Report of...

Compliance Emission Testing

performed for...

Viking Energy of Lincoln
Lincoln, Michigan

on the

Wood Fired Boiler

September 22-24, 2015

126.32

Network Environmental, Inc.
Grand Rapids, MI

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RECEIVED
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AIR QUALITY DIV.

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Viking Energy of Lincoln — County: Alcona

Source Address: 509 West State Street — City: Lincoln

AQD Source ID (SRN): N0890 — RO Permit No.: MI-ROP-N0890-2013 — RO Permit Section No.: EUBOIL

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From _____ To _____

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Results of Compliance Emissions Testing (ROP Stack Testing) on Sept 22 - 24, 2015.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete.

Neil Taratuta	Plant Manager	989-736-6618
Name of Responsible Official (print or type)	Title	Phone Number

Signature of Responsible Official — Date: Oct 28, 2015

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

I. INTRODUCTION

Network Environmental, Inc. was retained by Viking Energy of Lincoln, Michigan to conduct a compliance emission study at their facility. The purpose of the study was to meet the emission testing requirements of Renewable Operating Permit (ROP) No. MI-ROP-N0890-2013.

The following is a list of the applicable emission limits for the boiler exhaust:

Emission Limit(s)
Particulate (PM): 0.1 Lbs/MMBTU of Heat Input
PM-10: 0.10 Lbs/MMBTU of Heat Input, 23.0 Lbs/Hr & 98.9 Tons/Year
VOC's: 0.020 Lbs/MMBTU of Heat Input, 4.6 Lbs/Hr & 19.1 Tons/Year
Lead (Pb): 0.00003 Lbs/MMBTU of Heat Input, 0.0069 Lbs/Hr & 0.03 Tons/Year
Mercury (Hg): 0.8 ug/M^3 @ 7% O_2, 0.00015 Lbs/Hr & 0.0006 Tons/Year
Arsenic (As): 28.7 ug/M^3 @ 7% O_2, 0.0053 Lbs/Hr & 0.0233 Tons/Year
Total Chromium (Cr): 23.0 ug/M^3 @ 7% O_2, 0.0043 Lbs/Hr & 0.0186 Tons/Year
Hexavalent Chromium (Cr_6): 8.8 ug/M^3 @ 7% O_2, 0.0016 Lbs/Hr & 0.0071 Tons/Year
Dioxins & Furans: 0.000029 ug/M^3 @ 7% O_2, 5.4 x 10^{-9} Lbs/Hr & 2.3 x 10^{-8} Tons/Year
Benzo-A-Pyrene: 0.008 ug/M^3 @ 7% O_2, 0.0000015 Lbs/Hr & 0.0000065 Tons/Year
H_2SO_4: 0.0157 Lbs/MMBTU of Heat Input, 5.5 Lbs/Hr & 23.7 Tons/Year
HCL: 23,000 ug/M^3 @ 7% O_2, 2.07 Lbs/Hr & 8.9 Tons/Year

The following reference test methods were employed to conduct the emission sampling:

- Particulate Matter – U.S. EPA Methods 17 & 202
- VOC's – U.S. EPA Method 25A
- Metals – U.S. EPA Method 29
- Dioxins & Furans – U.S. EPA Method 23
- Benzo-A-Pyrene – U.S. EPA Method 23
- H_2SO_4 – U.S. EPA Method 8
- HCl – U.S. EPA Method 26A
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Methods 1- 4

During the sampling the boiler was firing a combination of wood waste and tire derived fuel (TDF).

The sampling was performed over the period of September 22-24, 2015 by R. Scott Cargill, Richard D. Eerdmans, and David D. Engelhardt of Network Environmental, Inc.. Assisting with the study were Mr. Neil Taratuta and the operating staff of the facility. Mr. Robert Dickman and Ms. Gloria Torello of the Michigan Department of Environmental Quality (MDEQ) - Air Quality Division were present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
FILTERABLE PARTICULATE EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Filterable Particulate Emissions	
				Lbs/Hr (2)	Lbs/MMBTU (3)
1	9/22/15	16:45-17:52	51,836	2.10	0.0085
2	9/22/15	18:30-19:35	51,358	2.04	0.0084
3	9/23/15	09:14-10:18	51,615	2.68	0.0107
Average			**51,603**	**2.28**	**0.0092**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) Lbs/Hr = Pounds Per Hour
(3) Lbs/MMBTU = Pounds Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)

II.2 TABLE 2
TOTAL PARTICULATE(1) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (2)	Total Particulate Emissions		
				Lbs/Hr (3)	Lbs/MMBTU (4)	Tons/Year (5)
1	9/22/15	16:45-17:52	51,836	5.75	0.0233	25.19
2	9/22/15	18:30-19:35	51,358	4.17	0.0171	18.26
3	9/23/15	09:14-10:18	51,615	5.20	0.0208	22.78
Average			**51,603**	**5.04**	**0.0204**	**22.08**

(1) Total Particulate = Front Half Filterable and Back Half Condensable
(2) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(3) Lbs/Hr = Pounds Per Hour
(4) Lbs/MMBTU = Pounds Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
(5) Tons/Year were calculated using 8,760 hours of operation per year.

II.3 TABLE 3
TOTAL HYDROCARBON (VOC) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate SCFM (1)	VOC Emissions		
				Lbs/Hr (2)	Lbs/MMBTU (3)	Tons/Year (4)
1	9/22/15	09:56-10:56	60,623	0.371	0.00158	1.62
2	9/22/15	11:33-12:33	61,604	0.042	0.00017	0.18
3	9/22/15	13:33-14:33	59,710	0.163	0.00070	0.71
Average			**60,646**	**0.192**	**0.00082**	**0.84**

(1) SCFM = Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) Lbs/Hr = Pounds Per Hour As Propane
(3) Lbs/MMBTU = Pounds Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
(4) Tons/Year were calculated using 8,760 hours of operation per year.

