

Title V Compliance Test Report

Billerud Quinnesec LLC
Quinnesec Mill
Lime Kiln Stack
Quinnesec, Michigan
Project No. M223101C
December 13, 2022





Title V Compliance Test Program Test Report

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Quinnesec Mill
Lime Kiln Stack
Quinnesec, Michigan
December 13, 2022**

**Report Submittal Date
January 16, 2023**

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Mostardi Platt

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1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a Title V compliance test program for Billerud Quinnesec LLC at the Quinnesec Mill on the Lime Kiln Stack on December 13, 2022. This report summarizes the results of the test program and test methods used.

Test locations, test date, and test parameters are summarized below.

TEST INFORMATION		
Test Locations	Test Dates	Test Parameters
Lime Kiln Stack	12/13/2022	Filterable Particulate Matter (FPM), Total Particulate Matter (TPM), Nitrogen Oxides (NO _x), Carbon Monoxide (CO), and Volatile Organic Compounds (VOC)

The purpose of the test program was to demonstrate compliance of the above emissions with the permitted limits. Selected results of the test program are summarized below. A complete summary of emission test results follows the narrative portion of this report.

TEST RESULTS				
Test Location	Test Date	Test Parameter	Emission Limit	Emission Rate
Lime Kiln Stack	12/13/2022	TPM	9.7 lb/hr	5.400 lb/hr
		FPM	9.4 lb/hr	4.985 lb/hr
		NO _x	0.3 lb/MMBtu 29 lb/hr	0.194 lb/MMBtu 20.03 lb/hr
		CO	0.64 lb/MMBtu	0.029 lb/MMBtu
		VOC	As CH ₄ 68 ppmvd @10% O ₂ 5 lb/hr	As CH ₄ 44.5 ppmvd @10% O ₂ 4.17 lb/hr

Emissions on lb/mmBtu basis were calculated using heat input supplied by Billerud Quinnesec LLC. Plant operating data as provided by Billerud Quinnesec LLC is included in Appendix A.

The identifications of individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	Address	Contact
Test Facility	Billerud Quinnesec LLC U.S. Highway 2 Quinnesec, Michigan 49876	Ms. Paula Lafleur Environmental Engineer (906) 779-3494 (phone) Paula.lafleur@billerud.com
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Daniel Kossack Project Manager (630) 993-2100 (phone) dkossack@mp-mail.com

The test crew consisted of Messrs. E. Thomas, M. Sather, R. Spoolstra, and D. Kossack of Mostardi Platt.

2.0 TEST METHODOLOGY

Emissions testing were conducted following the methods specified in 40 CFR, Part 60, Appendix A. Schematics of the test section diagrams and sampling trains used are found in Appendix B and C, respectively. Calculation nomenclature and sample calculations are found in Appendix D. Sample analysis data are found in Appendix E. Copies of reference method data and field data sheets for each test run are included in Appendix F and G, respectively.

The following methodologies were used during the test program:

Method 1 Traverse Point Determination

Test measurement points were selected in accordance with Method 1. The characteristics of the measurement location are summarized below.

TEST POINT INFORMATION						
Location	Stack Dimensions (Feet)	Stack Area (Square Feet)	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Lime Kiln Stack	8.0 (Diameter)	50.27	9.4	5	VOC	1
					NO _x , CO	12 Stratification
					NO _x , CO	Runs 2 and 3
					TPM	24

Gaseous Sampling Plan

Twelve test points were used to sample NO_x, and CO at the Lime Kiln Stack. A single test point was used to sample the VOC at the Lime Kiln Stack.

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate at the Lime Kiln. An S-type pitot tube, differential pressure gauge, thermocouple and temperature readout were used to determine gas velocity at each sample point. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H. All locations have passed the null point pitot check and the results are on file.

