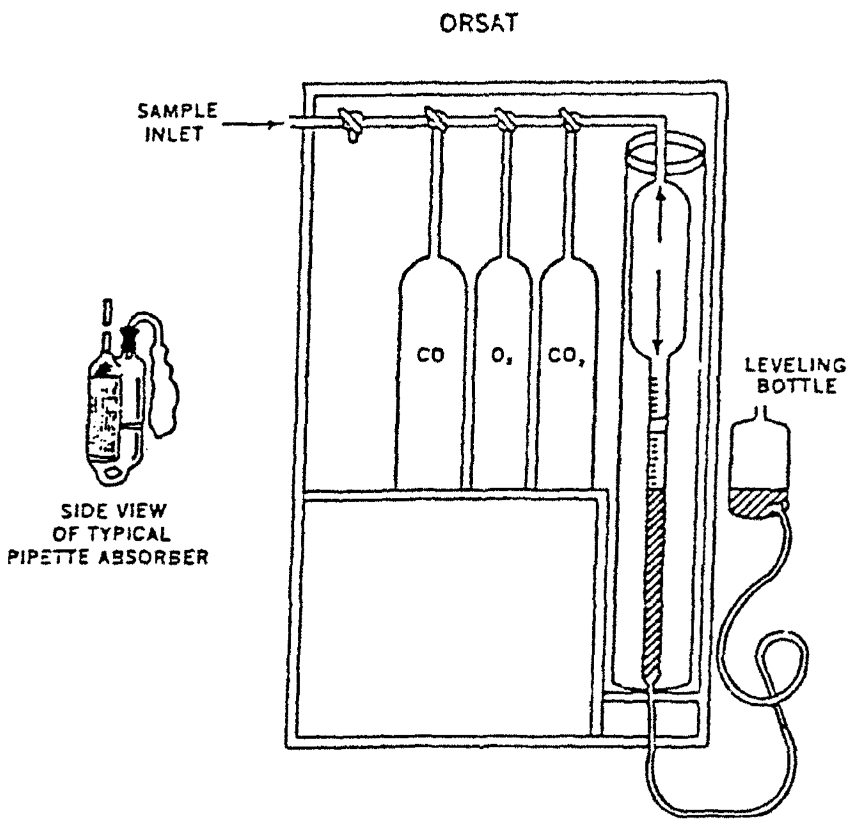

Figure 5. Orsat Analysis Apparatus.

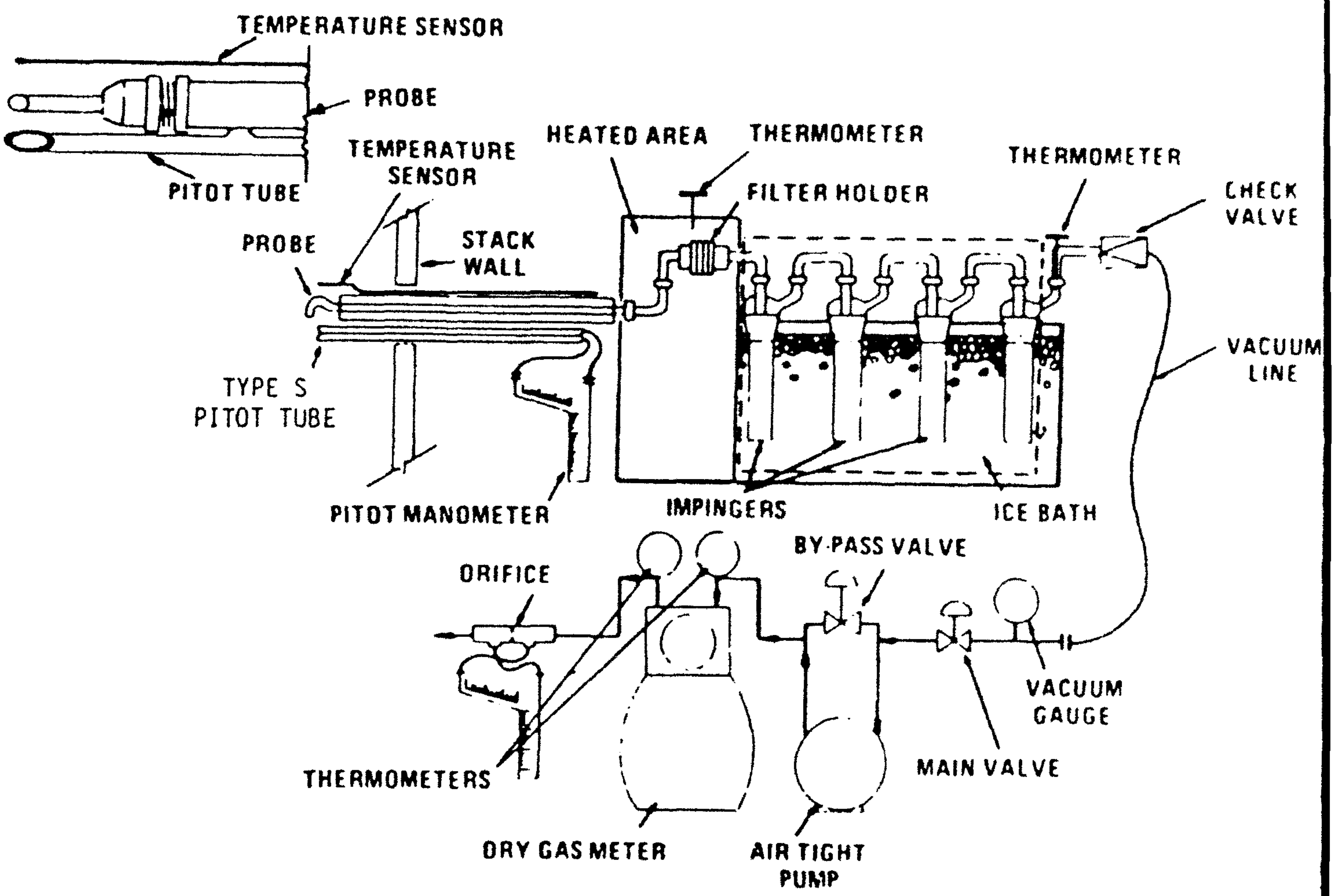

Figure 6. Particulate/Chloride Sampling Train.

Results of particulate sampling are shown in Table 1. The particulate emission rates are reported as grains per dry standard cubic foot of stack gas (gr/dscf), corrected to 12% CO_2. The final values are 0.032 gr/dscf, 0.053 gr/dscf, and 0.056 gr/dscf for sampling runs 1, 2, and 3, respectively. The average for all three runs is 0.047 gr/dscf.

Results of HCl sampling are shown in Table 2. The HCl concentrations are reported as parts per million (ppm) by volume, corrected to 7% O_2. The final values are 2.95 ppm, 9.98 ppm, and 8.99 ppm for sampling runs 1, 2, and 3, respectively. The average for all three runs is 7.31 ppm.

The time and amount of each waste charge, along with the primary and secondary chamber temperatures at the time of waste charging, are recorded in a log by the incinerator operator. The log entries for 9 Jul 92 are found in Appendix H and summarized in Table 3. The burn rate during sampling runs 1, 2, and 3 was 362 lb/hr, 339 lb/hr, and 341 lb/hr, respectively. The average burn rate for all three runs was 347 lb/hr.

As required by the temporary operating permit, the temperatures at the outlets of the primary and secondary chambers are continuously monitored and recorded on a strip chart. A second strip chart is used to continuously monitor and record the scrubber operating parameters; including the inlet temperature, pressure drop, and the pH and flow rate of the scrubbing solution. The strip charts for 9 Jul 92 are found in Appendix H. An interpretation of the scrubber strip chart is shown in Table 4.

CONCLUSIONS

The amount of waste loaded during each charge and the time interval between two succeeding charges met the requirements of the temporary operating permit. The average hourly burn rate during the three sampling runs was approximately 10% less than the rated burn rate.

Except for a brief period at the beginning of run 1 in which the secondary chamber fell below 1700 °F, the temperatures in the primary and secondary chambers were above the minimum temperatures required by the permit. However, a majority of the time the difference between the primary and secondary chamber temperatures was less than 150 °F.

The test results show the average particulate emission rate (0.047 gr/dscf) is above the Maryland standard of 0.03 gr/dscf while the average HCl gas concentration (7.31 ppm) is well below the Maryland standard of 50 ppm. The particulate results are surprising, since the filters appeared relatively clean and no visible particulate emissions could be seen coming out of the stack. Although the exact reason(s) for the high particulate emission rate are not known, several possibilities are listed below.

1. During waste charging, smoke and flames could be seen coming out of the incinerator. This emission indicates the primary chamber is operating under positive pressure, usually the result of excessive underfire air and/or too high a primary chamber operating temperature. These conditions typically create a high amount of turbulence which increases the amount of particulate matter entrained in the exhaust gas stream. Additionally, the emission of smoke and flames from the primary chamber poses a potential health and safety threat to nearby personnel.