II.4 TABLE 4
LEAD (Pb) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Lead (Pb) Emissions		
				Lbs/Hr (2)	Lbs/MMBTU (3)	Tons/Year (4)
1	9/22/15	09:52-10:58	50,383	0.00288	0.0000122	0.0126
2	9/22/15	12:02-13:07	51,140	0.00273	0.0000113	0.0120
3	9/22/15	14:40-15:46	49,336	0.00293	0.0000126	0.0128
Average			**50,286**	**0.00285**	**0.0000120**	**0.0125**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) Lbs/Hr = Pounds Per Hour
(3) Lbs/MMBTU = Pounds Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
(4) Tons/Year were calculated using 8,760 hours of operation per year.

II.5 TABLE 5
MERCURY (Hg) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Mercury (Hg) Emissions		
				ug/M^3 @ 7% O_2 (2)	Lbs/Hr (3)	Tons/Year (4)
1	9/22/15	09:52-10:58	50,383	N.D. (5)	N.D. (5)	N.D. (5)
2	9/22/15	12:02-13:07	51,140	N.D. (5)	N.D. (5)	N.D. (5)
3	9/22/15	14:40-15:46	49,336	N.D. (5)	N.D. (5)	N.D. (5)
Average			**50,286**	-----	-----	-----

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) ug/M^3 @ 7% O_2 = Micrograms Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen (STP = 68 °F and 29.92 in. Hg)
(3) Lbs/Hr = Pounds Per Hour
(4) Tons/Year were calculated using 8,760 hours of operation per year.
(5) N.D. = Non Detected At Detection Limits Of 0.429 ug/M^3 @ 7% O_2, 0.000091 Lbs/Hr & 0.00040 Tons/Year

II.6 TABLE 6
ARSENIC (As) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Arsenic (As) Emissions		
				ug/M³ @ 7% O_2 (2)	Lbs/Hr (3)	Tons/Year (4)
1	9/22/15	09:52-10:58	50,383	0.506	0.000106	0.00046
2	9/22/15	12:02-13:07	51,140	0.531	0.000114	0.00050
3	9/22/15	14:40-15:46	49,336	0.515	0.000107	0.00047
Average			**50,286**	**0.517**	**0.000109**	**0.00048**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) ug/M³ @ 7% O_2 = Micrograms Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen (STP = 68 °F and 29.92 in. Hg)
(3) Lbs/Hr = Pounds Per Hour
(4) Tons/Year were calculated using 8,760 hours of operation per year.

II.7 TABLE 7
TOTAL CHROMIUM (Cr) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Total Chromium (Cr) Emissions		
				ug/M³ @ 7% O_2 (2)	Lbs/Hr (3)	Tons/Year (4)
1	9/22/15	09:52-10:58	50,383	3.67	0.00077	0.0034
2	9/22/15	12:02-13:07	51,140	3.43	0.00074	0.0032
3	9/22/15	14:40-15:46	49,336	2.92	0.00061	0.0027
Average			**50,286**	**3.34**	**0.00071**	**0.0031**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) ug/M³ @ 7% O_2 = Micrograms Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen (STP = 68 °F and 29.92 in. Hg)
(3) Lbs/Hr = Pounds Per Hour
(4) Tons/Year were calculated using 8,760 hours of operation per year.

II.8 TABLE 8
TOTAL DIOXIN & FURAN(1) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (2)	Total Dioxin & Furan Emissions		
				ug/M³ @ 7% O_2 (3)	Lbs/Hr (4)	Tons/Year (5)
1	9/24/15	11:14-12:19	51,448	6.38E-06	1.41E-09	6.18E-09
2	9/24/15	13:30-14:35	51,540	4.05E-06	9.00E-10	3.94E-09
3	9/24/15	15:32-16:37	52,098	3.89E-06	8.52E-10	3.73E-09
Average			**51,695**	**4.77E-06**	**1.05E-09**	**4.62E-09**

(1) Compounds listed are the 2,3,7,8 cogeners of TCDDs/TCDFs with Toxic Equivalent Factors (TEFs) greater than zero.
(2) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(3) ug/M³ @ 7% O_2 = Micrograms Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen (STP = 68 °F and 29.92 in. Hg)
(4) Lbs/Hr = Pounds Per Hour
(5) Tons/Year were calculated using 8,760 hours of operation per year.

II.9 TABLE 9
BENZO-A-PYRENE EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Benzo-A-Pyrene Emissions		
				ug/M³ @ 7% O_2 (2)	Lbs/Hr (3)	Tons/Year (5)
1	9/24/15	11:14-12:19	51,448	0.0062	1.37E-06	6.00E-06
2	9/24/15	13:30-14:35	51,540	0.0065	1.44E-06	6.30E-06
3	9/24/15	15:32-16:37	52,098	0.0063	1.38E-06	6.04E-06
Average			**51,695**	**0.0063**	**1.40E-06**	**6.11E-06**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) ug/M³ @ 7% O_2 = Micrograms Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen (STP = 68 °F and 29.92 in. Hg)
(3) Lbs/Hr = Pounds Per Hour
(4) Tons/Year were calculated using 8,760 hours of operation per year.

II.10 TABLE 10
SULFURIC ACID (H_2SO_4) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (1)	Sulfuric Acid (H_2SO_4) Emissions		
				Lbs/Hr (2)	Lbs/MMBTU (3)	Tons/Year (4)
1	9/23/15	11:01-12:05	50,319	0.20	0.00086	0.88
2	9/23/15	12:51-13:55	50,760	0.32	0.00132	1.40
3	9/23/15	14:36-15:40	51,338	0.36	0.00143	1.58
Average			**50,806**	**0.29**	**0.00120**	**1.29**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) Lbs/Hr = Pounds Per Hour
(3) Lbs/MMBTU = Pounds Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
(4) Tons/Year were calculated using 8,760 hours of operation per year.

