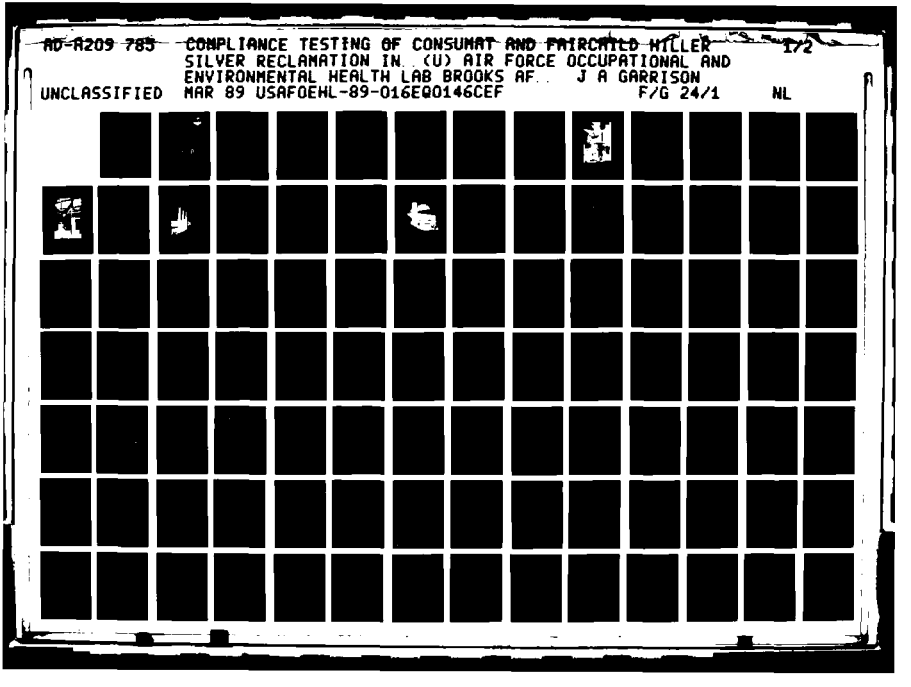
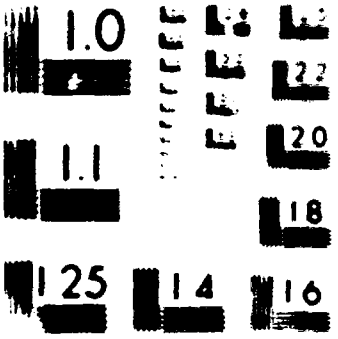
AD-A209 785 COMPLIANCE TESTING OF CONSUMAT AND FAIRCHILD MILLER SILVER RECLAMATION IN. (U) AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LAB BROOKS AF J A GARRISON

1/2

UNCLASSIFIED MAR 89 USAFOEHL-89-016EQ0146CEF F/G 24/1 NL




1.0
1.1
1.25
1.4
1.6
2.2
2.0
1.8

USAFOEHL REPORT

89-016EQ0146CEF

COMPLIANCE TESTING OF CONSUMAT AND FAIRCHILD HILLER SILVER RECLAMATION INCINERATORS, OFFUTT AFB NE

JAMES A. GARRISON, Maj, USAF, BSC

March 1989

Final Report

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

The Public Affairs Office has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nations.

This report has been reviewed and is approved for publication.

James A. Garrison

JAMES A. GARRISON, Maj, USAF, BSC
Chief, Air Quality Function

DENNIS R. SMALLA, Lt Col, USAF, BSC
Chief, Consultant Services Division

Air Force installations may direct requests for copies of this report to: USAF Occupational and Environmental Health Laboratory (USAFOEHL) Library, Brooks AFB TX 78235-5501.

Other Government agencies and their contractors registered with the DTIC should direct requests for copies of this report to: Defense Technical Information Center (DTIC), Cameron Station, Alexandria VA 22304-6145.

Non-Government agencies may purchase copies of this report from: National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield VA 22161

James C. Rock

JAMES C. ROCK, Colonel, USAF, BSC
Commander

REPORT DOCUMENTATION PAGE

Form Approved OMB No 0704-0188

1a. REPORT SECURITY CLASSIFICATION: Unclassified	1b. RESTRICTIVE MARKINGS: N/A
2a. SECURITY CLASSIFICATION AUTHORITY: N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT: Approved for public release. Distribution is unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S): USAFOEHL Report 89-016EQ0146CEF	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION: USAF Occupational and Environmental Health Laboratory. / 6b. OFFICE SYMBOL (If applicable): ECQ	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code): Brooks AFB TX 78235-5501	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION: Same as 6a / 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code): Same as 6c	10. SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO / PROJECT NO. / TASK NO / WORK UNIT ACCESSION NO

11. TITLE (Include Security Classification)
Compliance Testing of Consumat and Fairchild Hiller Silver Reclamation Incinerators

12. PERSONAL AUTHOR(S)
Maj James A. Garrison

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Final	FROM 1 11 TO Nov 88	March 1989	129

16. SUPPLEMENTARY NOTATION

17. COSATI CODES: FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Compliance Testing; Stack Sampling; Stationary Source Testing; Offutt; Garrison; Air Pollution; Particulates; Hydrogen Chloride; Heavy Metals

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

At the request of HQ SAC/SGPB, compliance testing for particulate emissions was conducted on four silver reclamation incinerators located in Bldg D, Offutt AFB NE. Testing was accomplished on 1-11 Nov 1988. Testing was required by the State of Nebraska Department of Environmental Control. The State of Nebraska requested the evaluation of emissions for hydrogen chloride and heavy metal (antimony, arsenic, cadmium, lead, mercury, silver and zinc) even though a standard does not exist for these pollutants. Results indicate that incinerators 1, 2 and 3 are in compliance with applicable state standards. Incinerator 4 failed to meet standard with respect to visible and particulate emissions.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	Unclassified

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (Include Area Code)	22c. OFFICE SYMBOL
Maj James A. Garrison	(512) 536-3305 AV 240	USAFOEHL/ECQ

DD Form 1473, JUN 86 — Previous editions are obsolete. — SECURITY CLASSIFICATION OF THIS PAGE

CONTENTS

Illustrations

Table

I. INTRODUCTION

On 1-11 November 1988, compliance testing was accomplished on four silver reclamation incinerators located in Bldg D, Offutt AFB NE. Testing was conducted by personnel of the Consultative Services Division, Environmental Quality Branch, Air Quality Function of the USAF Occupational and Environmental Health Laboratory (USAFOEHL/ECQ). The survey was requested by HQ SAC/SGPB to determine compliance with particulate emission standards as defined under Nebraska Air Pollution Control Rules and Regulations. Personnel involved with on-site testing are listed in Appendix A.

II. DISCUSSION

A. Background

In 1986, three silver reclamation incinerators were in operation and being used for film destruction and silver recovery. During an inspection of the incinerators, representatives of the Nebraska Department of Environmental Control determined that one or more of the units failed to meet opacity standards in accordance with Chapter 17 (Visible Emissions; Prohibited) of the Nebraska Air Pollution Control Rules and Regulations. The base was subsequently cited for failure to meet applicable regulations governing incineration emissions and operation of the incinerators was halted until source emission testing was accomplished on each unit. The state required that the incinerators meet both the standards for opacity and particulate emissions.

Because of the noncompliance status of the incinerators, HQ SAC/SGPB requested that USAFOEHL conduct emissions testing of the units to determine compliance. Testing was first accomplished in September 1986. The USAFOEHL source team conducted particulate emissions testing while State personnel determined visible emissions. Emissions data were analyzed on-site with the intent of determining compliance status during testing so that contractor personnel (available during testing) could make adjustments to the incinerators if found to be out of compliance.

Test results indicated that incinerators 1 and 2 failed to meet both the visible and particulate emissions standards; and, contractor personnel could not correct the operation of these two units to meet standards. Therefore, the state would not allow units 1 and 2 to continue operation. Incinerator 3 met both the visible and particulate emissions standards and was allowed to continue operation. After test results were known, a decision was made by appropriate base agencies to replace incinerators 1 and 2.

B. Site Description

Presently, there are four silver reclamation incinerators in operation. The incinerators are owned and operated by the 544th Target Materials Squadron. Incinerators 1, 2 and 4 are new units manufactured by Consumat Systems, Inc. and designated as a Model C-75 SR, Consumat Waste Disposal System. Incinerator 3 is one of the original units tested in 1986 and is a Consumat manufactured unit which was marketed by Fairchild Hiller and designated as a Model 1150, Transportable Silver Reclamation Processor. Each

unit is self-contained and used to destroy classified photographic film with the ashes sent to a contractor for silver recovery. Each system is completely refractory lined and has a capacity of 600 pounds per 24 hour period (lbs/24 hr) for the Model C-75 and 800 lbs/24 hr for the Model 1150. Both models are similar in appearance (Fig 1).

The incinerators are cylindrically shaped units consisting of three major components or assemblies: (1) combustion chamber, (2) a transition assembly and (3) a control box (Figs 2-5). The combustion chamber houses the loading door, ash removal port and the two primary burners. In this area, the film is volatilized and reduced to ash.

The transition assembly houses the afterburner and is located on top of the combustion chamber. Exhaust gases and particulate matter from the combustion chamber enter the transition assembly where combustion is completed. The intended design of the chamber is such that gas exit velocities from the chamber to the transitional assembly are so low that most particles remain in the chamber to be further reduced to ash. In the transition assembly, fine particulate matter is completely oxidized and carbon monoxide is converted to carbon dioxide to complete the combustion process. Exhaust gases from the transition assembly pass through a transitional exhaust duct section to a "free standing" stack. The transition and stack are shown in Figure 6. A separate free standing exhaust stack is dedicated to each incinerator. Each stack extends vertically through the roof of the building to a height of approximately 30 feet as shown in Figures 7 and 8.

The control box houses a forced air blower and electrical circuitry. The blower provides forced air to the combustion chamber to purge the chamber, aid in burning, and cool the transition assembly and combustion chamber at the end of the operating cycle. The electrical circuitry contains those subsystems which control and monitor the operation of the incinerator such as timers to control burner and blower cycles, pyrometer temperature monitor, air supply valves and others.

A typical operating scenario begins when the combustion chamber is loaded with film (normally 500-600 lbs). After purging the combustion chamber with air and preheating the afterburner section, the film is ignited by the primary burners. The desirable action is to volatilize the film by partial oxidation. Most particulate material remains in the combustion chamber to be further reduced to ash. The evolved gases and entrained fine particles are vented to the transition stage. Gas velocity increases as the gases are inducted into the flame of the afterburner. Combustion air is also supplied at this point. Because of the added heat and air, the hot gases and particles begin to burn and the combustion process is completed. The complete combustion and cool down cycle takes approximately 24 hours. The typical operation cycle is shown in Table 1.