Method 3A Oxygen (O₂)/Carbon Dioxide (CO₂) Determination

Stack gas molecular weight was determined in accordance with Method 3A, 40 CFR, Part 60, Appendix A at the Lime Kiln. Servomex analyzers were used to determine stack gas oxygen and carbon dioxide content and, by difference, nitrogen content. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H and gas cylinder certifications are presented in Appendix I.

Method 5 Filterable Particulate Matter (FPM) Determination

Stack gas FPM concentrations and emission rates were determined in accordance with USEPA Method 5, 40CFR60, Appendix A at the Lime Kiln. An Environmental Supply Company, Inc. sampling train was used to sample stack gas at an isokinetic rate, as specified in the Method utilizing Pallflex TX40HI45 filters. Particulate matter in the sample probe was recovered using a water rinse. The probe wash and filter catch were analyzed by Mostardi Platt in accordance with the Method in the Elmhurst, Illinois laboratory. Sample analysis data are found in Appendix E. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H.

Method 7E Nitrogen Oxides (NO_x) Determination

Stack gas nitrogen oxides concentrations and emission rates were determined in accordance with Method 7E at the Lime Kiln Stack. A Thermo Scientific nitrogen oxides analyzer was used to determine nitrogen oxides concentrations, in the manner specified in the Method.

Stack gas was delivered to the analyzer via a Teflon[®] sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in Appendix G. Copies of calibration gas certifications can be found in Appendix H.

Method 10 Carbon Monoxide (CO) Determination

Stack gas carbon monoxide concentrations and emission rates were determined in accordance with Method 10 at the Lime Kiln Stack. A Thermo Scientific carbon monoxide analyzer was used to determine carbon monoxide concentrations, in the manner specified in the Method.

Stack gas was delivered to the analyzer via a Teflon[®] sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in Appendix G. Copies of calibration gas certifications can be found in Appendix H.

Method 25A Volatile Organic Concentration Determination

The Method 25A sampling and measurement system meets the requirements for sampling of VOCs set forth by the United States Environmental Protection Agency (USEPA). In particular, it meets the requirements of USEPA Reference Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer," 40CFR60, Appendix A. This method applies to the measurement of total gaseous organic concentration of hydrocarbons. With this method, gas samples are extracted from the sample locations through heated Teflon sample lines to the analyzers. A Thermo Scientific 51i analyzer was used to perform sampling.

The flame ionization detector (FID) used during this program was a Thermo Scientific 51i High-Temperature Total Hydrocarbon Analyzer. It is a highly sensitive FID that provides a direct reading of total organic vapor concentrations with linear ranges of 0-10, 100, 1000, and 10,000

ppm by volume. The instrument was calibrated using ultra-zero air and propane in air EPA Protocol standards. The calibrations were performed before and after sampling with calibration checks performed between each test run. Sampling was conducted continuously for three one-hour periods. Sample times and locations are logged simultaneously on data loggers.

All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H. The gas cylinder certifications are found in Appendix I.

Method 202 Condensable Particulate Determination

Stack gas condensable particulate concentrations and emission rates were determined in accordance with the Method 202, in conjunction with Method 5 filterable particulate sampling. Condensable particulate matter was collected in the impinger portion of the Method 5 sampling trains.

The condensable particulate matter (CPM) was collected in impingers, after filterable particulate material was collected, using Method 5. The organic and aqueous fractions were then taken to dryness and weighed. The total of all fractions represents the CPM. Compared to the December 17, 1991 promulgated Method 202, this Method includes the addition of a condenser, followed by a water dropout impinger immediately after the final heated filter. One modified Greenburg Smith impinger and an ambient temperature filter follow the water dropout impinger. During run 1 the CPM filter could not get up to temperature for a portion of the first port. Data was not recorded during this time period. An equipment adjustment was made to the sampling system during the test to increase the CPM outlet temperature and those values were recorded.