II.11 TABLE 11
HYDROCHLORIC ACID (HCl) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
VIKING ENERGY OF LINCOLN
LINCOLN, MI

Sample	Date	Time	Air Flow Rate DSCFM (2)	Hydrochloric Acid (HCl) Emissions		
				ug/M^3 @ 7% O_2 (3)	Lbs/Hr (4)	Tons/Year (4)
1	9/23/15	12:14-13:21	50,862	11,648	2.55	11.17
2	9/23/15	13:58-15:06	49,364	3,392	0.72	3.15
3	9/23/15	15:42-16:45	49,833	2,222	0.48	2.10
Average			**50,020**	**5,754**	**1.25**	**5.47**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) ug/M^3 @ 7% O_2 = Micrograms Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen (STP = 68 °F and 29.92 in. Hg)
(3) Lbs/Hr = Pounds Per Hour
(4) Tons/Year were calculated using 8,760 hours of operation per year.

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Tables 1 through 11 (Sections II.1 through II.11). The results are presented as follows:

III.1 Filterable Particulate Emission Results (Table 1)

Table 1 summarizes the filterable particulate emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Particulate Mass Emission Rates:
  - ✧ Lbs/Hr - Pounds of Particulate Per Hour
  - ✧ Lbs/MMBTU - Pounds of Particulate Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)

III.2 Total Particulate Emission Results (Table 2)

Table 2 summarizes the total (front half filterable & back half condensable) particulate emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Particulate Mass Emission Rates:
  - ✧ Lbs/Hr - Pounds of Particulate Per Hour
  - ✧ Lbs/MMBTU - Pounds of Particulate Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
  - ✧ Tons/Year - Tons of Particulate Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.3 VOC Emission Results (Table 3)

Table 3 summarizes the total hydrocarbon (VOC) emission results as follows:

- Sample
- Date
- Time

- Air Flow Rate (SCFM) - Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- VOC Mass Emission Rates:
  - ✧ Lbs/Hr - Pounds of VOC Per Hour As Propane
  - ✧ Lbs/MMBTU - Pounds of VOC Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
  - ✧ Tons/Year - Tons of VOC Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.4 Lead (Pb) Emission Results (Table 4)

Table 4 summarizes the lead (Pb) emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Lead (Pb) Mass Emission Rates:
  - ✧ Lbs/Hr - Pounds of Lead Per Hour
  - ✧ Lbs/MMBTU - Pounds of Lead Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
  - ✧ Tons/Year - Tons of Pb Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.5 Mercury (Hg) Emission Results (Table 5)

Table 5 summarizes the mercury (Hg) emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Mercury (Hg) Concentration (ug/M^3 @ 7% O_2) - Micrograms of Mercury Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen
- Mercury (Hg) Mass Emission Rate:
  - ✧ Lbs/Hr - Pounds of Mercury Per Hour
  - ✧ Tons/Year - Tons of Hg Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.6 Arsenic (As) Emission Results (Table 6)

Table 6 summarizes the arsenic (As) emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Arsenic (As) Concentration (ug/M^3 @ 7% O_2) - Micrograms of Arsenic Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen
- Arsenic (As) Mass Emission Rate:
  - ✧ Lbs/Hr - Pounds of Arsenic Per Hour
  - ✧ Tons/Year - Tons of As Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.7 Total Chromium (Cr) Emission Results (Table 7)

Table 7 summarizes the total chromium (Cr) emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Chromium (Cr) Concentration (ug/M^3 @ 7% O_2) - Micrograms of Chromium Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen
- Chromium (Cr) Mass Emission Rate:
  - ✧ Lbs/Hr - Pounds of Chromium Per Hour
  - ✧ Tons/Year - Tons of Cr Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.8 Total Dioxin & Furan Emission Results (Table 8)

Table 8 summarizes the total dioxin & furan emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Total Dioxin & Furan Concentration (ug/M^3 @ 7% O_2) - Micrograms of Dioxins & Furans Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen
- Total Dioxin & Furan Mass Emission Rate:

- ✧ Lbs/Hr - Pounds of Dioxins & Furans Per Hour
- ✧ Tons/Year - Tons of Dioxins & Furans Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

The total dioxin & furan results consist of the 2,3,7,8 cogeners of TCDDs/TCDFs with Toxic Equivalent Factors (TEFs) greater than zero. Whenever a compound was non detected, the detection limit value was used in the calculations.

III.9 Benzo-A-Pyrene Emission Results (Table 9)

Table 9 summarizes the benzo-a-pyrene emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Benzo-A-Pyrene Concentration (ug/M^3 @ 7% O_2) - Micrograms of Benzo-A-Pyrene Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen
- Benzo-A-Pyrene Mass Emission Rate:
  - ✧ Lbs/Hr - Pounds of Benzo-A-Pyrene Per Hour
  - ✧ Tons/Year - Tons of Benzo-A-Pyrene Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.10 Sulfuric Acid (H_2SO_4) Emission Results (Table 10)

Table 10 summarizes the sulfuric acid (H_2SO_4) emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Sulfuric Acid (H_2SO_4) Mass Emission Rates:
  - ✧ Lbs/Hr - Pounds of Sulfuric Acid Per Hour
  - ✧ Lbs/MMBTU - Pounds of Sulfuric Acid Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,475 DSCF/MMBTU)
  - ✧ Tons/Year - Tons of H_2SO_4 Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

III.11 Hydrochloric Acid (HCl) Emission Results (Table 11)

Table 11 summarizes the hydrochloric acid (HCl) emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) - Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Hydrochloric Acid (HCl) Concentration (ug/M^3 @ 7% O_2) - Micrograms of Hydrochloric Acid Per Dry Standard Cubic Meter Corrected To 7 Percent Oxygen
- Hydrochloric Acid (HCl) Mass Emission Rate:
  - ✧ Lbs/Hr - Pounds of Hydrochloric Acid Per Hour
  - ✧ Tons/Year - Tons of HCl Per Year (Calculated using 8,760 hours of operation per year. This is based on 24 hours per day and 365 days per year of operation).

