Report of...

Compliance Emission Sampling

Performed for...

Great Lakes Castings LLC

Ludington, Michigan

On...

Various Sources

November 9-11, 2021

Project#: 013.32

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performed for

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I. INTRODUCTION

Network Environmental, Inc. was retained by Great Lakes Castings LLC of Ludington, Michigan, to conduct an emission study at their facility. The purpose of the study was to meet the 2021 emission testing requirements of Renewable Operating Permit (ROP) No. MI-ROP-A3934-2015. Two emission unit/groups were tested. The emission unit/groups were as follows:

Emission Unit/Group ID	Emission Unit/Process Group Description	Stack/Vent ID
EUHUNTERPOURING	Hunter Iron Pouring Process	SVH-POURING-#1-5
EUCUPOLA	The Cupola and associated demister, afterburner, quencher and venturi scrubber.	SVCUPOLA

The EUHUNTERPOURING has five (5) exhaust stacks. Three (3) of the five stacks (SVH-POURING #1, #3 & #4) needed to be sampled as per the agreement with EGLE. Only SVH-POURING #3 & #4 were sampled during this trip to the facility. SVH-POURING #1 was sampled during a previous trip in October 2021.

The following is a list of the sources and applicable emission limits :

EUHUNTERPOURING:

Particulate: 0.10 Lbs/1000 Lbs

EUCUPOLA:

The Area Source Standard (40 CFR Part 63 Subpart ZZZZZ) has established the following emission limits for the cupola:

- 0.8 Pounds Of Particulate Matter (PM) Per Ton Of Metal Charged **Or** 0.06 Pounds of Total Metal Hazardous Air Pollutants (HAP's) Per Ton Of Metal Charged

Permit No. MI-ROP-A3934-2015 has established the following emission limits for the cupola:

Particulate: 0.25 Lbs/1000 Lbs on a Dry Basis, 28.0 Lbs/Hr, 50.8 Tons/Year & 1.4 Lbs/Ton of Metal Charged

PM-10: 21.6 Lbs/Hr, 39.2 Tons/Year & 1.08 Lbs /Ton of Metal Charged

SO_2: 30.0 Lbs/Hr, 54.4 Tons/Year & 1.5 Lbs/Ton of Metal Charged

CO: 225.0 Lbs/Hr, 408.0 Tons/Year & 11.25 Lbs/Ton of Metal Charged

VOC: 8.4 Lbs/Hr, 13.6 Tons/Year & 0.42 Lbs/Ton of Metal Charged

Pb: 0.4 Lbs/Hr, 0.76 Tons/Year & 0.02 Lbs/Ton of Metal Charged

As: 0.0036 Lbs/Hr

Mn: 0.87 Lbs/Hr

The following is a list of the parameters (compounds) sampled and the test methods used for the sampling:

- Metals & PM (Area Source Standard) – U.S. EPA Method 29 (multiple metals train)
- Particulate w/ Back Half Condensables – U.S. EPA Methods 17 & 202 (Front Half Filterable used to document compliance with the Particulate emission limits; Front Half Filterable and Back Half Condensables used to document compliance with the PM-10 emission limits)
- Sulfur Dioxide (SO_2) – U.S. EPA Method 6C
- Carbon Monoxide (CO) – U.S. EPA Method 10
- Total Hydrocarbons (VOC) – U.S. EPA Method 25A
- Particulate (EUHUNTERPOURING) – U.S. EPA Method 17
- Exhaust Gas Parameters (All Sources) – U.S. EPA Methods 1 through 4

The sampling was performed over the period of November 9-11, 2021 by Stephan K. Byrd, R. Scott Cargill, Richard D. Eerdmans, and David D. Engelhardt of Network Environmental, Inc.. Assisting with the sampling were Mr. Gordon Anderson and Mr. Frank Zarate of Great Lakes Castings LLC and the operating staff of the facility. Mr. Jeremy Howe and Ms. Caryn Owens of the Michigan Department of Environment, Great Lakes & Energy (EGLE) – Air Quality Division were present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
AREA SOURCE STANDARD
PARTICULATE EMISSION RESULTS (1)
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate DSCFM (2)	Concentration		Mass Emission Rates	
				Lbs/1000 Lbs, Dry (3)	Grains/DSCF (4)	Lbs/Hr (5)	Lbs/Ton of Charge (6)
1	11/9/21	09:52-12:02	17,950	0.109	0.060	9.24	0.55
2	11/9/21	13:45-15:52	18,362	0.147	0.081	12.71	0.77
3	11/10/21	08:55-12:25	18,559	0.179	0.098	15.53	1.06
Average			**18,290**	**0.145**	**0.080**	**12.50**	**0.79**

(1) Particulate Emissions (Front Half Filterable)
(2) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 Inches Hg)
(3) Lbs/1000 Lbs, Dry = Pounds Per Thousand Pounds On A Dry Basis
(4) Grains/DSCF = Grains Per Dry Standard Cubic Foot
(5) Lbs/Hr = Pounds Per Hour
(6) Lbs/Ton of Charge = Pounds Per Ton of Metal Charged. Charge Rates were calculated from data supplied by Great Lakes Castings LLC (16.90 Tons/Hr For Sample 1, 16.60 Tons/Hr For Sample 2 & 14.70 Tons/Hr For Sample 3).

II.2 TABLE 2
TOTAL METAL HAP'S EMISSION RESULTS
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate DSCFM (1)	Total Metal HAP's Mass Rates	
				Lbs/Hr (2)	Lb/Ton of Charge (3)
1	11/9/21	09:52-12:02	17,950	0.42	0.025
2	11/9/21	13:45-15:52	18,362	0.48	0.029
3	11/10/21	08:55-12:25	18,559	0.76	0.052
Average			**18,290**	**0.56**	**0.035**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Lbs/Hr = Pounds Per Hour
(3) Lbs/Ton of Charge = Pounds Per Ton of Metal Charged. Charge Rates were calculated from data supplied by Great Lakes Castings LLC (16.90 Tons/Hr For Sample 1, 16.60 Tons/Hr For Sample 2 & 14.70 Tons/Hr For Sample 3).