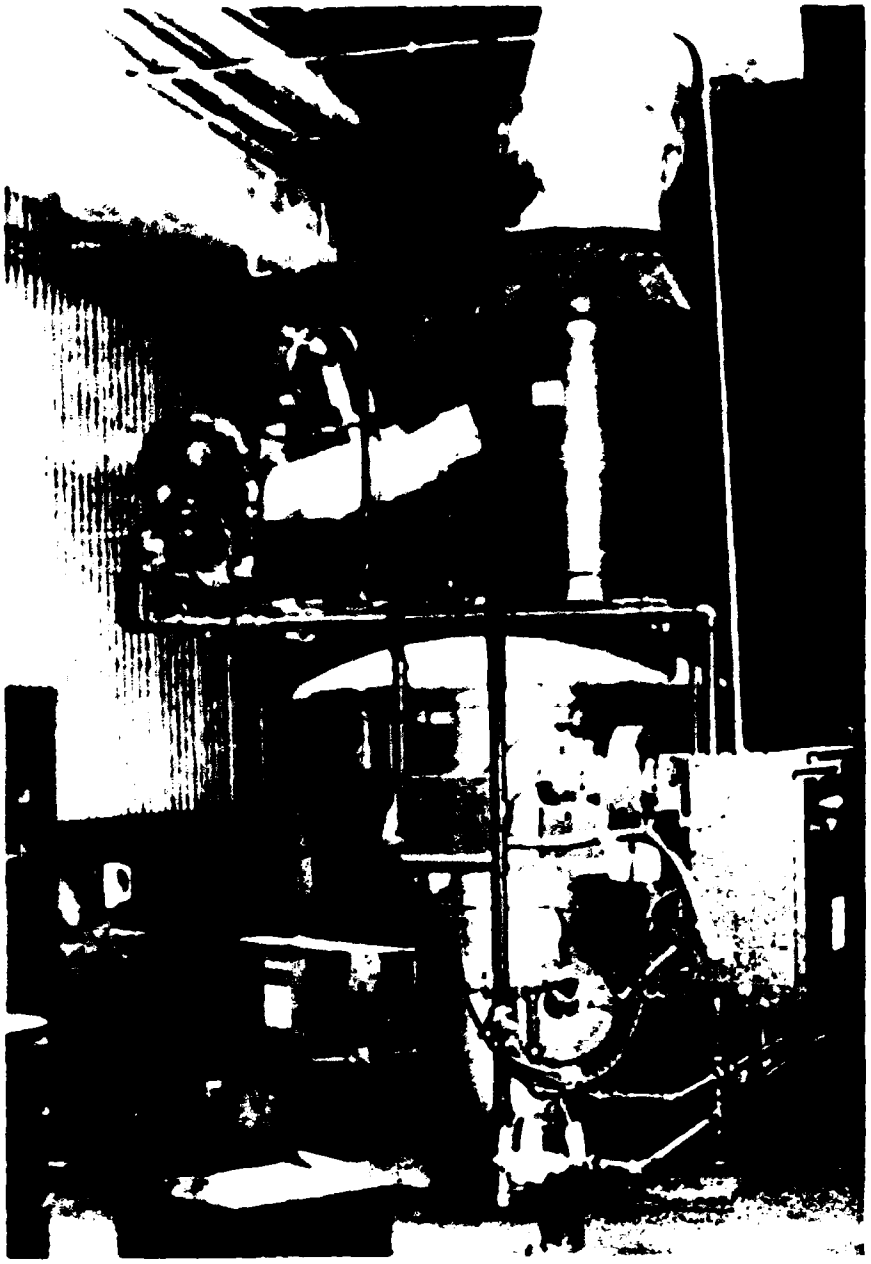


Figure 1. Silver Reclamation Incinerator

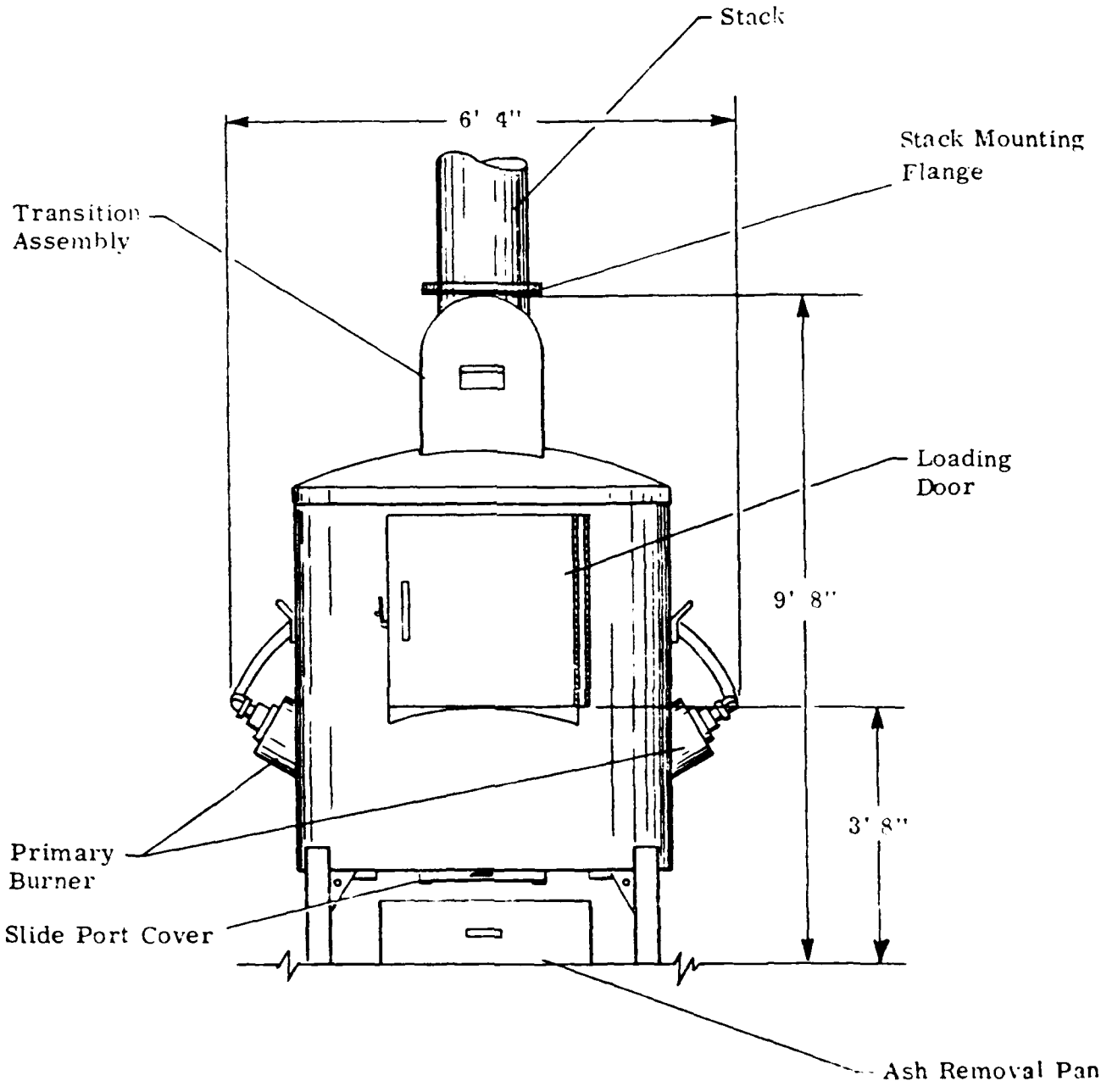


Figure 2. Incinerator Front View

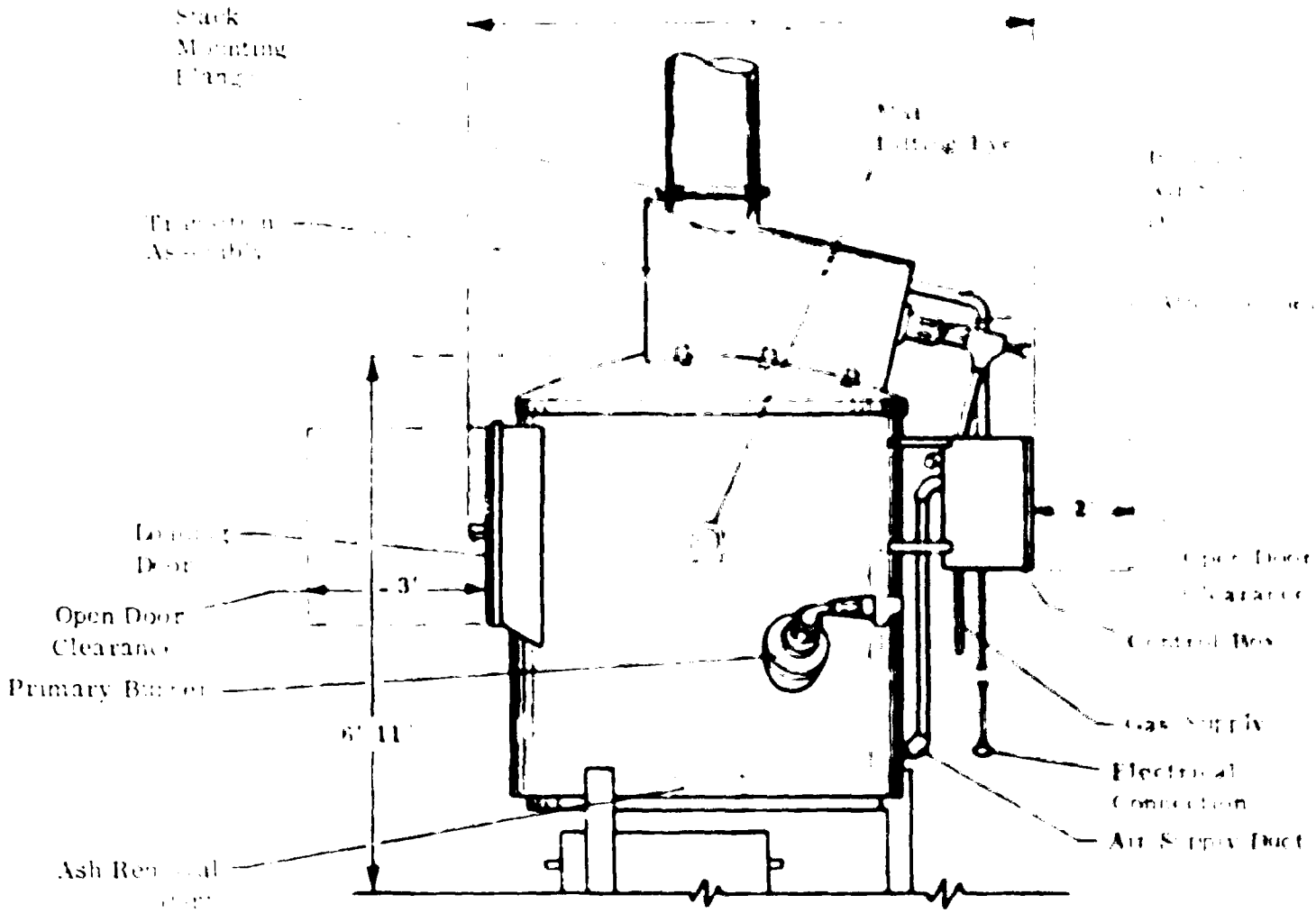


Figure 3. Incinerator Side View

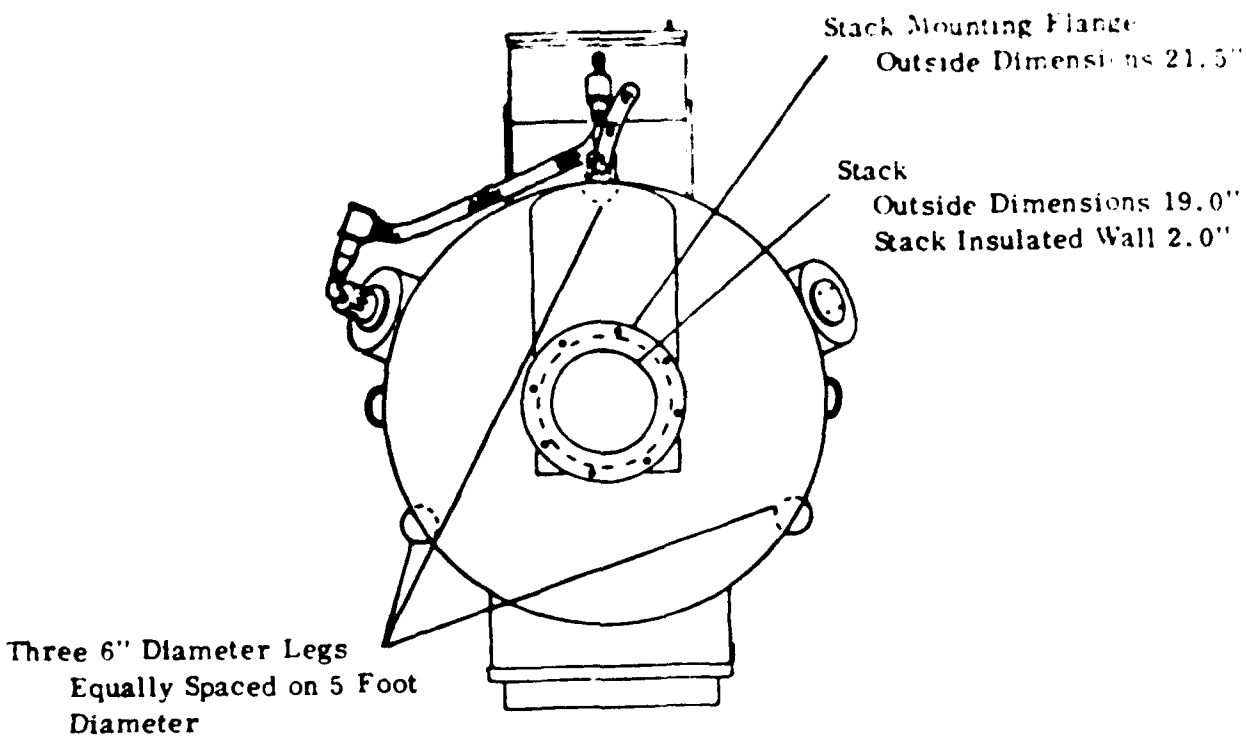


Figure 4. Incinerator Top View

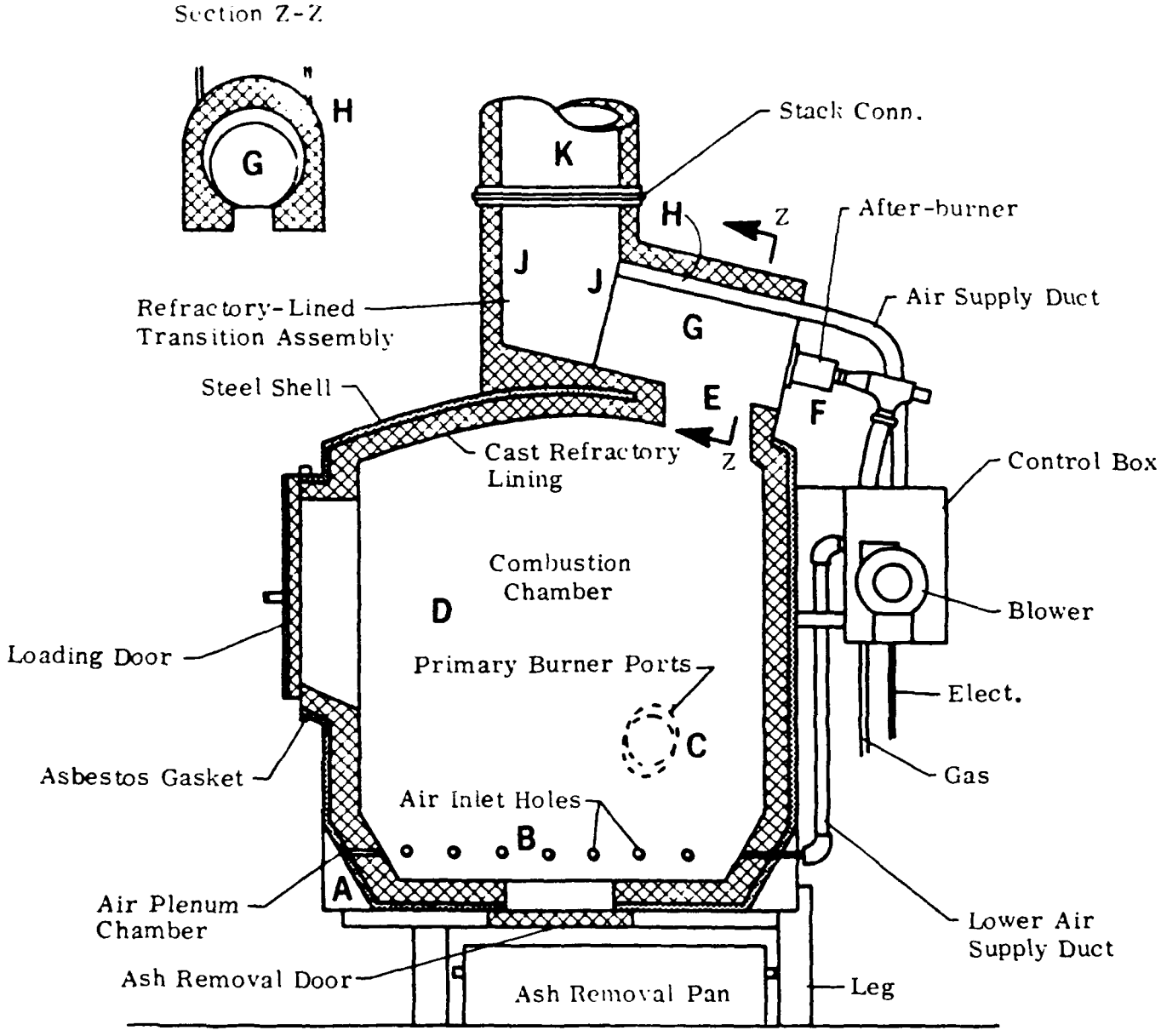


Figure 5. Incinerator Combustion System

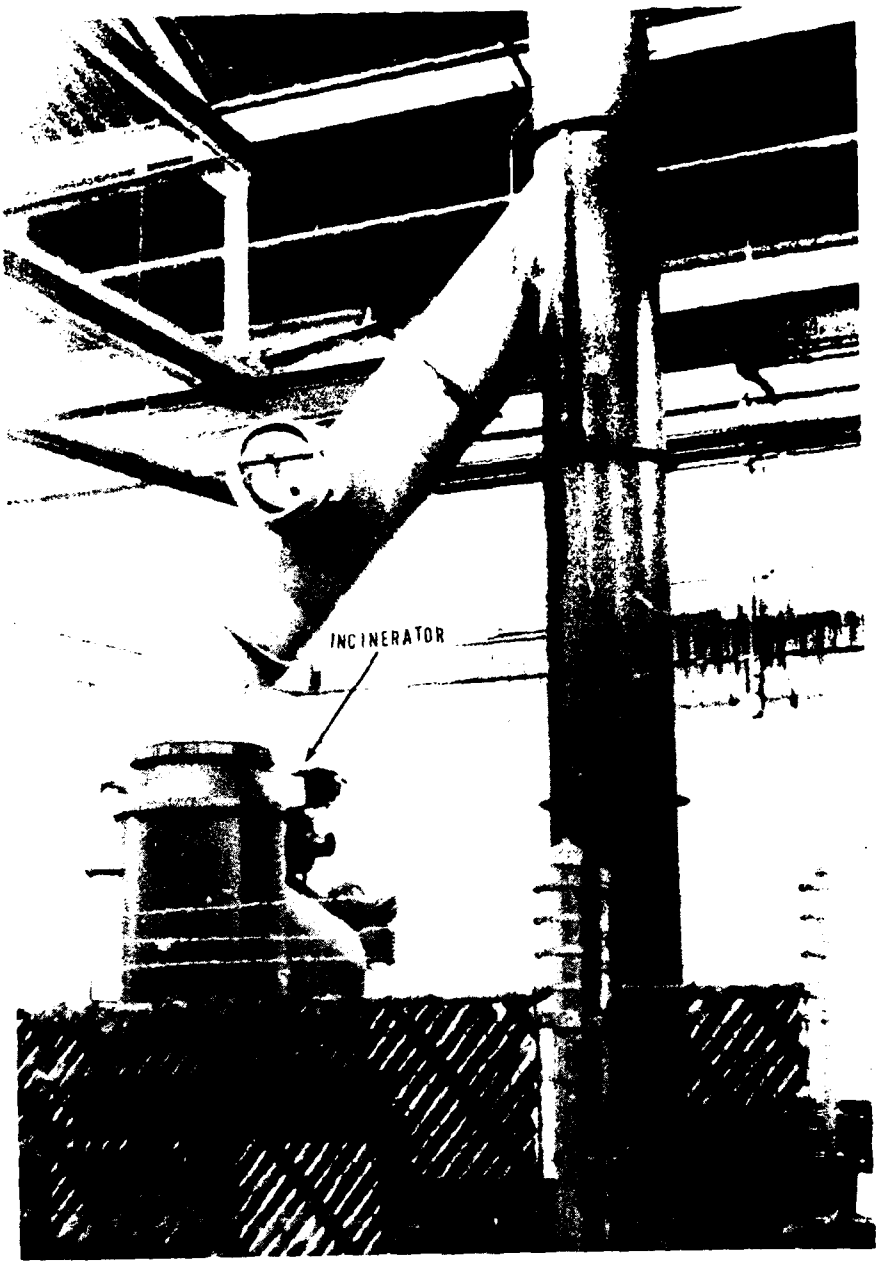


Figure 6. Transition Duct and Free Standing Stack

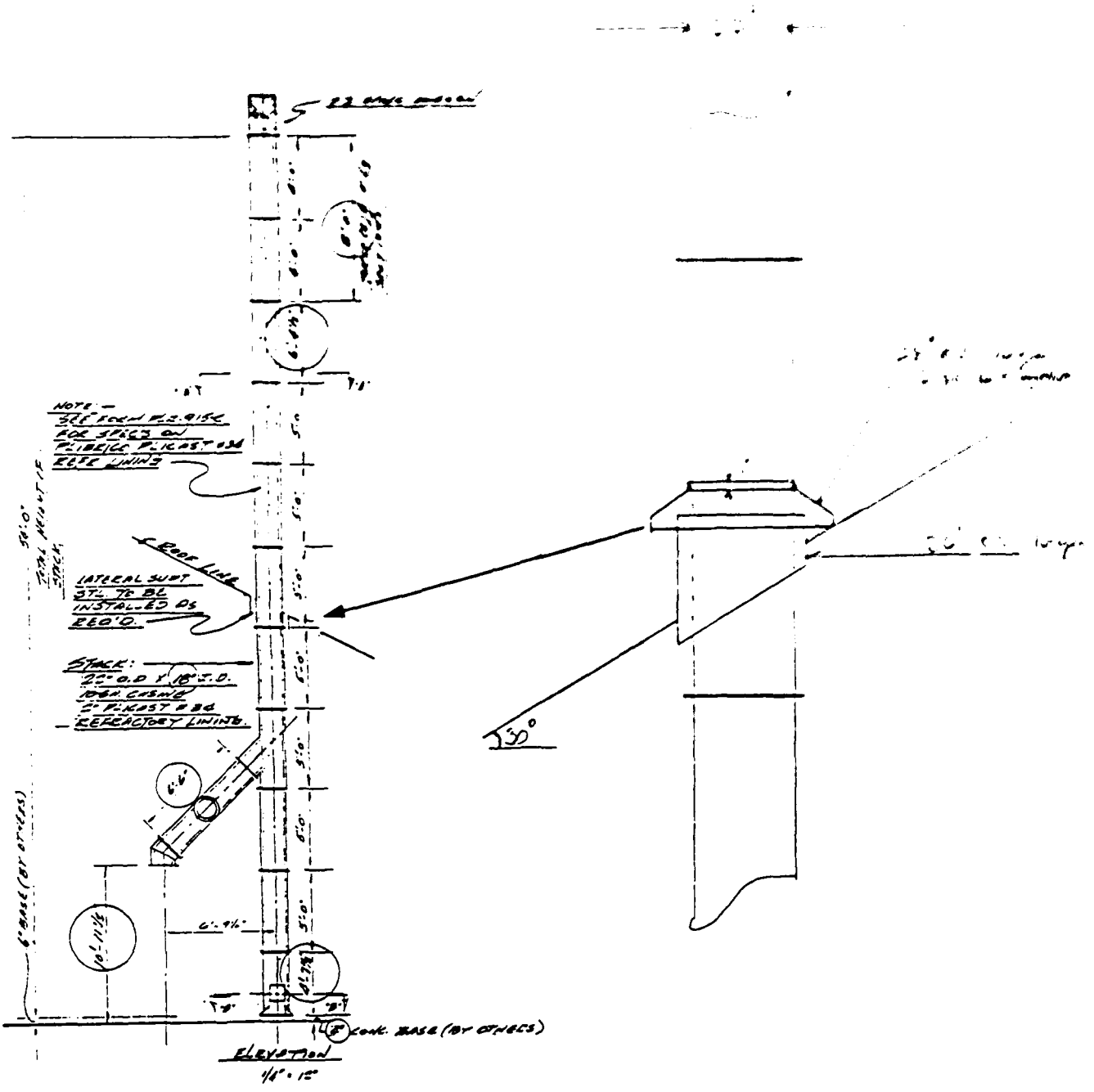


Figure 7. Schematic of Incinerator Exhaust Stack

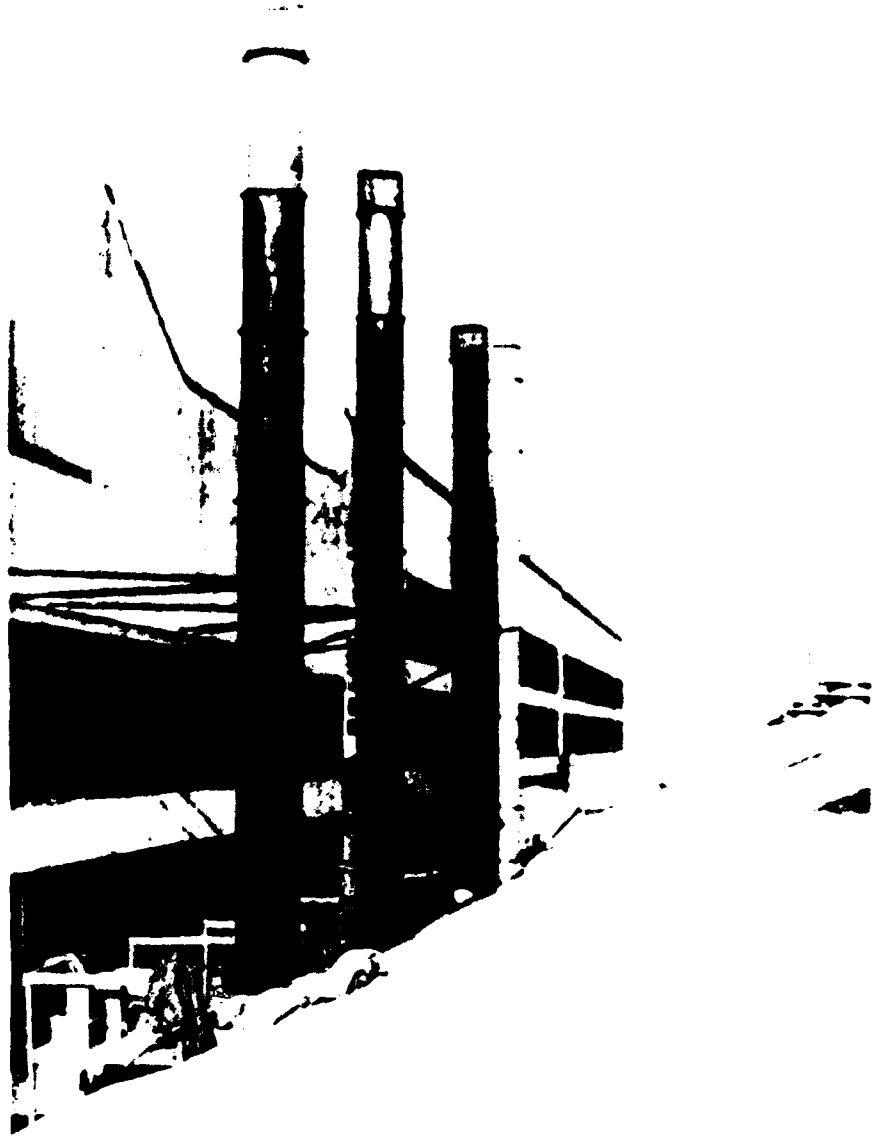


Figure 8. Incinerator Exhaust Stacks

TABLE 1. INCINERATOR COMBUSTION CYCLE

Time Into Cycle(hrs)	Event
0.0	Afterburner on for preheat
	Blower on
0.5	Primary burners on to start film combustion process
1.0	Primary burners off
12.0	Afterburner off
20.0	Blower off
23.0	Ash removed from combustion chamber

C. Applicable Standards

State standards applicable to incinerators used for refuse disposal or processing of salvageable materials are defined under the Nebraska Code of Rules and Regulations, Department of Environmental Control, Title 129 - Nebraska Air Pollution Control Rules and Regulations, Chapters 11 and 17. These regulations are found in Appendix B.

1. Chapter 11 - Incinerators; Emission Standards

Chapter 11 prohibits the emission of particulate matter in excess of 0.2 grains of particulate matter per standard dry cubic foot of exhaust gas (gr/dscf), corrected to 12% carbon dioxide (CO_2), from any incinerator with a waste burning capacity less than 2,000 pounds per hour.

2. Chapter 17 - Visible Emissions; Prohibited

Chapter 17 prohibits emissions from any existing source which are of a shade or density equal to or darker than that designated as No. 1 on the Ringelmann chart or equivalent opacity of 20%.

D. Sampling Methods and Procedures

The Nebraska Code of Rules and Regulations, Title 129, Chapter 21 requires that emission testing be conducted in accordance with Appendix A to Title 40, Code of Federal Regulations, Part 60 (40 CFR 60). Therefore, sample train preparation, sampling and recovery, calculations and quality assurance were done in accordance with the methods and procedures outlined in 40 CFR 60, Appendix A. The state requested that emission testing be directed towards the following pollutants:

1. Particulate matter

2. Hydrogen chloride (HCl)

3. Heavy metals: antimony, arsenic, cadmium, lead, mercury, silver, zinc

A State on-site observer evaluated visible emissions.

For testing purposes, the incinerators were operated according to normal day-to-day procedures; this included testing with the normal charge weight of 500 to 600 pounds of film.

Particulate emissions testing was conducted in accordance with EPA Method 5, found in 40 CFR 60, Appendix A. Testing requires three one-hour sample runs per stack; the results of which are averaged for a final emission rate. Based on a request from the state, we tried to start the first sampling run as close to 30 minutes into the incinerator burn as possible. Table 2 provides a summary of test conditions including incinerator start times, run start times, charge weights and stack conditions encountered during testing.

Sampling ports were installed in each stack approximately 4 feet above the roof line which provided sampling sites between 7 and 8 duct diameters downstream (each stack had a slightly different inside diameter) and greater than 2 duct diameters upstream from any flow disturbance. Sampling ports and platforms can be seen in Figure 9. Based on the inside stack diameters, port locations and type of sample (particulate), 16 traverse points (8 per diameter) were used to collect a representative particulate sample. A typical stack cross section and the actual traverse point locations for each stack is provided in Appendixes C-F.

Prior to every sample run on each stack, cyclonic flow was determined by using the Type S pitot tube and measuring the stack gas rotational angle at each traverse point. Flow conditions were considered acceptable when the arithmetic average of the rotational angles was 20 degrees or less. A preliminary velocity pressure traverse was also accomplished at this time.

A grab sample for Orsat analysis (measures oxygen and CO for stack gas molecular weight determination) was taken during each sample run. Orsat sampling and analysis equipment are shown in Figures 10 and 11. Flue gas moisture content, needed for determination of flue gas molecular weight determination, was obtained during particulate sampling.

TABLE 2: TEST CONDITIONS

TEST CONDITIONS

INCINERATOR #	RUN #	INCINERATOR START TIME (MILITARY)	RUN START TIME (MILITARY)	CHARGE* WEIGHT (lb)	AVG STACK TEMPERATURE (F)	STACK** FLOWRATE (dscfm)	% CO2	% O2
1	1	1330(9 NOV)	1347	523	554	1089	2.2	16.7
1	2	0900(8 NOV)	1100		518	994	2.6	18.2
1	3		1245		493	914	1.8	18.6
2	1	0900	0937	542	648	1007	3.1	17.0
2	2		1221		640	1021	2.5	17.7
2	3		1416		623	987	2.0	18.2
3	1	0800	0823	529	619	817	2.1	17.3
3	2		1000		627	803	2.5	17.5
3	3		1129		623	771	1.2	17.9
4	1	0930	1020	544	638	1165	3.4	15.6
4	2		1226		587	1105	2.4	15.2
4	3		1421		455	1213	1.6	16.3