IV. SAMPLING AND ANALYTICAL PROTOCOL

The sampling location for the boiler exhaust was on the 71 inch diameter exhaust at a location that meets the 8 duct diameter downstream and 2 duct diameter upstream requirement of U.S. EPA Method 1. There are 4 sample ports. Only two (2) of the sampling ports were used. Twelve (12) sampling points (6 per port) were used for the isokinetic sampling. The sampling point dimensions were as follows:

Sample Point	Dimension (Inches)
1	3.12
2	10.37
3	21.02
4	49.98
5	60.63
6	67.88

IV.1 Particulate – The particulate determinations were performed in accordance with U.S. EPA Methods 17 & 202. Method 17 is an in-stack filtration method. Three (3) samples, each sixty (60) minutes in duration, were collected from the exhaust. Each sample had a minimum sample volume of thirty (30) dry standard cubic feet. The sampling systems were operated isokinetically. After the completion of each

sample, a sixty (60) minute nitrogen purge was conducted on the back half (impingers) in accordance with Method 202.

The front and back half catches were recovered as per Methods 17 & 202. The front half (nozzle/probe acetone rinse & filter) were measured gravimetrically. The back half was measured for condensables. The condensable fraction was determined by using the extraction technique found in EPA Method 202 and separate gravimetric analysis of the solvent (organic) and water (inorganic) fractions. All the quality assurance requirements specified in the methods were incorporated in the sampling and analysis. Figure 1 is a diagram of the particulate sampling train.

IV.2 VOC – The total hydrocarbon (VOC) emission sampling was conducted in accordance with U.S. EPA Reference Method 25A. A J.U.M. Model 3-500 flame ionization detector (FID) analyzer was used to monitor the boiler exhaust. Sample gas was extracted through a heated probe. A heated teflon sample line was used to transport the exhaust gases to the analyzer. The analyzer produces instantaneous readouts of the VOC concentrations (PPM).

The analyzer was calibrated by system injection (from the back of the stack probe to the analyzer) prior to the testing. A span gas of 85.78 PPM was used to establish the initial instrument calibration. Calibration gases of 29.17 PPM and 50.19 PPM were used to determine the calibration error of the analyzer. After each sample, a system zero and system injection of 29.17 PPM were performed to establish system drift and system bias during the test period. All calibration gases used were EPA Protocol Propane Calibration Gases. Three (3) samples were collected from the boiler exhaust. Each sample was sixty (60) minutes in duration.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler exhaust. All reference method data was corrected using Equation 7E-5 from U.S. EPA Method 7E. Figure 2 is a diagram of the Method 25A VOC sampling train.

IV.3 Metals – The metals emission sampling was conducted by employing U.S. EPA Method 29. This is an out of stack filtration method, where the sampling probe and filter are heated at 250 °F (plus or minus 25 °F).

The samples were collected isokinetically on quartz filters, and in a nitric acid/hydrogen peroxide solution and an acidic potassium permanganate solution.

The nozzle/probe rinses, filters and nitric acid/hydrogen peroxide solutions were analyzed for all the above listed metals by inductively coupled argon plasma/mass spectrophotometry (ICAP/MS) analysis in accordance with Method 29. The nozzle/probe rinses, filters, nitric acid/hydrogen peroxide solutions, and acidic potassium permanganate solutions were analyzed for mercury (Hg) by cold vapor atomic absorption spectroscopy (CVAAS) analysis in accordance with Method 29. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. Figure 3 is a diagram of the metals sampling train.

IV.4 Dioxins, Furans & Benzo-A-Pyrene – The PCDD's/PCDF's (polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans: 2,3,7,8 substituted cogeners from the Tetra through Octa homologs) and benzo-a-pyrene emission sampling was performed in accordance with U.S. EPA Method 23. A Modified Method 5 (MM5) sampling train, as described in Method 23, was used to collect the samples. The sampling train consisted of a heated glass lined probe followed by a heated pre-cleaned quartz filter. A condenser coil followed by an XAD sorbent trap followed the heated filter. An impinger train containing HPLC water followed the XAD trap. All sampling train components were pre-cleaned in accordance with the method.

Three (3) samples were collected. Each sample was sixty (60) minutes in duration, and had a minimum sample volume of thirty (30) dry standard cubic feet. The sampling system operation was consistent with U.S. EPA Method 5. The three samples and the blank train were recovered in pre-cleaned sample bottles with Teflon lined caps. The probe rinse and filter rinse were combined with the XAD extract for analysis. The back-half impinger condensate was also analyzed. The analytes were extracted from the sample, separated by high resolution gas chromatography, and measured by high resolution mass spectrometry. The analysis followed the procedures of SW-846 Method 8290. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis. Figure 4 is a diagram of the Method 23 sampling train.

IV.5 HCl – The HCL emission sampling was conducted in accordance with U.S. EPA Method 26A. The sampling was performed isokinetically in accordance with the method. The HCL was collected in the first two impingers of the sampling train, which contained 100 mls of 0.1 normal sulfuric acid. The probe rinse and the impinger catch were combined and analyzed for HCL using Ion-chromatography as described in the method.

All the quality assurance and quality control requirements specified in the method were incorporated in the sampling and analysis. A diagram of the sampling train is shown in Figure 5.

IV.6 Sulfuric Acid – The sulfuric acid determinations were conducted in accordance with U.S. EPA Method 8. The exhaust gas was extracted through a heated probe which lead to an impinger train. The first impinger contained 80% isopropyl alcohol (IPA), which is where the sulfuric acid was collected. The samples were collected isokinetically as described in the method. Immediately following each sample, a twenty (20) minute purge (at approximately the average sampling rate) using ambient air was performed on the impinger train. The purge is designed to remove any SO_2 that might remain in the first impinger. The sulfuric acid content in the samples was determined by the barium thorin titration technique described in the method. Three (3) samples, were collected. Each sample was sixty (60) minutes in duration and had a minimum sample volume of thirty (30) dry standard cubic feet. All the quality assurance and quality control requirements of the method will be incorporated in the sampling and analysis. The sulfuric acid sampling train is shown in Figure 6.

