Report of...

Compliance Emission Sampling

Performed for...

Morton Salt

Manistee, Michigan

On...

Various Sources

May 31 - June 2, 2023

Project #: 203.14

By...

Network Environmental, Inc.
Grand Rapids, MI

B1824_test_20230531

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I. INTRODUCTION

Network Environmental, Inc. was retained by Morton Salt (SRN: B1824 - Manistee County) of Manistee, Michigan, to conduct an emission study at their facility. The purpose of the study was to meet the emission testing requirements of Michigan Department of Environment, Great Lakes and Energy (EGLE) – Air Quality Division Renewable Operating Permit No. MI-ROP-B1824-2015a and EGLE Permit To Install (PTI) No. 54-14A . The following is a list of the sampling conducted and the established emission limits for each source:

Source	Compound(s) Sampled	Emission Limit
#6 Boiler Baghouse Exhaust **EU#6BOILER**	Particulate & Sulfur Dioxide (SO_2)	**Particulate:** 0.30 Lbs/1000 Lbs of exhaust gas @ 50% excess air **SO_2:** 2.5 Lbs/MMBTU
MAC Baghouse Exhaust **FGPELLPRETZEL** (EUPELLPROD & EUPRETZELSALT)	Particulate [1] (See Below)	**Particulate (PM):** 0.014 Grains/DSCF **PM 10:** 3.56 Lbs/Hr **PM 2.5:** 2.53 Lbs/Hr
Pellet Cooling Scrubber Exhaust **EUPELLETCOOLING**	Particulate	**Particulate:** 0.032 Lbs/1000 Lbs of exhaust gas

(1) The total particulate (front half filterable and back half condensable) emissions was determined. By adding the condensable particulate to the filterable particulate the testing was designed to meet the PM 10 & PM 2.5 requirements of the permit. Both the pellet production and the pretzel salt operations were running during the sampling.

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

- Particulate – U.S. EPA Method 17
- PM 10 & PM 2.5 – U.S. EPA Methods 17 & 202
- Sulfur Dioxide (SO_2) – U.S. EPA Method 6C
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Reference Methods 1 through 4.

The sampling was performed over the period of May 31 - June 2, 2023 by Stephan K. Byrd, Richard D. Eerdmans, and David D. Engelhardt of Network Environmental, Inc.. Assisting with the sampling were Mr. Tim Lovley of Morton Salt and the operating staff of the facility. Mr. Robert Dickman of the Michigan Department of Environment, Great Lakes and Energy (EGLE) – Air Quality Division was present to observe the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
PARTICULATE
EMISSION RESULTS SUMMARY
#6 BOILER EXHAUST
MORTON SALT
MANISTEE, MICHIGAN
MAY 31, 2023

Source	Sample	Time	Air Flow Rate DSCFM(1)	Concentration Lbs/1000 Lbs @50%EA(2)	Mass Emission Rate	
					Lbs/Hr (3)	Lbs/MMBTU (4)
#6 Boiler Exhaust	1	09:57-11:00	44,317	0.0046	0.90	0.0056
	2	11:23-12:27	39,976	0.0020	0.41	0.0025
	3	12:50-13:54	38,486	0.0025	0.49	0.0031
	Average		**40,926**	**0.0030**	**0.60**	**0.0037**

(1) DSCFM = Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) Lbs/1000 Lbs @50% EA = Pounds of Particulate Per Thousand Pounds of Exhaust Gas Corrected to 50% Excess Air
(3) Lbs/Hr = Pounds of Particulate Per Hour
(4) Lbs/MMBTU = Pounds Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,780 DSCF/MMBTU)
(5) **Permit No. MI-ROP-B1824-2015a has established a particulate emission limit of 0.30 Lbs/1000 Lbs @ 50% Excess Air for the #6 Boiler**

II.2 TABLE 2
SULFUR DIOXIDE (SO_2)
EMISSION RESULTS SUMMARY
#6 BOILER EXHAUST
MORTON SALT
MANISTEE, MICHIGAN
MAY 31, 2023

