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Report of...

Compliance Emission Testing

performed for the...

Hillman Power Company
Hillman, Michigan

on the

Wood Fired Boiler

February 11-13, 2014

130.26

Network Environmental, Inc.
Grand Rapids, MI

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I. INTRODUCTION

Network Environmental, Inc. was retained by the Hillman Power Company of Hillman, 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-N1266-2009.

ROP No. MI-ROP-N1266-2009 specifies that the emission rates of the following parameters be verified: Particulate Matter, Sulfuric Acid (H₂SO₄), Total Hydrocarbons (VOC's) and Benzo-A-Pyrene. All the testing followed the Michigan Department of Environmental Quality (MDEQ) and U.S. EPA testing protocols.

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

Emission Limit(s)
Particulate: 0.014 Grains/DSCF, 0.1 Lbs/MMBTU of Heat Input & 7.8 Lbs/Hr
H₂SO₄: 5.0 PPM (v/v), Dry @ 7% O ₂ & 4.6 Lbs/Hr
VOC's: 57.3 PPM (v/v), Dry @ 7% O ₂ & 7.0 Lbs/Hr
Benzo-A-Pyrene: 0.0006 Lbs/Hr

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

- Particulate Matter – U.S. EPA Method 17 (Combined with Method 8)
- H₂SO₄ – U.S. EPA Method 8 (Combined with Method 17)
- VOC's – U.S. EPA Method 25A
- Benzo-A-Pyrene – U.S. EPA Method 23
- 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 February 11-13, 2014 by Stephan K. Byrd, Richard D. Eerdmans, and David D. Engelhardt of Network Environmental, Inc.. Assisting with the study were Mr. Keith Mulka of the Hillman Power Company and the operating staff of the facility. Mr. Rob Dickman and Mr. William Rogers, Jr. 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
PARTICULATE EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
HILLMAN POWER COMPANY
HILLMAN, MI**

Sample	Date	Time	Air Flow Rate DSCFM ⁽¹⁾	Particulate Emissions		
				Grains/DSCF ⁽²⁾	Lbs/MMBTU ⁽³⁾	Lbs/Hr ⁽⁴⁾
1	2/11/14	10:25-11:31	72,227	0.0402	0.0771	24.86
2	2/11/14	12:03-13:12	71,636	0.0594	0.1125	36.49
3	2/11/14	13:42-14:49	69,828	0.0320	0.0601	19.13
Average			71,231	0.0439	0.0832	26.83

- (1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
 (2) Grains/DSCF = Grains Per Dry Standard Cubic Foot (STP = 68 °F and 29.92 in. Hg)
 (3) Lbs/MMBTU = Pounds Of Particulate Per Million BTU of Heat Input. Calculated Using The Formula Found In Section 2.1 Of Method 19 For O₂ On A Dry Basis With An F Factor Of 9,127.2.
 (4) Lbs/Hr = Pounds Per Hour

**II.2 TABLE 2
SULFURIC ACID (H₂SO₄) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
HILLMAN POWER COMPANY
HILLMAN, MI**

Sample	Date	Time	Air Flow Rate DSCFM ⁽¹⁾	H ₂ SO ₄ Emissions	
				PPM @ 7% O ₂ ⁽²⁾	Lbs/Hr ⁽³⁾
1	2/11/14	10:25-11:31	72,227	0.55	0.61
2	2/11/14	12:03-13:12	71,636	0.35	0.39
3	2/11/14	13:42-14:49	69,828	0.41	0.45
Average			71,231	0.43	0.48

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)

(2) PPM @ 7% O₂ = Parts Per Million (v/v) On A Dry Basis Corrected To 7 Percent Oxygen