IV.7 Exhaust Gas Parameters – The exhaust gas parameters (air flow rate, temperature, moisture and density) were determined in conjunction with the other sampling by employing U.S. EPA Methods 1 through 4. Air flow rates, temperatures, moistures and densities were determined using the isokinetic sampling trains. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

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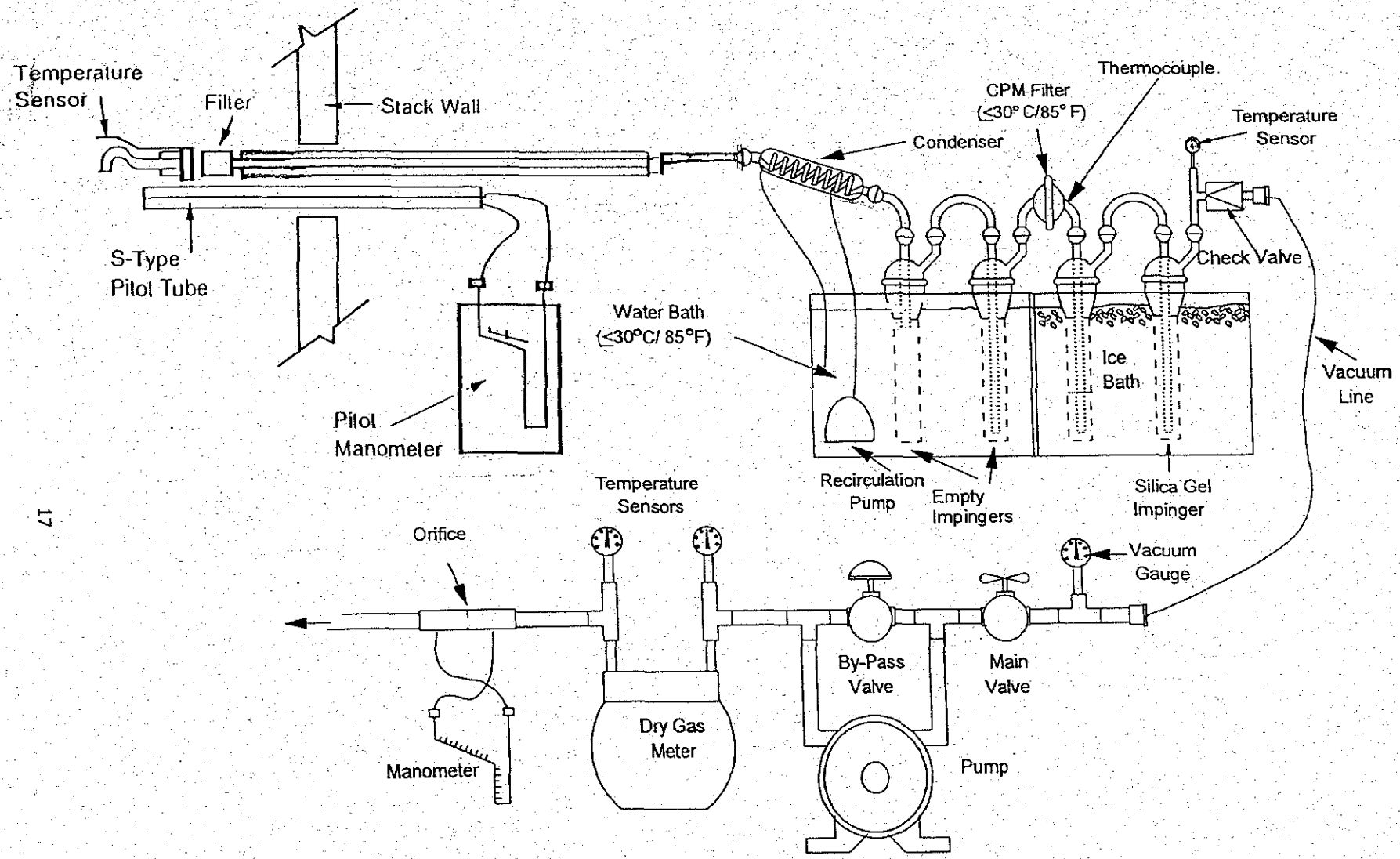