CPM was collected in the water dropout, modified Greenburg Smith impinger and ambient filter portion of the sampling train as described in this Method. The impinger contents were purged with nitrogen (N_2) immediately after sample collection to remove dissolved sulfur dioxide (SO_2) gases from the impingers. The impinger solution was then extracted with DI water, acetone, and hexane. The organic and aqueous fractions were dried and the residues weighed. The total of the aqueous, organic, and ambient filter fractions represents the CPM. Laboratory analysis data are found in Appendix E. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix H.

3.0 TEST RESULTS SUMMARIES

Client: Billerud Quinnesec LLC
Facility: Quinnesec, Michigan
Test Location: Lime Kiln Stack
Test Method: 5/202

Source Condition	Normal	Normal	Normal	
Date	12/13/22	12/13/22	12/13/22	
Start Time	10:20	14:25	17:36	
End Time	12:13	16:43	19:18	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	166.3	166.3	167.5	166.7
Flue Gas Moisture, percent by volume	30.3%	30.7%	39.3%	33.4%
Average Flue Pressure, in. Hg	29.26	29.26	29.26	29.26
Gas Sample Volume, dscf	52.428	57.084	53.069	54.194
Average Gas Velocity, ft/sec	13.634	13.432	13.595	13.554
Gas Volumetric Flow Rate, acfm	41,118	40,511	41,001	40,877
Gas Volumetric Flow Rate, dscfm	23,612	23,145	20,478	22,412
Gas Volumetric Flow Rate, scfm	33,895	33,395	33,736	33,675
Average %CO ₂ by volume, dry basis	21.4	21.2	21.6	21.4
Average %O ₂ by volume, dry basis	2.7	3.0	2.4	2.7
Isokinetic Variance	91.8	102.0	107.2	100.3
Filterable Particulate Matter (Method 5)				
grams collected	0.07038	0.12473	0.07984	0.09165
grains/acf	0.0119	0.0193	0.0116	0.0143
grains/dscf	0.0207	0.0337	0.0232	0.0259
lb/hr	4.192	6.688	4.075	4.985
Condensable Particulate Matter (Method 202)				
grams collected	0.00960	0.00791	0.00490	0.00747
grains/acf	0.0016	0.0012	0.0007	0.0012
grains/dscf	0.0028	0.0021	0.0014	0.0021
lb/hr	0.572	0.424	0.250	0.415
Total Particulate Matter (5/202)				
grams collected	0.07998	0.13263	0.08474	0.09912
grains/acf	0.0135	0.0205	0.0123	0.0154
grains/dscf	0.0235	0.0358	0.0246	0.0280
lb/hr	4.764	7.112	4.325	5.400

Billerud Quinnesec LLC Quinnesec, Michigan Lime Kiln Stack Gaseous Summary									
Test No.	Date	Start Time	End Time	NO _x ppmvd	CO ppmvd	CO ₂ % (dry)	Moisture, %	Flowrate, DSCFM	Flowrate, SCFM
1	12/13/22	10:20	11:24	114.5	29.9	21.5	30.3	23,612	33,895
2	12/13/22	14:25	15:49	122.0	31.8	22.8	30.7	23,145	33,395
3	12/13/22	17:36	18:38	139.7	30.8	22.8	39.3	20,478	33,736
Average				125.4	30.8	22.4	33.4	22,412	33,675

Emission Rate Summary								
Test No.	Date	Start Time	End Time	Heat Input MMBTU/hr	O2 based NO _x lb/MMBtu	O2 based CO lb/MMBtu	NO _x lb/hr	CO lb/hr
1	12/13/22	10:20	11:24	103.6	0.187	0.030	19.37	3.08
2	12/13/22	14:25	15:49	103.7	0.195	0.031	20.23	3.21
3	12/13/22	17:36	18:38	103.1	0.199	0.027	20.49	2.75
Average				103.5	0.194	0.029	20.03	3.01