Source	Sample	Time	Air Flow Rate DSCFM (1)	Concentration PPM (2)	Mass Emission Rate	
					Lbs/Hr (3)	Lbs/MMBTU (4)
#6 Boiler Exhaust	1	09:58-10:58	44,317	284.6	125.35	0.785
	2	11:26-12:26	39,976	323.9	128.69	0.785
	3	12:51-13:51	38,486	330.8	126.53	0.785
	Average		**40,926**	**313.1**	**126.86**	**0.785**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(2) PPM = Parts Per Million (v/v) On A Dry Basis
(3) Lbs/Hr = Pounds of SO_2 Per Hour
(4) Lbs/MMBTU = Pounds Per Million BTU of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,780 DSCF/MMBTU)
(5) **Permit No. MI-ROP-B1824-2015a has established an SO_2 emission limit of 2.5 Lbs/MMBTU for the #6 Boiler**

II.3 TABLE 3
PARTICULATE
EMISSION RESULTS SUMMARY
VARIOUS SOURCES
MORTON SALT
MANISTEE, MICHIGAN
JUNE 1-2, 2023

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration Grains/DSCF (2)	Emission Rate Lbs/Hr (3)
Pellet Production/ Pretzel Salt Baghouse	1	6/1/23	10:26-12:05	22,453	0.0015	0.28
	2	6/1/23	12:40-13:57	22,130	0.0013	0.25
	3	6/1/23	14:28-15:45	22,307	0.0018	0.35
	Average			**22,297**	**0.0015**	**0.30**

Source	Sample	Date	Time	Air Flow Rate DSCFM (1)	Concentration Lbs/1000 Lbs (4)	Emission Rate Lbs/Hr (3)
Pellet Cooling Scrubber	1	6/2/23	08:42-09:56	7,024	0.0045	0.14
	2	6/2/23	10:12-11:25	7,014	0.0038	0.12
	3	6/2/23	11:59-13:12	7,030	0.0046	0.15
	Average			**7,023**	**0.0043**	**0.14**

(1) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 ºF & 29.92 in. Hg)
(2) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(3) Lbs/Hr = Pounds Of Particulate Per Hour
(4) Lbs/1000 Lbs = Pounds Of Particulate Per Thousand Pounds Of Exhaust Gas On An Actual Basis
(5) **Permit No. MI-ROP-B1824-2015a (and PTI No. 54-14A for FGPELLPRETZEL only) has established particulate emission limits of 0.014 Grains/DSCF for the Pellet Production/Pretzel Salt Baghouse and 0.032 Lbs/1000 Lbs of Exhaust Gas for the Pellet Cooling Scrubber**

II.4 TABLE 4
TOTAL PARTICULATE(1) (PM 10 & PM 2.5)
EMISSION RESULTS SUMMARY
PELLET PRODUCTION/PRETZEL SALT BAGHOUSE
MORTON SALT
MANISTEE, MICHIGAN
JUNE 1, 2023

Source	Sample	Time	Air Flow Rate DSCFM (2)	Concentration Grains/DSCF (3)	Emission Rate Lbs/Hr (4)
Pellet Production/ Pretzel Salt Baghouse	1	10:26-12:05	22,453	0.0048	0.92
	2	12:40-13:57	22,130	0.0051	0.96
	3	14:28-15:45	22,307	0.0065	1.25
	Average		**22,297**	**0.0054**	**1.04**

(1) Total Particulate = Front Half Filterable Particulate Plus Back Half Condensable Particulate
(2) DSCFM = Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
(3) Grains/DSCF = Grains Of Particulate Per Dry Standard Cubic Foot Of Exhaust Gas
(4) Lbs/Hr = Pounds Of Particulate Per Hour
(5) **PTI No. 54-14A has established emission limits of 3.56 Lbs/Hr for PM 10 & 2.53 Lbs/Hr for PM 2.5**

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 #6 Boiler Particulate Emission Results (Table 1)