Figure 1

Particulate Sampling Train

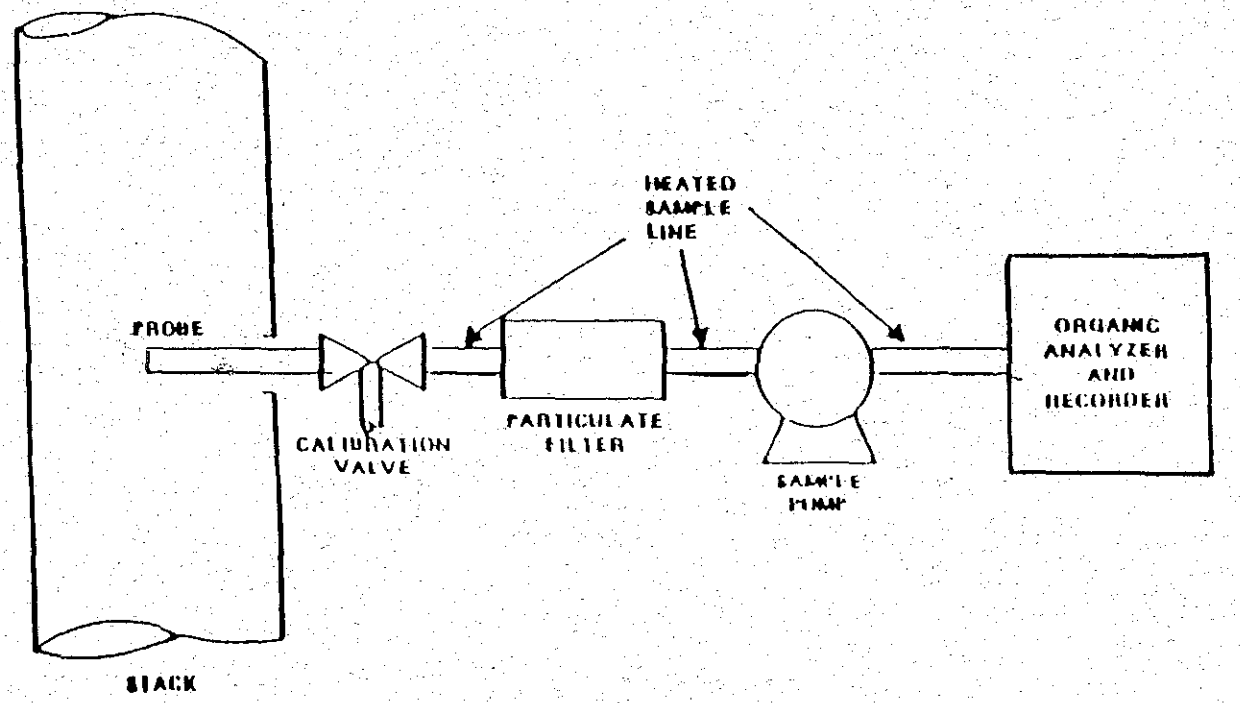

Figure 2

VOC Sampling Train

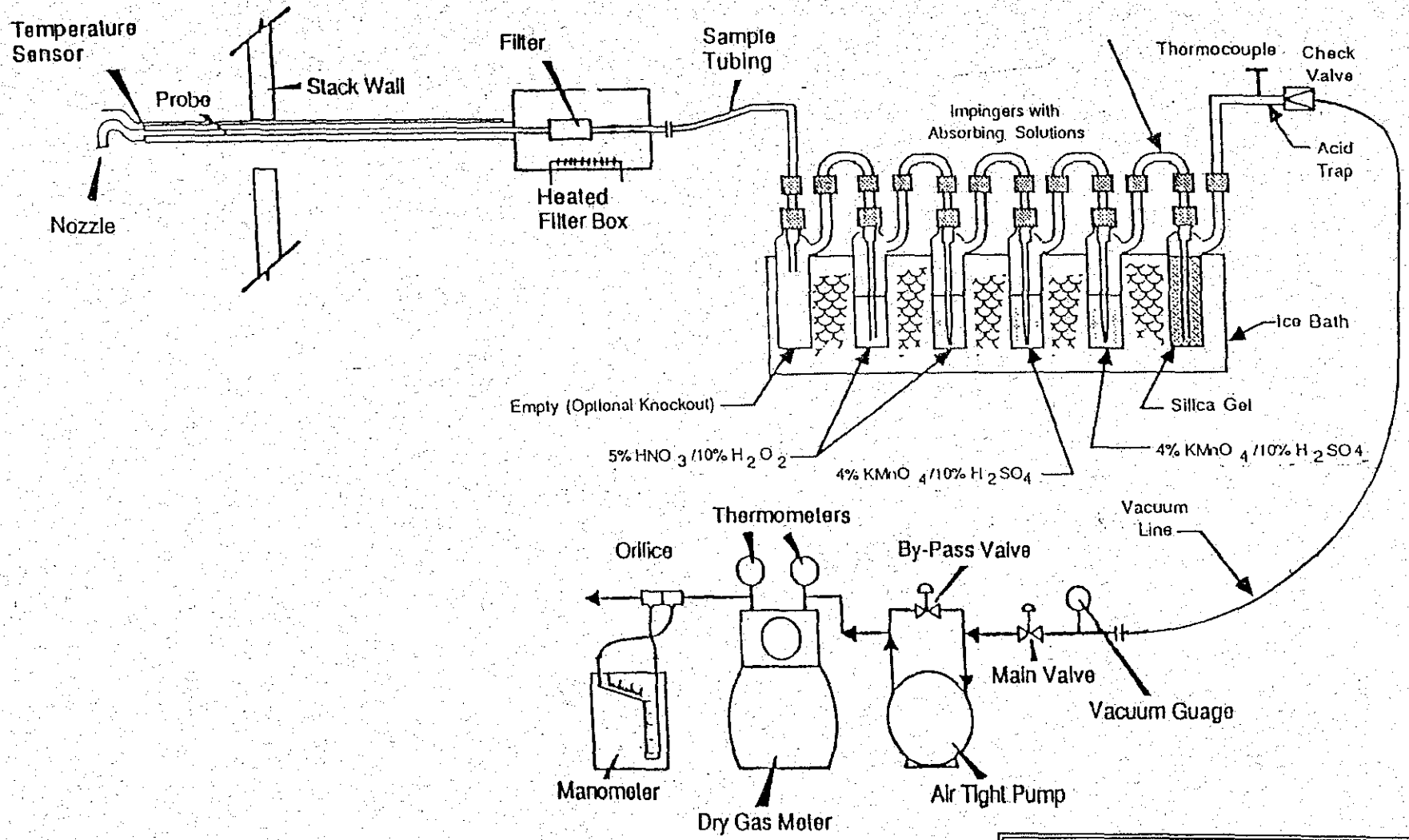