II.3 TABLE 3
METALS EMISSION RESULTS SUMMARY
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Metal	Sample 1 11/9/21 (09:52-12:02)		Sample 2 11/9/21 (13:45-15:52)		Sample 3 11/10/21 (08:55-12:25)		**Average**	
	Lbs/Hr	Lb/Ton	Lbs/Hr	Lb/Ton	Lbs/Hr	Lb/Ton	**Lbs/Hr**	**Lb/Ton**
Arsenic (As)	4.65E-04	2.75E-05	6.01E-04	3.62E-05	7.94E-04	5.40E-05	**6.20E-04**	**3.92E-05**
Antimony (Sb)	2.01E-03	1.19E-04	3.14E-03	1.89E-04	3.53E-03	2.40E-04	**2.90E-03**	**1.83E-04**
Beryllium (Be)	2.68E-05	1.58E-06	2.89E-05	1.74E-06	4.18E-05	2.84E-06	**3.25E-05**	**2.06E-06**
Cadmium (Cd)	2.84E-03	1.68E-04	4.09E-03	2.46E-04	6.70E-03	4.56E-04	**4.54E-03**	**2.90E-04**
Chromium (Cr)	3.58E-03	2.12E-04	4.70E-03	2.83E-04	5.65E-03	3.84E-04	**4.64E-03**	**2.93E-04**
Cobalt (Co)	1.24E-04	7.37E-06	1.57E-04	9.48E-06	1.78E-04	1.21E-05	**1.53E-04**	**9.65E-06**
Lead (Pb) (3)	5.41E-02	3.20E-03	7.93E-02	4.78E-03	1.26E-01	8.57E-03	**8.65E-02**	**5.52E-03**
Manganese (Mn)	3.58E-01	2.12E-02	3.89E-01	2.34E-02	6.19E-01	4.21E-02	**4.55E-01**	**2.89E-02**
Nickel (Ni)	8.69E-04	5.14E-05	9.01E-04	5.43E-05	9.90E-04	6.73E-05	**9.20E-04**	**5.77E-05**
Selenium (Se)	1.13E-04	6.71E-06	1.25E-04	7.52E-06	1.49E-04	1.01E-05	**1.29E-04**	**8.12E-06**
Mercury (Hg)	8.69E-04	5.14E-05	5.07E-04	3.05E-05	5.01E-04	3.40E-05	**6.25E-04**	**3.87E-05**

(1) Lbs/Hr = Pounds Per Hour (Calculated using 17,950 DSCFM for Sample 1, 18,362 DSCFM for Sample 2 & 18,559 DSCFM for Sample 3)
(2) Lbs/Ton = Pounds Per Ton of Metal Charged. Charge Rates were calculated from data supplied by Great Lakes Castings LLC (16.90 Tons/Hr For Sample 1, 16.60 Tons/Hr For Sample 2 & 14.70 Tons/Hr For Sample 3).
(3) **Lead (Pb) Emissions = 0.20 Tons/Year. Tons/Year was calculated using a maximum metal melt rate of 6,050 Tons/Month (72,600 Tons/Year).**

II.4 TABLE 4
TOTAL PARTICULATE (PM-10) EMISSION RESULTS [1]
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate DSCFM [2]	Concentration Lbs/1000 Lbs, Dry [3]	Total Particulate Mass Emission Rates		
					Lbs/Hr [4]	Lbs/Ton of Charge [5]	Tons/Year [6]
1	11/10/21	14:12-15:16	18,488	0.163	13.97	0.868	31.51
2	11/11/21	11:25-12:29	18,681	0.175	15.19	1.013	36.77
3	11/11/21	14:02-15:06	18,409	0.164	14.01	0.893	32.42
Average			**18,526**	**0.167**	**14.39**	**0.925**	**33.57**

(1) Total Particulate (PM-10) Emissions (Including Back Half Condesables)
(2) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 Inches Hg)
(3) Lbs/1000 Lbs, Dry = Pounds Of Particulate Per Thousand Pounds Of Exhaust Gas On A Dry Basis
(4) Lbs/Hr = Pounds Of Particulate Per Hour
(5) Lbs/Ton of Charge = Pounds Of Particulate Per Ton of Metal Charged. Calculated using charge rates of 16.10 Tons/Hr for Sample 1, 15.00 Tons/Hr for Sample 2 and 15.70 Tons/Hr for Sample 3. Charge Rates were supplied by Great Lakes Castings LLC.
(6) Tons/Year = Tons Per Year calculated using the maximum rate of 72,600 tons of metal charged per year (6,050 tons per month as established in MI-ROP-A3934-2015).