Table 1 summarizes the particulate emission results for the #6 Boiler 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 @ 50% EA) – Pounds of Particulate per Thousand Pounds of Exhaust Gas Corrected to Fifty Percent Excess Air
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds of Particulate Per Hour
- Particulate Mass Emission Rate (Lbs/MMBTU) – Pounds of Particulate Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,780 DSCF/MMBTU)

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

III.2 #6 Boiler Sulfur Dioxide (SO_2) Emission Results (Table 2)

Table 2 summarizes the SO_2 emission results for the #6 Boiler as follows:

- Sample
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (STP = 68 °F & 29.92 in. Hg)
- SO_2 Concentration (PPM) – Parts Per Million (v/v) On A Dry Basis
- SO_2 Mass Emission Rate (Lbs/Hr) – Pounds of SO_2 Per Hour
- SO_2 Mass Emission Rate (Lbs/MMBTU) – Pounds of SO_2 Per Million BTU Of Heat Input (Calculated Using U.S. EPA Method 19 With An F-Factor of 9,780 DSCF/MMBTU)

All the SO_2 sample data was calibration corrected using Equation 7E-5 from U.S. EPA Method 7E.

III.3 Pellet Production/Pretzel Salt Baghouse Particulate Emissions (Table 3)

Table 3 summarizes the particulate emission results for the Pellet Production/Pretzel Salt Baghouse as follows:

- Source
- Sample
- Date

- Time
- Air Flow Rate (DSCFM) – 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 On A Dry Basis
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds of Particulate Per Hour

III.4 Pellet Cooling Scrubber Particulate Emissions (Table 3)

Table 3 summarizes the particulate emission results for the Pellet Cooling Scrubber as follows:

- Source
- 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) – Pounds of Particulate Per Thousand Pounds of Exhaust Gas On An Actual Basis
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds of Particulate Per Hour

III.5 Pellet Production/Pretzel Salt Baghouse Total Particulate (PM 10 & PM 2.5) Emissions (Table 4)

Table 4 summarizes the total particulate emission results for the Pellet Production/Pretzel Salt Baghouse as follows:

- Source
- Sample
- Time
- Air Flow Rate (DSCFM) – 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 On A Dry Basis
- Particulate Mass Emission Rate (Lbs/Hr) – Pounds of Particulate Per Hour

III.6 Emission Limits

Source	Emission Limit(s)
#6 Boiler Baghouse Exhaust **EU#6BOILER**	**Particulate:** 0.30 Lbs/1000 Lbs of exhaust gas @ 50% excess air **SO_2:** 2.5 Lbs/MMBTU

MAC Baghouse Exhaust **FGPELLPRETZEL** (EUPELLPROD & EUPRETZELSALT)	**Particulate (PM):** 0.014 Grains/DSCF **PM 10:** 3.56 Lbs/Hr **PM 2.5:** 2.53 Lbs/Hr
Pellet Cooling Scrubber Exhaust **EUPELLETCOOLING**	**Particulate:** 0.032 Lbs/1000 Lbs of exhaust gas

The results of all the testing conducted were below the established emission limits from MI-ROP-B1824-2015a and PTI No. 54-14A

IV. SOURCE DESCRIPTION

IV.1 #6 Boiler (EU#6BOILER) – The #6 Boiler is a Wickes spreader stoker coal and natural gas co-fired boiler. It's maximum rating is 180,000 pounds of steam per hour (216 MMBTU/Hr). The particulate matter is controlled by a baghouse equipped with a Lime injection system. This boiler is used for generating process steam and electricity. Source operating data during the sampling can be found in Appendix B.

IV.2 Pellet Production/Pretzel Salt (FGPELLPRETZEL) – The pellet production area produces water softener pellets. The sources included in this process are; pellet briquetting machines, a vibratory screen, belt conveyors, bucket elevators and an enclosed crusher to recycle pellets. The particulate matter from this area is controlled by the baghouse known as the MAC dust collector. All the sampling was conducted during normal operation of this process (See Appendix B).