* lb = pounds
** dscfm = DRY STANDARD CUBIC FEET PER MINUTE

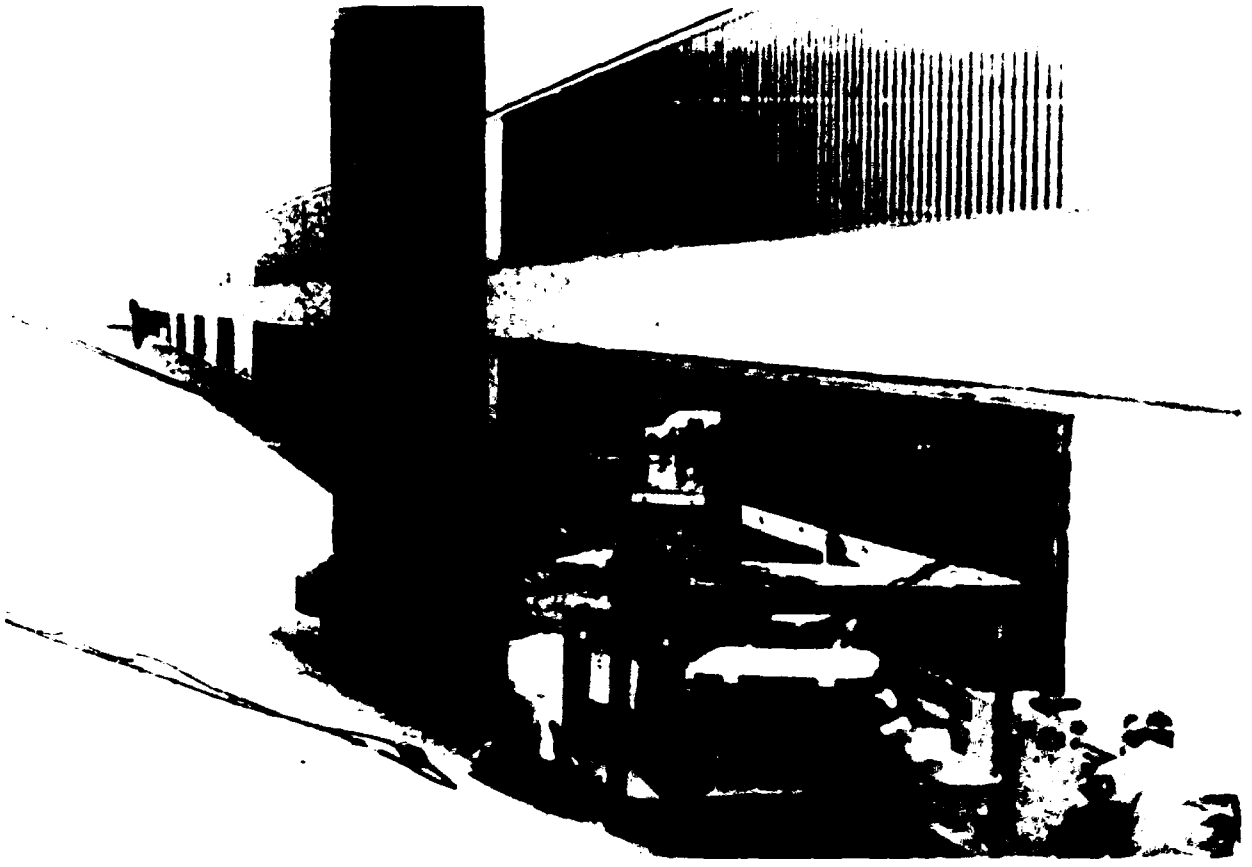


Figure 9. View of Sampling Ports and Platforms

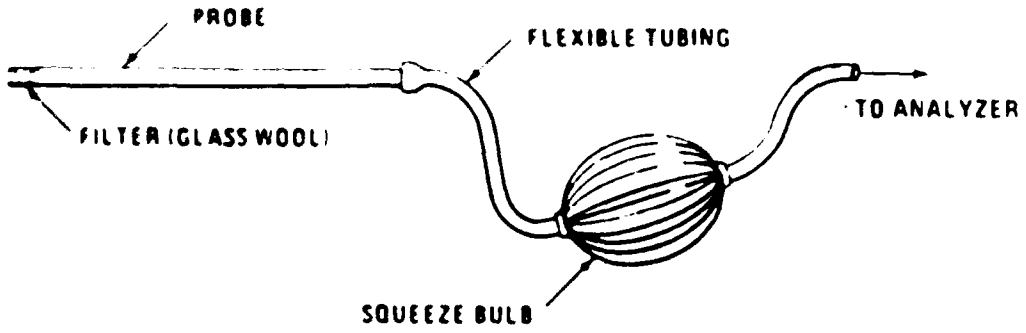


Figure 10. Grab Sampling Train

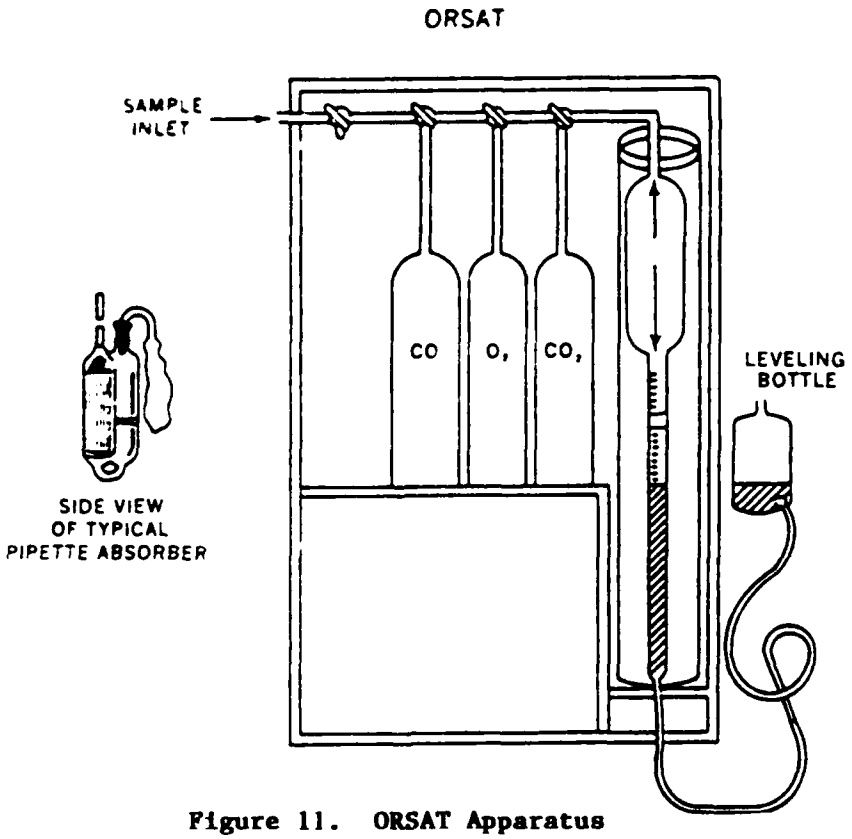


Figure 11. ORSAT Apparatus

Particulate and HCl samples were collected using the sampling train shown in Figure 12. The train consisted of a button-hook probe nozzle, heated stainless steel-lined probe, heated glass filter, impingers and a pumping and metering device. The nozzle was sized prior to each sample so that the gas stream could be sampled isokinetically. In other words, the velocity at the nozzle tip was the same as the stack gas velocity at each point sampled. Flue gas velocity pressure was measured at the nozzle tip using a Type S pitot tube connected to a 10-inch inclined-vertical manometer. Type K thermocouples were used to measure flue gas as well as sampling train temperatures. The probe liner was heated to minimize moisture condensation. The heated filter was used to collect particulates. The impinger train (first, third and fourth impingers: modified Greenburg-Smith type, second impinger: standard Greenburg-Smith design) was used as a condenser to collect stack gas moisture and HCl. A modification to the condenser was made to accomplish for the collection of HCl; the distilled water normally used in the first two impingers was replaced with known quantities of 0.1 N sodium carbonate to remove water from the gas sample as well as act as the collection media for the HCl. The pumping and metering system was used to control and monitor the sample gas flow rate. Equipment calibration data are found in Appendix G.

Particulate samples were analyzed according to the methods specified in Method 5. HCl samples were analyzed by ion chromatography. Heavy metals were analyzed by first combining the filter and acetone wash for each run, digesting the sample in an acid solution, and using atomic absorption to determine each metal.

E. Results

1. Visible Emissions:

Plume opacity was observed and recorded by the Department of Environmental Control on-site observer. Visible emissions from incinerator 4, run 2 were greater than 20% and, therefore, failed to meet the applicable state standards. Visible emissions from incinerators 1, 2 and 3 were determined to have an opacity of less than 20% and, therefore, met the applicable state standards.

2. Particulate emissions:

Front half or filterable particulate matter (material collected on sampling train surfaces up to and including the filter) was determined for compliance purposes. Condensable particulate matter (material collected in the impingers) was not determined. Field data sheets are found in Appendixes C-F and the resulting particulate emissions calculations are presented in Appendix H. Table 3 provides the final particulate emissions test results. All emissions results were corrected to 12% CO_2. The average particulate emissions determined for units 1, 2, 3 and 4 were 0.07, 0.10, 0.05 and 0.30 gr/dscf, respectively. Based on the state particulate emission standard of 0.2 gr/dscf, units 1, 2 and 3 meet the state standards. Unit 4 failed to meet the emissions standard because of the high particulate emissions encountered during run 2.

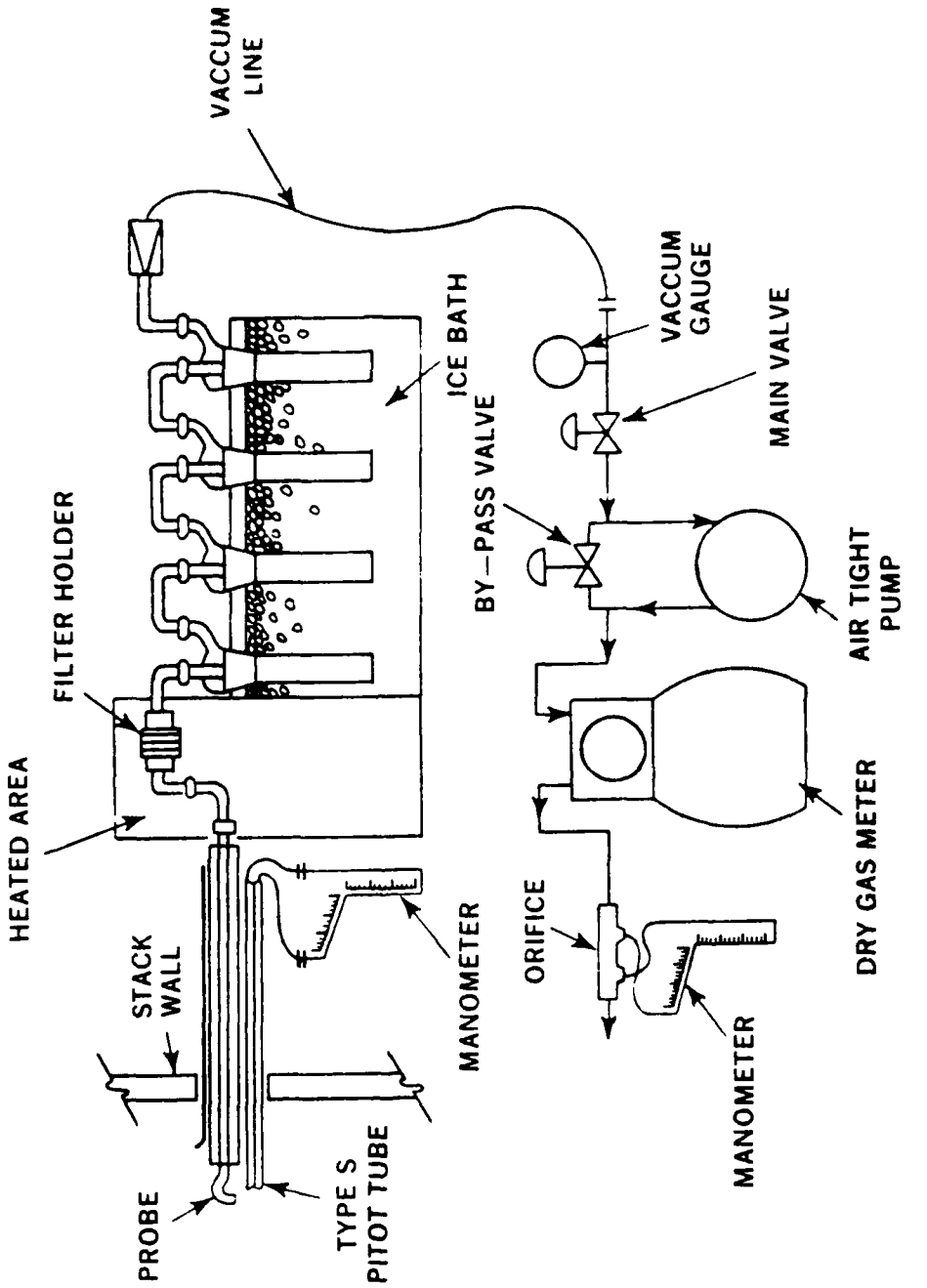


Figure 12. Particulate Sampling Train

TABLE 3: PARTICULATE EMISSION TEST RESULTS

INCINERATOR #	RUN #	STACK GAS %CO2	STACK GAS %02	CORRECTION FACTOR (12%/%CO2)	TOTAL* CATCH (mg)	EMISSIONS** (gr/dscf)	EMISSIONS** CORRECTED TO 12% CO2 (gr/dscf)
1	1	2.2	16.7	5.455	24.0	0.010	0.06
	2	2.6	18.2	4.615	47.1	0.021	0.10
	3	1.8	18.6	6.667	17.6	0.008	0.06
						AVG =	0.07
2	1	3.1	17.0	3.871	46.0	0.013	0.05
	2	2.5	17.7	4.800	82.3	0.038	0.18
	3	2.0	18.2	6.000	29.3	0.014	0.08
						AVG =	0.10
3	1	2.1	17.3	5.714	15.7	0.006	0.03
	2	2.5	17.5	4.800	22.4	0.009	0.04
	3	1.2	17.9	10.000	19.1	0.008	0.08
						AVG =	0.05
4	1	3.4	15.6	3.529	61.4	0.027	0.10
	2	2.4	15.2	5.000	305.5	0.145	0.73
	3	1.6	16.3	7.500	24.7	0.010	0.08
						AVG =	0.30

* mg = milligrams
** gr/dscf = grains per dry standard cubic foot

TABLE 4: HYDROGEN CHLORIDE EMISSION TEST RESTULTS

INCINERATOR #	RUN #	TOTAL HCl* COLLECTED (mg)	SAMPLE** VOLUME (dscf)	STACK GAS*** FLOW RATE (dscfm)		E M I S S I O N S**** (gr/dscf)	(lb/hr)
1	1	14.7	35.9	1089		0.006	0.059
	2	25.0	34.1	994		0.011	0.097
	3	8.7	32.7	914		0.004	0.032
					AVG =	0.007	0.063
2	1	47.0	53.7	1007		0.014	0.117
	2	11.2	33.7	1021		0.005	0.045
	3	6.0	32.9	987		0.003	0.024
					AVG =	0.007	0.062
3	1	48.2	39.9	817		0.019	0.131
	2	55.1	38.1	803		0.022	0.154
	3	18.8	38.1	771		0.008	0.050
					AVG =	0.016	0.112
4	1	26.8	34.6	1165		0.012	0.119
	2	11.1	32.6	1105		0.005	0.050
	3	3.0	36.8	1213		0.001	0.013
					AVG =	0.006	0.061

* mg = milligrams
** dscf = dry standard cubic foot
*** dscfm = dry standard cubic feet per minute
**** gr/dscf = grains per dry standard cubic foot
lb/hr = pounds per hour

TABLE 5: HEAVY METALS EMISSIONS TEST RESULTS

INCINERATOR #	RUN #	SAMPLE* VOLUME (dscf)	STACK GAS** FLOW RATE (dscfm)		EMISSIONS*** (gr/dscf/lb/hr) ANTIMONY	ARSENIC	CADMIUM	LEAD	MERCURY	SILVER	ZINC
1	1	35.9	1089								
1	2	34.1	994		1.7E-5/2.0E-4	<	<	<	6.5E-6/1.0E-4	5.0E-4/4.8E-3	3.0E-4/2.8E-3
1	3	32.7	914		2.7E-5/2.0E-4	<	<	1.2E-5/1.0E-4	1.1E-5/1.0E-4	9.0E-4/7.5E-3	2.0E-4/1.4E-3
					1.8E-5/1.0E-4	<	<	<	8.5E-6/1.0E-4	4.0E-4/3.2E-3	2.0E-4/1.3E-3
				AVG =	2.1E-5/1.7E-4			3.9E-6/3.3E-5	8.7E-6/1.0E-4	6.0E-4/5.2E-3	2.3E-4/1.8E-3
2	1	53.7	1007								
2	2	33.7	1021		1.1E-5/1.0E-4	<	2.9E-6/2.5E-5	4.3E-6/3.7E-5	4.6E-6/4.0E-5	1.0E-3/8.5E-3	2.0E-4/1.8E-3
2	3	32.9	987		1.7E-5/2.0E-4	<	8.2E-6/1.0E-5	2.7E-5/2.0E-4	2.6E-5/2.0E-4	6.0E-4/5.0E-3	3.0E-4/2.5E-3
					1.9E-5/2.0E-4	<	<	1.2E-5/1.0E-4	1.9E-5/2.0E-4	6.0E-4/2.3E-3	5.0E-4/4.4E-3
				AVG =	1.6E-5/1.7E-4		3.7E-6/1.2E-5	1.4E-5/1.0E-4	1.7E-5/1.0E-4	7.3E-4/5.3E-3	3.3E-4/2.9E-3
3	1	39.9	817								
3	2	38.1	803		1.6E-5/1.0E-4	<	<	1.8E-5/1.0E-4	3.9E-6/2.7E-5	3.0E-4/2.2E-3	2.0E-4/1.5E-3
3	3	38.1	771		1.6E-5/1.0E-4	<	<	1.4E-5/1.0E-4	5.3E-6/3.6E-5	6.0E-4/4.1E-3	4.0E-4/2.7E-3
					4.1E-6/2.7E-5	<	<	5.7E-6/3.8E-5	2.0E-7/1.3E-6	2.0E-4/1.1E-3	2.0E-4/1.1E-3
				AVG =	1.2E-5/1.0E-4			1.2E-5/1.0E-4	3.1E-6/2.2E-5	3.7E-4/2.5E-3	2.7E-4/1.8E-3
4	1	34.6	1165								
4	2	32.6	1105		1.6E-5/2.0E-4	<	5.0E-6/5.0E-5	8.0E-6/1.0E-4	3.9E-5/4.0E-4	9.0E-4/9.4E-3	4.0E-4/4.1E-3
4	3	36.8	1213		1.9E-5/2.0E-4	<	8.1E-6/1.0E-4	2.5E-5/2.0E-4	4.2E-5/4.0E-4	1.0E-3/9.0E-3	3.0E-4/2.7E-3
					1.7E-5/2.0E-4	<	<	7.1E-6/1.0E-4	2.4E-5/2.0E-4	2.0E-4/2.0E-3	3.0E-4/3.6E-3
				AVG =	1.7E-5/2.0E-4		4.4E-6/5.0E-5	1.3E-5/1.3E-4	3.5E-5/3.3E-4	7.0E-4/6.8E-3	3.3E-4/3.5E-3

* dscf = dry standard cubic feet
** dscfm = dry standard cubic feet per minute
*** gr/dscf = grains per dry standard cubic foot
lb/hr = pounds per hour
E-X = 10 raised to the -X power
< = less than the analytical detection limit of 10 micrograms

3. HCl emissions:

At this time, there are no state standards for emissions of HCl. Table 4 presents the final HCl emissions test results. HCl calculations are found in Appendix I.

4. Heavy metal emissions:

At this time, there are no State standards for emissions of those metals for which we tested. Table 5 presents the final metals emissions test results. An example of the heavy metal emissions calculations (zinc) is found in Appendix J.

All calculations were made using the Environmental Protection Agency publication entitled Source Test Calculation and Check Programs for Hewlett-Packard 41 Calculators (EPA-340/1-85-013) and associated software programs.

III. CONCLUSIONS AND RECOMMENDATIONS

Compliance testing results indicate that incinerators 1, 2 and 3 are in compliance with applicable State visible and particulate emissions standards. Incinerator 4 failed to meet State compliance standards with respect to both visible and particulate emissions standards. This unit failed to meet emissions standards only on test run 2. Runs 1 and 3 were below applicable standards. It is not known at this time what caused the high degree of plume opacity and particulate emissions during this one test run; however, it appears that a combustion malfunction might have occurred during the run such as a malfunction of a supply air fan or cutback of the secondary burner. We noted that the secondary burner did not shutdown completely because it could be heard operating by the test team.

It is our opinion that a problem with incinerator 4's operation caused it to fail the emission testing. All operational components should be checked, their operation verified, and the unit operated within manufacturer's specifications. If the cause is corrected, a retest of this incinerator would show the incinerator able to meet applicable limits.

REFERENCES

1. Standards of Performance for New Stationary Sources, Title 40, Part 60, Code of Federal Regulations, July 1, 1984.

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, April 1977.

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, Sept 1985.

APPENDIX A

Personnel Information

(This page left blank)

1. Test Team

Maj James Garrison, Chief, Air Quality Function Staff
Capt Paul Scott, Meteorologist
1Lt Charles Attebery, Consultant, Environmental Quality
SrA James Jarbeau, Industrial Hygiene Technician

USAFOEHL/ECQ
Brooks AFB TX 78235-5501

2. Offutt AFB on-site representatives

Capt Randall Boyce	Ehrling Berquist Strategic Hospital/SGPB AV 271-6372/3714 COM (402)294-6372/3714
Ed Lueninghoener Johnette Shockley Lynn Tungland	55 CSG/DEEV 55 CSG/DEEV 55 CSG/DEEV AV 271-4087/7621 COM (402)294-4087/7621
SSgt Patrick McAlexander	544 TMS/TGOPWL AV 271-3434/4404 COM (402)294-3434/4404

3. State of Nebraska on-site representative

David Meierhenry
Air Quality Division
Inspection and Compliance
Nebraska Department of Environmental Control
Box 94877
Lincoln NE 68509-4877
(402)471-2186

(This page left blank)

APPENDIX B

State Regulations

(This page left blank)

Chapter 9 — CONTROLS FOR TRANSFERRING, CONVEYING, RAILCAR AND TRUCK LOADING AT ROCK PROCESSING OPERATIONS IN CASS COUNTY

001 By July 1, 1981, the owner or operator of any rock processiong operation located in Cass County shall install, operate and maintain a system to reduce potential emissions from conveying, transfer operations, and railcar and truck loading by 85 percent Compliance with this Chapter may be demonstrated by the application of a system of sprays, hoods, enclosures, and/or filters deemed adequate by the Director.

Chapter 10 — FUEL BURNING EQUIPMENT; PARTICULATE EMISSIONS LIMITATIONS FOR EXISTING SOURCES

001 No person shall cause or allow particulate matter caused by the combustion of fuel to be emitted from any stack or chimney into the outdoor atmosphere in excess of the hourly rate set forth in the following table

Total Heat Input in Million British Thermal Units Per Hour	Maximum Allowable Emissions of Particulate Matter in Pounds per Million British Thermal Units
10 or less	0.60
10,000 or more	0.12

002 The allowable emission rate for equipment having immediate heat input between 10 (10^6) BTU and 10,000 (10^6) BTU may be determined by the formula:

$$A = \frac{1.026}{233}$$

A = The allowable emission rate in Lb/Hr/10^6 BTU
I = The total heat input in 10^6 BTU/Hr

003 For the purpose of these regulations, the heat input shall be the aggregate heat content of all fuels whose products of combustion pass through a stack, or the equipment manufacturer's or designer's guaranteed maximum input, whichever is greater. The total heat input of all fuel burning units at a plant or on a premises shall be used for determining the maximum allowable amount of particulate matter which may be emitted.

Chapter 11 — INCINERATORS; EMISSION STANDARDS

001 These regulations shall apply to all existing incinerators used for refuse disposal or for the processing of salvageable materials except refuse incinerators located on residential premises containing five or less dwelling units and used exclusively for the disposal of waste originating on said premises.

002 No person shall cause or permit emissions of particulate matter to be discharged into the outdoor atmosphere:

002.01 From any incinerator with a waste burning capacity less than 2,000 pounds per hour, to exceed 0.2 grains of particulate matter per standard dry cubic foot of exhaust gas, corrected to twelve percent (12%) carbon dioxide.

002.02 From any incinerator with a waste burning capacity equal to or in excess of 2,000 pounds per hour, to exceed 0.1 grains of particulate matter per standard dry cubic foot of exhaust gas, corrected to twelve percent (12%) carbon dioxide. In correcting the grain loading to twelve percent (12%) carbon dioxide, the exhaust gases contributed by the burning of a liquid or gaseous fuel shall be excluded.

003 The burning capacity of an incinerator shall be the manufacturer's or designer's guaranteed maximum rate or such other rate as may be determined by the Director in accordance with good engineering practice.

004 Waste burned during performance testing required by Chapter 21 shall be representative of the waste normally generated by the affected facility and shall be charged at a rate equal to the burning capacity of the incinerator. Copies of any additional operational data recorded during the test shall be submitted to the Department together with the completed test report forms.

Chapter 12 — HAZARDOUS AIR POLLUTANTS: EMISSION STANDARDS

001 Not withstanding any other provisions of these regulations, the "National Emissions Standards for Hazardous Air Pollutants", published at 40 CFR Sections 61.01-61.18, 61.30-61.71, 61.110-61.112, 61.140-61.247 for beryllium, beryllium rocket motor firing, mercury, vinyl chloride, equipment leaks (fugitive emission sources) of benzene, asbestos, and equipment leaks (fugitive emission sources) of hazardous volatile air pollutants, respectively, effective July 1, 1985, as amended at 50 Fed. Reg. 46290 (November 7, 1985), are hereby adopted and incorporated into these regulations. Appendices A, B, and C of 40 CFR Part 61 are also adopted and incorporated into these regulations

Chapter 13 — SULFUR COMPOUND EMISSIONS; EMISSION STANDARDS

001 No person shall allow sulfur oxides to be emitted from any existing fossil fuel burning equipment in excess of two and one half (2.5) pounds per million BTU input, maximum 2-hour average.

002 For the purpose of these regulations, the heat input shall be the aggregate heat content of all fuels whose products of combustion pass through a stack, or the equipment manufacturer's or designer's guaranteed maximum input, whichever is greater. The total heat input of all fuel burning units at a plant or on a premises shall be used for determining the maximum allowable amount of sulfur dioxide which may be emitted.