(3) Lbs/Hr = Pounds Per Hour

**II.3 TABLE 3
TOTAL HYDROCARBON (VOC) EMISSION RESULTS
WOOD FIRED BOILER EXHAUST
HILLMAN POWER COMPANY
HILLMAN, MI**

Sample	Date	Time	Air Flow Rate SCFM ⁽¹⁾	VOC Emissions	
				PPM @ 7% O ₂ ⁽²⁾	Lbs/Hr ⁽³⁾
1	2/11/14	11:10-12:10	88,096	4.06	2.04
2	2/11/14	12:40-13:40	87,605	3.78	1.91
3	2/11/14	14:19-15:19	85,737	4.71	2.33
Average			87,146	4.18	2.09

- (1) SCFM = Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
(2) PPM @ 7% O₂ = Parts Per Million (v/v) On A Dry Basis Corrected To 7 Percent Oxygen
(3) Lbs/Hr = Pounds Per Hour

**II.4 TABLE 4
 BENZO-A-PYRENE EMISSION RESULTS
 WOOD FIRED BOILER EXHAUST
 HILLMAN POWER COMPANY
 HILLMAN, MI**

Sample	Date	Time	Air Flow Rate DSCFM ⁽¹⁾	Benzo-A-Pyrene Emissions	
				ug/M ³ ⁽²⁾	Lbs/Hr ⁽³⁾
1	2/12/14	11:00-14:06	69,975	0.0115	3.02E-06
2	2/12/14	16:04-17:08	69,947	0.0108	2.83E-06
3	2/13/14	09:15-10:20	68,743	0.0105	2.69E-06
Average			69,555	0.0109	2.85E-06

- (1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F and 29.92 in. Hg)
 (2) ug/M³ = Micrograms Per Dry Standard Cubic Meter (STP = 68 °F and 29.92 in. Hg)
 (3) Lbs/Hr = Pounds Per Hour

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Tables 1 through 4 (Sections II.1 through II.4). The results are presented as follows:

III.1 Particulate Emission Results (Table 1)

Table 1 summarizes the 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 Concentration (Grains/DSCF) – Grains of Particulate Per Dry Standard Cubic Foot of Exhaust Gas
- Particulate Mass Emission Rate (Lbs/MMBTU) – Pounds of Particulate Per Million BTU of Heat Input. Calculated Using The Formula Found In Section 2.1 Of Method 19 For O₂ On A Dry Basis With An F Factor Of 9,127.2.
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds of Particulate Per Hour

III.2 H₂SO₄ Emission Results (Table 2)

Table 2 summarizes the sulfuric acid 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 Concentration (PPM @ 7% O₂) – Parts Per Million (v/v) On a Dry Basis Corrected To 7 Percent Oxygen
- Sulfuric Acid Mass Emission Rate (Lbs/Hr) – Pounds of H₂SO₄ Per Hour

III.3 VOC Emission Results (Table 3)

Table 3 summarizes the total hydrocarbon emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (SCFM) – Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)

4	50.70
5	61.50
6	68.80

V.1 Particulate & Sulfuric Acid – The particulate and H₂SO₄ emission sampling was conducted in accordance with U.S. EPA Reference Method 17 and Method 8. A Method 17 sampling train, modified with 80% isopropyl alcohol (IPA) in the first Impinger with glass wool between the first and second impingers, was used to collect the samples.

The sampling system was operated isokinetically. 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. Each sample was purged for fifteen-minutes after completion of each test run, to remove any SO₂ from the IPA impinger.

The samples were recovered and refrigerated until they were analyzed. The filters and nozzle rinses were analyzed for total particulate by gravimetric analysis. The IPA impinger contents and rinses were titrated in accordance with Method 8 using the Barium-Thorin titration technique for H₂SO₄. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis. Figure 1 is a diagram of the particulate and sulfuric acid sampling train.

V.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 30.37 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 30.37 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.

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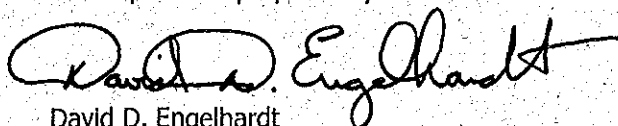
The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the boiler exhaust. All reference method data was corrected using Equation 7E-5 from U.S. EPA Method 7E. Figure 2 is a diagram of the Method 25A VOC sampling train.