Billerud Quinnesec LLC Quinnesec, Michigan Lime Kiln Stack Gaseous Summary										
Test No.	Date	Start Time	End Time	Moisture, %	Flowrate, DSCFM	Flowrate, SCFM	THC ppm as C ₃ H ₈ (wet)	THC ppm as C ₃ H ₈ (dry)	THC ppm CH ₄ (dry)	VOC as CH ₄ lb/hr
1	12/13/22	10:20	11:24	30.3	23,612	33,895	14.6	20.9	62.8	3.71
2	12/13/22	14:25	15:49	30.7	23,145	33,395	16.8	24.2	72.7	4.21
3	12/13/22	17:36	18:39	39.3	20,478	33,736	18.2	30.0	90.0	4.60
Average				33.4	22,412	33,675	16.5	25.1	75.2	4.17

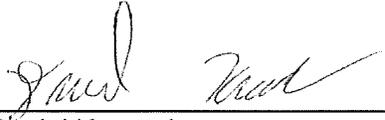
Emission Rate Summary						
Test No.	Date	Start Time	End Time	O ₂ %	THC ppm CH ₄ (dry) @ 10% O ₂	VOC as CH ₄ lb/hr
1	12/13/22	10:20	11:24	2.6	37.43	3.71
2	12/13/22	14:25	15:49	2.5	43.08	4.21
3	12/13/22	17:36	18:39	2.4	53.00	4.60
Average				2.5	44.50	4.17

4.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Billerud Quinnesec LLC. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

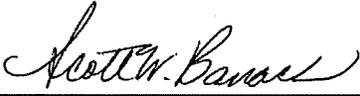
As project manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results, and the test program was performed in accordance with the methods specified in this test report.

MOSTARDI PLATT



Daniel Kossack

Program Manager



Scott W. Banach

Quality Assurance

APPENDICES

Appendix A - Plant Operating Data

LIME KILN - Operating/Process Data

Lime Kiln Run Time/Production Data

Particulate (EPA 5 + 202)	Run Start	Run End	Lime Mud tons/day	Nat Gas scfm	MMBTU / HR	Lime Kiln Scrubber	
						Pressure Drop psi	Flow Rate gpm
Run 1	12/13/22 10:20	12/13/22 12:13	701	1710	105.2	32.8	304.9
Run 2	12/13/22 14:25	12/13/22 16:43	700	1711	105.3	32.8	307.7
Run 3	12/13/22 17:36	12/13/22 19:18	699	1701	104.7	32.8	310.6

Nox, CO (7E and 10)	Run Start	Run End	Lime Mud tons/day	Nat Gas scfm	MMBTU / HR	Lime Kiln Scrubber	
						Pressure Drop psi	Flow Rate gpm
Run 1	12/13/22 10:20	12/13/22 11:24	701	1706	105.0	32.8	303.8
Run 2	12/13/22 14:25	12/13/22 15:49	699	1712	105.4	32.8	307.5
Run 3	12/13/22 17:36	12/13/22 18:39	699	1701	104.7	32.8	309.8

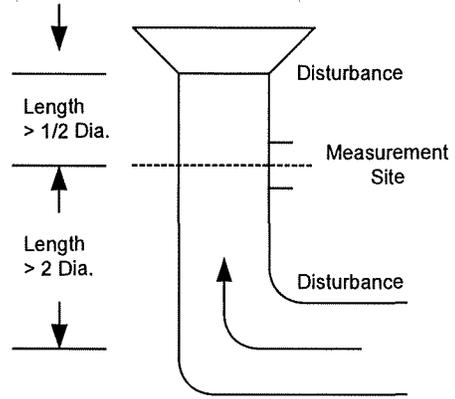
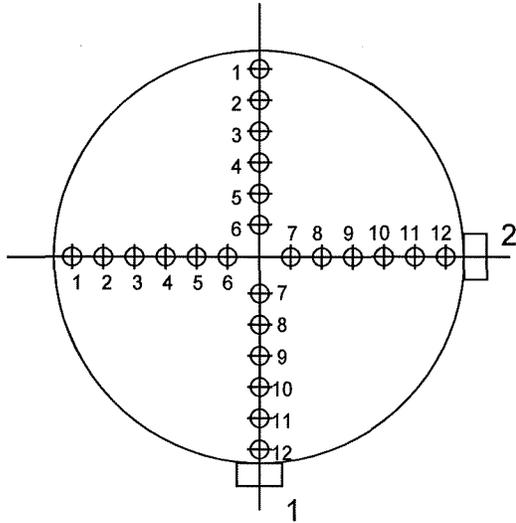
Gases 25A	Run Start	Run End	Lime Mud tons/day	Nat Gas scfm	MMBTU / HR	Lime Kiln Scrubber	
						Pressure Drop psi	Flow Rate gpm
Run 1	12/13/22 10:20	12/13/22 11:24	701	1706	103.4	32.8	303.8
Run 2	12/13/22 14:25	12/13/22 15:49	699	1712	103.8	32.8	307.5
Run 3	12/13/22 17:36	12/13/22 18:39	699	1701	103.1	32.8	309.8