II.5 TABLE 5
FILTERABLE PARTICULATE EMISSION RESULTS [1]
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate DSCFM [2]	Concentration Lbs/1000 Lbs, Dry [3]	Filterable Particulate Mass Emission Rates		
					Lbs/Hr [4]	Lbs/Ton of Charge [5]	Tons/Year [6]
1	11/10/21	14:12-15:16	18,488	0.157	13.49	0.838	30.42
2	11/11/21	11:25-12:29	18,681	0.163	14.14	0.943	34.23
3	11/11/21	14:02-15:06	18,409	0.153	13.11	0.835	30.31
Average			**18,526**	**0.158**	**13.58**	**0.872**	**31.65**

(1) Filterable (Front Half) Particulate
(2) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 Inches Hg)
(3) Lbs/1000 Lbs, Dry = Pounds Of Particulate Per Thousand Pounds Of Exhaust Gas On A Dry Basis
(4) Lbs/Hr = Pounds Of Particulate Per Hour
(5) Lbs/Ton of Charge = Pounds Of Particulate Per Ton of Metal Charged. Calculated using charge rates of 16.10 Tons/Hr for Sample 1, 15.00 Tons/Hr for Sample 2 and 15.70 Tons/Hr for Sample 3. Charge Rates were supplied by Great Lakes Castings LLC.
(6) Tons/Year = Tons Per Year calculated using the maximum rate of 72,600 tons of metal charged per year (6,050 tons per month as established in MI-ROP-A3934-2015).

II.6 TABLE 6
SULFUR DIOXIDE (SO_2) EMISSION RESULTS
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration PPM (2)	SO_2 Mass Emission Rates		
					Lbs/Hr (3)	Lbs/Ton of Charge (4)	Tons/Year (5)
1	11/9/21	09:52-10:52	17,950	0.5	0.089	0.0055	0.200
2	11/9/21	11:22-12:22	17,950	0.2	0.036	0.0020	0.073
3	11/9/21	13:45-14:45	18,362	0.2	0.036	0.0021	0.076
Average			**18,087**	**0.3**	**0.191**	**0.0032**	**0.116**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 Inches Hg)
(2) PPM = Parts Per Million (v/v) On A Dry Basis
(3) Lbs/Hr = Pounds Of SO_2 Per Hour
(4) Lbs/Ton of Charge = Pounds Of SO_2 Per Ton of Metal Charged. Calculated using charge rates of 16.30 Tons/Hr for Sample 1, 17.60 Tons/Hr for Sample 2 and 17.50 Tons/Hr for Sample 3. Charge Rates were supplied by Great Lakes Castings LLC.
(5) Tons/Year = Tons Per Year calculated using the maximum rate of 72,600 tons of metal charged per year (6,050 tons per month as established in MI-ROP-A3934-2015).

II.7 TABLE 7
CARBON MONOXIDE (CO) EMISSION RESULTS
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration PPM (2)	CO Mass Emission Rates		
					Lbs/Hr (3)	Lbs/Ton of Charge (4)	Tons/Year (5)
1	11/9/21	09:52-10:52	17,950	1,689.7	131.88	8.09	293.67
2	11/9/21	11:22-12:22	17,950	1,671.0	130.42	7.41	268.98
3	11/9/21	13:45-14:45	18,362	1,308.5	104.47	5.97	216.71
Average			**18,087**	**1,556.4**	**122.26**	**7.16**	**259.79**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 Inches Hg)
(2) PPM = Parts Per Million (v/v) On A Dry Basis
(3) Lbs/Hr = Pounds Of CO Per Hour
(4) Lbs/Ton of Charge = Pounds Of CO Per Ton of Metal Charged. Calculated using charge rates of 16.30 Tons/Hr for Sample 1, 17.60 Tons/Hr for Sample 2 and 17.50 Tons/Hr for Sample 3. Charge Rates were supplied by Great Lakes Castings LLC.
(5) Tons/Year = Tons Per Year calculated using the maximum rate of 72,600 tons of metal charged per year (6,050 tons per month as established in MI-ROP-A3934-2015).

II.8 TABLE 8
TOTAL HYDROCARBON (VOC) EMISSION RESULTS
CUPOLA SCRUBBER EXHAUST
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Sample	Date	Time	Air Flow Rate SCFM (1)	Concentration PPM (2)	VOC Mass Emission Rates		
					Lbs/Hr (3)	Lbs/Ton of Charge (4)	Tons/Year (5)
1	11/10/21	11:26-12:26	23,807	4.5	0.73	0.062	2.25
2	11/10/21	13:55-14:55	23,742	6.6	1.07	0.060	2.18
3	11/11/21	11:16-12:16	24,246	3.8	0.63	0.043	1.56
Average			**23,932**	**5.0**	**0.81**	**0.055**	**2.00**

(1) SCFM = Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 Inches Hg)
(2) PPM = Parts Per Million (v/v) On An Actual (Wet) Basis As Propane
(3) Lbs/Hr = Pounds Of VOC Per Hour As Propane
(4) Lbs/Ton of Charge = Pounds Of VOC Per Ton of Metal Charged. Calculated using charge rates of 11.70 Tons/Hr for Sample 1, 17.80 Tons/Hr for Sample 2 and 14.63 Tons/Hr for Sample 3. Charge Rates were supplied by Great Lakes Castings LLC.
(5) Tons/Year = Tons Per Year calculated using the maximum rate of 72,600 tons of metal charged per year (6,050 tons per month as established in MI-ROP-A3934-2015).

II.9 TABLE 9
PARTICULATE EMISSION RESULTS SUMMARY
EUHUNTERPOURING
GREAT LAKES CASTINGS LLC
LUDINGTON, MICHIGAN

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration Lbs/1000 Lbs, Dry (2)	Emission Rate Lbs/Hr (3)
SVH-POURING #3 (EUHUNTERPOURING)	1	11/11/21	08:17-09:20	8,976	0.0150	0.60
	2	11/11/21	09:39-10:41	8,867	0.0170	0.67
	3	11/11/21	10:54-11:57	8,642	0.0204	0.79
	Average			**8,828**	**0.0175**	**0.69**
SVH-POURING #4 (EUHUNTERPOURING)	1	11/10/21	09:50-10:53	8,516	0.0143	0.54
	2	11/10/21	11:29-12:32	8,232	0.0111	0.41
	3	11/10/21	13:19-14:22	8,072	0.0170	0.61
	Average			**8,274**	**0.0141**	**0.52**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Lbs/1000 Lbs, Dry = Pounds Of Particulate Per Thousand Pounds Of Exhaust Gas On A Dry Basis
(3) Lbs/Hr = Pounds Of Particulate Per Hour