V.3 Benzo-A-Pyrene - The determination for benzo-a-pyrene was performed in accordance with U.S. EPA Method 23 modified for PAH's. A Modified Method 5 (MM5) sampling train, as described in Method 23, was used to collect the PAH 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 benzo-a-pyrene analysis was performed in accordance with California Air Resources Board (CARB) Method 429, which is separation by high-resolution gas chromatography and measurement by high-resolution mass spectrometry. All quality assurance requirements specified in the method were incorporated in the sampling and analysis. Figure 3 is a diagram of the Method 23 benzo-a-pyrene sampling train.

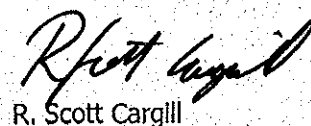
V.4 Exhaust Gas Parameters - The exhaust gas parameters (air flow rate, temperature, moisture and density) were determined in conjunction with the other sampling by employing U.S. EPA Methods 1 through 4. Air flow rates, temperatures, moistures and densities were determined using the isokinetic sampling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

This report was prepared by:



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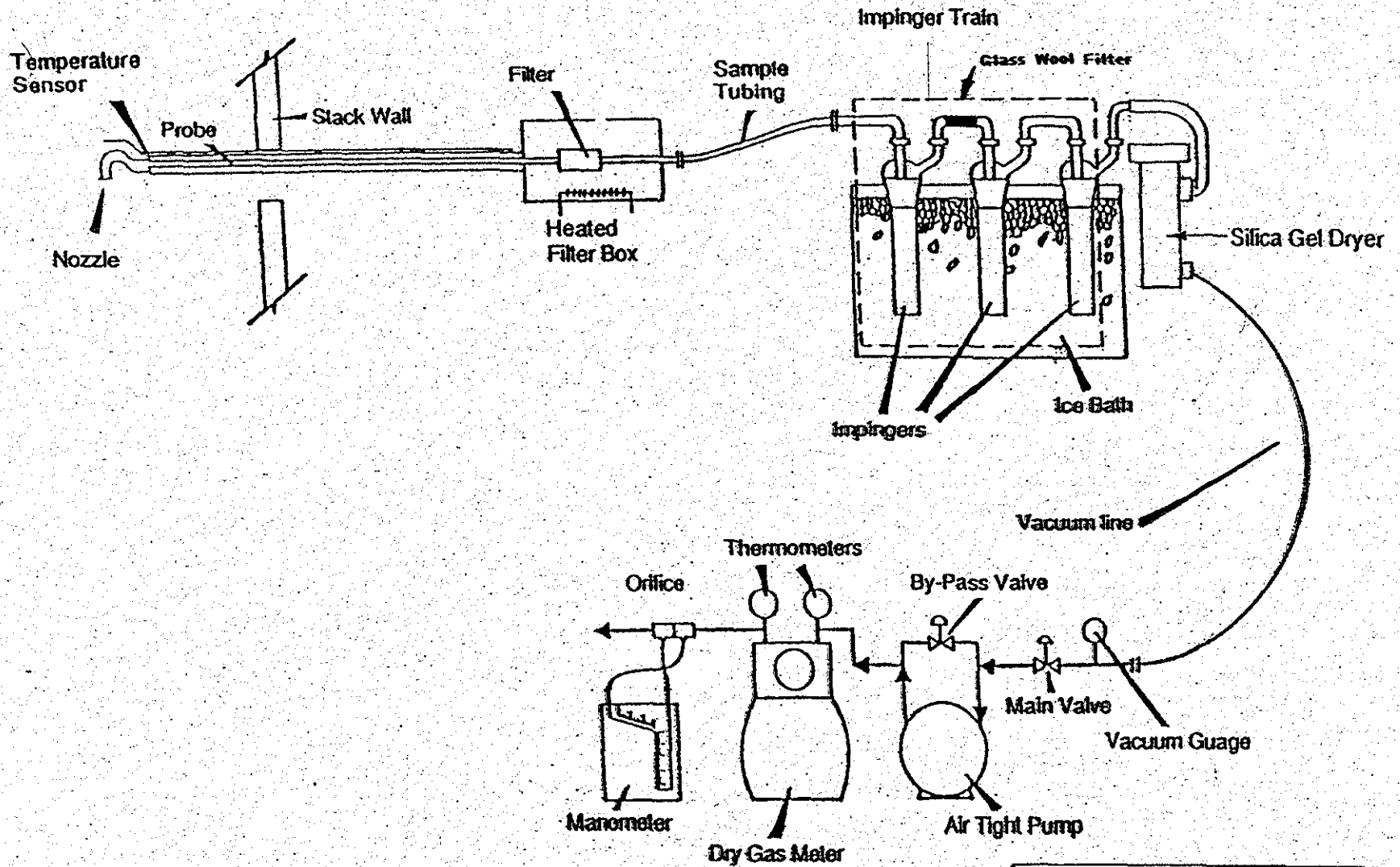