Lime Kiln Hourly Process Data

Date & Time	Lime Mud tons/day	Lime Kiln Scrubber		Slaker Flow gpm	Nat Gas scfm	Heat Input MMBTU/hr
		Pressure Drop psi	Flow Rate gpm			
13-Dec-22 10:00:00	701	32.8	307.5	799.9	1705.6	103.4
13-Dec-22 11:00:00	700	32.8	305.7	799.9	1710.3	103.6
13-Dec-22 12:00:00	701	32.9	306.6	800.1	1714.7	103.9
13-Dec-22 13:00:00	701	33.1	306.3	800.0	1712.2	103.8
13-Dec-22 14:00:00	701	33.0	306.5	800.0	1712.2	103.8
13-Dec-22 15:00:00	698	32.8	307.6	800.0	1712.2	103.8
13-Dec-22 16:00:00	700	32.7	308.8	800.0	1706.0	103.4
13-Dec-22 17:00:00	700	32.7	310.1	799.9	1701.2	103.1
13-Dec-22 18:00:00	699	32.9	310.3	800.0	1701.2	103.1

Appendix B - Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS



Job: Billerud Quinnesec LLC
Quinnesec, Michigan

Date: December 13, 2022

Test Location: Lime Kiln Stack

Stack Diameter: 8.0 Feet

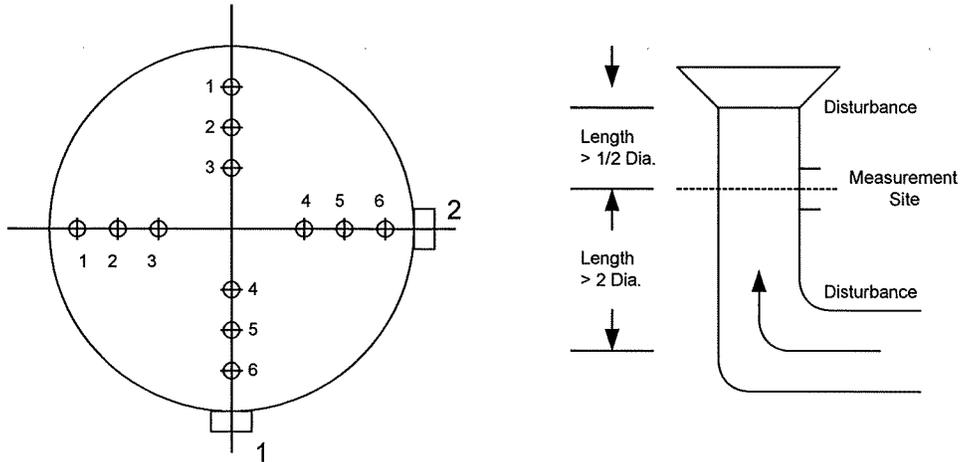
Stack Area: 50.27 Square Feet

No. Points Across Diameter: 24