003 No person shall cause or allow sulfur oxides to be emitted from any existing equipment, other than fuel burning equipment, in excess of the following limits:

003.01 During any consecutive 12-month period, sulfur oxides in excess of the amount emitted during the 1971 calendar year.

003.02 During any 24-hour period, sulfur oxides exceeding the maximum amount emitted during any consecutive 24-hour period during the 1971 calendar year.

003.03 Nothing in sections 003.01 and 003.02 of this Chapter shall be construed to allow sources to conduct operations not in accordance with Chapters 4 and 6.

003.04 Nothing in 003.01, 003.02 or 003.03 of this Chapter shall be interpreted to allow any source to operate in violation of emergency reduction plans pursuant to Chapter 25.

003.05 If emission data for sulfur dioxide for the 1971 calendar year is not available, estimates of emissions shall be made based on materials processed or produced and appropriate emission factors developed by the U.S. Environmental Protection Agency.

Chapter 14 — NITROGEN OXIDES (CALCULATED AS NITROGEN DIOXIDE); EMISSIONS STANDARDS FOR EXISTING STATIONARY SOURCES

001 Nitric Acid Manufacturing — No owner or operator of an installation pro-

ducing nitric acid either as an end product or for use in intermediate steps in production of other products will exceed the following limitations on the emission of oxides of nitrogen (calculated as nitrogen dioxide):

001.01 5.5 pounds per ton of 100 percent nitric acid produced, or

001.02 A concentration of nitrogen dioxide equivalent to 400 parts per million (p.p.m.) by volume, whichever is more stringent.

Chapter 15 — OPEN FIRES, PROHIBITED; EXCEPTIONS

001 No person shall cause or allow any open fires.

002 Exceptions

002.01 Fires set solely for recreational purposes or for outdoor cooking of food for human consumption on other than commercial premises and no nuisance or hazard is created.

002.02 Fires set for the purpose of training public and industrial fire fighting personnel.

002.03 Fires set in the operation of smokeless flare stacks for the combustion of waste gases, provided they meet the requirements of Chapter 17, Visible Emissions for Stationary Sources.

002.04 Fires set in an agricultural operation where no nuisance or traffic hazard is created. For the purpose of this regulation, "fires set in an agricultural operation" shall mean:

002.04A The burning of any trees or vegetation indigenous to the property of the owner or person in lawful possession of the land; and

002.04B The burning of any agriculturally related material potentially hazardous and where disposal by burning is recommended by the manufacturer. Such materials must have been used on the owner's property or person in legal possession of the said property.

002.05 Unless prohibited by local ordinances, fires set to destroy household refuse on residential premises containing ten or less dwelling units, by individuals residing on the premises and no nuisance or traffic hazard is created.

002.06 For the purpose of plant and wildlife and parks management, provided such burning is conducted by the Nebraska Game Commission, the United States Forest Service, or the University of Nebraska.

002.07 Unless prohibited by local ordinances or regulations, fires set with the written permission of the Director:

002.07A For the purpose of destroying dangerous materials, diseased trees, or abatement of a fire hazard.

002.07B For the purpose of land clearing for roads or other construction activity.

002.07C For the purpose of destroying wood and trees at community land disposal sites, in which case such burning must be distinctly separate from the disposal area for non-burnables.

002.08 Permits for open fires as specified in this regulation will be granted only if there is no other practical means of disposal. Any burning of materials not specified in the burning permit will result in immediate withdrawal of the permit.

Chapter 16 — RESPONSIBILITY; DEFINED

001 It shall be prima facie evidence that the person who owns or controls property on which burning occurs has caused or permitted said open burning.

Chapter 17 — VISIBLE EMISSIONS; PROHIBITED (EXCEPTIONS DUE TO BREAKDOWNS OR SCHEDULED MAINTENANCE: SEE CHAPTER 22)

001 No person shall cause or allow emissions, except steam, from any existing source, which are of a shade or density equal to or darker than that designated as No. 1 on the Ringelmann Chart, or equivalent opacity of twenty percent (20%).

002 Exceptions:

002.01 No person shall cause or allow emissions from any existing teepee waste wood burner which are of a shade or density equal to or darker than that designated as No. 2 on the Ringelmann Chart, or equivalent opacity of forty percent (40%).

002.02 No person shall cause or allow emissions from any existing alfalfa dehydration plant dryer which are of a shade, density or opacity greater than thirty percent (30%).

002.03 This rule shall not be applied to food processing ovens in Dodge County until April 30, 1981.

003 All new sources shall comply with section 001 of this Chapter unless a New Source Performance Standard applies as specified in Chapter 6.

Chapter 18 — DUST; DUTY TO PREVENT ESCAPE OF

001 Handling, Transportation, Storing. No person may cause or permit the handling, transporting or storage of any material in a manner which may allow particulate matter to become airborne in such quantities and concentrations that it remains visible in the ambient air beyond the premises where it originates.

002 Construction, Use, Repair, Demolition. No person may cause or permit a building or its appurtenances or a road, or a driveway, or an open area to be constructed, used, repaired or demolished without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the premises where it originates. The Director may require such reasonable measures as may be necessary to prevent particulate matter from becoming airborne, including but not limited to paving or frequent cleaning of roads, driveways and parking lots; application of dust-free surfaces; application of water; and the planting and maintenance of vegetative ground cover.

Chapter 19 — COMPLIANCE; TIME SCHEDULE FOR

001 Except as otherwise noted in specific emission control regulations, compliance to these regulations shall be according to the following schedule:

001.01 All new or modified installations that required approval under the provisions of Chapter 6 shall be in compliance with all applicable emission control regulations at start-up any time after the effective date of the applicable emission control regulation. Provided, however, such installation may, at the request of the operator and under conditions approved by the Department, be operated for such specified time periods as are required to make necessary adjustments on the equipment. Compliance must be demonstrated in conformance with Chapter 21.

001.02 All existing installations and open burning operations subject to Chapter 4, 004 shall be in compliance with

Published by THE BUREAU OF NATIONAL AFFAIRS INC., Washington, D.C. 20037

APPENDIX C

Incinerator 1 Field Data

(This page left blank)

DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: #1 Stack diameter at ports: 1.42 (ft)

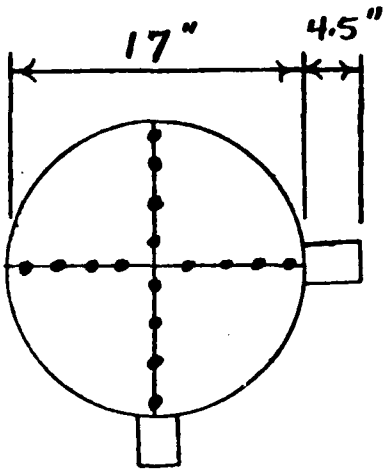
Distance A (ft) _____ (duct diameters) > 2

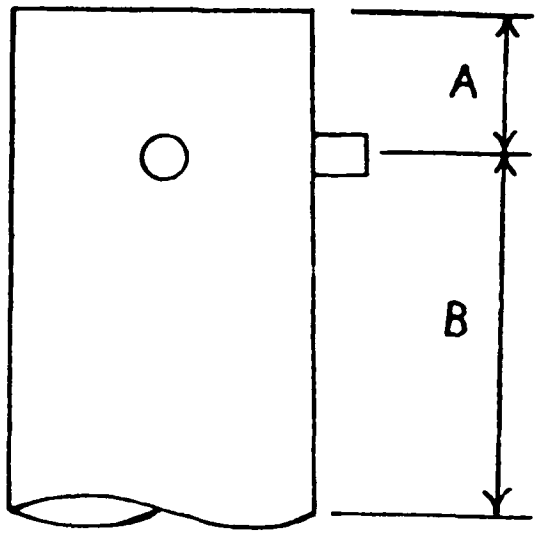
Recommended number of traverse points as determined by distance A: 8

Distance B (ft) _____ (duct diameters) > 7

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

Number of traverse points used: 16





STACK TRAVERSE POINT LOCATIONS

STACK DIAMETERS(inches)

Stack #1 = 17.0

Stack #2 = 16.5

Stack #3 = 13.4

Stack #4 = 18.3

	STACK #			
	DISTANCE FROM WALL(inches)			
POINT NUMBER	#1	#2	#3	#4
1	0.5	0.5	0.5	0.6
2	1.7	1.7	1.4	1.9
3	3.3	3.2	2.6	3.5
4	5.5	5.3	4.3	5.9
5	11.5	11.2	9.1	12.4
6	13.7	13.3	10.8	14.8
7	15.2	14.8	12.0	16.4
8	16.5	16.0	12.9	17.7

INCINERATOR # 1

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1
DATE: 4 NOV 80
PLANT: BLDG D
BASE: OFFUTT
SAMPLE BOX NUMBER: RHC
METER BOX NUMBER: NUTECH
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION
CHARGE WT:
523
negligible opacity

EQUATIONS
$°R = °F + 460$
$H = \left[\frac{(13.6)(\Delta H)(C_p)(A)}{C_f} \right]^2 \frac{T_s}{T_m} V_t$

Pitot q.f
Preheated 15 min
Post heated 5 min

Fired at 1330
stud 1347

AMBIENT TEMP: 50 °F
STATION PRESS: 28.74 in Hg
HEATER BOX TEMP: °F
PROBE HEATER SETTING:
PROBE LENGTH: 41 in
NOZZLE AREA: .376 sq ft
C_p: 0.84
DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	STACK TEMP (°F)	STACK TEMP (°R)	VELOCITY HEAD (V_p)	ORIFICE DIFF. PRESS. (H)	GAS SAMPLE VOLUME (cu ft)	GAS METER TEMP IN (°F)	GAS METER TEMP ΔH (T−) (°R)	GAS METER TEMP OUT (°F)	SAMPLE BOX TEMP (°F)	IMPINGER OUTLET TEMP (°F)
1	0	-2.0	550		.095	1.25	815.119	52		50	275	52
2	4	-2.4	604		.077	1.03		53		53	276	52
3	8	-2.4	602		.094	1.25		54		53	279	51
4	12	-2.4	514		.116	1.54		56		53	279	52
5	16	-2.4	534		.126	1.68		57		53	278	52
6	20	-2.5	534		.096	1.21		57		53	243	52
7	24	-2.5	543		.104	1.31		60		54	248	52
8	28	-2.5	548		.100	1.20	916.130	61		54	250	53
1	0	-2.0	512		.071	0.87		60		55	244	50
2	4	-2.3	521		.080	0.99		60		55	246	48
3	8	-2.5	529		.090	1.10		62		56	250	49
4	12	-2.5	540		.090	1.09		63		56	251	50
5	16	-2.5	548		.090	1.09		63		57	251	50
6	20	-3.0	550		.100	1.21		64		57	248	51
7	24	-3.0	552		.100	1.21		66		58	249	51
8	28	-3.0	554		.095	1.15	932.847	68		59	250	51
T_m = 57		T_s = 554	Δt = 147		$\sqrt{\Delta p}$ = 9.4855		V_m =					

OEHL FORM MAY 78 18

35

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
[illegible]	4 Aug 85	1

BUILDING NUMBER	SOURCE NUMBER
Bldg D	ENGINE #1

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.2995	0.2948	0.0047
ACETONE WASHINGS (Probe, Front Half Filter)	100.8616	100.8523	0.0093
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0240 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	207.0	200.0	7.0
IMPINGER 2 (H20)	206.0	200.0	6.0
IMPINGER 3 (Dry)	1.0	0	1.0
IMPINGER 4 (Silica Gel)	208.6	200.0	8.6
	Total Weight of Water Collected		22.6 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.2	2.2	2.2		2.2
VOL % O_2	16.6	16.8	16.8		16.7
VOL % CO					
VOL % N_2					

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

INCINERATOR #2

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2
DATE: 8 NOV 88
PLANT: BLDG D
BASE: OFFUTT
SAMPLE BOX NUMBER: RAC
METER BOX NUMBER: NUTECH
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

$°R = °F + 460$

$H = \left[\frac{5130\ F_d C_p A}{Co}\right]^2 \frac{T_m}{T_s} Vp$

Pitot check good
Pre-leak check at 15 in Hg good
Post good at 9 in Hg

start time 1100 L

AMBIENT TEMP: 52 F
STATION PRESS: 28.74 in Hg
HEATER BOX TEMP:
PROBE HEATER SETTING:
PROBE LENGTH: 4.5
NOZZLE AREA: .37 sq ft
Cp: 0.84
DRY GAS FRACTION (F_d):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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)
A 1	0	-3.0	482		.040	0.51	724.238	54		54	224	51
2	4.5	-3.0	500		.060	0.75		56		54	233	52
3	9.0	-4.0	518		.075	0.93		57		55	240	48
4	13.5	-5.0	555		.090	1.07		60		56	252	52
5	18.0	-5.0	553		.090	1.08		63		57	252	52
6	22.5	-5.0	556		.090	1.09		65		58	256	53
7	27.0	-5.0	547		.090	1.09		66		59	261	55
8	31.5	-5.0	546		.085	1.03	740.900	66		59	261	55
	36											
B 1	0	-4.0	490		.040	0.52		65		61	252	56
2	4.5	-4.0	511		.060	0.51		66		62	256	57
3	9.0	-5.0	492		.060	0.77		67		63	256	56
4	13.5	-5.0	526		.070	0.88		69		64	256	59
5	18.0	-5.0	511		.080	1.02		70		64	259	60
6	22.5	-5.0	494		.075	0.93		71		65	253	64
7	27.0	-5.0	507		.085	1.09		72		65	253	64
8	31.5	-5.0	516		.080	1.02	756.912	73		66	259	63
	36											
$\bar{T}_m$ = 63		$\bar{T}_s$ = 518	$\bar{\Delta H}$ = 0.90		$\sqrt{\Delta PSTS}$ = 8.3195		Vol = 37.274					

37

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	8 NOV 88	2

BUILDING NUMBER	SOURCE NUMBER
BLDG D	INCINERATOR # 1

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3150	0.2835	0.0315
ACETONE WASHINGS (Probe, Front Half Filter)	95.8243	95.8087	0.0156
BACK HALF (If needed)			0
	Total Weight of Particulates Collected		0.0471 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	202.0	200.0	2.0
IMPINGER 2 (H20)	208.0	200.0	8.0
IMPINGER 3 (Dry)	1.0	0	1.0
IMPINGER 4 (Silica Gel)	209.2	200.0	9.2
	Total Weight of Water Collected		20.2 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.4	2.6	2.6		2.6
VOL % O_2	18.2	18.0	18.2		18.2
VOL % CO					
VOL % N_2					

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

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

INJECTION # 1

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 3
DATE: 8 NOV 85
PLANT: BLDG D
BASE: OFFUTT
SAMPLE BOX NUMBER: RAC
METER BOX NUMBER: NUTECH
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

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

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

Pre leak check at 15 in Hg good
Data good
Post leak at 8 in Hg good

AMBIENT TEMP: 52 °F
STATION PRESS: 28.974 in Hg
HEATER BOX TEMP: °F
PROBE HEATER SETTING:
PROBE LENGTH: 45 in
NOZZLE ~~AREA (A)~~ Diameter: .376 sq ft
Cp: 0.84
DRY GAS FRACTION (Fd):

start 1245

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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	0	2.0	474		.020	0.26	756.766	66		66	236	59
2	4.5	2.0	490		.040	0.52		67		66	238	56
3	9.0	-2.0	492		.060	0.78		68		66	244	54
4	13.5	-2.0	510		.070	0.89		70		67	252	54
5	18.0	-2.0	525		.080	1.00		70		67	250	53
6	22.5	-2.5	488		.085	1.04		71		67	253	54
7	27.0	-3.0	487		.080	1.05		72		67	253	55
8	31.5	-3.0	493		.070	0.91		72		67	253	56
1	0	-3.0	480		.010	0.13		71		68	254	56
2	4.5	-3.0	490		.040	0.52		72		68	255	54
3	9.0	-3.0	487		.050	0.65		72		68	255	54
4	13.5	-3.0	496		.060	0.78		72		68	255	56
5	18.0	-3.0	499		.070	0.91		72		68	255	55
6	22.5	-3.0	493		.075	0.97		72		68	253	54
7	27.0	-3.0	492		.085	1.11		72		68	253	53
8	31.5	-3.0	490		.080	1.04	788.675	72		68	255	54
$\bar{T}_M$ = 69		$\bar{T}_S$ = 493	$\bar{\Delta H}$ = 0.79		$\sqrt{PSTS}$ = 7.4248		$\sqrt{Vol}$ = 31.369					

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	8NOV88	3

BUILDING NUMBER	SOURCE NUMBER
BLDG D	INCINERATOR #1

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.2970	0.2895	0.0075
ACETONE WASHINGS *(Probe, Front Half Filter)*	95.3917	95.3816	0.0101
BACK HALF *(If needed)*			
	Total Weight of Particulates Collected		0.0176 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 *(H20)*	204	200	4.0
IMPINGER 2 *(H20)*	204	200	4.0
IMPINGER 3 *(Dry)*	1.0	0	1.0
IMPINGER 4 *(Silica Gel)*	208.3	200	8.3
	Total Weight of Water Collected		17.3 gm

III. GASES *(Dry)*

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	1.8	1.8	1.8		1.8
VOL % O_2	18.6	18.6	18.6		18.6
VOL % CO					
VOL % N_2					

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

PRELIMINARY SURVEY DATA SHEET NO. 1

(Stack Geometry)

BASE: OFFUTT AFB	PLANT: BLDG D
DATE: 8 NOV 88	SAMPLING TEAM:
SOURCE TYPE AND MAKE: SILVER RECOVERY INCINERATOR	
SOURCE NUMBER: #1	INSIDE STACK DIAMETER: 21.5 - 4.5 = 17" Inches
RELATED CAPACITY: 600 lb/24hr	TYPE FUEL: gas
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER: 4.5 Inches	
NUMBER OF TRAVERSES:	NUMBER OF POINTS/TRAVERSE:

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			5.0
2			6.3
3			7.8
4			10.0
5			16.0
6			18.2
7			19.7
8			21.0

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE: OFFUTT	DATE: 8 NOV 88
~~BOILER NUMBER~~: INCINERITOR #1	
INSIDE STACK DIAMETER: 17	Inches
STATION PRESSURE: 28.974	In Hg
STACK STATIC PRESSURE: −0.16	In H20
SAMPLING TEAM:	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	CYCLONE ~~$\sqrt{\Delta P}$~~ α	STACK TEMPERATURE (°F)
1	.05	8	490
2	.05	7	490
3	.06	5	500
4	.09	4	505
5	.10	0	505
6	.10	2	506
7	.09	2	500
8	.05	3	495
	$\bar{\Delta P}$ = 0.074		
	$\bar{T_s}$ = 498		
	FPS = 21		
	NOZZLE DIA = 0.459		
AVERAGE			

NOZZLE CALIBRATION DATA FORM

Date 8 NOV 88 Calibrated by GARRISON

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
3	0.376	0.377	0.375	0.002	0.376

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.

(This page left blank)

APPENDIX D

Incinerator 2 Field Data

(This page left blank)

DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: #2 Stack diameter at ports: 1.38 (ft)

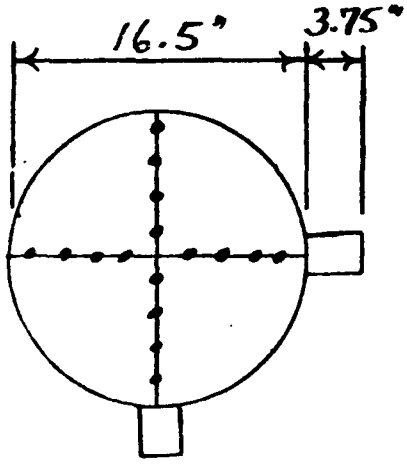
Distance A (ft) _____ (duct diameters) > 2

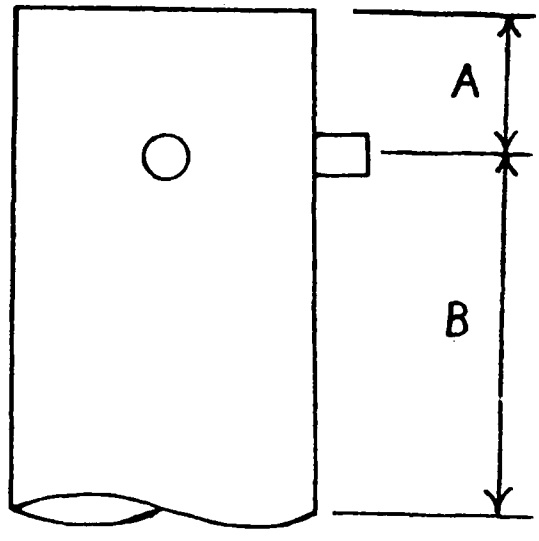
Recommended number of traverse points as determined by distance A: 8

Distance B (ft) _____ (duct diameters) > 7

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

Number of traverse points used: 16





STACK TRAVERSE POINT LOCATIONS

STACK DIAMETERS(inches)

Stack #1 = 17.0

Stack #2 = 16.5

Stack #3 = 13.4

Stack #4 = 18.3

	STACK #			
	DISTANCE FROM WALL(inches)			
POINT NUMBER	#1	#2	#3	#4
1	0.5	0.5	0.5	0.6
2	1.7	1.7	1.4	1.9
3	3.3	3.2	2.6	3.5
4	5.5	5.3	4.3	5.9
5	11.5	11.2	9.1	12.4
6	13.7	13.3	10.8	14.8
7	15.2	14.8	12.0	16.4
8	16.5	16.0	12.9	17.7

INCIN # 2

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1

DATE: 4/NOV 85

PLANT SITE: RAILROAD INCIN.