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Tables 1 through 9 (Sections II.1 through II.9). The results are presented as follows:

III.1 Cupola (Area Source Standard) Particulate Emission Results (Table 1)

Table 1 summarizes the cupola particulate emission results as follows:

- Sample
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68°F & 29.92 in. Hg)
- Particulate Concentration (Lbs/1000 Lbs, Dry) – Pounds Per Thousand Pounds Of Exhaust Gas On A Dry Basis
- Particulate Concentration (Grains/DSCF) – Grains Per Dry Standard Cubic Foot Of Exhaust Gas
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds Per Hour
- Particulate Mass Emission Rate (Lb/Ton) – Pound Per Ton of Metal Charged

A more detailed breakdown for each sample can be found in Appendix A. These particulate results were determined from the metals (Method 29) sampling trains and can be used to compare to the Area Source Standard (40 CFR Part 63 Subpart ZZZZZ).

III.2 Cupola Total Metal HAP's Emission Results (Table 2)

Table 2 summarizes the cupola total metal HAP's emission results as follows:

- Sample
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68°F & 29.92 in. Hg)
- Total Metal HAP's Mass Emission Rate (Lbs/Hr) – Pounds Per Hour
- Total Metal HAP's Mass Emission Rate (Lb/Ton) – Pound Per Ton of Metal Charged

A more detailed breakdown for each sample can be found in Appendix A.

III.3 Cupola Metals Emission Results (Table 3)

Table 3 summarizes the cupola metals emission results as follows:

- Sample
- Time
- Metals Mass Emission Rate (Lbs/Hr) – Pounds Per Hour

- Metals Mass Emission Rate (Lb/Ton) – Pound Per Ton of Metal Charged

Also shown is the average Lead (Pb) emission rate in Tons/Year. This emission rate was calculated using the average Pb Lb/Ton of Metal Charged and a maximum allowable melt rate of 6,050 Tons/Month (72,600 Tons/Year).

III.4 Total Particulate (PM-10) Emission Results (Table 4)

Table 4 summarizes the total particulate (front half filterable and back half condensable) 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 (Lbs/1000 Lbs, Dry) – Pounds of Particulate per Thousand Pounds of Exhaust Gas On A Dry Basis
- Mass Emission Rates In Terms Of:
  - ◊ Lbs/Hr – Pounds Per Hour
  - ◊ Lbs/Ton of Charge – Pounds Per Ton Of Metal Charged
  - ◊ Tons/Year – Tons Per Year

The charging rates used to calculate Lbs/Ton of Charge were supplied by Great Lakes Castings LLC. The Tons/Year results were calculated using the maximum rate of 72,600 tons of metal charge per year (6,050 tons per month), as established in MI-ROP-A3934-2015.

A more detailed breakdown of each individual particulate sample can be found in Appendix A.

III.5 Filterable Particulate Emission Results (Table 5)

Table 5 summarizes the filterable (front half) 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 (Lbs/1000 Lbs, Dry) – Pounds of Particulate per Thousand Pounds of Exhaust Gas On A Dry Basis
- Mass Emission Rates In Terms Of:

- ◊ Lbs/Hr – Pounds Per Hour
- ◊ Lbs/Ton of Charge – Pounds Per Ton Of Metal Charged
- ◊ Tons/Year – Tons Per Year

The charging rates used to calculate Lbs/Ton of Charge were supplied by Great Lakes Castings LLC. The Tons/Year results were calculated using the maximum rate of 72,600 tons of metal charge per year (6,050 tons per month), as established in MI-ROP-A3934-2015.

A more detailed breakdown of each individual particulate sample can be found in Appendix A. The filterable (front half) particulate results were determined from the Method 17 sampling train.

III.6 Sulfur Dioxide (SO_2) Emission Results (Table 6)

Table 6 summarizes the SO_2 emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Concentration (PPM) – Parts Per Million (v/v) On A Dry Basis
- Mass Emission Rates In Terms Of:
  - ◊ Lbs/Hr – Pounds Per Hour
  - ◊ Lbs/Ton of Charge – Pounds Per Ton Of Metal Charged
  - ◊ Tons/Year – Tons Per Year

All reference method PPM data was calibration corrected using U.S. EPA Equation 7E-5. The charging rates used to calculate Lbs/Ton of Charge were supplied by Great Lakes Castings LLC. The Tons/Year results were calculated using the maximum rate of 72,600 tons of metal charge per year (6,050 tons per month), as established in MI-ROP-A3934-2015.

III.7 Carbon Monoxide (CO) Emission Results (Table 7)

Table 7 summarizes the CO emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Concentration (PPM) – Parts Per Million (v/v) On A Dry Basis

- Mass Emission Rates In Terms Of:
  - ◊ Lbs/Hr – Pounds Per Hour
  - ◊ Lbs/Ton of Charge – Pounds Per Ton Of Metal Charged
  - ◊ Tons/Year – Tons Per Year

All reference method PPM data was calibration corrected using U.S. EPA Equation 7E-5. The charging rates used to calculate Lbs/Ton of Charge were supplied by Great Lakes Castings LLC. The Tons/Year results were calculated using the maximum rate of 72,600 tons of metal charge per year (6,050 tons per month), as established in MI-ROP-A3934-2015.