TABLE 1. Summary of Particulate Emission Results

Run #	Standard/Dry Sampling Gas Volume (dscf)	% CO_2	Particulate Mass Collected (mg)	Particulate Emission Rate (gr/dscf)	Particulate Emission Rate Corrected to 12% CO_2 (gr/dscf)
1	30.975	8.3	44.5	0.022	0.032
2	35.268	6.2	63.1	0.028	0.053
3	37.639	6.7	75.9	0.031	0.056
				Avg = 0.027	Avg = 0.047

Maryland Standard = 0.03

TABLE 2. Summary of Hydrogen Chloride Emission Results

Run #	Standard/Dry Sampling Gas Volume (dscf)	% O_2	Liquid Sample Volume (ml)	Cl^- Concentration in Liquid Sample (µg/ml)	HCl Concentration in Stack Gas Corrected to 7% O_2 (ppm)
1	30.975	8.7	716.0	4.6	2.95
2	35.268	11.7	753.5	12.7	9.98
3	37.639	11.3	800.0	12.0	8.99
					Avg = 7.31

Maryland Standard = 50

Units for Tables 1 & 2

dscf = dry standard cubic foot
ppm = parts per million by volume
gr = grains
mg = milligrams
µg = micrograms
ml = milliliters

TABLE 3. Incinerator Operating Parameters, 9 Jul 92

Time (24 hr)	Weight of Waste Loaded (lb)	Primary Chamber Temperature (°F)	Secondary Chamber Temperature (°F)
		Run # 1	
1024	48	1517	1620
1032	48	1607	1662
1040	44	1509	1734
1048	46	1762	1741
1057	45	1637	1772
1105	44	1608	1769
1114	44	1676	1751
1122	43	1758	1768
	Total = 362	Avg = 1634	Avg = 1727
		Run # 2	
1314	37	1813	1797
1322	44	1782	1834
1330	36	1756	1845
1338	46	1762	1832
1346	41	1713	1878
1354	48	1691	1856
1403	44	1810	1849
1411	43	1731	1878
	Total = 339	Avg = 1757	Avg = 1846
		Run # 3	
1531	40	1920	1805
1539	41	1864	1848
1547	44	1874	1843
1555	43	1905	1825
1604	42	1792	1906
1612	43	1763	1905
1620	46	1778	1903
1628	42	1734	1934
	Total = 341	Avg = 1829	Avg = 1871

Units
24 hr = 24-hour clock (i.e., military time)
lb = pounds
°F = degrees Fahrenheit

TABLE 4. Scrubber Operating Parameters, 9 Jul 92

Time (24 hr)	Scrubber Inlet Temp (°F)	Scrubber Pressure Drop (in. w.c.)	Scrubber Flow Rate (GPM)	Scrubber pH
		Run # 1		
1026	1010	66	125	8.8
1031	1060	66	125	8.7
1036	1060	51	125	9.3
1041	1120	65	125	9.3
1046	1120	64	125	8.9
1051	1140	63	125	8.8
1101	1120	43	125	8.3
1106	1170	64	125	9.1
1111	1160	64	125	9.3
1116	1190	65	125	9.3
1121	1200	63	125	7.3
1126	1170	65	125	8.5
Avg =	1130	62	125	8.8
		Run # 2		
1311	1230	61	125	9.2
1316	1250	62	125	7.3
1321	1260	61	125	7.1
1326	1260	54	125	7.5
1331	1260	61	125	6.8
1336	1270	60	125	6.7
1346	1290	60	125	6.6
1351	1290	58	125	6.7
1356	1290	60	125	6.6
1401	1290	58	125	6.6
1406	1290	54	125	6.6
1411	1310	57	125	6.8
Avg =	1270	59	125	7.0
		Run # 3		
1531	1290	59	125	6.7
1536	1320	57	125	6.6
1541	1290	61	125	6.7
1546	1280	60	125	6.9
1551	1260	54	125	8.7
1556	1320	57	125	9.2
1601	1340	56	125	9.4
1606	1340	57	125	9.4
1611	1360	55	125	7.2
1616	1330	44	125	6.9
1621	1370	56	125	6.9
1626	1370	55	125	6.8
Avg =	1320	56	125	7.6

Units
in. w.c. = inches water column
24 hr = 24-hour clock (i.e., military time)
GPM = gallons per minute
°F = degrees Fahrenheit

2. The density and turbidity (amount of dissolved and suspended solids) of the scrubber liquid may be too high. Excessive solids (e.g., particulate matter and salts) can result in erosion and pluggage of scrubber equipment such as spray nozzles. In addition, this condition also increases the amount of solids entrained in water droplets being carried out the stack.

3. The use of a caustic scrubber liquid may create scaling inside the scrubber system. This scaling may contribute to the solids content of the scrubber liquid and possibly cause plugging of equipment.

4. The scrubber system uses a stainless steel impact (louver/baffle type) mist eliminator. Although this type is extremely efficient for water droplets above 100 micrometers (μm), it is not very effective for smaller droplets.

5. The gas flow rate and/or the liquid-to-gas ratio in the scrubber may not be properly set for effective particulate matter capture.

RECOMMENDATIONS

The following recommendations are provided to help locate and correct possible problems with the incinerator/scrubber system:

1. The primary chamber temperature and underfire air should be adjusted to ensure a negative pressure within the chamber. The EPA recommends a draft of -0.05 to -0.1 inches water column (in. w.c.).

2. A 150 °F difference in primary and secondary temperatures must be maintained. If possible, the primary chamber temperature should be kept between 1400 and 1600 °F.

3. The density and turbidity of the scrubber liquid should be checked. If a high solids content exists, then the bleed rate should be increased to lower the solids to an optimum level.

4. The scrubber system should be inspected to ensure that no scaling, corrosion, erosion, or plugging of equipment has occurred.

5. Replace the current louver/baffle type mist eliminator with a filtering mesh pad type. The mesh pad is much more efficient for controlling smaller droplets (e.g., droplets 5 to 100 μm). Ensure that a differential pressure gauge is used with any mesh pad mist eliminator.

6. The gas flow rate and liquid-to-gas ratio in the scrubber should be checked and optimally set to obtain maximum particulate capture efficiency.

7. Install oxygen sensors in both the primary and secondary chambers. This installation will help ensure the proper amount of combustion air is supplied. The EPA recommends operating the primary chamber under slightly starved air conditions (approximately 80% of stoichiometric) and operating the secondary chamber under excess air conditions (140 to 200% excess air or 12 to 14% O_2).

8. The strip-chart recorder for the primary and secondary chamber temperatures is extremely hard to interpret. Replace the current strip-chart recorder with one that has a degrees Fahrenheit scale. In addition, the pens for both chambers should be set for the same time.

The medical waste incinerator will need to be retested following your evaluation and implementation of corrective measures. Armstrong Laboratory will remain active in supporting the base's present and future needs.

REFERENCES

1. Code of Federal Regulations, Title 40, Parts 53-60, The Office of the Federal Register National Archives and Records Service, General Services Administration, Washington DC, July 1991.

2. Quality Assurance Handbook for Air Pollution Measurement Systems - Volume III, Stationary Source Specific Methods, U.S. Environmental Protection Agency, EPA-600/4-77-027-b, Research Triangle Park, North Carolina, December 1984.

3. Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators, U.S. Environmental Protection Agency, EPA-340/1-85-018, Research Triangle Park, North Carolina, May 1987.

APPENDIX A

Survey Request Letter

DEPARTMENT OF THE AIR FORCE
MALCOLM GROW USAF MEDICAL CENTER (MAC)
ANDREWS AIR FORCE BASE DC 20331-6300

REPLY TO ATTN OF: MGMC/SGG (Lt Klimek)

19 June 1991

SUBJECT: Request for Incinerator Stack Testing

TO: AL/OEB
Brooks AFB
San Antonio TX 78235

1. The purpose of this letter is to request that your unit perform the required stack testing on our newly installed incinerator/scrubber at Malcolm Grow Medical Center, Andrews AFB, DC. (Reference: telcon, 17 Jun 91 between Maj Rick Cook, AFMLO and Capt Vaughn, your organization.)

2. The stack emission tests conducted must demonstrate compliance with all Maryland and EPA requirements for an operating permit. See attachment 1 for specific requirements and attachment 2 for incinerator type.

3. We are now in the process of hooking up utilities to our incinerator. I anticipate we will be ready for stack emission testing some time after 15 Jul 91. We have requested the State of Maryland provide a temporary operating permit to allow burning to begin on 15 Jul 91.

4. If you have any questions regarding this request, please contact Lt Stephan M. Klimek or myself at DSN 858-6373/6530 or commercial 301-981-6373/6530.