Figure 1
Particulate & H₂SO₄
Sampling Train

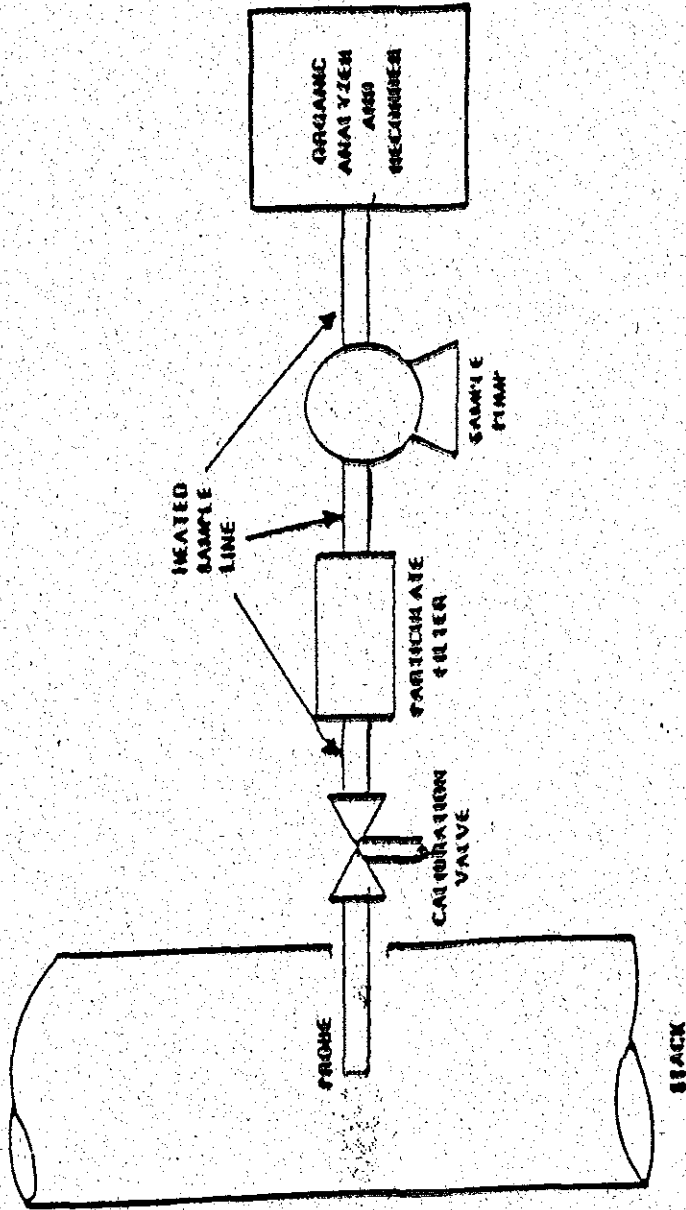


Figure 2