III.8 Total Hydrocarbon (VOC) Emission Results (Table 8)

Table 8 summarizes the VOC emission results as follows:

- Sample
- Date
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- Concentration (PPM) – Parts Per Million (v/v) On A Wet (Actual) Basis As Propane
- Mass Emission Rates In Terms Of:
  - ◊ Lbs/Hr – Pounds Per Hour As Propane
  - ◊ Lbs/Ton of Charge – Pounds Per Ton Of Metal Charged
  - ◊ Tons/Year – Tons Per Year

All reference method PPM data was calibration corrected using U.S. EPA Equation 7E-5. The charging rates used to calculate Lbs/Ton of Charge were supplied by Great Lakes Castings LLC. The Tons/Year results were calculated using the maximum rate of 72,600 tons of metal charge per year (6,050 tons per month), as established in MI-ROP-A3934-2015.

III.9 EUHUNTERPOURING (SVH #3 &#4) Particulate Emission Results (Table 9):

Table 9 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 (Lbs/1000 Lbs, Dry) – Pounds Of Particulate Per Thousand Pounds Of Exhaust Gas On A Dry Basis

- Particulate Emission Rate (Lbs/Hr) – Pounds Of Particulate Per Hour

A more detailed breakdown of each individual particulate sample can be found in Appendix A.

IV. SOURCE DESCRIPTION

IV.1 Cupola (EUCUPOLA) – This source is the exhaust of the cupola. The exhaust gases from the cupola pass through a afterburner, quencher and then a wet scrubber system (venturi scrubber & demister) before being emitted to atmosphere. Process operation information during the testing can be found in Appendix G.

IV.2 SVH Pouring Exhausts (EUHUNTERPOURING) – These exhausts are from the Hunter Iron Pouring process. The exhaust gases from the Hunter Pouring process are ducted uncontrolled straight to atmosphere. There are five (5) Hunter pouring exhaust stacks. Exhaust stacks 3 and 4 were sampled this trip. Process operation information during the testing can be found in Appendix G.

V. SAMPLING AND ANALYTICAL PROTOCOL

A schematic diagram of the sampling locations can be found in Appendix F. The sampling locations were as follows:

- **Cupola (EUCUPOLA)** – On the 45 inch I.D. exhaust stack at a location approximately 8 duct diameters downstream and 9 duct diameters upstream from the nearest disturbances. A total of 12 sample points were used for the sample traversing (6 points per port).

- **SVH Pouring #3** – On the 35 inch I.D. exhaust stack with 2 sample ports in a location approximately 4 duct diameters downstream and 4 duct diameters upstream from the nearest disturbances. Twenty-Four (24) sampling points were used for this source. Because of the presence of a vane axial fan, straightening vanes were installed on this exhaust.

- **SVH Pouring #4** – On the 35 inch I.D. exhaust stack with 2 sample ports in a location approximately 4 duct diameters downstream and 4 duct diameters upstream from the nearest

disturbances. Twenty-Four (24) sampling points were used for this source. Because of the presence of a vane axial fan, straightening vanes were installed on this exhaust.

Prior to the emission testing, preliminary velocity/cyclonic (turbulent) flow measurements/checks were conducted. All the sampling locations and flows passed the requirements of Methods 1 and 2.

The following is a list of the parameters (compounds) sampled and the test methods used for the sampling:

- Metals & PM (Area Source Standard) – U.S. EPA Method 29 (multiple metals train)
- Particulate w/ Back Half Condensables – U.S. EPA Methods 17 & 202 (Front Half Filterable to be used to document compliance with the Particulate emission limits; Front Half Filterable and Back Half Condensables to be used to document compliance with the PM-10 emission limits)
- Sulfur Dioxide (SO_2) – U.S. EPA Method 6C
- Carbon Monoxide (CO) – U.S. EPA Method 10
- Total Hydrocarbons (VOC) – U.S. EPA Method 25A
- Particulate (EUHUNTERPOURING) – U.S. EPA Method 17
- Exhaust Gas Parameters (All Sources) – U.S. EPA Methods 1 through 4

V.1 Particulate & Metal HAP's – The particulate and metals 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).

Three (3) samples were collected from the cupola scrubber exhaust stack. Each sample was one hundred twenty (120) minutes in duration. Each sample had a minimum sample volume of sixty (60) dry standard cubic feet. The samples were collected isokinetically on quartz filters, and in a nitric acid/hydrogen peroxide solution and an acidic potassium permanganate solution.

The filters, nozzle/probe rinses (front half) were analyzed gravimetrically for particulates in accordance with U.S. EPA Method 5. 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 1 is a diagram of the sampling train. It should be noted that halfway

through sample 3 the filter plugged and was replaced. A post-leak check was conducted after the first half of the sample, and a pre-leak check was conducted after the filter was changed out. The sample volume that was added by the additional leak checks was subtracted from the total before calculating results.

V.2 Particulate Including Back Half Condensables – The Particulate (including back half condensable) emission sampling was conducted in accordance with U.S. EPA Methods 17 and 202. Method 17 is an in-stack filtration method. Three (3) samples were collected from the cupola scrubber exhaust. Each sample was sixty (60) minutes in duration and had a minimum sample volume of thirty (30) dry standard cubic feet. The samples were collected isokinetically and analyzed for Particulate by gravimetric analysis.

In addition to the standard front half analysis, the back half condensable particulate matter was determined in accordance with U.S. EPA Method 202 (Dry Impinger Technique). A sixty (60) minute nitrogen purge (as specified in Method 202) was conducted for the back half condensables immediately following each sample. The back half samples were extracted and analyzed for condensable particulate in accordance with Method 202. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis. Figure 2 is a diagram of the particulate sampling train.

V.3 Sulfur Dioxide (SO_2) – The Sulfur Dioxide (SO_2) emission sampling was conducted in accordance with U.S. EPA Reference Method 6C. The sample gas was extracted from the source through a heated teflon sample line which led to a VIA MAK 2 sample gas conditioner and then to a Bovar Model 721M portable stack gas monitor. This analyzer is capable of giving instantaneous readouts of the SO_2 concentrations (PPM).