JOHN A. VALENTINO
Facilities Manager

2 Atch
1. Spec for Operating Permit for MD
2. Incinerator Type

APPENDIX B

Personnel Information

PERSONNEL INFORMATION

1. Armstrong Laboratory Air Quality Test Team

   Maj Ramon Cintron-Ocasio, Chief, Air Quality Function
   Capt Robert O'Brien, Air Quality Consultant, Project Officer
   Capt Dennis Sylvia, Air Quality Meteorologist
   MSgt Kurt Jagielski, Air Quality Technician

   AL/OEBE
   2402 E Dr
   Brooks AFB TX 78235-5114

   Phone: DSN 240-3305
   Comm (210) 536-3305

2. Andrews AFB On-Site Representatives

   Mr John Valentino, Facility Manager
   Lt Eric Huweart, Facility Management
   Mr Joseph Thompson, Incinerator Operator

   MGMC/SGG
   Andrews AFB MD 20331-5300

   Phone: DSN 858-6373
   Comm (301) 981-6373

3. Incinerator Contractor Representatives

   Mr Robert Winterbottom
   Mr Harry Nelson

   Robert J. Winterbottom, Inc.
   7101 Redmiles Road
   Laurel, MD 20707

   Phone: (410) 792-2590

4. State of Maryland Representatives

   Mr Donald Chi (Maryland Air Management Administration)
   Mr John Ault (Prince George's County)

APPENDIX C

Temporary Operating Permit

KEEP PERMIT AT SITE

CONTROL NO. 001973

State of Maryland

DEPARTMENT OF THE ENVIRONMENT

AIR MANAGEMENT ADMINISTRATION
2500 BROENING HIGHWAY
BALTIMORE, MARYLAND 21224

William Donald Schaefer
Governor

Robert Perciasepe
[redacted]
Secretary

[ ] Construction Permit [X] Temporary Operating Permit

PERMIT NO. 16-0655-2-0116 N

Date Issued October 20, 1991

PERMIT FEE None

Expiration Date February 28, 1992

LEGAL OWNER & ADDRESS

Malcolm Grow Medical Center
MGMC/SGGP
Andrews Air Force Base MD 20331

SITE

Same
Prince George's County

SOURCE DESCRIPTION

One Joy Energy Systems Model 480-E special medical waste incinerator equipped with a high energy venturi caustic scrubber.

This source is subject to the conditions described on the attached pages.

Page 1 of 6

Program Administrator

Director, Air Management Administration

AMA-1 (Rev. 10-1-89)
MDE 130

(NOT TRANSFERABLE)

MALCOLM GROW MEDICAL CENTER
TEMPORARY OPERATING PERMIT CONDITIONS
PERMIT NUMBER 16-0655-2-0116N

This permit is subject to the following terms and conditions:

Part A - General

1. Except as otherwise provided in the following provisions, the Company's application is incorporated as part of this Permit to Operate. That application consists of the original application received by the Air Management Administration (AMA) on June 26, 1991 and all amendments to the application. If there are any discrepancies between this permit and the application, the conditions on this permit will take precedence.

2. Right of Entry:

   The Secretary, Department of the Environment, or the Secretary's authorized representative, including inspectors of the Air Management Administration, shall be afforded access to the Company's property, at any reasonable time and upon presentation of credentials:

   a. to determine compliance with the permit and applicable regulations;

   b. to sample any waste, air, or discharge into the atmosphere;

   c. to inspect any monitoring equipment required by this permit or applicable regulation;

   d. to have access to and copy any records required to be kept by this permit or by applicable regulations; or

   e. to obtain any photographic documentation or evidence.

(3) This source is subject to all applicable Federal, State, or local requirements, including but not limited to the following regulations:

   (a) COMAR 26.11.02.03, which prohibits the generation of noise such that the sound levels on the receiving property exceed the following values:

SOUND LEVEL dBA

	Receiving Land Use Categories		
	Industrial	Commercial	Residential
day	75	67	65
night	75	62	55

(b) COMAR 26.11.02.03A which requires the Company to obtain a new permit to construct for this source if it is modified in such a manner that there is a change in the quantity, nature, or characteristics of emissions from the source.

(c) COMAR 26.11.02.04A which requires the Company to obtain a permit to operate from the Department before operating the incinerator.

(d) COMAR 26.11.06.08 and 26.11.06.09 which generally prohibit the discharge of emissions beyond the property line in such a manner that a nuisance or air pollution is created.

(e) COMAR 26.11.08.04B which prohibits visible emissions other than water vapor in an uncombined form.

(f) COMAR 26.11.15.05 which requires the Company to use the Best Available Control Technology for Toxics (T-BACT) to minimize toxic air pollutants.

(g) To meet the T-BACT requirements for heavy metals, particulate matter emissions shall not exceed 0.03 grains per standard cubic foot of dry gas corrected to 12% CO_2.

(h) COMAR 26.11.15.06 which prohibits the discharge of toxic air pollutants to the extent that the emissions will unreasonably endanger human health.

(4) Prior to any changes in the quantities and/or types of materials used in this installation, approval shall be obtained from the Department.

(5) Nothing in this permit authorizes the violation of any rule or regulation nor the creation of a nuisance or air pollution.

(6) If any provision of this permit shall be held invalid for any reason, the remaining provisions shall remain in full force and effect, and such invalid provisions shall be considered severed and deleted from the permit.

Part B - Operation

(1) Except as otherwise provided in this part, the special medical waste incinerator shall be operated in accordance with the application and operating procedures as provided by the equipment vendors.

(2) Each charge shall be timed and weighed to monitor the hourly burn rate.

(3) The weight of each charge may not exceed one-fifth of the rated hourly burn. The time interval between two succeeding charges may not be less than the time (T) in minutes determined as follows:

$$T = 60 \times (\text{charge/hour burn rate}).$$

(4) Auxiliary burners shall be used to raise the temperature in the primary chamber to be greater than 1400°F and the secondary chambe to be greater than 1700° prior to charging any infectious waste. The temperature in the secondary chamber shall be at least 150°F higher than that in the primary chamber.

(5) The primary chamber shall be visually monitored hourly to assure that the burnout is complete before ash is removed and new waste is loaded. Ash shall be visually inspected periodically to assure the complete combustion of infectious waste.

(6) The incinerator stack shall be monitored hourly to assure compliance with the requirement of no visible emissions.

(7) The secondary chamber burners shall be operated for at least two hours after the last charge.

(8) The proposed incineration system including a venturi caustic scrubber shall be properly maintained and visually inspected hourly to ensure the integrity and good working condition for each unit operation.

(9) The Company shall use the time period granted for the temporary operating permit to solve operational problems and to demonstrate compliance with all applicable air quality control regulations including stack emission tests.

(10) The Company shall not operate the existing incinerator unless the incinerator is shut down for repair and maintenance.

(11) Additional and modified requirements may be imposed by the Department as part of the annual Permit to Operate required by COMAR 26.11.02.04A.

(12) The incinerator shall not be operated prior to installation of temperature recorders.

PART C - TESTING, MONITORING, REPORTING AND RECORDKEEPING

(1) The Company shall report periods of excess emissions to the Department as required by COMAR 26.11.01.07.

(2) Before the temporary permit to operate expires, stack emission tests shall be conducted to demonstrate compliance with the following:

(a) At least a 90 percent reduction of hydrogen chloride gas (HCl) unless the HCl concentration in the exhaust gas is less than 50 ppm by volume corrected to 7% O_2.

(b) Particulate matter emissions standard of 0.03 grains per standard cubic foot of dry gas corrected to 12 percent CO_2.

(3) At least 15 working days before the stack test is conducted, the Company shall submit to the Department a test protocol for review and approval.

(4) Within 45 days after the stack tests, the Company shall submit to the Department the stack test reports which shall include the following:

(a) Emission data and the incinerator burn rate;

(b) Operating temperature in both the primary and secondary combustion chambers;

(c) The flow rate and alkalinity of the scrubbing solution; and

(d) The temperature at the inlets of the venturi caustic scrubber.

(5) The following parameters shall be continuously monitored and recorded:

(a) Temperatures at the outlets of the primary and secondary chambers of the incinerator and the inlets of the venturi caustic scrubber; and

(b) The pH and flowrate of the scrubbing solution.

The records shall be kept on site for at least two years and shall be made available to inspectors upon their request.

STATE OF MARYLAND-DEPARTMENT OF THE ENVIRONMENT
Air Management Administration
2500 Broening Highway
Baltimore, Maryland 21224

28

APPLICATION FOR PERMIT TO OPERATE INCINERATORS

I. PREMISE IDENTIFICATION:

Malcolm Grow Medical Center, Bldg 1050 — 16 0655
PREMISE NAME OR IDENTIFICATION — PREMISE NUMBER

MGMC/SGG Andrews AFB MD 20331 — Prince Georges
PREMISE ADDRESS — COUNTY

II. EQUIPMENT IDENTIFICATION:

UNIT	TYPE EQUIPMENT (By-product waste, municipal, etc.)	LBS/HR (Design)	REGISTRATION NO.
1	Regulated Medical Waste	385	20116 90
2			

III. AMOUNT AND DESCRIPTION OF WASTE BEING INCINERATED:

UNIT	AMOUNT (Tons/Year)	DESCRIPTION OF WASTE
1	136	Type 6, Infectious/Pathological
2		

IV. DESCRIPTION OF AIR POLLUTION CONTROL DEVICE

UNIT	TYPE CONTROL DEVICE	GRAIN LOADING (at 12% CO_2)
1	High Energy Venturi (Wet) Scrubber	0.03 grs/scfd
2		

V. ☐ Yes ☒ No ON-SITE TESTS PERFORMED

UNIT TO BE TESTED 15 Oct 91
Date

Stephen M. Klimek
STEPHAN M. KLIMEK, 2LT, USAF, MSC
Director, Construction Plans
SIGNATURE AND TITLE

26 Jun 91
DATE

AMA-27 MDE 209

FIELD REPORT

INSPECTOR:	DATE OF INSPECTION:	PERSON CONTACTED:
Donald Chi Lee Haskins John Ault	October 2, 1991	Lt. Stephan M. Klimek

DISCUSSION, CONDITIONS AND RECOMMENDATION:

The newly constructed special medical waste incinerator was inspected for Temporary Permit to Operate. The construction work has been completed except the installation of temperature recorders. The temperature recorders are expected to arrive any day.

It is recommended to issue the Temporary Permit to Operate with the condition that the incinerator shall not be operated prior to installing of the temperature recorders.