BASE: BLDG - D

SAMPLE BOX NUMBER: RAC

METER BOX NUMBER: NUTECH

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION

CHARGE WT: 542 #

PORT TEMP:

STK TEMP:

N ↑

B A

Assumed H_2O : 30
CO_2 : 30
O_2 = 17.0
M_d = 29.2

EQUATIONS

$°R = °F + 460$

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

Pre leak check at 15 in Hg

Post leak check at 15 in Hg

Pitot tube check good

static P = -.22

Start up time of incinerator 0900

Start temp 0937

AMBIENT TEMP: 48 °F

STATION PRESS: 28.34 in Hg

HEATER BOX TEMP: 240 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 48 in

NOZZLE AREA (A): .501 sq ft

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H2O) ΔP across Filter	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)
A 1	0	-5.0	590		.040	1.45	471.816	51		56	226	47
2	4	-6.0	600		.060	2.15		52		58	229	46
3	8	-8.5	604		.080	2.87		55		57	236	46
4	12	-10.0	645		.090	3.12		58		59	234	51
5	16	-15.0	664		.120	4.10		60		64	224	53
6	20	-18.0	684		.140	4.72		62		65	237	51
7	24	-18.0	690		.150	4.85		63		65	240	57
8	28	-18.0	692		.140	4.69	497.456	62		57	240	60
	32											
B 1	0	-7.0	585		.03	1.11		60		56	240	56
2	4	-4.6	597		.02	0.73		61		56	245	55
3	8	-14.0	624		.11	3.92		62		57	242	55
4	12	-17.0	670		.12	4.12		66		59	237	55
5	16	-17.0	683		.13	4.43		67		60	239	53
6	20	-17.0	687		.13	4.41		67		60	235	55
7	24	-17.5	672		.13	4.47		67		60	235	55
8	28	-17.5	683		.12	4.09	522.008	66		61	228	55
	32											
	$\bar{T}_M$ = 59	$\bar{T}_S$ = 648	$\bar{\Delta H}$ = 3.46		$\sqrt{PSTS}$ = 10.2976		CU FT 51.192					

522.008
471.816

OEHL FORM MAY 78 18

49

59
648

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	4 NOV 88	1

BUILDING NUMBER	SOURCE NUMBER
BLDG D	SILVER RECOVERY INCINERATOR #2

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3457	0.2756	0.0301
ACETONE WASHINGS (*Probe, Front Half Filter*)	104.2717	104.2558	0.0159
BACK HALF (*If needed*)			
	Total Weight of Particulates Collected		0.0460 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (*H20*)	214.0	200	14
IMPINGER 2 (*H20*)	200	200	0
IMPINGER 3 (*Dry*)	5.0	0	5.0
IMPINGER 4 (*Silica Gel*)	218.9	200.0	18.9
	Total Weight of Water Collected		37.9 gm

III. GASES (*Dry*)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	3.2	3.0	3.2		3.1
VOL % O_2	17.0	17.0	17.0		17.0
VOL % CO					
VOL % N_2					

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

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

INCIN # 2

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2

DATE: 4 NOV 88

PLANT/SL. REGIONAL INCIN BLDG D

BASE: OFFUTT

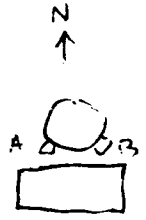
SAMPLE BOX NUMBER: RAC

METER BOX NUMBER: NUTEC II

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

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

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

Pre-leak check at 18 in Hg

Post-leak check at 7 in Hg

Pitot good

-.22 static P

start time 1221

AMBIENT TEMP: 55 °F

STATION PRESS: 28.374 in Hg

HEATER BOX TEMP: 235 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 72 in

NOZZLE ~~AREA (in²)~~ Diameter: .376 sq ft

Cp: 0.0841

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	ΔP STATIC PRESSURE (in H2O) Filter in Hg	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)
A 1	0	-2.0	587		.050	0.58	522.238	58		58	227	65
2	4	-2.0	598		.080	0.92		61		58	237	65
3	8	-3.0	615		.100	1.13		62		59	245	66
4	12	-3.0	655		.110	1.21		65		60	248	62
5	16	-3.0	661		.120	1.31		66		61	244	64
6	20	-3.0	671		.120	1.30		68		62	255	66
7	24	-3.0	661		.110	1.21		69		62	250	63
8	28	-3.0	653		.110	1.22	538.773	70		63	248	65
	32							68		63	243	64
B 1	0	-2.5	640		.060	0.70		68		63	243	64
2	4	-2.5	618		.065	0.75		69		64	250	63
3	8	-3.0	627		.080	0.91		69		63	242	56
4	12	-3.0	644		.090	1.01		70		64	240	57
5	16	-3.0	655		.120	1.33		70		65	244	54
6	20	-3.0	661		.130	1.43		71		66	245	54
7	24	-3.0	665		.130	1.43		72		66	246	56
8	28	-3.0	674		.120	1.31	554.977	72		66	245	56
	32											

$\overline{T_M} = 65$ $\overline{T_S} = 640$ $\overline{\Delta H} = 1.11$ $\overline{\sqrt{Ps}} = 10.3938$ vol = 32.739

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	4 NOV 88	2

BUILDING NUMBER	SOURCE NUMBER
BLDG D	SILVER RECOVERY INCINERATOR #2

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3410	0.2827	0.0583
ACETONE WASHINGS (Probe, Front Half Filter)	89.4720	89.4080	0.0640
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0823 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	206	200	6
IMPINGER 2 (H20)	208	200	8
IMPINGER 3 (Dry)	3.5	0	3.5
IMPINGER 4 (Silica Gel)	210.0	200.0	10.0
	Total Weight of Water Collected		27.5 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.6	2.4	2.4		2.5
VOL % O_2	17.6	17.8	17.8		17.7
VOL % CO					
VOL % N_2					

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

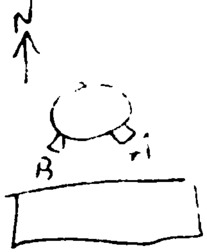
551.120
555.235
32.153

INCIN #2

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER	3
DATE	4 NOV 88
PLANT	SL. RECOVERY INCIN. BLDG D
BASE	OFFUTT
SAMPLE BOX NUMBER	RAC
METER BOX NUMBER	NUTECH
Qw/Qm	
Co	

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

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

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

Pre leak check 0.11 scfm @ 15 in Hg good
Post good at 0.1 in Hg
Pitot good

static P. -.22

Start time: 1416

AMBIENT TEMP (°F)	64
STATION PRESS (in Hg)	28.374
HEATER BOX TEMP (°F)	~250
PROBE HEATER SETTING	~190
PROBE LENGTH (in)	72
NOZZLE ~~AREA (A)~~ Diameter (sq ft)	.376
Cp	0.84
DRY GAS FRACTION (Fd)	

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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	0	-2.0	600		.055	0.64	555.235	66	~~65~~	65	227	58
2	4	-2.4	610		.070	0.84		66		65	235	58
3	8	-3.0	612		.075	0.87		68		65	240	59
4	12	-3.5	623		.080	0.94		69		65	233	57
5	16	-4.4	631		.110	1.44		70		66	240	58
6	20	-5.0	643		.120	1.34		70		66	244	57
7	24	-5.4	646		.120	1.34		71		66	241	52
8	28	-5.4	647		.11	1.23	571.140	72		66	241	52
	32							~~72~~		~~67~~	~~236~~	~~48~~
1	0	-3.4	596		.070	0.82		72		67	236	48
2	4	-3.4	607		.070	0.81		72		67	236	48
3	8	-3.4	610		.080	0.93		72		68	233	49
4	12	-4.0	626		.095	1.09		72		67	240	52
5	16	-4.5	632		.100	1.13		72		67	232	44
6	20	-5.0	637		.110	1.25		72		67	230	46
7	24	-5.0	621		.100	1.14		72		67	232	46
8	28	-5.4	621		.100	1.15	587.388	72		67	234	47
	32											
$\bar{T}_M$ = 530	$\bar{T}_S$ = 1083				$\bar{T}m$ = 68.5	$\bar{\Delta H}$ = 1.04		Vol = 32.153				
					$\bar{T}s$ = 623	$\bar{\sqrt{\Delta P}}$ =	0.9661					

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
CHANUTE	4 NOV 88	3

BUILDING NUMBER	SOURCE NUMBER
BLDG D	SILVER RECOVERY INCINERATOR #2

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.2986	0.2836	0.0150
ACETONE WASHINGS (Probe, Front Half Filter)	99.6415	99.6272	0.0143
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0293 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	214	200	14
IMPINGER 2 (H20)	204	200	4
IMPINGER 3 (Dry)	3	0	3
IMPINGER 4 (Silica Gel)	208.3	200.0	8.3
	Total Weight of Water Collected		29.3 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.0	2.0	2.1		2.0
VOL % O_2	18.2	18.2	18.1		18.2
VOL % CO					
VOL % N_2					

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

PRELIMINARY SURVEY DATA SHEET NO. 1

(Stack Geometry)

BASE: OFFUTT	PLANT: BLDG D
DATE: 4 NOV 83	SAMPLING TEAM: OEHL/ECG Air Quality
SOURCE TYPE AND MAKE: SILVERY RECOVERY INCINERATOR #2	
SOURCE NUMBER: #2	INSIDE STACK DIAMETER: 16.5 Inches
RELATED CAPACITY: 600 lbs/24 hr	TYPE FUEL: gas
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER: 3.75 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			4.3
2			5.5
3			6.9
4			9.1
5			14.9
6			17.1
7			18.5
8			19.7

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE: OFFUTT	DATE: 4 NOV '87
~~BOILER NUMBER~~: SILVER RECOVERY INCINERATOR # 2	
INSIDE STACK DIAMETER: 16.5 Inches	
STATION PRESSURE: 28.37Ø In Hg	
STACK STATIC PRESSURE: -.22 In H20	
SAMPLING TEAM:	

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	CYCLONIC ~~∝~~ ∝	STACK TEMPERATURE (°F)
1	.Ø2Ø	1	595
2	.Ø3Ø	1	598
3	.Ø4Ø	1	600
4	.Ø8Ø	1	6ØØ
5	.115	Ø	625
6	.14Ø	4	634
7	.14Ø	4	638
8	.14Ø	4	638
		AVG = 2°	
	% H_2O = 3		
	% CO_2 = 3		
	% O_2 = 17		
	MW = 29.2		
	FPS = 23.Ø		
	$\bar{T}_s$ = 611	Θ = .469	
AVERAGE			

NOZZLE CALIBRATION DATA FORM

Date 4 NOV 88 Calibrated by GARRISON

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
5	.500	.502	.502	.002	.501
3	.377	.377	.375	.002	.376

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.

(This page left blank)

APPENDIX E

Incinerator 3 Field Data

(This page left blank)

DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: #3 Stack diameter at ports: 1.12 (ft)

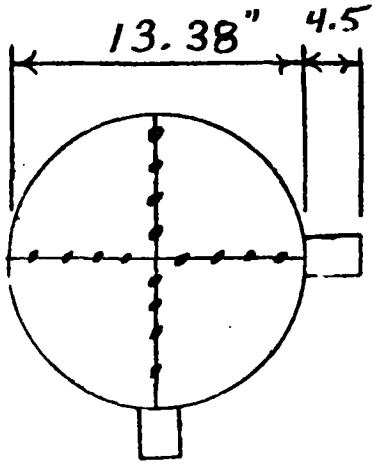
Distance A (ft) _____ (duct diameters) >2

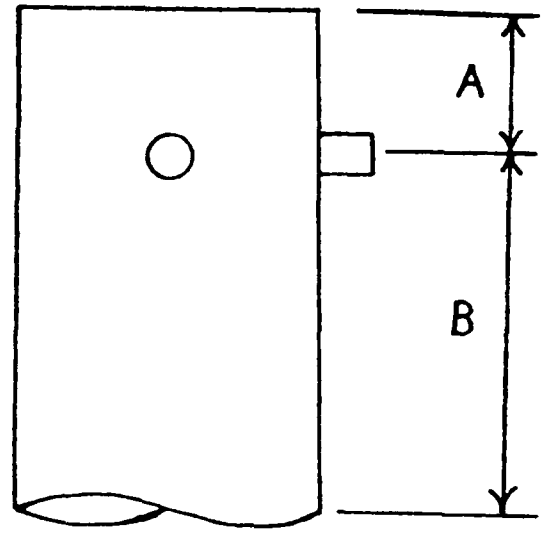
Recommended number of traverse points as determined by distance A: 8

Distance B (ft) _____ (duct diameters) >7

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

Number of traverse points used: 16





STACK TRAVERSE POINT LOCATIONS

STACK DIAMETERS(inches)

Stack #1 = 17.0

Stack #2 = 16.5

Stack #3 = 13.4

Stack #4 = 18.3

	STACK #			
	DISTANCE FROM WALL(inches)			
POINT NUMBER	#1	#2	#3	#4
1	0.5	0.5	0.5	0.6
2	1.7	1.7	1.4	1.9
3	3.3	3.2	2.6	3.5
4	5.5	5.3	4.3	5.9
5	11.5	11.2	9.1	12.4
6	13.7	13.3	10.8	14.8
7	15.2	14.8	12.0	16.4
8	16.5	16.0	12.9	17.7

INCINERATOR # 3

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1

DATE: 9 NOV 83

PLANT: BLDG D

BASE: OFFUTT

SAMPLE BOX NUMBER: RAC

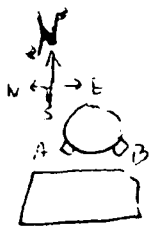
METER BOX NUMBER: NUTECH

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION

CHARGE OUT



Opacity Record

EQUATIONS

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

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

Pitot good

Pre leak check passed (5 min)

Post 9

Static P_s = -2.1

Fire hose check started 0823

AMBIENT TEMP: 58 °F

STATION PRESS: 29.746 in Hg

HEATER BOX TEMP: °F

PROBE HEATER SETTING:

PROBE LENGTH: 4 ft

NOZZLE AREA (A): .376 sq ft

Cp: 84

DRY GAS FRACTION (F.S):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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)
A 1	0	-2.5	581		.050	0.57	788.270	46		46	233	55
2	4	-3.0	606		.120	1.34		47		46	233	46
3	8	-3.0	624		.150	1.64		49		47	233	44
4	12	-3.0	619		.152	1.71		51		47	233	41
5	16	-3.0	615		.136	1.66		54		48	224	42
6	20	-3.0	622		.166	1.77		56		49	238	54
7	24	-3.0	630		.165	1.84		57		50	248	54
8	28	-3.0	622		.160	1.78	846.460	58		51	255	58
	32							54		51	226	54
B 1	0	-3.0	576		.096	1.05		59		51	260	59
2	4	-3.5	602		.140	1.59		60		52	260	56
3	8	-3.5	610		.160	1.81		61		53	266	54
4	12	-3.5	646		.160	1.76		62		54	255	55
5	16	-3.5	646		.160	1.76		63		55	255	56
6	20	-3.5	646		.160	1.76		64		56	254	61
7	24	-3.5	626		.145	1.63		65		56	255	62
8	28	-3.5	643		.135	1.49	825.235	66		57	257	62
	32											
$\bar{T}_m$ = 54		$\bar{T}_s$ = 619	ΔH = 1.57		$\sqrt{\Delta ps}$ = 1.2595		V_{mc} = 37.465 ft³					

OEHL FORM 18 MAY 78

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
CFEUTT	9 Nov 88	1

BUILDING NUMBER	SOURCE NUMBER
Bldg D	INCIN # 3

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.2892	0.2838	0.0054
ACETONE WASHINGS (Probe, Front Half Filter)	92.1820	92.1717	0.0103
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0157 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	202.0	200.0	2.0
IMPINGER 2 (H20)	214.0	200.0	14.0
IMPINGER 3 (Dry)	1.0	0	1.0
IMPINGER 4 (Silica Gel)	210.2	200.0	10.2
	Total Weight of Water Collected		27.2 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.1	2.1	2.0		2.1
VOL % O_2	17.3	17.3	17.4		17.3
VOL % CO					
VOL % N_2					

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

INCINERATOR # 3

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2

DATE: 9 NOV 83

PLANT: BLDG D

BASE: OFFUTT

SAMPLE BOX NUMBER: RAC

METER BOX NUMBER: NUTECH

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

$°R = °F + 460$

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

Pitot good

Pre leak test 15 in Hg good

static P = -.21

Post at 6 in Hg good

start at 1000

AMBIENT TEMP: 52 °F

STATION PRESS: 28.746 in Hg

HEATER BOX TEMP: °F

PROBE HEATER SETTING:

PROBE LENGTH: 6ft in

NOZZLE AREA (A) Dia: .376 sq ft

Cp: 0.84

DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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)
A 1	0	~~-3.2~~	593		.075	0.86	825.884	57		52	274	53
2	4	-2.0	611		.090	1.59		60		57	234	48
3	8	-2.5	618		.150	1.69		62		58	242	47
4	12	-2.5	657		.166	1.74		63		58	248	46
5	16	-2.5	655		.164	1.75		64		59	248	46
6	20	-2.5	659		.165	1.86		66		61	252	48
7	24	-3.0	662		.155	1.69		66		66	259	51
8	28	-3.0	661		.130	1.42	843.876	66		66	264	52
	32	|	|	|	|	|	|	|	|	|	|	|
B 1	0	-2.5	587		.080	0.93		64		59	246	56
2	4	-2.5	664		.100	1.15		65		60	246	55
3	8	-2.5	617		.130	1.49		67		61	249	56
4	12	-3.5	627		.130	1.69		67		61	247	55
5	16	-3.0	626		.140	1.58		68		61	245	62
6	20	-3.0	621		.145	1.65		69		62	246	61
7	24	-3.0	614		.150	1.72		69		62	247	62
8	28	-3.0	630		.145	1.64	862.289	70		63		

T_m=63 T_s=627 ΔH=1.52 $\sqrt{P_{STS}}$=12.0985 VOL=36.405 ft³

OEHL FORM 18 MAY 78

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
EFFUTT	9 NOV 78	2.

BUILDING NUMBER	SOURCE NUMBER
BLDG D	INCIN # 3

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.2988	0.2859	0.0129
ACETONE WASHINGS (Probe, Front Half Filter)	98.7299	98.7204	0.0095
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0224 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	202 ml	200	2.0
IMPINGER 2 (H20)	208 ml	200	8.0
IMPINGER 3 (Dry)	1 ml	0	1.0
IMPINGER 4 (Silica Gel)	210.6	200	10.6
	Total Weight of Water Collected		21.6 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.6	2.4	2.4		2.5
VOL % O_2	17.4	17.4	17.6		17.5
VOL % CO					
VOL % N_2					

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

INCINERATOR #3

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 3
DATE: 9 NOV 85
PLANT: BLDG D
BASE: OFFUTT
SAMPLE BOX NUMBER: RAC
METER BOX NUMBER: NUTECH
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION

EQUATIONS

$°R = °F + 460$

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

Pilot good
Pre leak check Pitot Hg good
Post leak check out

start at 1129 L

AMBIENT TEMP: 56 °F
STATION PRESS: 28.70 in Hg
HEATER BOX TEMP: °F
PROBE HEATER SETTING:
PROBE LENGTH: 48 in
NOZZLE ~~AREA (A)~~ Dia: .376 sq ft
Cp: 0.84
DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE ~~(in H2O)~~ inHg	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)
A 1	0	-3.4	600		.070	0.80	862.405	61		61	224	52
2	4	-4.0	606		.090	1.03		62		61	225	48
3	8	-5.0	610		.120	1.37		63		61	228	48
4	12	-5.5	613		.135	1.52		64		61	233	47
5	16	-6.0	613		.135	1.50		66		62	240	52
6	20	-6.0	638		.140	1.56		66		61	251	54
7	24	-6.0	636		.150	1.68		66		61	254	54
8	28	-6.0	633		.145	1.63	870.615	67		62	255	55
B 1	0	-4.0	598		.055	0.64		65		62	255	57
2	4	-5.0	604		.105	1.21		65		61	253	54
3	8	-6.0	624		.140	1.58		65		62	257	52
4	12	-6.0	640		.150	1.67		66		62	256	53
5	16	-6.0	633		.155	1.74		66		62	253	52
6	20	-6.5	622		.145	1.64		66		62	255	55
7	24	-6.5	640		.145	1.61	898.770	66		61	255	56
8	28		613		.140	1.60		66		62	255	56
$\bar{T}_m = 63$		$\bar{T}_s = 623$	$\Sigma H = 1.42$		$\overline{\sqrt{Ts}} \cdot \Sigma = 11.6027$		vol = 36.365					

OEHL FORM MAY 78 18

67

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	9 NOV 88	3

BUILDING NUMBER	SOURCE NUMBER
BLDG D	INCIN # 3

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.2952	0.2836	0.0116
ACETONE WASHINGS (Probe, Front Half Filter)	99.5655	99.5580	0.0075
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0191 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	206 ml	200	6.0
IMPINGER 2 (H20)	210 ml	200	10.0
IMPINGER 3 (Dry)	1 ml	0	1.0
IMPINGER 4 (Silica Gel)	210.4 g	200	10.4
	Total Weight of Water Collected		27.4 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	1.3	1.2	1.2		1.2
VOL % O_2	17.8	17.9	18.0		17.9
VOL % CO					
VOL % N_2					

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

PRELIMINARY SURVEY DATA SHEET NO. 1

(Stack Geometry)

BASE: OFFUTT	PLANT: BLDG 1
DATE: 9 NOV 85	SAMPLING TEAM: OEHL/ECQ Mir
SOURCE TYPE AND MAKE: SILVER RECOVERY INCINERATOR	
SOURCE NUMBER: # 3	INSIDE STACK DIAMETER: 13.38 Inches
RELATED CAPACITY: ~600 lbs/24 hrs	TYPE FUEL: gas
DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER: 4.5 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			5.6
2			5.9
3			7.1
4			8.8
5			13.6
6			15.3
7			16.5
8			17.4

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE: OFFUTT

DATE: 9 NOV

~~BOILER NUMBER~~

INCIN. # 3

INSIDE STACK DIAMETER: Inches

STATION PRESSURE: 28.706 In Hg

STACK STATIC PRESSURE: -.21 In H20

SAMPLING TEAM: OEHL/ECQ

TRAVERSE POINT NUMBER	VELOCITY HEAD, Vp IN H20	CYCLONIC $\sqrt{Vp}$ ∠	STACK TEMPERATURE (°F)
1	.094	5	585
2	.120	5	605
3	.140	0	617
4	.160	0	638
5	.150	0	625
6	.155	4	615
7	.150	4	618
8	.130	6	619
	AVERAGE		

NOZZLE CALIBRATION DATA FORM

Date 9 NOV 88 Calibrated by BARRISON

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.)		
3	0.377	0.375	0.377	0 002	0.376

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.