Three (3) samples were collected from the cupola scrubber exhaust. Each sample was sixty (60) minutes in duration. The analyzer was calibrated with EPA protocol SO_2 calibration gases. A span gas of 95.2 PPM was used to establish the initial instrument calibration. Calibration gases of 50.2 PPM and 25.0 PPM were used to determine the calibration error of the analyzer. The sampling system (from the back of the stack probe to the analyzer) was injected using the 25.0 PPM gas to determine the system bias. After each sample, a system zero and system injection of 25.0 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the exhaust. The analyzer averages were corrected for calibration error and drift using formula EQ. 7E-5 from 40 CFR Part 60, Appendix A, Method 7E. A diagram of the SO_2 sampling train is shown in Figure 3.

V.4 Carbon Monoxide (CO) – The Carbon Monoxide (CO) emission sampling was conducted in accordance with U.S. EPA Reference Method 10. The sample gas was extracted from the source through a heated teflon sample line which led to a VIA MAK 2 sample gas conditioner and then to a Thermo Environmental Model 48C portable stack gas monitor. This analyzer is capable of giving instantaneous readouts of the CO concentrations (PPM).

Three (3) samples were collected from the cupola scrubber exhaust. Each sample was sixty (60) minutes in duration. The analyzer was calibrated with EPA protocol CO calibration gases. A span gas of 4,509 PPM was used to establish the initial instrument calibration. Calibration gases of 2,215 PPM and 998 PPM were used to determine the calibration error of the analyzer. The sampling system (from the back of the stack probe to the analyzer) was injected using the 2,215 PPM gas to determine the system bias. After each sample, a system zero and system injection of 2,215 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the exhaust. The analyzer averages were corrected for calibration error and drift using formula EQ. 7E-5 from 40 CFR Part 60, Appendix A, Method 7E. A diagram of the CO sampling train is shown in Figure 3.

V.5 Total Hydrocarbons (VOC) – The VOC 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 source sampled. 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 94.90 PPM Propane was used to establish the initial instrument calibration. Calibration gases of 30.2 PPM & 50.6 PPM Propane were used to determine the calibration error of the analyzer. After each sample, a system zero and system injection of 30.2 PPM Propane were performed to establish system drift and system bias during the test period. All calibration gases used were EPA Protocol Calibration Gases. Three (3) samples were collected from the cupola scrubber 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 exhaust. The analyzer averages were corrected for calibration error and drift using formula EQ.7E-5 from 40 CFR Part 60, Appendix A, Method 7E. Figure 4 is a diagram of the VOC sampling train.

V.6 Oxygen & Carbon Dioxide (Cupola 11/9/21) – The O_2 & CO_2 sampling was conducted in accordance with U.S. EPA Reference Method 3A. Servomex Model 1400M portable stack gas analyzers were used to monitor the exhaust. A heated teflon sample line was used to transport the exhaust gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzers. The analyzers produce instantaneous readouts of the O_2 & CO_2 concentrations (%).

Three (3) samples were collected from the cupola scrubber exhaust. Each sample was sixty (60) minutes in duration. The analyzers were calibrated by direct injection prior to the testing. Span gases of 21.0% O_2 and 21.1% CO_2 were used to establish the initial instrument calibrations. Calibration gases of 12.06% O_2/6.01% CO_2 and 5.97% O_2/12.1% CO_2 were used to determine the calibration error of the analyzers. The sampling system (from the back of the stack probe to the analyzers) was injected using the 12.06% O_2/6.01% CO_2 gas to determine the system bias. After each sample, a system zero and system injection of 12.06% O_2/6.01% CO_2 were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzers were calibrated to the output of the data acquisition system (DAS) used to collect the data from the exhaust. The analyzer averages were corrected for calibration error and drift using formula EQ.7E-5 from 40 CFR Part 60, Appendix A, Method 7E. A diagram of the sampling train is shown in Figure 3.

V.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 and moistures were determined using the isokinetic sampling trains. O_2 & CO_2 for the cupola was determined as described above on 11/9/21. Over the period 11/10-11/21, bag samples from the cupola isokinetic sampling trains were collected and analyzed by Orsat for the O_2 and CO_2 content. Previous compliance testing has demonstrated that all of the hunter pouring exhausts (SVHPOURING) have ambient air gas density (20.9 %O_2 & 0.0 %CO_2). These ambient gas density default values were used for

all of the SVHPOURING calculations. All the quality assurance and quality control procedures listed in the methods were incorporated in the sampling and analysis.