VOC
Sampling Train

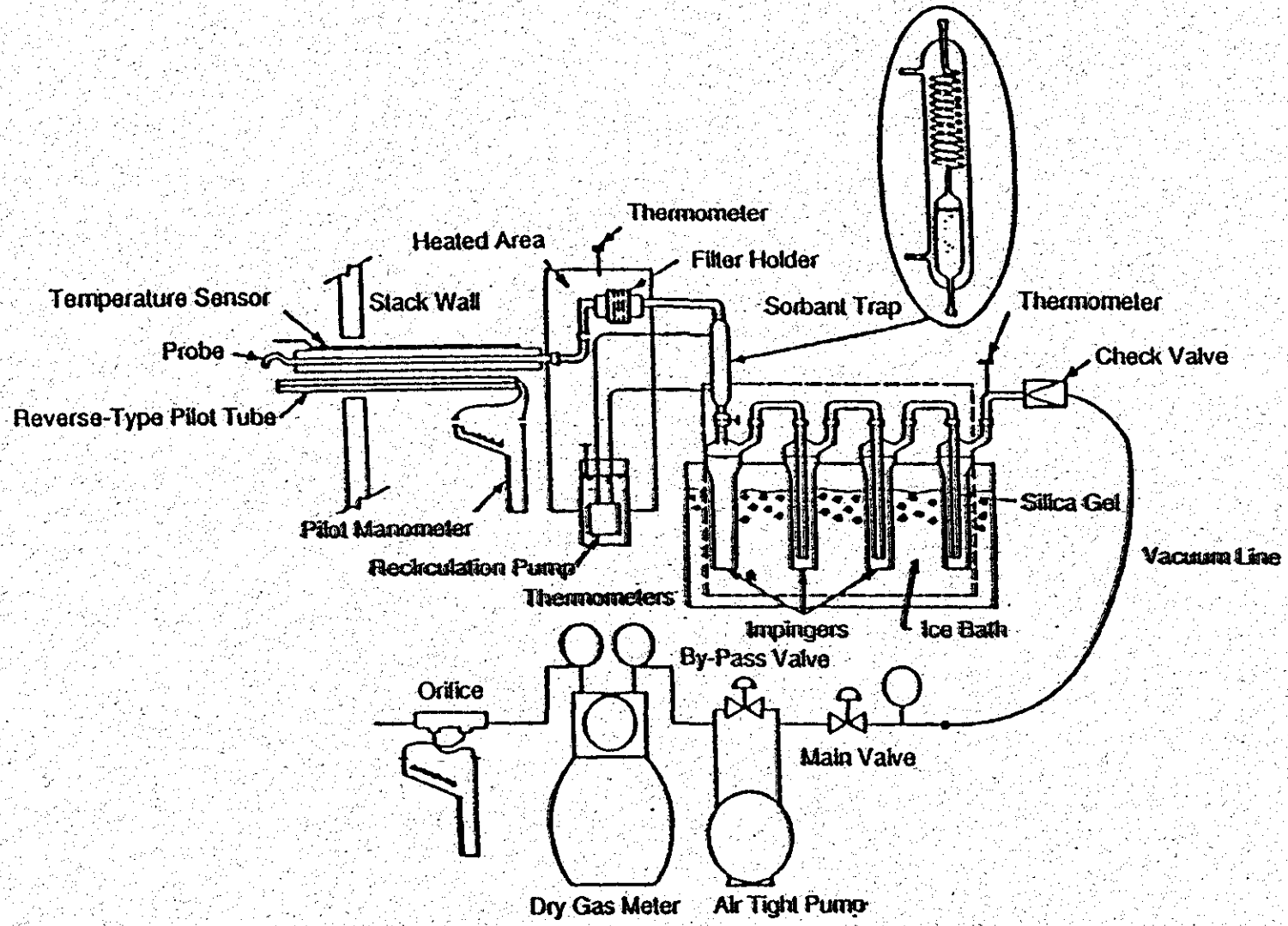


Figure 3
Benzo-A-Pyrene
Sampling Train