(This page left blank)

APPENDIX F

Incinerator 4 Field Data

(This page left blank)

DETERMINATION OF MINIMUM NUMBER OF TRAVERSE POINTS

Stack ID: #4 Stack diameter at ports: 1.52 (ft)

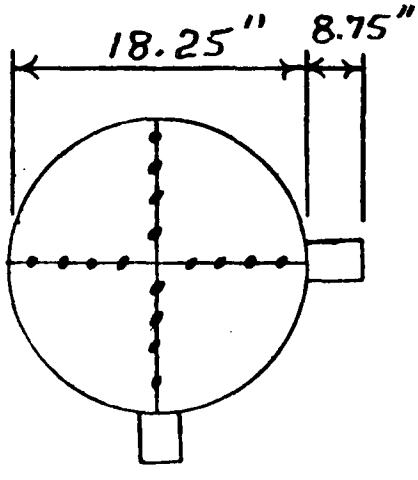
Distance A (ft) _____ (duct diameters) >2

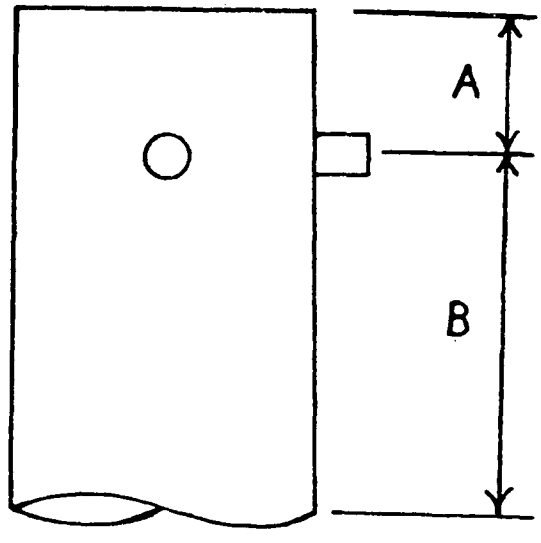
Recommended number of traverse points as determined by distance A: 8

Distance B (ft) _____ (duct diameters) >7

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

Number of traverse points used: 16





STACK TRAVERSE POINT LOCATIONS

STACK DIAMETERS(inches)

Stack #1 = 17.0

Stack #2 = 16.5

Stack #3 = 13.4

Stack #4 = 18.3

	STACK #			
	DISTANCE FROM WALL(inches)			
POINT NUMBER	#1	#2	#3	#4
1	0.5	0.5	0.5	0.6
2	1.7	1.7	1.4	1.9
3	3.3	3.2	2.6	3.5
4	5.5	5.3	4.3	5.9
5	11.5	11.2	9.1	12.4
6	13.7	13.3	10.8	14.8
7	15.2	14.8	12.0	16.4
8	16.5	16.0	12.9	17.7

INCINERATOR ~~[illegible]~~ # 1

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 1

DATE: 7 NOV

PLANT: BLDG. D

BASE: OFFUTT

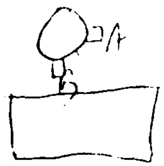
SAMPLE BOX NUMBER: RAC

METER BOX NUMBER: NUTECH

Qw/Qm:

Co:

SCHEMATIC OF STACK CROSS SECTION
Load 544 lbs



EQUATIONS

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

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

Pitot good

Burn start at 0830

Preleak check at 15 in Hg good

Post lk ck at 8 in Hg

Start time 1020

AMBIENT TEMP: 56 °F

STATION PRESS: 28.92 in

HEATER BOX TEMP: 238 °F

PROBE HEATER SETTING: 190

PROBE LENGTH: 4 in

NOZZLE AREA: .376 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)
A 1	0	-2.0	490		.035	0.44	588.335	50		49	225	49
2	4.5	-2.0	506		.080	0.81		52		52	226	49
3	9.0	-2.0	683		.090	0.94		54		52	224	46
4	13.5	-2.5	696		.105	1.09		56		52	227	48
5	18.0	-2.5	696		.105	1.09		57		52	236	50
6	22.5	-2.5	685		.100	1.05		59		53	244	52
7	27.0	-2.5	691		.100	1.05		64		54	246	52
8	31.5	-2.5	697		.095	0.99	604.600	60		54	246	52
	36											
B 1	0	-2.5	500		.045	0.57		58		56	237	48
2	4.5	-2.5	510		.080	0.87		60		56	240	48
3	9.0	-2.5	658		.090	0.98		61		56	242	48
4	13.5	-2.5	681		.090	0.96		61		56	243	49
5	18.0	-2.5	675		.090	0.96		61		56	243	50
6	22.5	-2.5	682		.090	0.96		61		57	243	51
7	27.0	-2.5	675		.100	1.07		62		57	242	49
8	31.5	-3.0	680		.095	1.01	621.185	62		57	244	50
	36											
	$\bar{T}_m$ = 56	$\bar{T}_s$ = 638	ΔH = 0.9[illegible]		√ΔP [illegible]	9.624	Vol	32.850				

OEHL FORM MAY 78 18

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
CHANUTE	7 NOV 85	1

BUILDING NUMBER	SOURCE NUMBER
BLDG	INCIN # 4

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.3260	0.2906	0.0354
ACETONE WASHINGS (Probe, Front Half Filter)	98.2814	98.2554	0.0260
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0614 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	211.0	200.0	11.0
IMPINGER 2 (H20)	206.0	200.0	6.0
IMPINGER 3 (Dry)	0.5	0	0.5
IMPINGER 4 (Silica Gel)	208.0	200.0	8.0
	Total Weight of Water Collected		25.5 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	3.4	3.4	3.3		3.4
VOL % O_2	15.6	15.6	15.6		15.6
VOL % CO					
VOL % N_2					

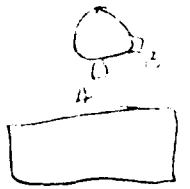
Vol % N_2 = (100% - % CO_2 - % O_2 - % CO)

INCINERATOR #1

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 2
DATE: 7 NOV 83
PLANT: BLDG-D
BASE: OFFUTT
SAMPLE BOX NUMBER: RDC
METER BOX NUMBER: NUTECH
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

$°R = °F + 460$

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

Pre leak check good at 15 in Hg
Post leak check at 7.5 in Hg

Pitot good

MEASURING OPACITY WITH THIS RUN — START 1226

AMBIENT TEMP: 50 °F
STATION PRESS: 29.21 in Hg
HEATER BOX TEMP: °F
PROBE HEATER SETTING:
PROBE LENGTH: 48 in
NOZZLE AREA (A): .37 sq ft
Cp: 0.54
DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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	0	-3.0	524		.060	0.74	628.692	56		55	225	48
2	4.5	-3.0	541		.065	0.78		56		55	235	48
3	9.0	-3.0	433		.065	0.72		56		55	236	49
4	13.5	-3.0	630		.080	0.84		59		56	247	52
5	18.0	-3.0	614		.080	0.90		59		56	256	52
6	22.5	-3.0	631		.080	0.89		59		56	257	52
7	27.0	-4.0	585		.070	1.04		59		56	260	52
8	31.5	-5.0	616		.090	1.01	637.158	59		56	257	51
1	0	-4.5	531		.030	0.37		59		57	224	52
2	4.5	-6.0	522		.065	0.76		59		57	226	51
3	9.0	-6.5	574		.080	0.94		61		57	226	51
4	13.5	-6.5	590		.080	0.93		61		58	225	51
5	18.0	-6.5	567		.080	0.95		61		58	226	51
6	22.5	-6.5	589		.075	0.87		61		57	229	52
7	27.0	-6.5	588		.075	0.87		62		58	228	56
8	31.5	-6.5	609		.065	0.74	652.765	62		58	229	57
	26											
T_m	58	T_s = 587	ΔH = .084		$\sqrt{P_{STS}}$ = 8.6698		VOL = 31.073 ft³					

OEHL FORM 18 MAY 78

79

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	7 NOV 88	2

BUILDING NUMBER	SOURCE NUMBER
BLDG D	INCIN #4

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	0.5280	0.2857	0.2423
ACETONE WASHINGS (*Probe, Front Half Filter*)	98.4794	98.4162	0.0632
BACK HALF (*If needed*)			
	Total Weight of Particulates Collected		0.3055 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (*H20*)	206.0	200.0	6.0
IMPINGER 2 (*H20*)	205.0	200.0	5.0
IMPINGER 3 (*Dry*)	3.0	0	3.0
IMPINGER 4 (*Silica Gel*)	208.8	200.0	8.8
	Total Weight of Water Collected		22.8 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	2.4	2.4	2.2		2.4
VOL % O_2	15.2	15.2	15.2		15.2
VOL % CO					
VOL % N_2					

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

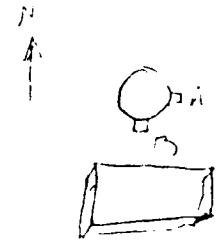
AMD FORM FEB 84 651 REPLACES OEHL 20, MAY 78, WHICH IS OBSOLETE.

INCINERATOR #4

PARTICULATE SAMPLING DATA SHEET

RUN NUMBER: 3
DATE: 7 NOV 85
PLANT: BL-DG D
BASE: OFFUTT
SAMPLE BOX NUMBER: RAC.
METER BOX NUMBER: NUTEC 11
Qw/Qm:
Co:

SCHEMATIC OF STACK CROSS SECTION



EQUATIONS

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

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

Pre leak check test is fairly good
Pitot good
Post leak check test is faulty

START @ 1421

AMBIENT TEMP: 50 °F
STATION PRESS: 28.291 in Hg
HEATER BOX TEMP: °F
PROBE HEATER SETTING:
PROBE LENGTH: 48 in
NOZZLE AREA ~~(A)~~ Diameter: .376 sq ft
Cp: 0.84
DRY GAS FRACTION (Fd):

TRAVERSE POINT NUMBER	SAMPLING TIME (min)	STATIC PRESSURE (in H20)	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)
A 1	0	-3.0	527		.04	0.49	652.955	57		58	225	54
2	4.5	-3.5	540		.085	0.97		61		59	228	54
3	9.0	-3.5	538		.080	0.98		61		59	226	56
4	13.5	-3.5	506		.085	1.07		61		59	228	54
5	18.0	-5.0	456		.095	1.26		62		59	224	52
6	22.5	-5.0	438		.100	1.36		62		61	224	52
7	27.0	-5.0	444		.100	1.35		63		64	228	52
8	31.5	-5.0	473		.100	1.31	671.721	63		66	228	52
	36											
B 1	0	-3.0	390		.030	0.43		63		64	224	48
2	4.5	-3.0	400		.035	0.58		63		60	224	46
3	9.0	-4.0	452		.080	1.07		63		68	244	49
4	13.5	-4.0	432		.090	1.23		64		60	222	50
5	18.0	-4.0	416		.080	1.10		65		61	236	50
6	22.5	-4.0	423		.080	1.11		65		61	228	48
7	27.0	-4.0	421		.080	1.11		65		61	226	46
8	31.5	-4.5	424		.086	1.11	688.520	65		61	236	45
$\bar{T}_M = 61$		$\bar{T}_S = 455$	$\bar{\Delta H} = 1.03$		$\bar{T}135 =$	8.3030	VOL 35.565 ft³					

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT	7 NOV 85	3

BUILDING NUMBER	SOURCE NUMBER
BLDG D	INCIN. #4

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER	Ø.2996	Ø.2846	Ø.Ø15Ø
ACETONE WASHINGS (Probe, Front Half Filter)	103.1278	103.1181	ØØØ97
BACK HALF (If needed)			
	Total Weight of Particulates Collected		Ø.Ø247 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)	208.Ø	200.Ø	8.Ø
IMPINGER 2 (H20)	204.Ø	200.Ø	4.Ø
IMPINGER 3 (Dry)	Ø.5	Ø	Ø.5
IMPINGER 4 (Silica Gel)	208.Ø	200	8.Ø
	Total Weight of Water Collected		20.5 gm

III. GASES (Dry)

ITEM	ANALYSIS 1	ANALYSIS 2	ANALYSIS 3	ANALYSIS 4	AVERAGE
VOL % CO_2	1.6	1.6	1.6		1.6
VOL % O_2	16.4	16.4	16.3		16.3
VOL % CO					
VOL % N_2					

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

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

PRELIMINARY SURVEY DATA SHEET NO. 1

(Stack Geometry)

BASE	PLANT
OFFUTT	BLDG D
DATE	**SAMPLING TEAM**
7 NOV 88	

SOURCE TYPE AND MAKE: SILVER RECOVERY INCINERATOR

SOURCE NUMBER	INSIDE STACK DIAMETER
#4	27 - 8.75 = 18.25 Inches
RELATED CAPACITY	**TYPE FUEL**
600 lbs/HR 24/M	gas

DISTANCE FROM OUTSIDE OF NIPPLE TO INSIDE DIAMETER: 8.75 Inches

NUMBER OF TRAVERSES	NUMBER OF POINTS/TRAVERSE
2	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			9.3
2			10.7
3			12.3
4			14.6
5			21.1
6			23.5
7			25.1
8			26.4

PRELIMINARY SURVEY DATA SHEET NO. 2

(Velocity and Temperature Traverse)

BASE: OFFUTT

DATE: 7 NOV 88

~~BOILER NUMBER~~: SILVER RECOVERY INCINERATOR #4

INSIDE STACK DIAMETER: Inches

STATION PRESSURE: 28.25 In Hg

STACK STATIC PRESSURE: -.18 In H20

SAMPLING TEAM:

TRAVERSE POINT NUMBER	VELOCITY HEAD, V_p IN H20	CYCLONIC ~~V_p~~ α	STACK TEMPERATURE (°F)
1	.020	0	488
2	.035	0	494
3	.045	0	510
4	.050	0	517
5	.065	0	550
6	.070	0	561
7	.070	0	567
8	.065	0	577
			FPS = ~~[illegible]~~ 17
			$\bar{T}$ = 532
			~~[illegible]~~
			θ .529
AVERAGE			

NOZZLE CALIBRATION DATA FORM

Date 7 NOV 85 Calibrated by GARRISON

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
3	.375	.377	.377	.042	.376

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.

(This page left blank)

APPENDIX G
Calibration Data

(This page left blank)

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English units)

Date 12 Jul 88 Meter box number 2010 NUTECH #1

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

Vac in. Hg	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/R	Temperature: Dry gas meter Inlet (t_{d_i}), °F/R	Temperature: Dry gas meter Outlet (t_{d_o}), °F/R	Temperature: Dry gas meter Avg[a] (t_d), °F/R	Time (θ), min	Y_i	$\Delta H@_i$ in. H_2O
4	0.5	5	4.668	78/78 538	76/83 539.5	78/78 536.5	538	13.1	1.070	2.010
4	1.0	5	4.670	78/78 538	89/89 546.5	78/81 539.5	543	9.3	1.078	2.008
4	1.5	10	9.390	78/78 538	90/96 553	82/86 544	548.5	15.5	1.082	2.070
4	2.0	10	9.455	79/80 539.5	96/101 558.5	87/90 548.5	553.5	13.5	1.070	2.087
4	3.0	10	9.470	80/81 540.5	101/106 563.5	90/93 551.5	557.5	11.1	1.081	2.109
4	4.0	10.1	9.590	81/81 541	106/109 567.5	94/96 555	561.3	9.8	1.082	2.138
								Avg	1.077	2.070

ΔH, in. H_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	$Y_1 = \frac{(5)(29.119)(538)}{(4.668)(29.119 + 0.5/13.6)(538)}$	$\Delta H@_1 = \frac{(.0317)(.5)}{(29.119)(538)} \left[\frac{(538)(13.1)}{5} \right]^2$
1.0	0.0737	$Y_2 = \frac{(5)(29.119)(543)}{(4.67)(29.119 + 1/13.6)(538)}$	$\Delta H@_2 = \frac{(.0317)(1)}{(29.119)(543)} \left[\frac{(538)(9.3)}{5} \right]^2$
1.5	0.110	$Y_3 = \frac{(10)(29.119)(548.5)}{(9.39)(29.119 + 1.5/13.6)(538)}$	$\Delta H@_3 = \frac{(.0317)(1.5)}{(29.119)(548.5)} \left[\frac{(538)(15.5)}{10} \right]^2$
2.0	0.147	$Y_4 = \frac{(10)(29.119)(553.5)}{(9.455)(29.119 + 2/13.6)(539.5)}$	$\Delta H@_4 = \frac{(.0317)(2.0)}{(29.119)(553.5)} \left[\frac{(539.5)(13.5)}{10} \right]^2$
3.0	0.221	$Y_5 = \frac{(10)(29.119)(557.5)}{(9.47)(29.119 + 3/13.6)(540.5)}$	$\Delta H@_5 = \frac{(.0317)(3)}{(29.119)(557.5)} \left[\frac{(540.5)(11.1)}{10} \right]^2$
4.0	0.294	$Y_6 = \frac{(10.1)(29.119)(561.3)}{(9.59)(29.119 + 4/13.6)(541)}$	$\Delta H@_6 = \frac{(.0317)(4)}{(29.119)(561.3)} \left[\frac{(541)(9.8)}{10.1} \right]^2$

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

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units) PRE-OFFUTT

Test number PRE OFFUTT Date 17 Oct 88 Meter box number Nutech #1 Plant Cutler's Point

Barometric pressure, P_b = 29.345 in. Hg Dry gas meter number Rockwell Pretest Y 1.077 (±.054)

Orifice manometer setting, (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperature: Wet test meter (t_w), °F	Temperature: Dry gas meter: Inlet (t_{d_i}), °F	Temperature: Dry gas meter: Outlet (t_{d_o}), °F	Temperature: Dry gas meter: Average[a] (t_d), °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
Ø.6	10	9.252	76 536	84 541	86 541.5	541.25	23.4Ø	4.0	1.Ø9Ø	(10)(29.345)(541.25) / (9.252)(29.345 + .4/13.6)(536)
Ø.6	10	9.272	76 536	84 545.5	86 544.5	545.00	24.1Ø	4.Ø	1.Ø95	(10)(29.345)(545.0) / (9.272)(29.349)(536)
Ø.6	10	9.317	76 536	87 548	86 544.5	545.75	25.6	4.Ø	1.Ø91	(10)(29.345)(545.75) / (9.317)(29.349)(536)
									Y = 1.Ø92	

[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.

Y RANGE = 1.0232 ⟷ 1.1309

POSTTEST DRY GAS METER CALIBRATION DATA FORM (English units)

Test number Post Date 18 Nov 82 Meter box number Nutech #1 Plant Offsite

Barometric pressure, P_b = 29.82 in. Hg Dry gas meter number Rockwell Pretest Y 1.022

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)[a], °F	Time (θ), min	Vacuum setting, in. Hg	Y_i	$Y_i \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$
.9	10	9.152	81 85 543	88 85 543	77 79 538	540.5	20 95	4	1.085	(10)(29.82)(540.5) / (9.152)(29.82 + .9/13.6)(543)
.9	10	9.214	85 86 546	85 89 547	79 84 541.5	544.25	20 18	4	1.079	(10)(29.82)(544.25) / (9.214)(29.886)(546)
.9	10	9.272	67 68 547.5	89 90 549.5	87 85 544.5	547.0	20.10	4	1.075	(10)(29.82)(547.0) / (9.272)(29.886)(547.5)
									Y = 1.080	

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

where

1.02315 ← 1.077 → 1.13085

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

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

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

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

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

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

ΔH = Pressure differential across orifice, in. H_2O.

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

Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest $Y \pm 0.05Y$. .05385

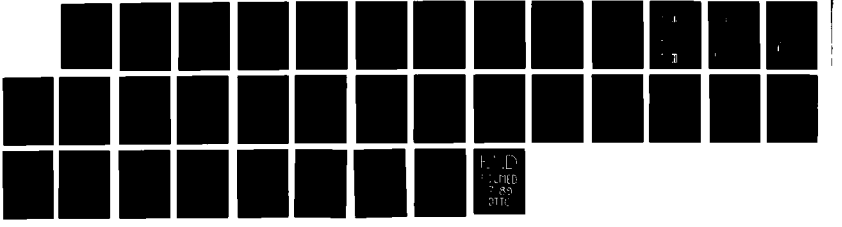
P_b = Barometric pressure, in. Hg.

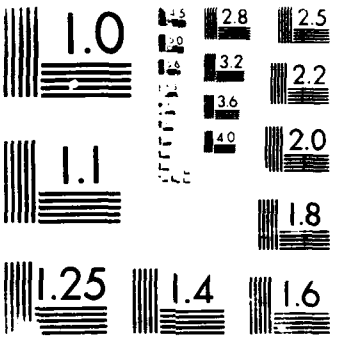
θ = Time of calibration run, min.

AD-A209 785 COMPLIANCE TESTING OF CONSUMAT AND FAIRCHILD MILLER SILVER RECLAMATION IN. (U) AIR FORCE OCCUPATIONAL AND ENVIRONMENTAL HEALTH LAB BROOKS AF.. J A GARRISON

2/2

UNCLASSIFIED MAR 89 USAFOEHL-89-016EQ0146CEF F/G 24/1 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0

STACK TEMPERATURE SENSOR CALIBRATION DATA FORM

Date 19/20 OCT 88 Thermocouple number IMPINGER D1

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

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

other

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

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

[b] Type of calibration system used.

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

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

STACK TEMPFRATURE SENSOR CALIBRATION DATA FORM

Date 19/20 OCT 88 Thermocouple number IMPINGER D2

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

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

other

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

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

[b] Type of calibration system used.

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

* MUST BE WITHIN 1°C OF REF

Quality Assurance Handbook M2-2.10

DRY GAS METER
~~STACK~~ TEMPERATURE SENSOR CALIBRATION DATA FORM

NOTECH

Date 20 Oct 88 Thermocouple number INLET/OUTLET

Ambient temperature 26 °C Barometric pressure 29.175 in. Hg

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

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] % °C *
INLET				
—	HOT WATER BATH	43	44	1.0
—	ROOM TEMP	26	26.5	0.5
OUTLET				
—	HOT WATER BATH	43	43.5	0.5
—	ROOM TEMP	26	27.2	1.2

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

[b] Type of calibration system used.

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

* MUST BE WITHIN 3°C OF REF.

Quality Assurance Handbook M2-2.10

STACK SENSOR CALIBRATION: 19-20 Oct 88

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

Regression Output:

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

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

P2	273.30	273.60
	371.80	373.60
	447.60	450.80

Regression Output:

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

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

P3	273.30	274.10
	371.90	374.10
	447.60	450.80

Regression Output:

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

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

P4	273.30	273.60
	371.80	373.60
	447.60	450.80

Regression Output:

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

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

P5	273.30	274.10	Regression Output:
	371.90	373.60	Constant -3.03
	447.60	450.80	Std Err of Y Est 0.37
			R Squared 1.00
			No. of Observations 3.00
			Degrees of Freedom 1.00
			X Coefficient(s) 1.01
			Std Err of Coef. 0.00
			% Deviation @ 2000 F(1093.3 K) = 1.08%
P6	273.30	273.30	Regression Output:
	371.90	373.60	Constant -5.03
	447.60	450.80	Std Err of Y Est 0.09
			R Squared 1.00
			No. of Observations 3.00
			Degrees of Freedom 1.00
			X Coefficient(s) 1.02
			Std Err of Coef. 0.00
			% Deviation @ 2000 F(1093.3 K) = 1.37%
P7	273.30	273.30	Regression Output:
	371.90	373.60	Constant -5.03
	447.60	450.80	Std Err of Y Est 0.09
			R Squared 1.00
			No. of Observations 3.00
			Degrees of Freedom 1.00
			X Coefficient(s) 1.02
			Std Err of Coef. 0.00
			% Deviation @ 2000 F(1093.3 K) = 1.37%
P8	273.60	273.60	Regression Output:
	371.80	373.00	Constant -4.75
	449.40	452.40	Std Err of Y Est 0.39
			R Squared 1.00
			No. of Observations 3.00
			Degrees of Freedom 1.00
			X Coefficient(s) 1.02
			Std Err of Coef. 0.00
			% Deviation @ 2000 F(1093.3 K) = 1.25%

TYPE S PITOT TUBE INSPECTION DATA FORM

#4A

Pitot tube assembly level? ✓ yes _____ no

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

α_1 = 0 ° (<10°), α_2 = 1 ° (<10°), β_1 = 0 ° (<5°),
β_2 = 1 ° (<5°)

γ = 0 °, θ = 1 °, A = 1.0 ~~cm~~ (in.)

z = A sin γ = 0.0 ~~cm~~ (in.); <0.32 cm (<1/8 in.),

w = A sin θ = 0.0175 ~~cm~~ (in.); <.08 cm (<1/32 in.) 0.0313

P_A 0.5 ~~cm~~ (in.) P_b 0.5 ~~cm~~ (in.)

D_t = 0.375 ~~cm~~ (in.)

Comments: CONSTRUCTED 1990 40 CFR 60, APP A, METH 2 FIG 2.2. ASSIGNED BASELINE COEFFICIENT = 0.84

Calibration required? _____ yes ✓ no

Quality Assurance Handbook M2-1.7

#6A

Pitot tube assembly level? ✓ yes _____ no

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

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

β_2 = 3 ° (<5°)

γ = 4 °, θ = 0 °, A = 13/16 (1.1875) ~~cm~~ (in.)

z = A sin γ = 0.082E ~~cm~~ (in.); <0.32 cm (<1/8 in.), 0.125

w = A sin θ = 0.0 ~~cm~~ (in.); <.08 cm (<1/32 in.) 0.0313

P_A 19/32 (0.5935) ~~cm~~ (in.) P_b 19/32 (0.5938) ~~cm~~ (in.)

D_t = 0.375 cm (in.)