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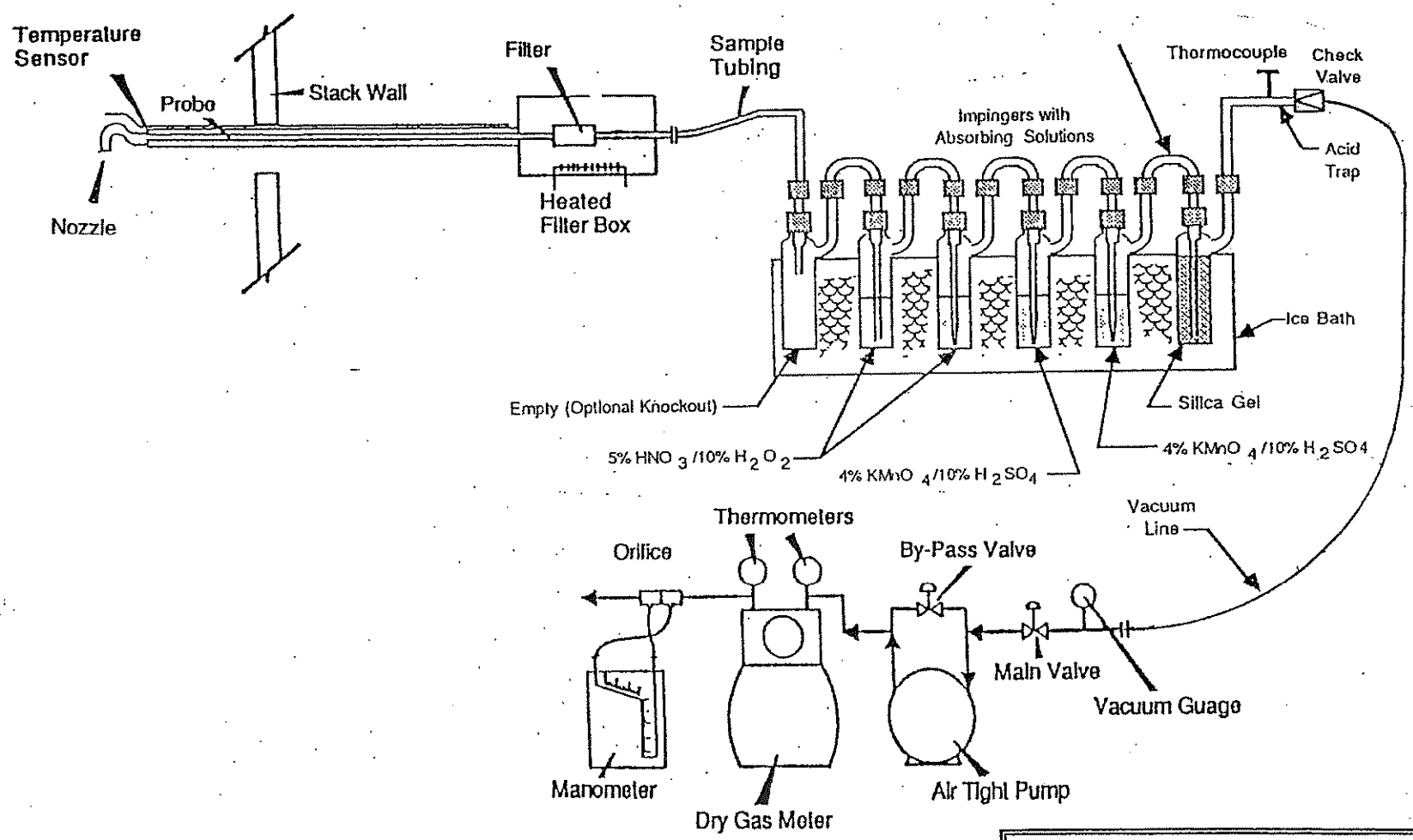