The Pretzel Salt process is a totally enclosed pretzel salt production system which includes a main crusher, a pellet press, an enclosed screw conveyor, a recycle crusher, a bucket elevator and a sizing screener. The particulate matter from this area is controlled by the baghouse known as the MAC dust collector. All the sampling was conducted during normal operation of this process (See Appendix B).

IV.3 Pellet Cooling (EUPELLETCOOLING) – The pellet cooling is a cooling system used in the production of water softener pellets. The particulate matter is controlled by a venturi scrubber. All the sampling was conducted during normal operation of this process (See Appendix B).

V. SAMPLING AND ANALYTICAL PROTOCOL

Schematic diagrams of the sampling locations can be found in Appendix G. The sampling locations were as follows:

- #6 Boiler – A 78 inch I.D. stack with two (2) sample ports in a location that exceeds the eight (8) duct diameters downstream and two (2) duct diameters upstream from the nearest disturbances requirement of U.S. EPA Method 1. Twelve (12) sampling points were used for the isokinetic sampling.

- Pellet Production/Pretzel Salt Baghouse – A 36 inch I.D. exhaust stack with two (2) sample ports in a location approximately two (2) duct diameters downstream and six (6) duct diameters upstream from the nearest disturbances. Twenty-four (24) sampling points were used for the isokinetic sampling.

- Pellet Cooling Scrubber – A 21 inch I.D. exhaust stack with two (2) sample ports in a location approximately six (6) duct diameters downstream and four (4) duct diameters upstream from the nearest disturbances. Twenty (20) sampling points were used for the isokinetic sampling.

The sampling point dimensions for the isokinetic sampling trains were as follows:

Sample Point	FGPELLPRETZEL Dimension (Inches)	EUPELLETCOOLING Dimension (Inches)	EU#6BOILER Dimension (Inches)
1	1.00	0.55	3.43
2	2.41	1.72	11.39
3	4.25	3.07	23.90
4	6.37	4.75	54.91
5	9.00	7.18	66.61
6	12.82	13.82	74.57
7	23.18	16.25	----
8	27.00	17.93	----
9	29.63	19.28	----
10	31.75	20.45	----
11	33.59	----	----
12	35.00	----	----

Three (3) test runs (samples) were conducted for each of the compounds on each of the sources as listed below. Sample duration and minimum total sample volume were as follows:

Source	Compound(s) Sampled	Sample Duration / Minimum Sample Volume
#6 Boiler Baghouse Exhaust **EU#6BOILER**	Particulate	60 Minutes / 30 DSCF
	Sulfur Dioxide (SO_2)	60 Minutes / NA
MAC Baghouse Exhaust **FGPELLPRETZEL** (EUPELLPROD & EUPRETZELSALT)	Particulate	72-96 Minutes / 60 DSCF
Pellet Cooling Scrubber Exhaust **EUPELLETCOOLING**	Particulate	70 Minutes / 60 DSCF
(1) NA = Not Applicable (2) DSCF = Dry Standard Cubic Feet (STP = 29.92 in Hg & 68 Deg. F)		

The following reference test methods were used to conduct the sampling:

- Particulate Matter (EU#6BOILER & EUPELLETCOOLING) – U.S. EPA Method 17
- PM, PM 10 & PM 2.5 (FGPELLPRETZEL) – U.S. EPA Methods 17 & 202
- Sulfur Dioxide (SO_2) – U.S. EPA Method 6C
- Exhaust Gas Parameters (flow rate, temperature, moisture & density) – U.S. EPA Methods 1- 4

V.1 Particulate (EU#6BOILER & EUPELLETCOOLING) – The particulate emission sampling was conducted in accordance with U.S. EPA Reference Method 17. Method 17 is an in-stack filtration method. Three (3) samples were collected from each of the sources sampled. Sample duration and total sample volume were as listed in the above table. The samples were collected isokinetically and analyzed for total particulate by gravimetric analysis. All the quality assurance and quality control procedures listed in the method were incorporated in the sampling and analysis. The particulate sampling train is shown in Figure 1.