Figure 3

Metals Sampling Train

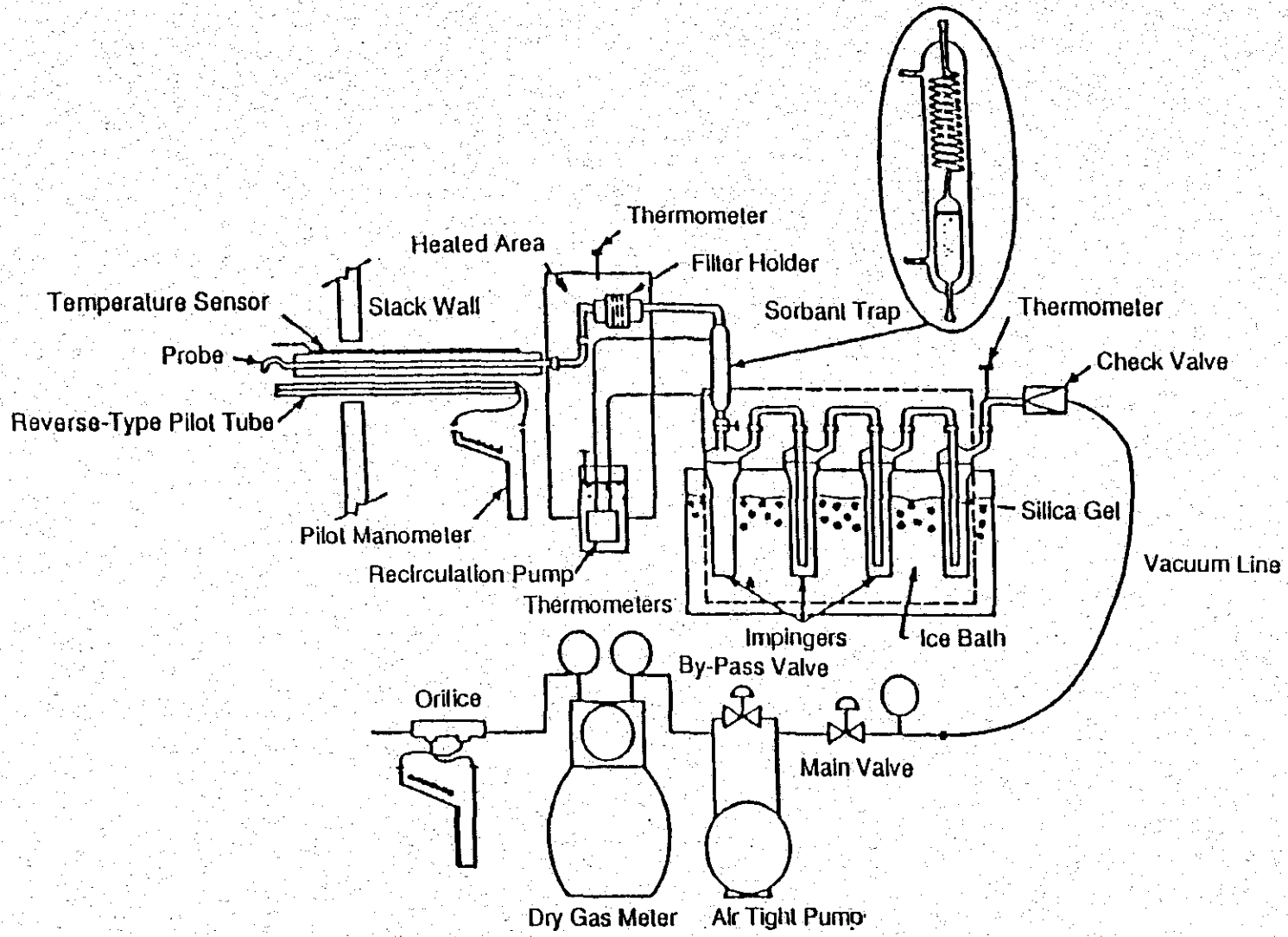

Figure 4

Dioxin, Furan & Benzo-A-Pyrene Sampling Train