John Ault of Prince George's County will inspect again when the temperature recorders are installed.

APPENDIX D

Calibration Data

NOZZLE CALIBRATION DATA FORM

Date 9 July 92 Calibrated by O'Brien

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
	0.300 in.	0.300 in.	0.301 in.	0.001 in.	0.300 in.

where:

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

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

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

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

N_c	Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w)[a], ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter Inlet (t_{d_i}), °F	Temperature: Dry gas meter Outlet (t_{d_o}), °F	Temperature: Dry gas meter Avg[a] (t_d), °F	Time (Θ), min	Y_i	$\Delta H@_i$ in. H_2O
4.0	0.5	5	5.015	69 71 70	70 74 72	68 70 69	70.5	12.88	0.997	1.90
3.9	1.0	5	5.013	72 73 72.5	77 81 79	71 73 72	75.5	9.079	1.001	1.888
3.9	1.5	10	10.042	75 74 74.5	82 87 84.5	74 78 76	80.25	15.179	1.003	1.976
3.9	2.0	10	10.086	75 75 75	88 93 90.5	78 81 79.5	85.0	13.163	1.005	1.968
4.0	3.0	10	10.103	75 74 74.5	93 96 94.5	81 84 82.5	88.5	10.789	1.008	1.967
4.0	4.0	10	10.122	74 74 74	96 94 95	84 86 85	90	9.459	1.007	2.007
								Avg	1.0047	1.951

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \dfrac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$	$\Delta H@_i = \dfrac{0.0317\ \Delta H}{P_b (t_d + 460)} \left[\dfrac{(t_w + 460)\ \Theta}{V_w}\right]^2$
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	$Y_i = \frac{(5)(29.313)(75.5+460)}{(5.013)(29.313+\frac{1.0}{13.6})(72.5+460)}$	$\Delta H@_i = \frac{(0.0317)(1.0)}{29.313(75.5+460)}\left[\frac{(72.5+460)(9.079)}{5}\right]^2$
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)

JAGIELSKI/BISHOP

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Post Cal

Test numbers ________ Date 31 Aug 92 Meter box number #3 Plant Andrews Park. Incin.

Barometric pressure, P_b = 29.250 in. Hg Dry gas meter number 1 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[a] (t_d), °F	Time (Θ), min	Vacuum setting, in. Hg	Y_i	$Y_i = \dfrac{V_w P_b (t_d + 460)}{V_d \left(P_b + \dfrac{\Delta H}{13.6}\right)(t_w + 460)}$
1.4	10	10.01	77 77 77	86 88 87	78 80 79	83	15.71	5.0	1.007	$\frac{(10)(29.250)(83+460)}{(10.01)(29.250+\frac{1.4}{13.6})(77+460)}$
1.4	10	9.88	77 77 77	88 92 90	79 85 82	86	15.53	5.0	1.075	$\frac{(10)(29.250)(86+460)}{(9.88)(29.250+\frac{1.4}{13.6})(77+460)}$
1.4	10	9.875	77 77 77	92 94 93	85 85 85	89	15.71	5.0	1.032	$\frac{(10)(29.250+\frac{1.4}{13.6})(89+460)}{(9.875)(29.250+\frac{1.4}{13.6})(77+460)}$
									Y = 1.021	

[a] If there is only one thermometer on the dry gas meter, record the temperature under t_d. Acceptable Range .954-1.054

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

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

t_w = Temperature of the gas in the wet test meter, °F.

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

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

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

ΔH = Pressure differential across orifice, in H_2O.

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

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

P_b = Barometric pressure, in. Hg.

Θ = Time of calibration run, min.

APPENDIX E

Laboratory Results

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
BROOKS AFB, TEXAS, 78235-5000

REPORT OF ANALYSIS

BASE SAMPLE NO: CN920002

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 920728

DATE COLLECTED: 920709 DATE REPORTED: 920805

SAMPLE SUBMITTED BY: MALCOLM GROW MED CEN/SGPB

PRESERVATION GROUP G OEHL SAMPLE NUMBER: 92044223

Test	Results	Units	Method
Chloride	4.6	µg/mL	EPA 300.0

Comments:

ANALYSIS WAS DONE BY ION CHROMOTOGRAPHY.

Reviewed by:

Duryl S. Bird, GS-12
Chief, Inorganic Analysis

TO:

AL/OEBE
BROOKS AFB, TX 78235-5000

PAGE 1

AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
BROOKS AFB, TEXAS, 78235-5000

REPORT OF ANALYSIS

BASE SAMPLE NO: CN920003

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 920728

DATE COLLECTED: 920709 DATE REPORTED: 920805

SAMPLE SUBMITTED BY: MALCOLM GROW MED CEN/SGPB

PRESERVATION GROUP G OEHL SAMPLE NUMBER: 92044224

Test	Results	Units	Method
Chloride	12.7	µg/mL	EPA 300.0

Comments:

ANALYSIS WAS DONE BY ION CHROMOTOGRAPHY.

Reviewed by:

Duryl S. Bird, GS-12
Chief, Inorganic Analysis

TO:

AL/OEBE
BROOKS AFB, TX 78235-5000

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AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
BROOKS AFB, TEXAS, 78235-5000

REPORT OF ANALYSIS

BASE SAMPLE NO: CN920004

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 920728

DATE COLLECTED: 920709 DATE REPORTED: 920805

SAMPLE SUBMITTED BY: MALCOLM GP JW MED CEN/SGPB

PRESERVATION GROUP G OEHL SAMPLE NUMBER: 92044225

Test	Results	Units	Method
Chloride	12.0	µg/mL	EPA 300.0

Comments:

ANALYSIS WAS DONE BY ION CHROMOTOGRAPHY.

Reviewed by:

Duryl S. Bird, GS-12
Chief, Inorganic Analysis

TO:

AL/OEBE
BROOKS AFB, TX 78235-5000

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AIR FORCE
OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
BROOKS AFB, TEXAS, 78235-5000

REPORT OF ANALYSIS

BASE SAMPLE NO: BK920005

SAMPLE TYPE: BLANK/CONTROL SAMPLE

SITE IDENTIFIER: DATE RECEIVED: 920728

DATE COLLECTED: 920709 DATE REPORTED: 920805

SAMPLE SUBMITTED BY: MALCOLM GROW MED CEN/SGPB

PRESERVATION GROUP G OEHL SAMPLE NUMBER: 92044226

Test	Results	Units	Method
Chloride	<.3	µg/mL	EPA 300.0

Comments:

ANALYSIS WAS DONE BY ION CHROMOTOGRAPHY.
< - Signifies none detected and the detection limits.

Reviewed by:

Duryl S. Bird, GS-12
Chief, Inorganic Analysis

TO:

AL/OEBE
BROOKS AFB, TX 78235-5000

PAGE 1

BLANK ANALYTICAL DATA FORM

Plant Hospital Incinerator

Sample location Andrews AFB

Relative humidity

Liquid level marked and container sealed ✓

Density of acetone (ρ_a) ______ g/ml

Blank volume (V_a) 150 ml

Date and time of wt 3 Aug 92 0800 hrs Gross wt 102346.1 mg

Date and time of wt 3 Aug 92 1630 hrs Gross wt 102346.0 mg

Average gross wt 102346.1 mg

Tare wt 102345.1 mg

Weight of blank (m_{ab}) 1.0 mg

$$C_a = \frac{m_{ab}}{V_a \rho_a} = \frac{(\ 1.0\ )}{(\ 150\ )\ (\ 0.786\ )} = 0.0085 \text{ mg/g}$$

Note: In no case should a blank residue greater than 0.01 mg/g (or 0.001% of the blank weight) be subtracted from the sample weight.

Filters Filter number

Date and time of wt ______ Gross wt ______ mg

Date and time of wt ______ Gross wt ______ mg

Average gross wt ______ mg

Tare wt ______ mg

Difference wt ______ mg

Note: Average difference must be less than ±5 mg or 2% of total sample weight whichever is greater.

Remarks

Signature of analyst Robert J. O'Brien

Signature of reviewer

Quality Assurance Handbook M5-5.4

SAMPLE ANALYTICAL DATA FORM

Plant Andrews AFB Run number 1

Sample location Hospital Incinerator

Relative humidity ________

Density of acetone (ρ_a) 0.786 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container number ________

Acetone rinse volume (V_{aw}) 150 ml

Acetone blank residue concentration (C_a) 0.0085 mg/g

$W_a = C_a V_{aw} \rho_a$ = (0.0085) (150) (0.786) = 1.0 mg

Date and time of wt 3 Aug 92 0800 hrs Gross wt 104864.9 mg

Date and time of wt 3 Aug 92 1630 hrs Gross wt 104865.3 mg

Average gross wt 104865.1 mg

Tare wt 104857.6 mg

Less acetone blank wt (W_a) 1.0 mg

Weight of particulate in acetone rinse (m_a) 6.5 mg

Filter(s) container number ________

Date and time of wt 16 Jul 92 1500 hrs Gross wt 324.2 mg

Date and time of wt 17 Jul 92 1500 hrs Gross wt 324.4 mg

Average gross wt 324.3 mg

Tare wt 286.3 mg

Weight of particulate on filter(s) (m_f) 38.0 mg

Weight of particulate in acetone rinse 6.5 mg

Total weight of particulate (m_n) 44.5 mg

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks ________

Signature of analyst Robert G. O'Brien

Signature of reviewer ________

SAMPLE ANALYTICAL DATA FORM

Plant Andrews AFB Run number 2

Sample location Hospital Incinerator

Relative humidity

Density of acetone (ρ_a) 0.786 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container number