V.2 PM, PM 10 & PM 2.5 (FGPELLPRETZEL) – The particulate emission sampling was conducted in accordance with U.S. EPA Method 17. Method 17 is an in-stack filtration method. Three (3) samples were collected from the exhaust. Sample duration and total sample volume were as listed in the above table. 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. The particulate sampling train is shown in Figure 2.

V.3 Sulfur Dioxide (SO_2) – The SO_2 sampling was conducted in accordance with U.S. EPA Reference Method 6C. A Bovar Model 721M gas analyzer was used to monitor the boiler 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 analyzer. The analyzer produces instantaneous readouts of the SO_2 concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 491.0 PPM was used to establish the initial instrument calibration. Calibration gases of 269.0 PPM and 148.0 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 269.0 PPM gas to determine the system bias. After each sample, a system zero and system injection of 269.0 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified. 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. 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.4 Oxygen & Carbon Dioxide (EU#6BOILER) – 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 boiler 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 (%).

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 12.0% O_2/5.95% CO_2 and 6.03% O_2/11.9% 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 6.03% O_2/11.9% CO_2

gas to determine the system bias. After each sample, a system zero and system injection of 6.03% O_2/11.9% 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 boiler. 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.5 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 Reference Methods 1 through 4.

The air flow rate, temperature and moisture were determined using the isokinetic sampling trains. The ambient default factor (20.9 %O_2 & 0.0 %CO_2) was used for the gas density on FGPELLPRETZEL and EUPELLETCOOLING. Gas density on EU#6BOILER was determined in conjunction with the the other sampling trains by monitoring for O_2 & CO_2 using EPA Method 3A.

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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This report was reviewed by:

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President

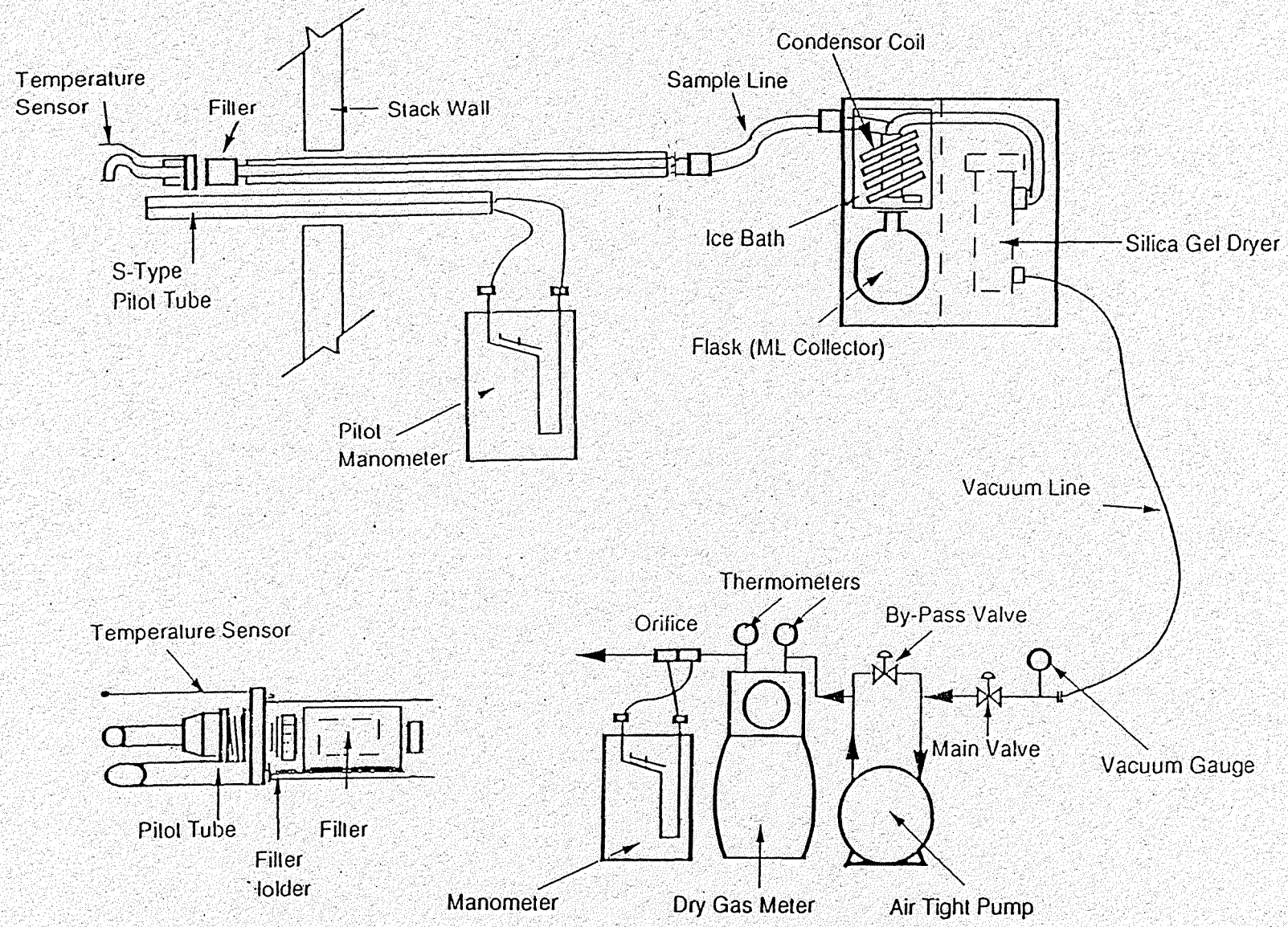

Figure 1

Particulate Sampling Train