Figure 1

Particulate & Metal HAP's Sampling Train

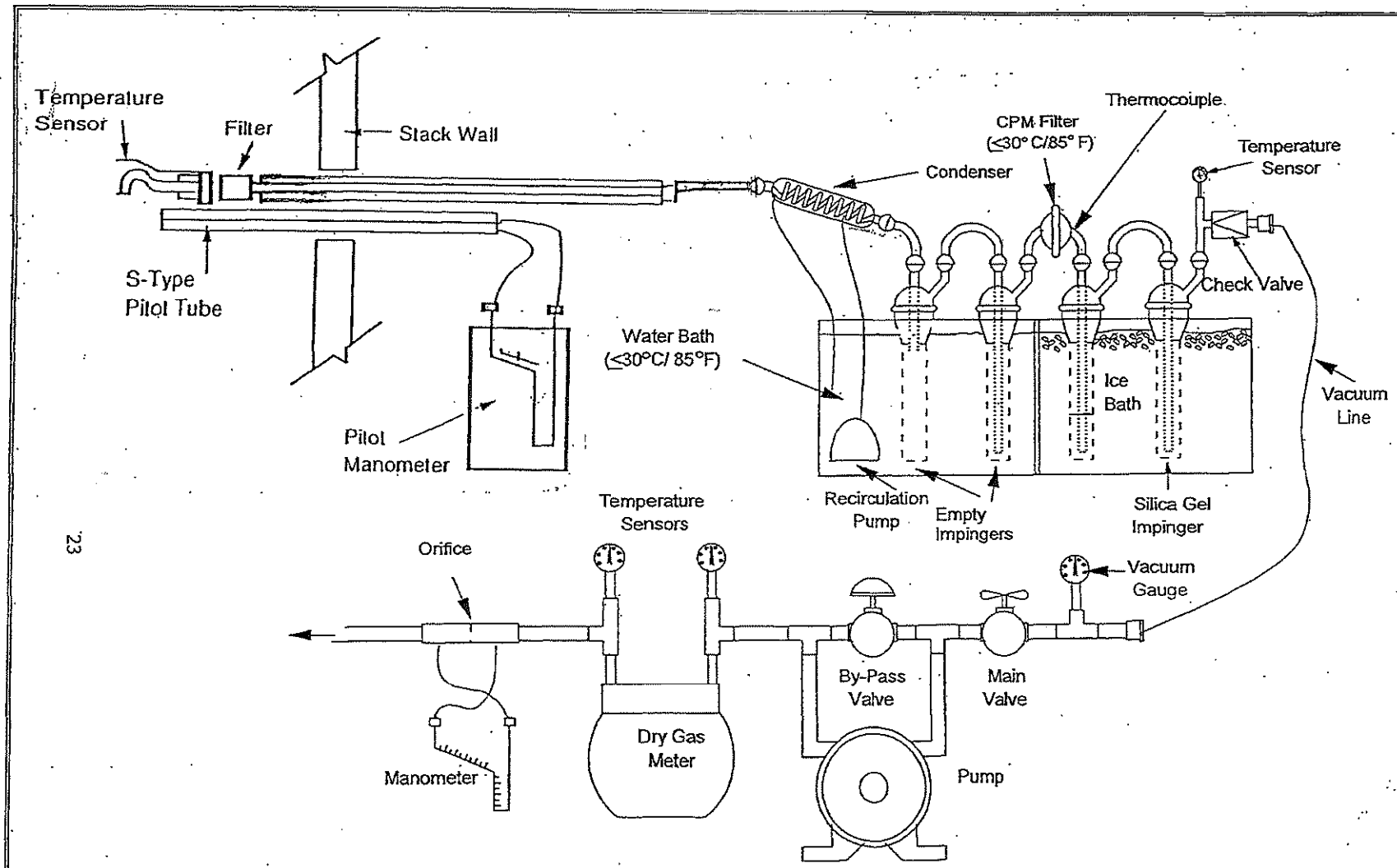

Figure 2

Total Particulate (PM-10) Sampling Train

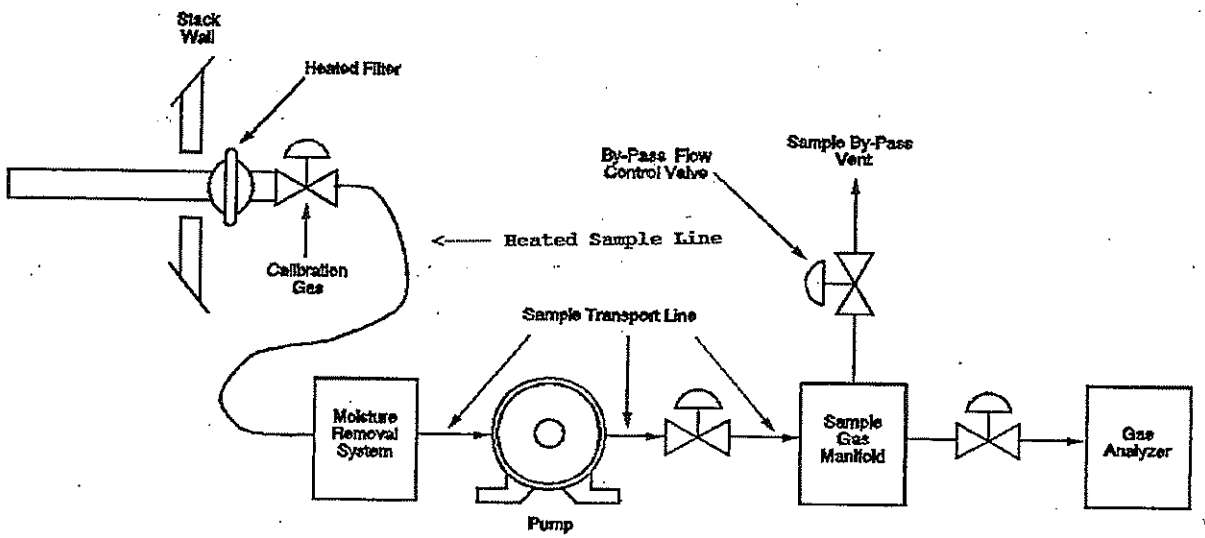

Figure 3

SO_2, CO, O_2 & CO_2 Sampling Train

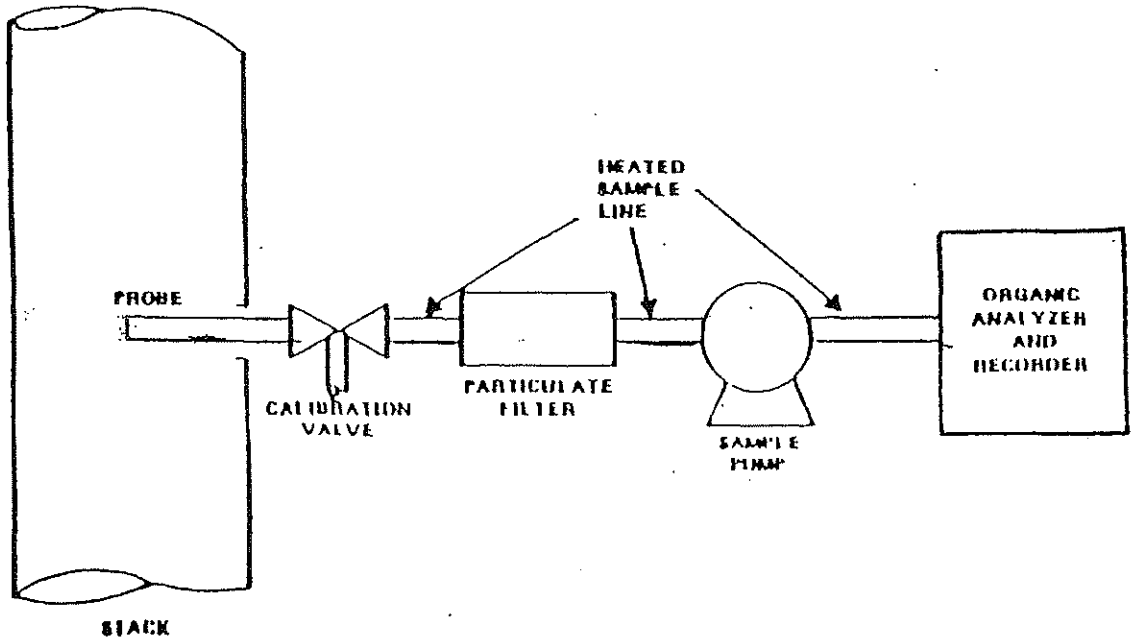

Figure 4

VOC
Sampling Train