Acetone rinse volume (V_{aw}) 150 ml

Acetone blank residue concentration (C_a) 0.0085 mg/g

$W_a = C_a V_{aw} \rho_a$ = (0.0085) (150) (0.786) = 1.0 mg

Date and time of wt 3 Aug 92 0830 hrs Gross wt 93634.4 mg

Date and time of wt 3 Aug 92 1630 hrs Gross wt 93634.3 mg

Average gross wt 93634.4 mg

Tare wt 93627.1 mg

Less acetone blank wt (W_a) 1.0 mg

Weight of particulate in acetone rinse (m_a) 6.3 mg

Filter(s) container number

Date and time of wt 16 Jul 92 1500 hrs Gross wt 346.4 mg

Date and time of wt 17 Jul 92 1500 hrs Gross wt 346.2 mg

Average gross wt 346.3 mg

Tare wt 289.5 mg

Weight of particulate on filter(s) (m_f) 56.8 mg

Weight of particulate in acetone rinse 6.3 mg

Total weight of particulate (m_n) 63.1 mg

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks

Signature of analyst Robert A. O'Brien

Signature of reviewer

SAMPLE ANALYTICAL DATA FORM

Plant Andrews AFB Run number 3

Sample location Hospital Incinerator

Relative humidity ____

Density of acetone (ρ_a) 0.786 g/ml

Sample type	Sample identifiable	Liquid level marked and/or container sealed
Acetone rinse	✓	✓
filter(s)	✓	✓

Acetone rinse container number ____

Acetone rinse volume (V_{aw}) 150 ml

Acetone blank residue concentration (C_a) 0.0085 mg/g

$W_a = C_a V_{aw} \rho_a$ = (0.0085) (150) (0.786) = 1.0 mg

Date and time of wt 3 Aug 92 0830 hrs Gross wt 100350.4 mg

Date and time of wt 3 Aug 92 1630 hrs Gross wt 100350.0 mg

Average gross wt 100350.2 mg

Tare wt 100339.7 mg

Less acetone blank wt (W_a) 1.0 ~~9.5~~ mg

Weight of particulate in acetone rinse (m_a) 9.5 mg

Filter(s) container number ____

Date and time of wt ____ Gross wt 358.5 mg

Date and time of wt ____ Gross wt 358.7 mg

Average gross wt 358.6 mg

Tare wt 292.2 mg

Weight of particulate on filter(s) (m_f) 66.4 mg

Weight of particulate in acetone rinse 9.5 mg

Total weight of particulate (m_n) 75.9 mg

Note: In no case should a blank residue >0.01 mg/g or 0.001% of the weight of acetone used be subtracted from the sample weight.

Remarks ____

Signature of analyst Robert J. O'Brien

Signature of reviewer ____

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Andrews AFB	9 July 92	#1

BUILDING NUMBER	SOURCE NUMBER

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3243	0.2863	0.038
ACETONE WASHINGS *(Probe, Front Half Filter)*	104.8651 acetone blank wt = 0.001	104.8576 (empty beaker)	0.0065
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0445 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 ~~(H2O)~~	322	0	322
IMPINGER 2 ~~(H2O)~~	150	100	50
IMPINGER 3 ~~(Dry)~~	102	100	2
IMPINGER 4 ~~(Silica Gel)~~	100	100	0
Impinger 5 (silica gel)	208	200	8
	Total Weight of Water Collected		382 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	8.2	8.3	8.3		8.3
VOL % O_2	8.6	8.8	8.8		8.7
VOL % CO	ND	ND			
VOL % N_2					

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

OEHL FORM MAY 76 20

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Andrews AFB	9 Jul 92	#2

BUILDING NUMBER	SOURCE NUMBER

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3463	0.2895	0.0568
ACETONE WASHINGS *(Probe, Front Half Filter)*	93.6344 acetone blank wt. = 0.001	93.6271 (empty beaker)	0.0063
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0631

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 ~~(H2O)~~	375	0	375
IMPINGER 2 ~~(H2O)~~	172	100	72
IMPINGER 3 ~~(Dry)~~	105.5	100	5.5
IMPINGER 4 ~~(Silica Gel)~~	100	100	0
Impinger 5 (silica gel)	207	200	7
	Total Weight of Water Collected		459.5

III. GASES *(Dry)*

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

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

OEHL FORM MAY 78 20

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
Andrews AFB	July 92	#3

BUILDING NUMBER	SOURCE NUMBER

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3586	0.2922	0.0664
ACETONE WASHINGS *(Probe, Front Half Filter)*	100.3502 acetone blank wt = 0.001	100.3397 (empty beaker)	0.0095
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0759 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 ~~(H2O)~~	348	0	348
IMPINGER 2 ~~(H2O)~~	254	100	154
IMPINGER 3 ~~(Dry)~~	107	100	7
IMPINGER 4 ~~(Silica Gel)~~	100	100	0
Impinger 5 (silica gel)	210.5	200	10.5
	Total Weight of Water Collected		519.5 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	6.8	6.7	6.7		6.7
VOL % O_2	11.2	11.4	11.2		11.3
VOL % CO					
VOL % N_2					

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

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APPENDIX F

Example Calculations

```
          XROM "METH 5"
RUN NUMBER
ONE, 9 JULY 92
 ANDREWS AFB
                    RUN
METER BOX Y?
          1.0040    RUN
DELTA H?
          1.0600    RUN
BAR PRESS ?
         29.5650    RUN
METER VOL ?
         32.8500    RUN
MTR TEMP F?
         97.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.2200    RUN
STACK TEMP.
        178.0000    RUN
ML. WATER ?
        382.0000    RUN


SAT % = 49.3


IMP. % HOH = 36.7

% HOH=36.7


% CO2?
          8.3000    RUN
% OXYGEN?
          8.7000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.68
MW WET=25.39


SQRT PSTS ?
         12.1136    RUN
TIME MIN ?
         60.0000    RUN
NOZZLE DIA ?
           .3000    RUN
STK DIA INCH ?
         15.5000    RUN

* VOL MTR STD = 30.975
  STK PRES ABS = 29.55
  VOL HOH GAS = 17.98
  % MOISTURE = 36.73
  MOL DRY GAS = 0.633
  % NITROGEN = 83.00
  MOL WT DRY = 29.68
  MOL WT WET = 25.39
  VELOCITY FPS = 31.76
  STACK AREA = 1.31
  STACK ACFM = 2,497.
* STACK DSCFM = 1,291.
  % ISOKINETIC =  106.78


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
TWO, 9 JULY 92
 ANDREWS AFB
                    RUN
METER BOX Y?
          1.0040    RUN
DELTA H?
          1.4500    RUN
BAR PRESS ?
         29.5650    RUN
METER VOL ?
         38.1050    RUN
MTR TEMP F?
        108.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.2200    RUN
STACK TEMP.
        185.0000    RUN
ML. WATER ?
        459.5000    RUN


SAT % = 57.6


IMP. % HOH = 38.0

% HOH=38.0


% CO2?
          6.2000    RUN
% OXYGEN?
         11.7000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.46
MW WET=25.10


SQRT PSTS ?
         14.1309    RUN
TIME MIN ?
         60.0000    RUN
NOZZLE DIA ?
           .3000    RUN
STK DIA INCH ?
         15.5000    RUN

* VOL MTR STD = 35.268
  STK PRES ABS = 29.55
  VOL HOH GAS = 21.63
  % MOISTURE = 38.01
  MOL DRY GAS = 0.620
  % NITROGEN = 82.10
  MOL WT DRY = 29.46
  MOL WT WET = 25.10
  VELOCITY FPS = 37.26
  STACK AREA = 1.31
  STACK ACFM = 2,929.
* STACK DSCFM = 1,468.
  % ISOKINETIC =  106.95


END OF FIELD DATA
```

```
          XROM "METH 5"
RUN NUMBER
THREE, 9 JULY 92
 ANDREWS AFB
                    RUN
METER BOX Y?
          1.0040    RUN
DELTA H?
          1.6600    RUN
BAR PRESS ?
         29.5650    RUN
METER VOL ?
         41.0750    RUN
MTR TEMP F?
        114.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.2200    RUN
STACK TEMP.
        193.0000    RUN
ML. WATER ?
        519.5000    RUN


SAT % = 68.4


IMP. % HOH = 39.4

% HOH=39.4


% CO2?
          6.7000    RUN
% OXYGEN?
         11.3000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.52
MW WET=24.99


SQRT PSTS ?
         15.3650    RUN
TIME MIN ?
         60.0000    RUN
NOZZLE DIA ?
           .3000    RUN
STK DIA INCH ?
         15.5000    RUN

* VOL MTR STD = 37.639
  STK PRES ABS = 29.55
  VOL HOH GAS = 24.45
  % MOISTURE = 39.38
  MOL DRY GAS = 0.606
  % NITROGEN = 82.00
  MOL WT DRY = 29.52
  MOL WT WET = 24.99
  VELOCITY FPS = 40.61
  STACK AREA = 1.31
  STACK ACFM = 3,193.
* STACK DSCFM = 1,546.
  % ISOKINETIC =  108.41


END OF FIELD DATA
```