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

Calibration required? _____ yes ✓ no

Quality Assurance Handbook M2-1.7

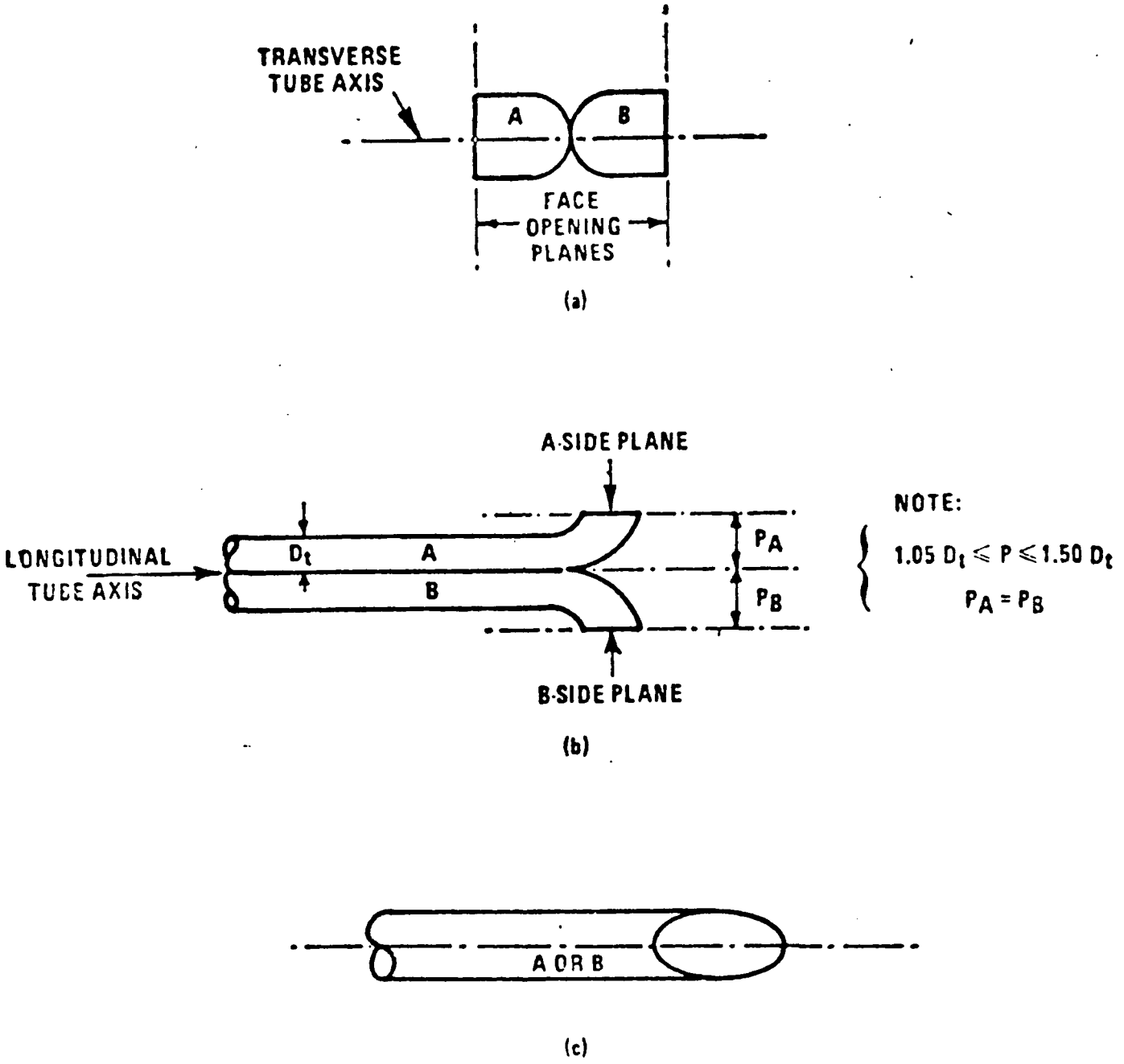


Figure 2-2. Properly constructed Type S pitot tube, shown in: (a) end view; face opening planes perpendicular to transverse axis; (b) top view; face opening planes parallel to longitudinal axis; (c) side view; both legs of equal length and centerlines coincident, when viewed from both sides. Baseline coefficient values of 0.84 may be assigned to pitot tubes constructed this way.

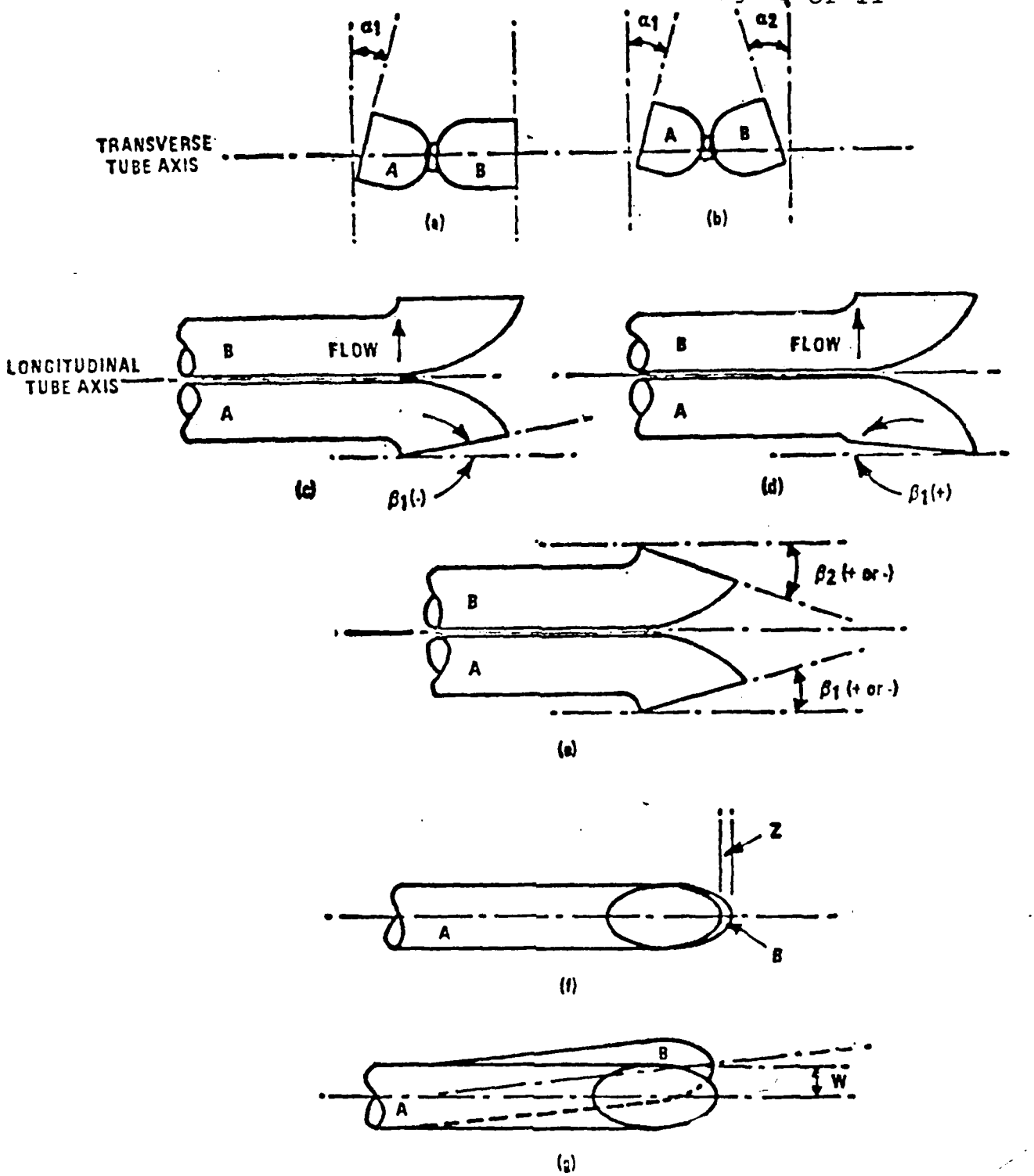


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of $\bar{C}p(s)$ so long as α_1 and $\alpha_2 < 10^\circ$, β_1 and $\beta_2 < 5^\circ$, $z < 0.32$ cm (1/8 in.) and $w <$ 0.08 cm (1/32 in.) (citation 11 in Section 6).

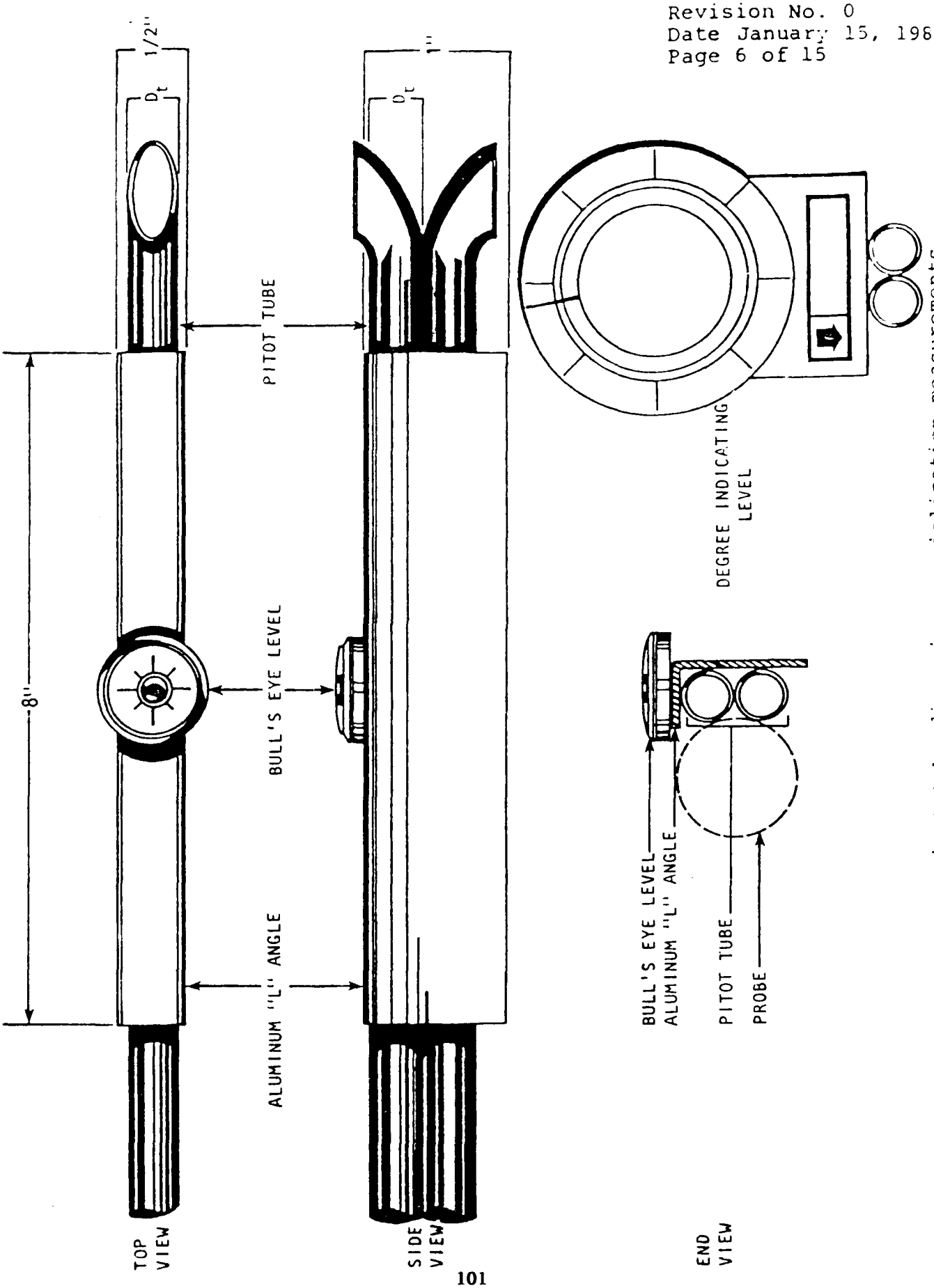


Figure 1.5 Type S pitot tube dimension specialization measurements.

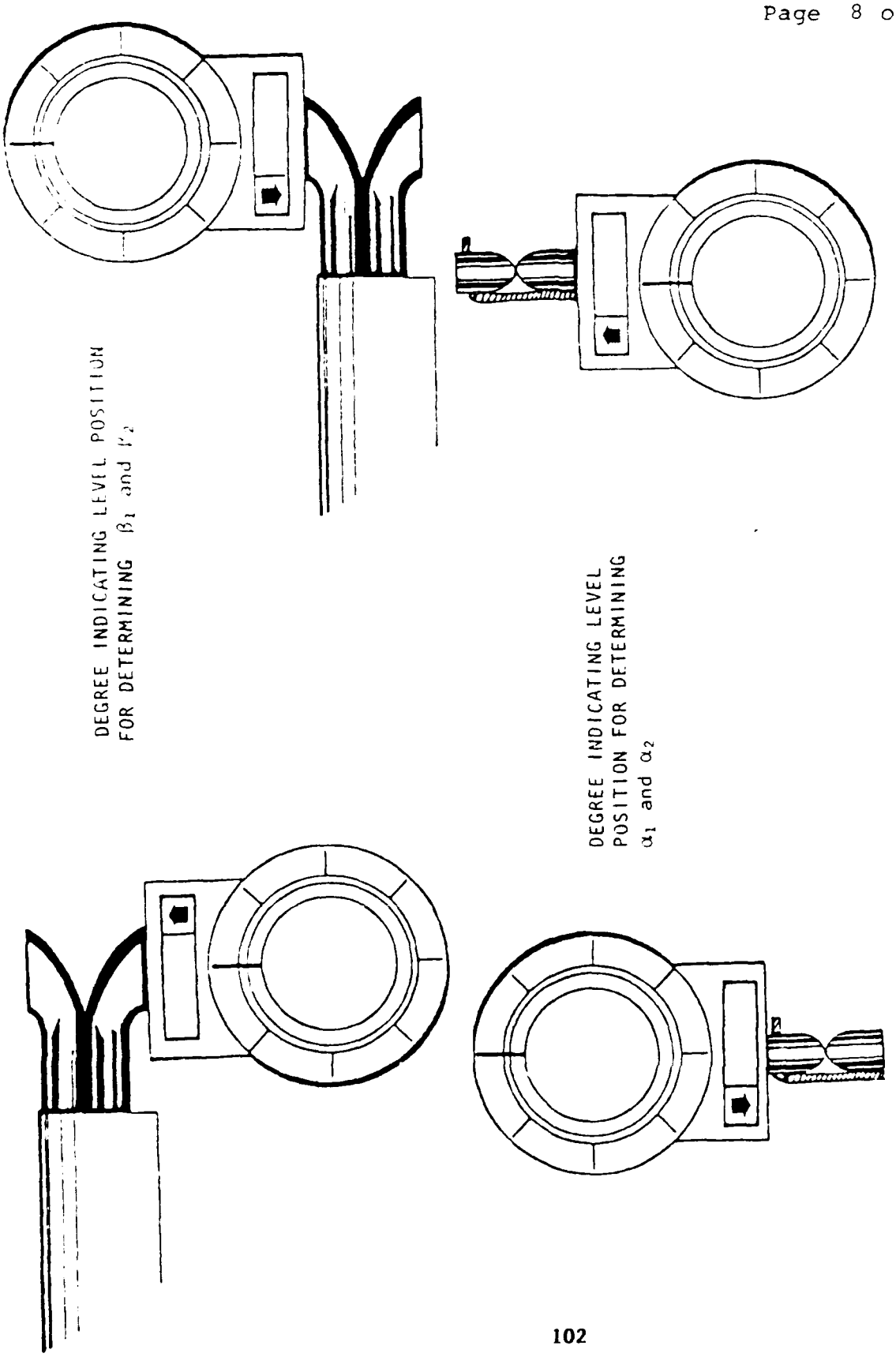
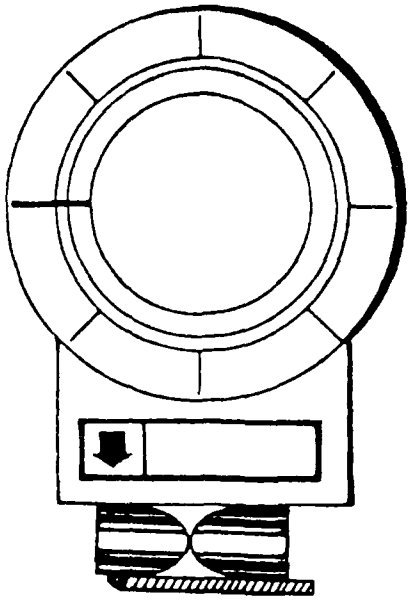
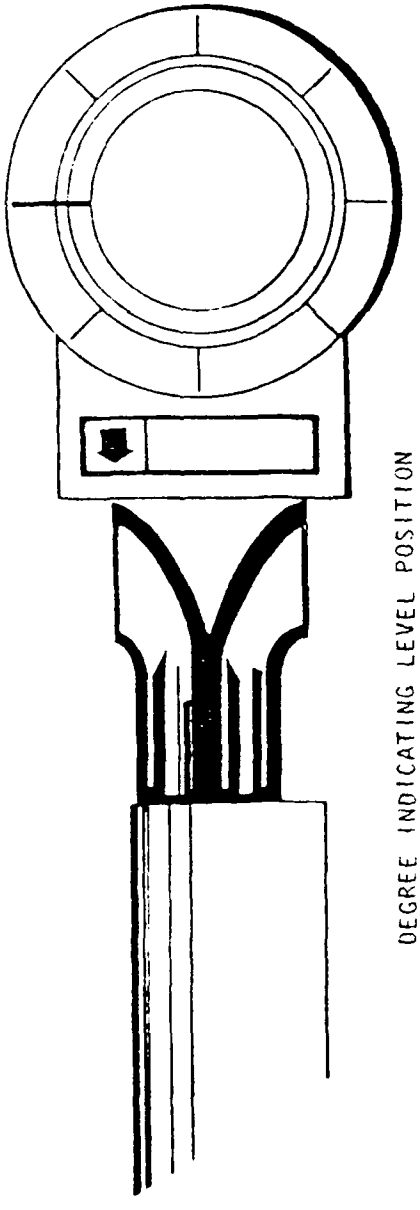


Figure 1.6 Position of dimension measurement.
(continued)



DEGREE INDICATING LEVEL POSITION FOR DETERMINING Θ, THEN CALCULATING W



DEGREE INDICATING LEVEL POSITION FOR DETERMINING Y, THEN CALCULATING Z

Figure 1.6 (continued)

(This page left blank)

APPENDIX H

Acetone Blank Results and Particulate Emissions Results

(This page left blank)

ACETONE BLANK ANALYTICAL DATA FORM

Plant: BLDG D, SILVER RECOVERY ENGINEERING'S

Location: OFFUTT AFB NE

Date of analysis: 2 DEC 88

Density of acetone(p_a): 0.79 g/ml

Acetone blank volume(V_a): 100 ml

Acetone wash volume(V_{aw}): 400 ml

Average gross wt: 105089.8 mg

Tare wt: 105089.6 mg

Weight of blank(m_{ab}): 0.2 mg

Acetone blank residue concentration(C_a):

$$C_a = \frac{m_{ab}}{V_a \times p_a} = \frac{0.2}{100 \times 0.79} = 0.0025 \text{ mg/g}$$

Weight of residue in acetone wash(W_a):

$$W_a = C_a \times V_{aw} \times p_a = (0.0025)(400)(0.79) = 0.79 \text{ mg}$$

AIR POLLUTION PARTICULATE ANALYTICAL DATA

BASE	DATE	RUN NUMBER
OFFUTT AFB	21 DEC 88 NOV 88	ACETONE BLANK

BUILDING NUMBER	SOURCE NUMBER
—	—

I. PARTICULATES

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT PARTICLES (gm)
FILTER NUMBER			
ACETONE WASHINGS (Probe, Front Half Filter)	105.0898	105.0896	0.0002
BACK HALF (If needed)			
	Total Weight of Particulates Collected		0.0002 gm

II. WATER

ITEM	FINAL WEIGHT (gm)	INITIAL WEIGHT (gm)	WEIGHT WATER (gm)
IMPINGER 1 (H20)			
IMPINGER 2 (H20)			
IMPINGER 3 (Dry)			
IMPINGER 4 (Silica Gel)			
	Total Weight of Water Collected		gm