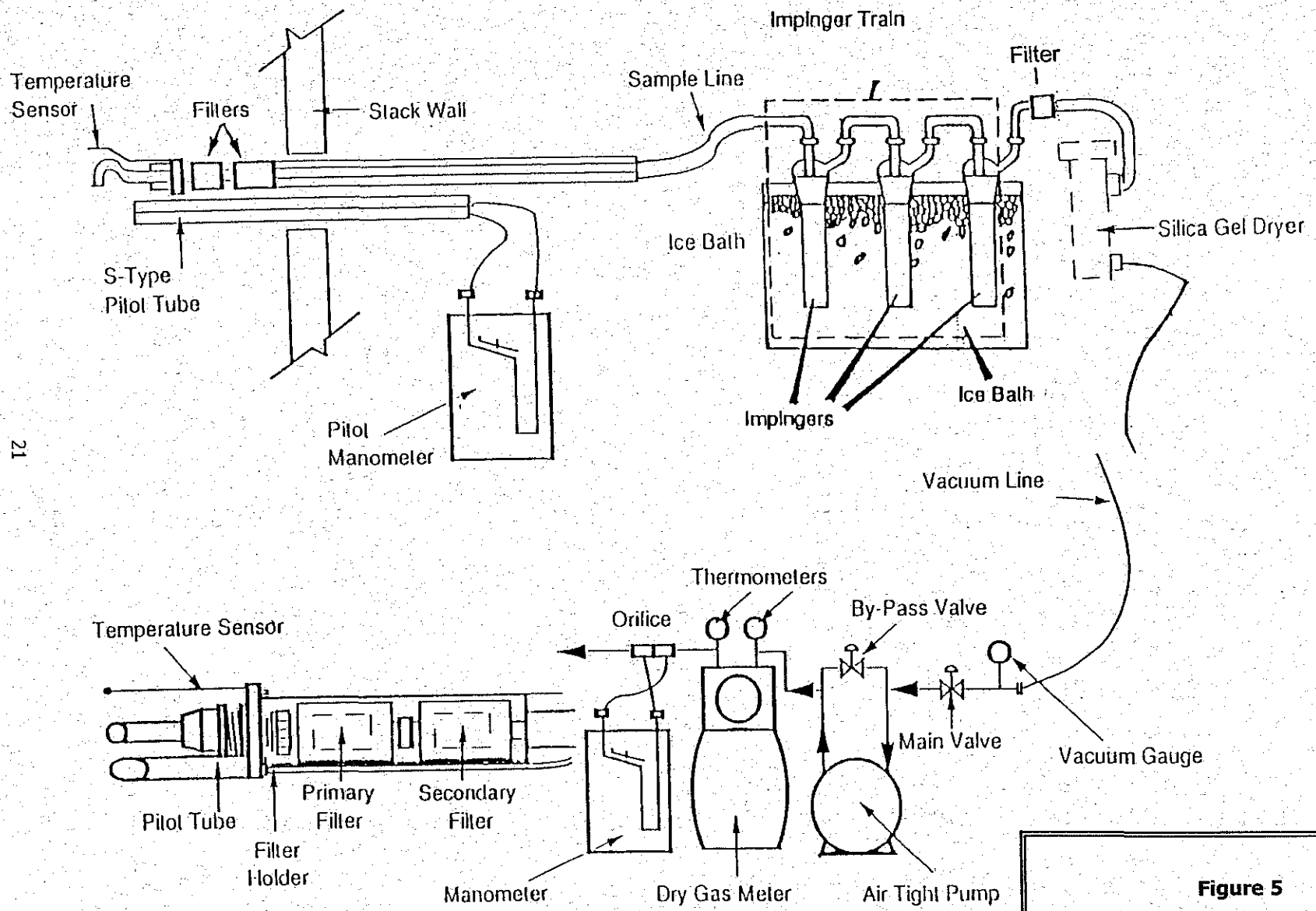

Figure 5

HCl Sampling Train

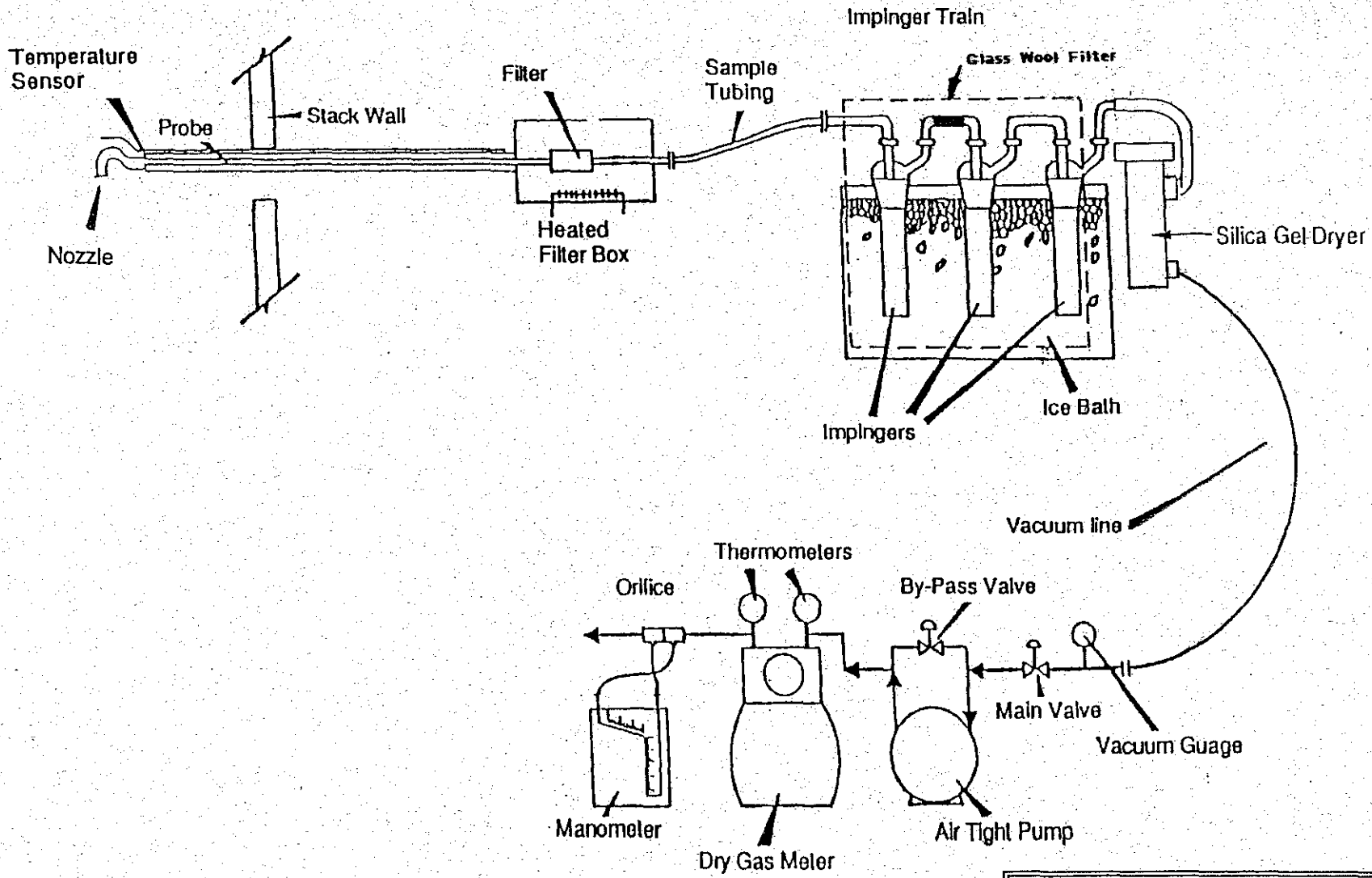

Figure 6

H_2SO_4 Sampling Train