Particulate Emissions

```
            XROM "MASSFLO"

RUN NUMBER
ONE, 9 JULY 92
 ANDREWS AFB
                        RUN

VOL MTR STD ?
            30.9750     RUN
STACK DSCFM ?
        1,291.0000      RUN
FRONT 1/2 MG ?
           44.5000      RUN
BACK 1/2 MG ?
                        RUN


F  GR/DSCF = 0.0222
F  MG/MMM = 50.7336
F  LB/HR = 0.2453
F  KG/HR = 0.1113
```

```
            XROM "MASSFLO"

RUN NUMBER
TWO, 9 JULY 92
 ANDREWS AFB
                        RUN

VOL MTR STD ?
            35.2680     RUN
STACK DSCFM ?
        1,468.0000      RUN
FRONT 1/2 MG ?
           63.1000      RUN
BACK 1/2 MG ?
                        RUN


F  GR/DSCF = 0.0276
F  MG/MMM = 63.1823
F  LB/HR = 0.3474
F  KG/HR = 0.1576
```

```
            XROM "MASSFLO"

RUN NUMBER
THREE, 9 JULY 92
 ANDREWS AFB
                        RUN

VOL MTR STD ?
            37.6390     RUN
STACK DSCFM ?
        1,546.0000      RUN
FRONT 1/2 MG ?
           75.9000      RUN
BACK 1/2 MG ?
                        RUN


F  GR/DSCF = 0.0311
F  MG/MMM = 71.2116
F  LB/HR = 0.4124
F  KG/HR = 0.1871
```

Procedures for Calculating Hydrogen Chloride (HCl) Concentrations

Step 1 - Calculate the mass of HCl in the liquid sample.

$$m = S * V * 36.46 / 35.453$$

Where:

m = mass of HCl in liquid sample (μg)
S = concentration of chlorides in liquid sample (μg Cl^-/ml)
V = Volume of liquid sample (ml)
36.46 = molecular weight of HCl (μg/μg-mole)
35.453 = molecular weight of Cl^- (μg/μg-mole)

Step 2 - Calculate the concentration of HCl in the exhaust gas.

$$C = [K * m] / V_m$$

Where:

C = Concentration of HCl, dry basis (mg/dscf)
$K = 10^{-3}$ mg/μg
m = mass of HCl in liquid sample (μg)
V_m = Dry gas volume measured by the dry gas meter, corrected to standard conditions (dscf)

Step 3 - Convert HCl concentration into units of parts per million (ppm)

$$\text{ppm} = [\text{mg/dscf} * 35.31 \text{ dscf/dscm}] * 24.45 / 36.46$$

Where:

24.45 = constant
36.46 = molecular weight of HCl

Step 4 - Correct HCl concentration to 7% oxygen.

$$\text{ppm corrected to 7\% } O_2 = \text{ppm} * [(20.9 - 7) / (20.9 - \%O_2)]$$

Where:

20.9 = percent oxygen in ambient air
$\%O_2$ = percent oxygen measured in the exhaust gas

Example Calculation for HCl Concentration - Run 1

$$m = 4.6 \text{ μg/ml} * 716 \text{ ml} * 36.46 / 35.453 = 3387 \text{ μg}$$

$$C = [10^{-3} \text{ mg/μg} * 3387 \text{ μg}] / 30.975 \text{ dscf} = 0.1093 \text{ mg/dscf}$$

$$\text{ppm} = [0.1093 \text{ mg/dscf} * 35.31 \text{ dscf/dscm}] * 24.45 / 36.46 = 2.588 \text{ ppm}$$

$$\text{ppm corrected to 7\% } O_2 = 2.588 \text{ ppm} * [(20.9 - 7) / (20.9 - 8.7)] = \mathbf{2.95 \text{ ppm}}$$

Procedure for Correcting Particulate Emissions to 12% Carbon Dioxide

$$\text{gr/dscf corrected to 12\% } CO_2 = \text{gr/dscf} * (12 / \%CO_2)$$

Where:

gr/dscf = particulate emission rate in grains per dry standard cubic feet of exhaust gas

$\%CO_2$ = percent carbon dioxide measured in the exhaust gas

Example Calculation for Particulate Emissions Correction - Run 1

$$\text{gr/dscf corrected to 12\% } CO_2 = 0.022 \text{ gr/dscf} * (12 / 8.3) = 0.032 \text{ gr/dscf}$$

APPENDIX G

Field Data

DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: Scrubber Stack diameter at ports: 1.29 (ft)

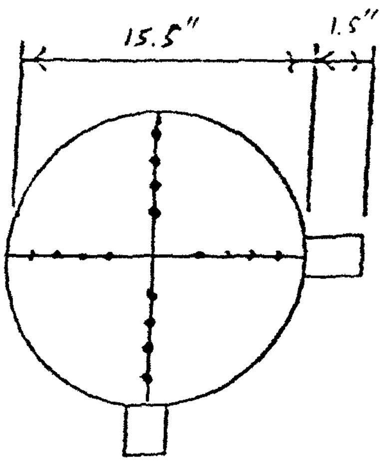
Distance A (ft) >12 ft (duct diameters) > 9

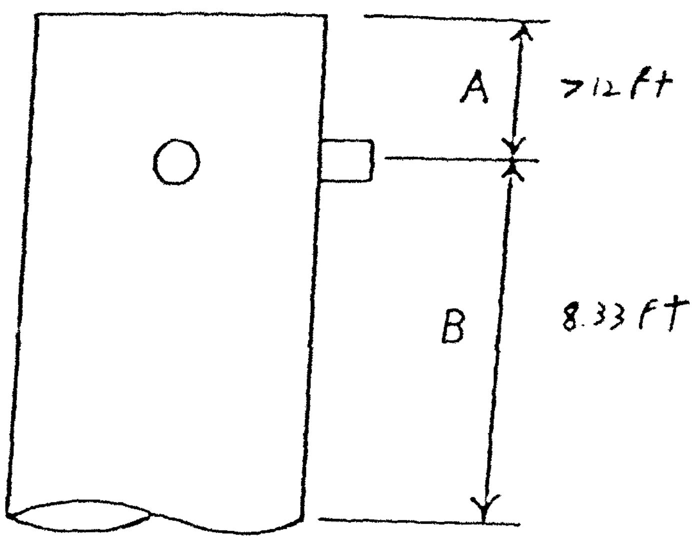
Recommended number of traverse points as determined by distance A: 8

Distance B (ft) 8.33 (duct diameters) 6.46

Recommended number of traverse points as determined by distance B: 16

Number of traverse points used: 16





PRELIMINARY SURVEY DATA SHEET NO. 1
(Stack Geometry)

BASE: Andrews	PLANT: Malcom Grow Pathological Incinerator
DATE: 8 Jul 92	SAMPLING TEAM:
SOURCE TYPE AND MAKE:	
SOURCE NUMBER:	INSIDE STACK DIAMETER: 15.5 Inches
RELATED CAPACITY:	TYPE FUEL:
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER: 17 Inches	
NUMBER OF TRAVERSES: 2	NUMBER OF POINTS/TRAVERSE: 8

LOCATION OF SAMPLING POINTS ALONG TRAVERSE

POINT	PERCENT OF DIAMETER	DISTANCE FROM INSIDE WALL (Inches)	TOTAL DISTANCE FROM OUTSIDE OF NIPPLE TO SAMPLING POINT (Inches)
1			2.0
2			3.1
3			4.5
4			6.5
5			12.0
6			14.0
7			15.4
8			16.5

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

BASE: ANDREWS AFB	DATE: 8 JUL 92
BOILER NUMBER: MALCOM GROW PATHOLOGICAL INCINERATOR	
INSIDE STACK DIAMETER	15.5 Inches
STATION PRESSURE	29.85 In Hg
STACK STATIC PRESSURE	- .22 In H20
SAMPLING TEAM	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	$\sqrt{V_p}$ CYCLONIC ∡	STACK TEMPERATURE (°F)
1	.13	5	156
2	.16	3	161
3	.21	~~3~~ 0	170
4	.23	4	183
5	.22	0	181
6	.25	3	191
7	.22	2	191
8	.18	1	189
	AVG FPS 28		AVG T° 179
	CALCULATED NOZ DIA 0.3378		
AVERAGE			

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: ~~X~~ RD ONE	SCHEMATIC OF STACK CROSS SECTION	EQUATIONS	AMBIENT TEMP: °F
DATE: 9 JUL		$°R = °F + 460$	STATION PRESS: ~~29.85~~ 29.565 in Hg
PLANT: Pathological Incin		$H = \left[\dfrac{5130 \cdot Fd \cdot Cp \cdot A}{Co}\right]^2 \cdot \dfrac{Tm}{Ts} \cdot Vp$	HEATER BOX TEMP: 248 ± 25 °F
BASE: Andrews		Pre Pitot Check - ok	PROBE HEATER SETTING: 248 ± 25
SAMPLE BOX NUMBER: —		Pre Leak Check - ok 15	PROBE LENGTH: 72 in
METER BOX NUMBER: #3 Y = 1.004		Post Pitot Check - ok	NOZZLE ~~AREA (A)~~ diam: ~~0.368~~ 0.300 sq ft
Qw/Qm		Post Leak Check - ok 5	Cp: 0.84
Co			DRY GAS FRACTION (Fd)