III. GASES (Dry)

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

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

OEHL FORM 20 MAY 78

```
          XROM "METH
RUN NUMBER
INCIN 1,R1, 9 NOV,88
                    RUN
METER BOX Y?
          1.0770    RUN
DELTA H?
          1.0700    RUN
BAR PRESS ?
         28.7200    RUN
METER VOL ?
         33.9700    RUN
MTR TEMP F?
         57.0000    R
% OTHER GAS?
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC H2O IN ?
           .0000    RUN
         -0.1600    RUN
STACK TEMP.
        554.0000    RUN
ML. WATER ?
         32.0000    RUN
IMP. % H2O = 3.9

% H2O=3.9
% CO2?
          3.2000    RUN
% OXYGEN?
         15.7000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.02
MW WET=28.70

SQRT PSTS ?
          9.4855    RUN
TIME MIN ?
         64.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         17.0000    RUN

* VOL MTR STD = 35.921
  STK PRES ABS = 28.71
  VOL H2O GAS = 1.06
  % MOISTURE = 2.99
  MOL DRY GAS = 0.971
  % NITROGEN = 81.10
  MOL WT DRY = 29.02
  MOL WT WET = 28.70
  VELOCITY FPS = 23.77
  STACK AREA = 1.58
  STACK ACFM = 3.244.
* STACK DSCFM = 1,089.
  % ISOKINETIC =  105.43
```

```
          XROM "METH 5"
RUN NUMBER
INCIN 1, R2, 8 NOV 88
                    RUN
METER BOX Y?
          1.0770    RUN
DELTA H?
           .9000    RUN
BAR PRESS ?
         28.9700    RUN
METER VOL ?
         30.2740    RUN
MTR TEMP F?
         62.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC H2O IN ?
         -0.1600    RUN
STACK TEMP.'
        518.0000    RUN
ML. WATER ?
         26.2000    RUN
IMP. % H2O = 2.7

% H2O=2.7

% CO2?
          2.6000    RUN
% OXYGEN?
         15.2000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.14
MW WET=28.84

SQRT PSTS ?
          8.3195    RUN
TIME MIN ?
         72.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         17.0000    RUN

* VOL MTR STD = 34.059
  STK PRES ABS = 28.96
  VOL H2O GAS = 0.95
  % MOISTURE = 2.72
  MOL DRY GAS = 0.973
  % NITROGEN = 79.20
  MOL WT DRY = 29.14
  MOL WT WET = 28.84
  VELOCITY FPS = 20.67
  STACK AREA = 1.58
  STACK ACFM = 1,955.
* STACK DSCFM = 994.
  % ISOKINETIC =  97.35
```

```
          XROM "MASSFLO"
RUN NUMBER
          1.1000    RUN

VOL MTR STD ?
         35.9210    RUN
STACK DSCFM ?
      1,089.0000    RUN
FRONT 1/2 MG ?
         24.0000    RUN
BACK 1/2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.0107
F  MG/MMM = 23.5944
F  LB/HR = 0.0962
F  KG/HR = 0.0437


          XROM "MASSFLO"
RUN NUMBER
          1.2000    RUN

VOL MTR STD ?
         34.0590    RUN
STACK DSCFM ?
       994.0000    RUN
FRONT 1/2 MG ?
         47.1000    RUN
BACK 1/2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.0213
F  MG/MMM = 48.8355
F  LB/HR = 0.1818
F  KG/HR = 0.0825
```

```
)
          XROM "METH 5"
RUN NUMBER
INCIN 1, P3, 6 NOV 95
                    RUN
METER BOX Y?
          1.0070    RUN
DELTA H?
           .7900    RUN
BAR PRESS ?
         28.4700    RUN
METER VOL ?
         31.7000    RUN
MTR TEMP F?
         69.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC H2O IN ?
         -0.1600    RUN
STACK TEMP.
        493.0000    RUN
ML. WATER ?
         17.3000    RUN
IMP. % H2O = 2.4

% H2O=2.4


% CO2?
          1.9000    RUN
% OXYGEN?
         18.6000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.03
MW WET=28.76


SQRT PSTS ?
          7.4248    RUN
TIME MIN ?
         72.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         17.0000    RUN

* VOL MTR STD = 32.657
  STK PRES ABS = 28.96
  VOL H2O GAS = 0.31
  % MOISTURE = 2.43
  MOL DRY GAS = 0.976
  % NITROGEN = 79.60
  MOL WT DRY = 29.03
  MOL WT WET = 28.76
  VELOCITY FPS = 18.47
  STACK AREA = 1.58
  STACK ACFM = 1,747.
* STACK DSCFM = 914.
  % ISOKINETIC =  101.43
```

```
)
          XROM "MASSFLO"
RUN NUMBER
          1.7400    RUN
VOL MTR STD ?
         32.6570    RUN
STACK DSCFM ?
        914.0000    RUN
PROBE 1,2 MG ?
         17.6000    RUN
BACK 1,2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.0093
F  MG/MMM = 19.8320
F  LB/HR = 0.0652
F  KG/HR = 0.0296
```

```
          XROM "METH 5
RUN NUMBER
INCIN 2, R1, 4 NOV 88
                    RUN
METER BOX Y?
          1.0770    RUN
DELTA H?
          3.4600    RUN
BAR PRESS ?
         28.3700    RUN
METER VOL ?
         51.1930    RUN
MTR TEMP F?
         59.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.2200    RUN
STACK TEMP.
        648.0000    RUN
ML. WATER ?
         37.9000    RUN
IMP. % HOH = 3.2

% HOH=3.2


% CO2?
          3.1000    RUN
% OXYGEN?
         17.0000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.18
MW WET=28.82


SQRT PSTS ?
         10.2976    RUN
TIME MIN ?
         64.0000    RUN
NOZZLE DIA ?
           .5010    RUN
STK DIA INCH ?
         16.5000    RUN

* VOL MTR STD = 53.661
  STK PRES AB  = 28.35
  VOL HOH GAS = 1.78
  % MOISTURE = 3.22
  MOL DRY GAS = 0.968
  % NITROGEN = 79.90
  MOL WT DRY = 29.18
  MOL WT WET = 28.82
  VELOCITY FPS = 25.87
  STACK AREA = 1.48
  STACK ACFM = 2,305.
* STACK DSCFM = 1,007.
  % ISOKINETIC =  90.33
```

```
          XROM "METH 5"
RUN NUMBER
INCIN 2, R2, 4 NOV 88
                    RUN
METER BOX Y?
          1.0770    RUN
DELTA H?
          1.1100    RUN
BAR PRESS ?
         28.3700    RUN
METER VOL ?
         22.7390    RUN
MTR TEMP F?
         65.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.2200    RUN
STACK TEMP.
        648.0000    RUN
ML. WATER ?
         27.5000    RUN
IMP. % HOH = 3.7

% HOH=3.7


% CO2?
          2.5000    RUN
% OXYGEN?
         17.7000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.11
MW WET=28.70


SQRT PSTS ?
         10.3938    RUN
TIME MIN ?
         64.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         16.5000    RUN

* VOL MTR STD = 33.721
  STK PRES ABS = 28.35
  VOL HOH GAS = 1.29
  % MOISTURE = 3.70
  MOL DRY GAS = 0.963
  % NITROGEN = 79.80
  MOL WT DRY = 29.11
  MOL WT WET = 28.70
  VELOCITY FPS = 26.17
  STACK AREA = 1.48
  STACK ACFM = 2,331.
* STACK DSCFM = 1,021.
  % ISOKINETIC =  99.41
```

```
          XROM "MASSFLO"

RUN NUMBER
          2.1000    RUN

VOL MTR STD ?
         53.6610    RUN
STACK DSCFM ?
       1,007.0000   RUN
FRONT 1/2 MG ?
         45.0000    RUN
BACK 1/2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.0173
F  MG/MMM = 30.2723
F  LB/HR = 0.1142
F  KG/HR = 0.0518

          XROM "MASSFLO"

RUN NUMBER
          2.2000    RUN

VOL MTR STD ?
         33.7210    RUN
STACK DSCFM ?
       1,021.0000   RUN
FRONT 1/2 MG ?
         82.3000    RUN
BACK 1/2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.0377
F  MG/MMM = 86.1879
F  LB/HR = 0.3296
F  KG/HR = 0.1495
```

```
) XROM "METH 5"
RUN NUMBER
INCIN 2  R3. 4 NOV 88
                    RUN
METER BOX Y?
          1.0770    RUN
DELTA H?
          1.0400    RUN
BAR PRESS ?
         28.3700    RUN
METER VOL ?
         32.1530    RUN
MTR TEMP F?
         68.5000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC H2O IN ?
          -.2200    RUN
STACK TEMP.
        623.0000    RUN
ML. WATER ?
         29.3000    RUN
IMP. % H2O = 4.0

% H2O=4.0


% CO2?
          2.0000    RUN
% OXYGEN?
         18.2000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.05
MW WET=28.60


SQRT PSTS ?
          9.9864    RUN
TIME MIN ?
         64.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         16.5000    RUN

* VOL MTR STD = 32.892
  STK PRES ABS = 28.35
  VOL H2O GAS = 1.38
  % MOISTURE = 4.02
  MOL DRY GAS = 0.960
  % NITROGEN = 79.80
  MOL WT DRY = 29.05
  MOL WT WET = 28.60
  VELOCITY FPS = 24.98
  STACK AREA = 1.48
  STACK ACFM = 2,226.
* STACK DSCFM = 987.
  % ISOKINETIC =  100.35
```

```
) XROM "MASSFLO"

RUN NUMBER
          2.3000    RUN

VOL MTR STD ?
         32.8920    RUN
STACK DSCFM ?
        987.0000    RUN
FRONT 1/2 MG ?
         29.3000    RUN
BACK 1/2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.8177
F  MG/KMR = 31.4575
F  LB/HR = 0.1163
F  KG/HR = 0.0528
```

```
          XROM "MET.
RUN NUMBER
INCIN 3, R1, 9 NOV 98
                    RUN
METER BOX Y?
         1.0770     RUN
DELTA H?
         1.5700     RUN
BAR PRESS ?
        28.7060     RUN
METER VOL ?
        37.4560     RUN
MTR TEMP F?
        54.0000     RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC H2O IN ?
         -.2100     RUN
STACK TEMP.
       619.0000     RUN
ML. WATER ?
        27.2000     RUN
IMP. % H2O = 7.1

% H2O=3.1


% CO2?
         2.1000     RUN
% OXYGEN?
        17.3000     RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.03
MW WET=28.69


SQRT PSTS ?
        12.2595     RUN
TIME MIN ?
        64.0000     RUN
NOZZLE DIA ?
          .3760     RUN
STK DIA INCH ?
        13.3800     RUN

* VOL MTR STD = 39.917
  STK PRES ABS = 28.69
  VOL H2O GAS = 1.28
  % MOISTURE = 3.11
  MOL DRY GAS = 0.969
  % NITROGEN = 80.60
  MOL WT DRY = 29.03
  MOL WT WET = 28.69
  VELOCITY FPS = 38.69
  STACK AREA = 0.98
  STACK ACFM = 1,799.
* STACK DSCFM = 817.
  % ISOKINETIC =  98.68
```

```
          XROM "METH F"
RUN NUMBER
INCIN 3, P2, 9 NOV 98
                    RUN
METER BOX Y?
         1.0770     RUN
DELTA H?
         1.5200     RUN
BAR PRESS ?
        28.7060     RUN
METER VOL ?
        36.4090     RUN
MTR TEMP F?
        63.0000     RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC H2O IN ?
         -.2100     RUN
STACK TEMP.
       627.0000     RUN
ML. WATER ?
        21.6000     RUN
IMP. % H2O = 5.6

% H2O=2..


% CO2?
         2.5000     RUN
% OXYGEN?
        17.5000     RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.10
MW WET=28.81


SQRT PSTS ?
        12.0985     RUN
TIME MIN ?
        64.0000     RUN
NOZZLE DIA ?
          .3760     RUN
STK DIA INCH ?
        13.3600     RUN

* VOL MTR STD = 38.129
  STK PRES ABS = 28.69
  VOL H2O GAS = 1.02
  % MOISTURE = 2.60
  MOL DRY GAS = 0.974
  % NITROGEN = 80.00
  MOL WT DRY = 29.10
  MOL WT WET = 28.81
  VELOCITY FPS = 38.22
  STACK AREA = 0.98
  STACK ACFM = 1,770.
* STACK DSCFM = 803.
  % ISOKINETIC =  93.90
```

```
          XROM "MASSFLO"

RUN NUMBER
         3.1000     RUN

VOL MTR STD ?
        39.9170     RUN
STACK DSCFM ?
       817.0000     RUN
FRONT 1/2 MG ?
        15.7200     RUN
BACK 1/2 MG ?
         0.0000     RUN


F  GR/DSCF = 0.0061
F  MG/MMM = 13.8896
F  LB/HR = 0.0425
F  KG/HR = 0.0193

          XROM "MASSFLO"

RUN NUMBER
         3.2000     RUN

VOL MTR STD ?
        38.1290     RUN
STACK DSCFM ?
       803.0000     RUN
FRONT 1/2 MG ?
        22.4000     RUN
BACK 1/2 MG ?
         0.0000     RUN


F  GR/DSCF = 0.0091
F  MG/MMM = 20.7462
F  LB/HR = 0.0624
F  KG/HR = 0.0283
```

```
          XROM "METH 5"
RUN NUMBER
INCIN 3, R3, 9 NOV 88
                         RUN
METER BOX Y?
          1.0770         RUN
DELTA H?
          1.4200         RUN
BAR PRESS ?
         28.7060         RUN
METER VOL ?
         36.3650         RUN
MTR TEMP F?
         63.0000         RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                         RUN
STATIC H0H IN ?
          -.2100         RUN
STACK TEMP.
        623.0000         RUN
ML. WATER ?
         27.4000         RUN
IMP. % H0H = 3.3

% H0H=3.3


% CO2?
          1.2000         RUN
% OXYGEN?
         17.9000         RUN
% CO ?
                         RUN
MOL WT OTHER?
                         RUN

MWd =28.91
MW WET=28.55


SQRT PSTS ?
         11.6027         RUN
TIME MIN ?
         64.0000         RUN
NOZZLE DIA ?
           .3760         RUN
STK DIA INCH ?
         13.3800         RUN

* VOL MTR STD = 38.073
  STK PRES ABS = 28.69
  VOL H0H GAS = 1.29
  % MOISTURE = 3.28
  MOL DRY GAS = 0.967
  % NITROGEN = 80.90
  MOL WT DRY = 28.91
  MOL WT WET = 28.55
  VELOCITY FPS = 29.11
  STACK AREA = 0.99
  STACK ACFM = 1,706.
* STACK DSCFM = 771.
  % ISOKINETIC =  97.73
```

```
          XROM "MASSFLO"
RUN NUMBER
          3.0000         RUN
VOL MTR STD ?
         38.0730         RUN
STACK DSCFM ?
        771.0000         RUN
FRONT [illegible] MG ?
         14.1000         RUN
BACK [illegible] MG ?
          0.0000         RUN


F  GR/DSCF = 6.0077
F  MG/MMM = 17.7159
F  LB HF = 0.0512
F  KG/HR = 0.0232
```

```
          XROM "METH
RUN NUMBER
INCIN 4, R1, 7 NOV 88
                    RUN
METER BOX Y?
          1.0270    RUN
DELTA H?
           .9360    RUN
BAR PRESS ?
         28.5210    RUN
METER VOL ?
         32.8500    RUN
MTR TEMP F?
         56.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.1800    RUN
STACK TEMP.
        638.0000    RUN
ML. WATER ?
         25.5000    RUN
IMP. % HOH = 3.4

% HOH=3.4


% CO2?
          3.4000    RUN
% OXYGEN?
         15.6000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =29.17
MW WET=28.79


SQRT PSTS ?
          9.6288    RUN
TIME MIN ?
         72.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         18.2500    RUN

* VOL MTR STD = 34.592
  STK PRES ABS = 28.51
  VOL HOH GAS = 1.20
  % MOISTURE = 3.35
  MOL DRY GAS = 0.966
  % NITROGEN = 81.00
  MOL WT DRY = 29.17
  MOL WT WET = 28.79
  VELOCITY FPS = 24.13
  STACK AREA = 1.82
  STACK ACFM = 2,631.
* STACK DSCFM = 1,165.
  % ISOKINETIC =  97.23
```

```
          XROM "METH 5"
RUN NUMBER
INCIN 4, R2, 7 NOV 88
                    RUN
METER BOX Y?
          1.0270    RUN
DELTA H?
           .8400    RUN
BAR PRESS ?
         28.5210    RUN
METER VOL ?
         31.0730    RUN
MTR TEMP F?
         56.0000    RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                    RUN
STATIC HOH IN ?
          -.1800    RUN
STACK TEMP.
        587.0000    RUN
ML. WATER ?
         22.8000    RUN
IMP. % HOH = 3.2

% HOH=3.2


% CO2?
          2.4000    RUN
% OXYGEN?
         15.2000    RUN
% CO ?
                    RUN
MOL WT OTHER?
                    RUN

MWd =28.99
MW WET=28.64


SQRT PSTS ?
          8.6698    RUN
TIME MIN ?
         72.0000    RUN
NOZZLE DIA ?
           .3760    RUN
STK DIA INCH ?
         18.2500    RUN

* VOL MTR STD = 32.587
  STK PRES ABS = 28.51
  VOL HOH GAS = 1.07
  % MOISTURE = 3.19
  MOL DRY GAS = 0.968
  % NITROGEN = 82.40
  MOL WT DRY = 28.99
  MOL WT WET = 28.64
  VELOCITY FPS = 21.79
  STACK AREA = 1.82
  STACK ACFM = 2,375.
* STACK DSCFM = 1,105.
  % ISOKINETIC =  96.59
```

```
          XROM "MASSFLO"

RUN NUMBER
          4.1000    RUN

VOL MTR STD ?
         34.5920    RUN
STACK DSCFM ?
      1,165.0000    RUN
FRONT 1 2 MG ?
         61.4000    RUN
BACK 1 2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.0274
F  MG/MMM = 62.6615
F  LB/HR = 0.2725
F  KG/HR = 0.1241

          XROM "MASSFLO"

RUN NUMBER
          4.2000    RUN

VOL MTR STD ?
         32.5[illegible]0    RUN
STACK DSCFM ?
      1,105.0000    RUN
FRONT 1/2 MG ?
        305.5000    RUN
BACK 1/2 MG ?
          0.0000    RUN


F  GR/DSCF = 0.1447
F  MG/MMM = 331.0654
F  LB/HR = 1.3703
F  KG/HR = 0.6216
```

```
)        XROM "METH 5"
RUN NUMBER
INCIN 4. P3. 7 NOV 88
                        RUN
METER BOX Y?
          1.0770        RUN
DELTA H?
          1.0300        RUN
BAR PRESS ?
         28.2510        RUN
METER VOL ?
         35.5450        RUN
MTR TEMP F?
         61.0000        RUN
% OTHER GAS
REMOVED BEFORE
DRY GAS METER ?
                        RUN
STATIC H2O IN ?
          -.1800        RUN
STACK TEMP.
        455.0000        RUN
ML. WATER ?
         20.5000        RUN
IMP. % H2O = 2.6

% H2O=2.6


% CO2?
          1.6000        RUN
% OXYGEN?
         16.3000        RUN
% CO ?
                        RUN
MOL WT OTHER?
                        RUN

MWd =28.91
MW WET=28.63


SQRT PSTS ?
          8.3030        RUN
TIME MIN ?
         72.0000        RUN
NOZZLE DIA ?
           .3760        RUN
STK DIA INCH ?
         18.2500        RUN

* VOL MTR STD = 36.751
  STK PRES ABS = 28.24
  VOL H2O GAS = 0.96
  % MOISTURE = 2.56
  MOL DRY GAS = 0.974
  % NITROGEN = 82.10
  MOL WT DRY = 28.91
  MOL WT WET = 28.63
  VELOCITY FPS = 28.97
  STACK AREA = 1.82
  STACK ACFM = 2,286.
* STACK DSCFM = 1,213.
  % ISOKINETIC =  99.20
```

```
)        XROM "MASSFL"

RUN NUMBER
          4.3000        RUN

VOL MTR STD ?
         36.7510        RUN
STACK DSCFM ?
      1,213.0000        RUN
FRONT 1.2 MG ?
         24.7000        RUN
BACK 1.2 MG ?
          0.0000        RUN


F  GR/DSCF = 0.0164
F  MG/NMP = 38.7343
F  LB/HR = 0.1070
F  KG/HR = 0.0499
```

APPENDIX I

Hydrogen Chloride Emissions Calculations

(This page left blank)

XROM "MASSFLO"

RUN NUMBER
1.1000 RUN

VOL MTR STD ?
75.9210 RUN
STACK DSCFM ?
1,089.0000 RUN
FRONT 1/2 MG ?
14.7000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0063
F MG/MMM = 14.4516
F LB/HR = 0.0589
F KG/HR = 0.0267

XROM "MASSFLO"

RUN NUMBER
1.2000 RUN

VOL MTR STD ?
34.0590 RUN
STACK DSCFM ?
994.0000 RUN
FRONT 1/2 MG ?
25.0000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0113
F MG/MMM = 25.9212
F LB/HR = 0.0965
F KG/HR = 0.0438

XROM "MASSFLO"

RUN NUMBER
1.3000 RUN

VOL MTR STD ?
32.6570 RUN
STACK DSCFM ?
914.0000 RUN
FRONT 1/2 MG ?
8.7000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0041
F MG/MMM = 9.4078
F LB/HR = 0.0322
F KG/HR = 0.0146

XROM "MASSFLO"

RUN NUMBER
2.1000 RUN

VOL MTR STD ?
53.6610 RUN
STACK DSCFM ?
1,007.0000 RUN
FRONT 1/2 MG ?
47.0000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0135
F MG/MMM = 30.9304
F LB/HR = 0.1167
F KG/HR = 0.0529

XROM "MASSFLO"

RUN NUMBER
2.2000 RUN

VOL MTR STD ?
33.7210 RUN
STACK DSCFM ?
1,021.0000 RUN
FRONT 1/2 MG ?
11.2000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0051
F MG/MMM = 11.7291
F LB/HR = 0.0449
F KG/HR = 0.0203

XROM "MASSFLO"

RUN NUMBER
2.3000 RUN

VOL MTR STD ?
32.8920 RUN
STACK DSCFM ?
987.0000 RUN
FRONT 1/2 MG ?
6.0000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0028
F MG/MMM = 6.4418
F LB/HR = 0.0238
F KG/HR = 0.0108

XROM "MASSFLO"

RUN NUMBER
3.1000 RUN

VOL MTR STD ?
39.9170 RUN
STACK DSCFM ?
817.0000 RUN
FRONT 1/2 MG ?
48.2000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0186
F MG/MMM = 42.6419
F LB/HR = 0.1305
F KG/HR = 0.0592

XROM "MASSFLO"

RUN NUMBER
3.2000 RUN

VOL MTR STD ?
38.1290 RUN
STACK DSCFM ?
803.0000 RUN
FRONT 1/2 MG ?
55.1000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0223
F MG/MMM = 51.0321
F LB/HR = 0.1535
F KG/HR = 0.0696

XROM "MASSFLO"

RUN NUMBER
3.3000 RUN

VOL MTR STD ?
38.0730 RUN
STACK DSCFM ?
771.0000 RUN
FRONT 1/2 MG ?
18.8000 RUN
BACK 1/2 MG ?
0.0000 RUN

F GR/DSCF = 0.0076
F MG/MMM = 17.4376
F LB/HR = 0.0504
F KG/HR = 0.0228

```
          XROM "MASSFLO"

RUN NUMBER
           4.1000    RUN

VOL MTR STD ?
          34.5920    RUN
STACK DSCFM ?
       1,165.0000    RUN
FRONT 1/2 MG ?
          26.8000    RUN
BACK 1/2 MG ?
           0.0000    RUN


F  GR/DSCF = 0.0120
F  MG/MMM = 27.3594
F  LB/HR = 0.1194
F  KG/HR = 0.0542

          XROM "MASSFLO"

RUN NUMBER
           4.2000    RUN

VOL MTR STD ?
          32.5870    RUN
STACK DSCFM ?
       1,105.0000    RUN
FRONT 1/2 MG ?
          11.1000    RUN
BACK 1/2 MG ?
           0.0000    RUN


F  GR/DSCF = 0.0053
F  MG/MMM = 12.0289
F  LB/HR = 0.0498
F  KG/HR = 0.0226

          XROM "MASSFLO"

RUN NUMBER
           4.3000    RUN

VOL MTR STD ?
          36.7510    RUN
STACK DSCFM ?
       1,213.0000    RUN
FRONT 1/2 MG ?
           3.0000    RUN
BACK 1/2 MG ?
           0.0000    RUN


F  GR/DSCF = 0.0013
F  MG/MMM = 2.8827
F  LB/HR = 0.0131
F  KG/HR = 0.0059
```

APPENDIX J

Example Heavy Metals Emissions Calculations

(This page left blank)

```
          XROM "MASSFLO"

RUN NUMBER
1.1 ZN
                          RUN

VOL MTR STD ?
          35.9210    RUN
STACK DSCFM ?
       1,089.0000    RUN
FRONT 1/2 MG ?
            .7000    RUN
BACK 1/2 MG ?
            0.0000    RUN


F  GR/DSCF = 0.0007
F  MG/MMM = 0.6892
F  LB/HR = 0.0020
F  KG/HR = 0.0013

          XROM "MASSFLO"

RUN NUMBER
1.2 ZN
                          RUN

VOL MTR STD ?
          34.0590    RUN
STACK DSCFM ?
         994.0000    RUN
FRONT 1/2 MG ?
            .3610    RUN
BACK 1/2 MG ?
            0.0000    RUN


F  GR/DSCF = 0.0002
F  MG/MMM = 0.3743
F  LB/HR = 0.0014
F  KG/HR = 0.0006

          XROM "MASSFLO"

RUN NUMBER
1.3 ZN
                          RUN

VOL MTR STD ?
          32.6570    RUN
STACK DSCFM ?
         914.0000    RUN
FRONT 1/2 MG ?
            .3440    RUN
BACK 1/2 MG ?
            0.0000    RUN


F  GR/DSCF = 0.0002
F  MG/MMM = 0.3720
F  LB/HR = 0.0013
F  KG/HR = 0.0006
```

(This page left blank)

DISTRIBUTION LIST

	Copies
HQ AFSC/SGPB Andrews AFB DC 20334-5000	1
HQ USAF/SGPA Bolling AFB DC 20332-6188	1
AAMRL/TH Wright-Patterson AFB OH 45433-6573	1
HQ SAC/SGPB Offutt AFB NE 68113-5001	1
USAF Regional Medical Center Wiesbaden/SGB APO New York 09220-5300	1
OL AD, USAFOEHL APO San Francisco 96274-5000	1
USAFSAM/TSK Brooks AFB TX 78235-5301	1
Defense Technical Information Center(DTIC) Cameron Station Alexandria VA 22304-6145	2
HQ USAF/LEEV Bolling AFB DC 20330-5000	1
HQ AFESC/RDV Tyndall AFB FL 32403-6001	1
HQ SAC/DE Offutt AFB NE 68113-5001	1
Ehrling Berquist USAF Regional Hospital/SGPB Offutt AFB NE 68113-5300	3
55 CSG/DEEV Offutt AFB NE 68113-5000	3

☆ U.S. GOVERNMENT PRINTING OFFICE: 1989—661-041/00021

END

FILMED

7-89

DTIC