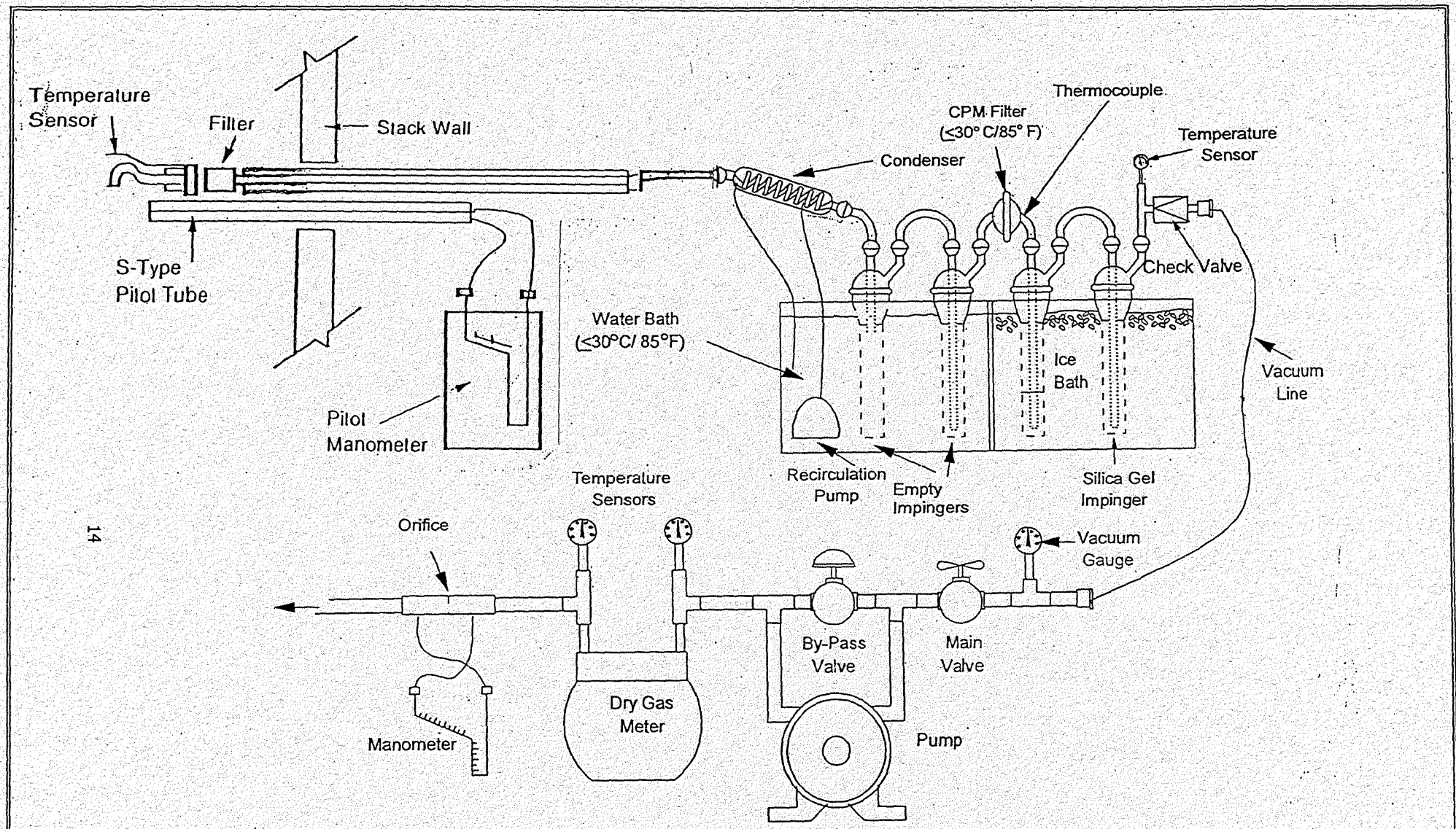

Figure 2

PM, PM 10 & PM 2.5 Sampling Train

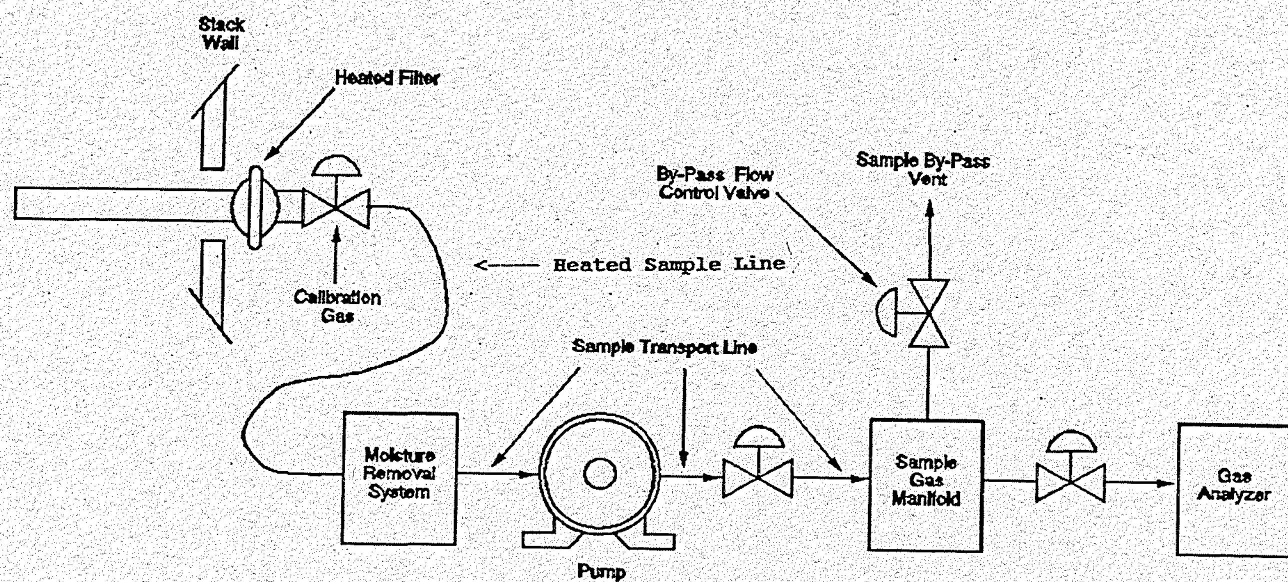

Figure 3

SO_2, O_2 & CO_2 Sampling Train