MIN ~~30.0~~ 29.2 MAX 28.2 29.2 25.8

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	VACUUM 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)
	1023L											
1	3.75	~~0.15~~ 2.0	145		0.17	0.80	197.916	91		90	246	55
2	7.50	2.0	169		0.21	0.96		91		92	245	48
3	11.25	2.2	183		.19	.85		93		92	246	49
4	15.00	2.2	190		.21	.93		95		92	246	51
5	18.75	2.3	192		.21	.93		98		93	245	51
6	22.50	2.5	192		.21	.93		99		93	246	51
7	26.25	2.5	194		.38	1.48		100		94	247	51
8	30.0	3.2	194		.24	1.06		101		94	247	50
	1052L						214.140					
B 1	3.75	2.0	133		.12	0.59		99		94	248	61
2	7.50	2.0	129		.13	1.64		100		95	246	55
3	11.25	2.0	~~127~~ 160		.31	1.45		100		95	246	52
4	15.00	3.0	~~[illegible]~~ 181		.32	1.44		102		95	246	50
5	18.75	3.0	195		.28	1.24		103		96	246	50
6	22.50	3.0	195		.20	1.25		104		96	246	51
7	26.25	3.1	195		.20	1.25		104		97	247	51
8	30.00	3.1	194		.21	0.94		105		97	248	52
		$\bar{T}_s$ 178		$\bar{T}_m$ 97			2[illegible].266					
							32.85 [cu ft]					
		$\sqrt{\Delta P}$ [illegible]		ΔH 1.06								

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER	~~3~~ 2nd Two
DATE	9 JUL
PLANT	Radiological Taxia
BASE	Andrews
SAMPLE BOX NUMBER	
METER BOX NUMBER	3
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

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

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

Pre Pitot Check - OK

Pre Leak Check - OK 10 in Hg

Post Pitot Check - OK

Post Leak Check - OK 7 in Hg

Md - 29.2 Mw - 25.78

AMBIENT TEMP	°F
STATION PRESS	~~29.85~~ 29.56 in Hg
HEATER BOX TEMP	248 ± 25 °F
PROBE HEATER SETTING	248 ± 25
PROBE LENGTH	72 in
NOZZLE ~~AREA (A)~~ dia	0.300 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)
	1309											
A 1	3.75	1.9	163		.18	0.84	231.475	102		101	231	67
2	7.50	2.0	159		.17	0.80		104		102	224	64
3	11.25	2.9	185		.21	0.96		107		104	231	60
4	15.00	2.0	195		.27	1.21		109		104	231	57
5	18.75	2.4	197		.30	1.35		110		104	236	55
6	22.50	2.8	196		.37	1.66		111		104	239	50
7	26.25	3.0	197		.38	1.71		111		104	241	47
8	30.00	3.0	194		.34	1.64		112		105	249	49
							249.703					
1343												
B 1	3.75	~~1.7~~ 1.8	155		.30	1.44		109		106	242	70
2	7.50	3.0	148		.30	1.46		112		109	244	55
3	11.25	3.0	179		.34	1.58		114		107	247	52
4	15.00	3.1	194		.61	2.77		115		108	247	53
5	18.75	3.5	198		.39	1.76		115		108	247	52
6	22.50	3.4	198		.33	1.49		116		108	247	53
7	26.25	3.2	198		.36	1.63		115		108	248	55
8	30.00	3.5	198		.22	1.00		116		109	247	56
							269.580					
		$\bar{T_s}$:	185	$\bar{T_m}$:	108		38.105					
		$(\Delta P)^{1/2}$:	14.1309	ΔH :	1.45							

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PARTICULATE SAMPLING DATA SHEET

RUN NUMBER	$\cancel{4g}$ Three
DATE	9 JUL 92
PLANT	Physiological Incin
BASE	Andrews
SAMPLE BOX NUMBER	
METER BOX NUMBER	3
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

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

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

Pre Pitot Check – OK
Post Pitot Check – OK
Pre Leak Check – OK 10in Hg
Post Leak Check – OK 10in Hg

AMBIENT TEMP	°F
STATION PRESS	29.5 in Hg
HEATER BOX TEMP	248 ± 25 °F
PROBE HEATER SETTING	248 ± 25
PROBE LENGTH	72 in
NOZZLE AREA (A) dia	0.300 sq ft
Cp	0.84
DRY GAS FRACTION (Fd)	

$MW_D \cdot 29^2$ $MW_W \cdot 25^{78}$

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)
A1	3.75	2.0	155		.22	1.06	269.801	109		108	210	68
2	7.50	2.1	182		.41	1.89		111		108	234	60
3	11.25	3.0	184		.24	1.10		112		108	231	57
4	15.00	2.4	195		.28	1.27		113		109	244	59
5	18.75	2.8	199		.41	1.85		115		109	246	59
6	22.50	3.2	200		.39	1.76		116		110	246	58
7	26.25	3.5	200		.32	1.45		117		110	247	60
8	30.00	3.1	199		.36	1.63		118		111	247	59
							289.462					
B1	3.75	2.9	174		.35	1.65						
2	7.50	3.2	200		.46	2.08		115		112	247	79
3	11.25	3.9	200		.41	1.86		118		112	247	60
4	15.00	3.9	200		.37	1.68		119		112	249	57
5	18.75	3.7	200		.42	1.91		120		113	250	58
6	22.50	4.0	201		.38	1.73		121		113	248	61
7	26.25	4.0	200		.41	1.87		121		114	248	61
8	30.00	4.2	201		.40	1.82		122		114	247	60
								123		115	248	62
		T_m : 114	$(\Delta T_s)^{1/2}$: 15.7658				310.826					
		T_s : 193	ΔH	: 1.66			41.025					

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APPENDIX H

Facility Data

Run 1 [illegible] 1057-[illegible]

[illegible]

INCINERATOR OPERATION

OPERATOR	DATE	TIME	WEIGHT	TEMPERATURE PRIMARY	TEMPERATURE SECONDARY	BOXES	
Joseph Thompson	7-8-92	1:59	[illegible]	[illegible]	[illegible]	2	
Joseph Thompson	7-8-92	2:11	57	[illegible]	[illegible]	2	
Joseph Thompson	7-8-92	2:[illegible]	61	1610	1792	2	
Joseph Thompson	7-8-92	2:34	57	[illegible]	1885	2	
Joseph Thompson	7-8-92	2:42	58	[illegible]	1816	2	
Joseph Thompson	7-8-92	2:50	58	[illegible]	1836	2	
Joseph Thompson	7-8-92	3:01	33	[illegible]	[illegible]	2	
Joseph Thompson	7-[illegible]-92	[illegible]	[illegible]	1440	[illegible]	2	
Joseph Thompson	[illegible]	[illegible]	[illegible]	1464	[illegible]	2	
Joseph Thompson	[illegible]	10:08	51	[illegible]	[illegible]	2	
Joseph Thompson	[illegible]	10:16	[illegible]	[illegible]	[illegible]	2	[illegible]
Joseph Thompson	[illegible]	10:24	[illegible]	[illegible]	1628	2	
Joseph Thompson	[illegible]	10:[illegible]	[illegible]	1407	[illegible]	2	
Joseph Thompson	[illegible]	10:40	49	[illegible]	[illegible]	2	
Joseph Thompson	[illegible]	10:[illegible]	[illegible]	[illegible]	[illegible]	2	
Joseph Thompson	[illegible]	10:[illegible]	[illegible]	[illegible]	[illegible]	2	
[illegible]	7-9-92	11:[illegible]	44	[illegible]	[illegible]	2	
Joseph Thompson	7-9-92	11:14	[illegible]	[illegible]	1731	2	
[illegible]	[illegible]	11:[illegible]	43	[illegible]	1765	2	

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GENERAL PURPOSE [illegible]

38

Run 2 1620 - 1837
1393 - 1419 339 lbs

Run 3 1527 - 1557
160[illegible] - 1520 341 lbs

INCINERATOR OPERATION

OPERATOR	DATE	TIME	WEIGHT	TEMPERATURE PRIMARY	TEMPERATURE SECONDARY	BOXES	
Joseph Thompson	1-9-92	12:18	31	[illegible]	1753	2	
Joseph Thompson	1-9-92	12:31	27			2	
Joseph Thompson	1-9-92	12:44	28	1707	1770	2	
Joseph Thompson	1-9-92	12:53	29	1730	1800	2	
Joseph Thompson	1-9-92	1:06	37	1841	1761	2	
Joseph Thompson	1-9-92	1:14	37	1613	1779	2	
Joseph Thompson	1-9-92	1:22	44	1782	1834	2	
Joseph Thompson	1-9-92	1:30	36	1756	1835	2	
Joseph Thompson	1-9-92	1:38	46	1762	1830	2	
Joseph Thompson	1-9-92	1:46	41	1713	1828	2	
Joseph Thompson	1-9-92	1:54	48	1691	1856	2	
Joseph Thompson	1-9-92	2:03	44	1810	1849	2	
Joseph Thompson	1-9-92	2:11	43	1731	1578	2	
Joseph Thompson	1-9-92	3:02	32	1837	1776	2	
Joseph Thompson	1-9-92	3:10	34	1952	1317	2	
Joseph Thompson	1-9-92	3:19	36	1873	1829	2	
Joseph Thompson	1-9-92	3:31	40	1120	1507	2	
Joseph Thompson	1-9-92	3:39	41	1864	1818	2	
Joseph Thompson	1-9-92	3:47	44	1874	1843	1	

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INCINERATOR OPERATION

OPERATOR	DATE	TIME	WEIGHT	TEMPERATURE PRIMARY	TEMPERATURE SECONDARY	BOXES
Joseph Thompson	2-9-92	3:35	43	1905	1845	2
Joseph Thompson	2-9-92	4:04	42	1792	906	2
Joseph Thompson	2-9-92	4:12	58	1763	1905	2
Joseph Thompson	2-9-92	4:20	46	1728	1808	2
Joseph Thompson	2-9-92	4:26	42	1334	1834	2
Joseph Thompson	2-9-92	4:36	43	1342	1924	2
Joseph Thompson	2-10-92	7:01	26	1303	1232	2
Joseph Thompson	2-10-92	[illegible]	24	1312	1720	2
Joseph Thompson	2-10-92	7:16	34	1310	[illegible]	2
Joseph Thompson	2-10-92	7:27	37	1323	1710	2
Joseph Thompson	2-10-92	7:38	48	[illegible]	1705	
[illegible]	2-10-92	7:46	26	1400	[illegible]	2
[illegible]	2-10-92	7:54	24	1460	[illegible]	2
Joseph Thompson	2-10-92	8:02	48	1458	1218	2
[illegible]	2-10-92	8:10	24	1436	1222	2
Joseph Thompson	2-10-92	8:19	30	1321	1795	2
Joseph Thompson	2-10-92	8:28	32	[illegible]	[illegible]	2
Joseph Thompson	2-10-92	8:36	33	1514	1512	2
Joseph Thompson	2-10-92	8:44	34	[illegible]	1814	2

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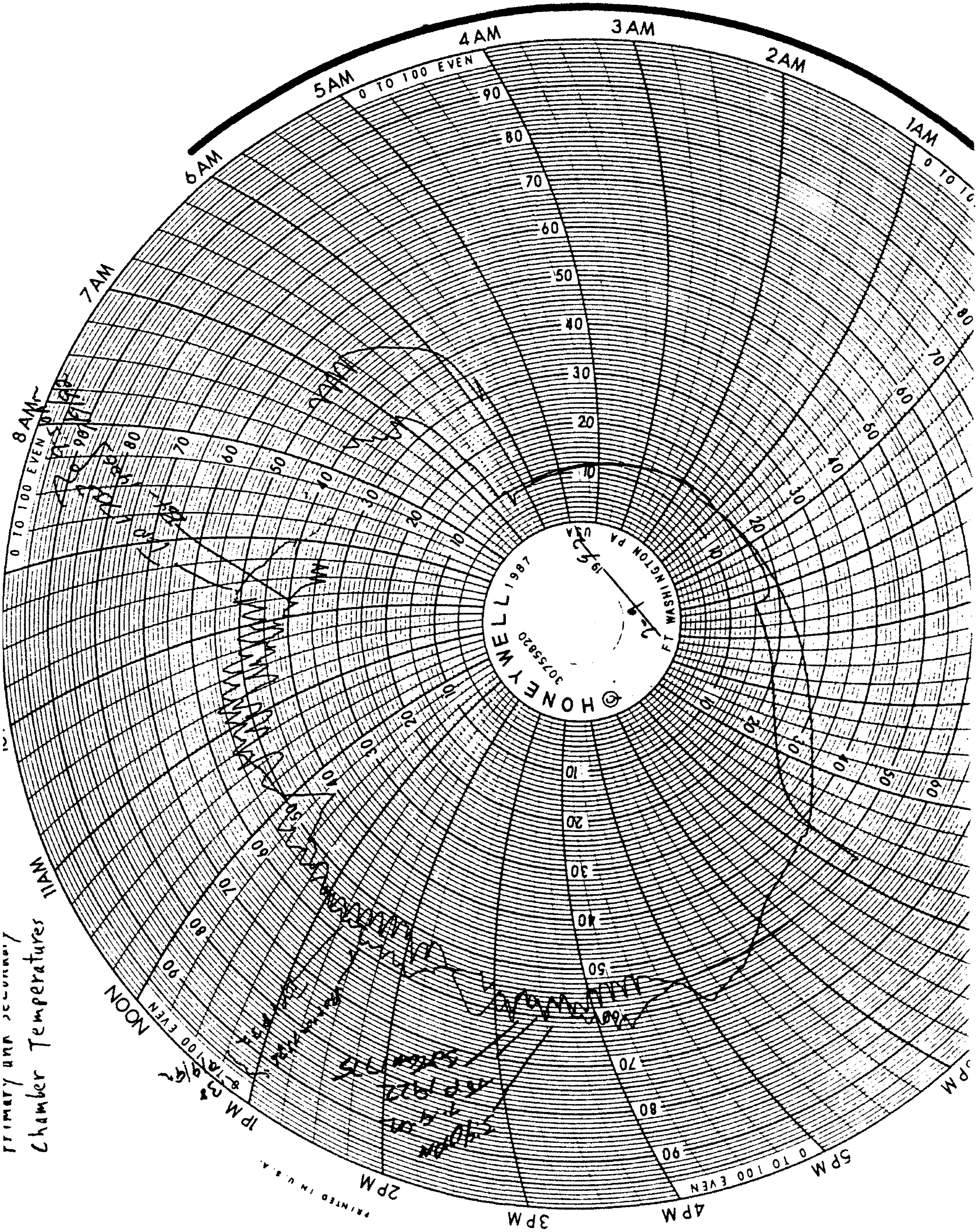
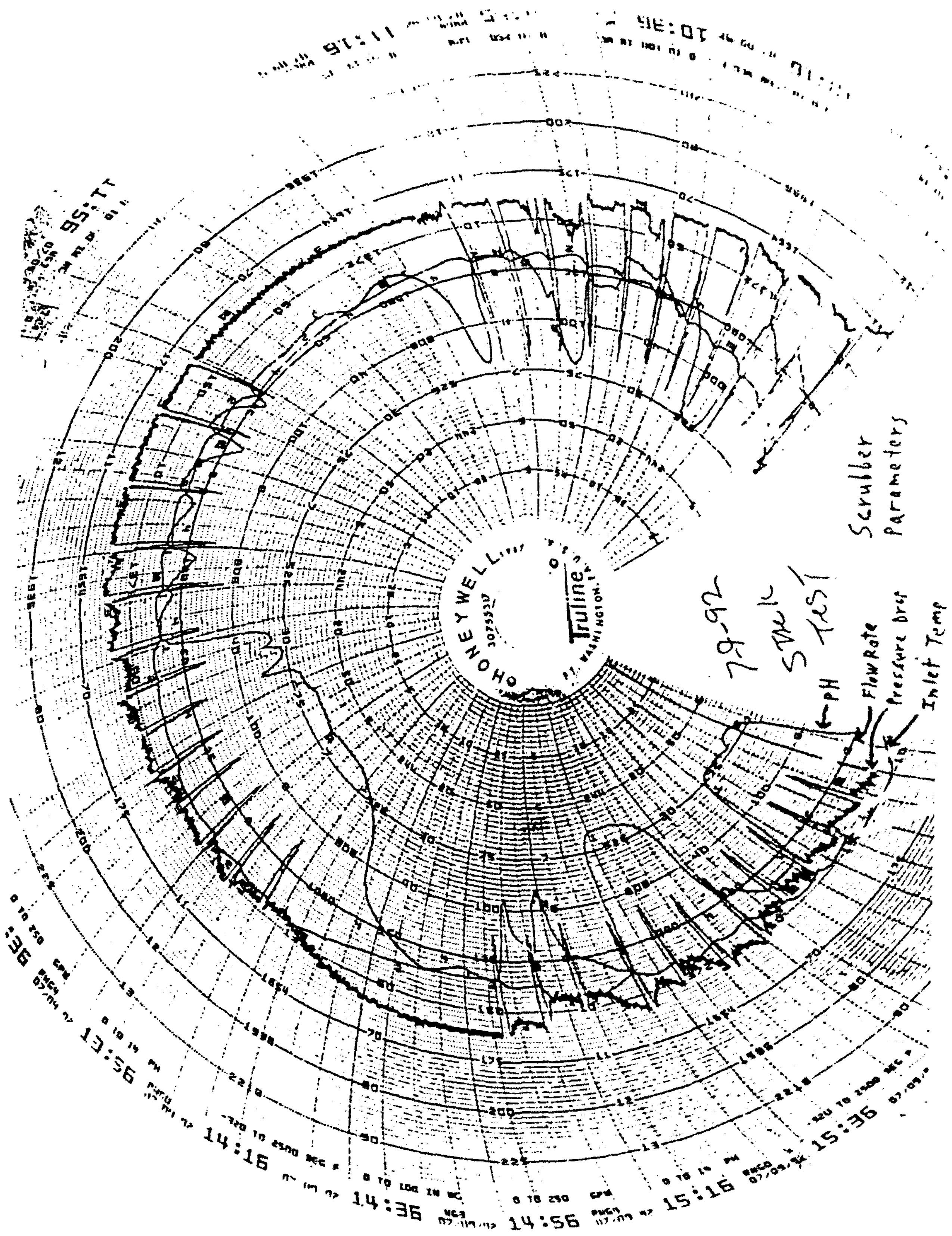


Primary and Secondary Chamber Temperatures


HONEYWELL
Truline
Scrubber Parameters
7-9-92 Stack Test
pH
Flow Rate
Pressure Drop
Inlet Temp