No. of Ports: 2

Port Length: 6 Inches

GASEOUS STRATIFICATION TEST TRAVERSE FOR ROUND DUCTS



Job: Billerud Quinnesec LLC
Quinnesec, Michigan

Date: December 13, 2022

Test Location: Lime Kiln Stack

Stack Diameter: 8.0 Feet

Stack Area: 50.27 Square Feet

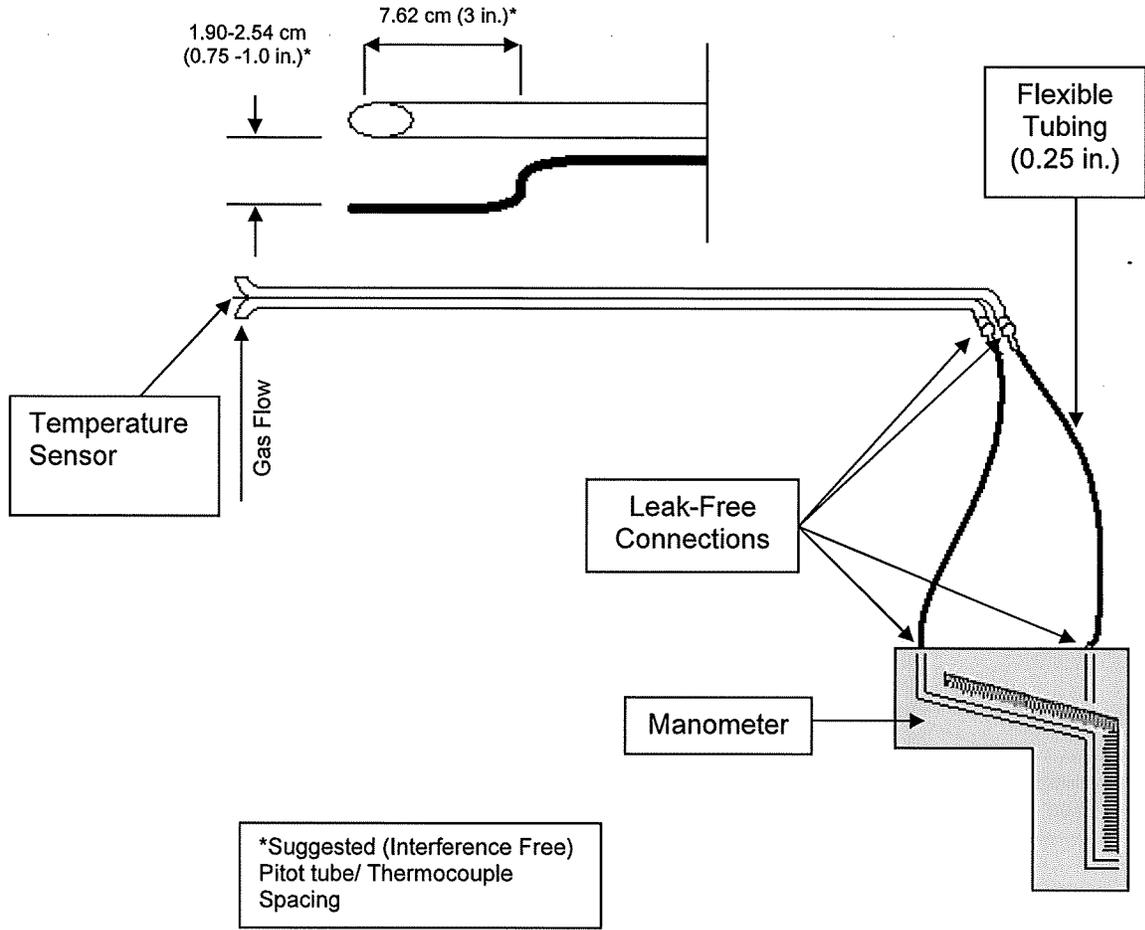
No. Sample Points: 12

Upstream: Approximately 75 Feet

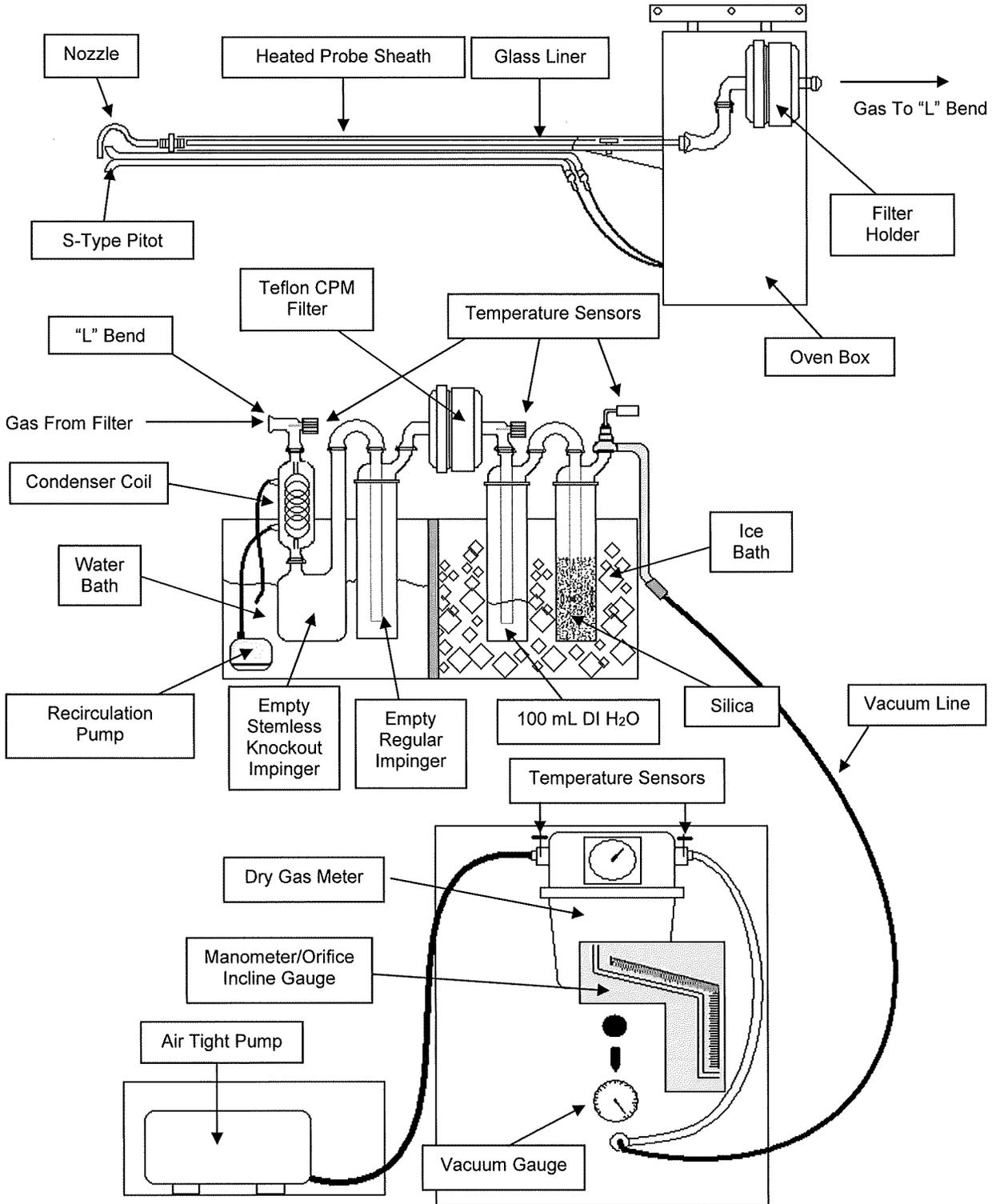
Downstream: Approximately 40 Feet

Appendix C - Sample Train Diagrams

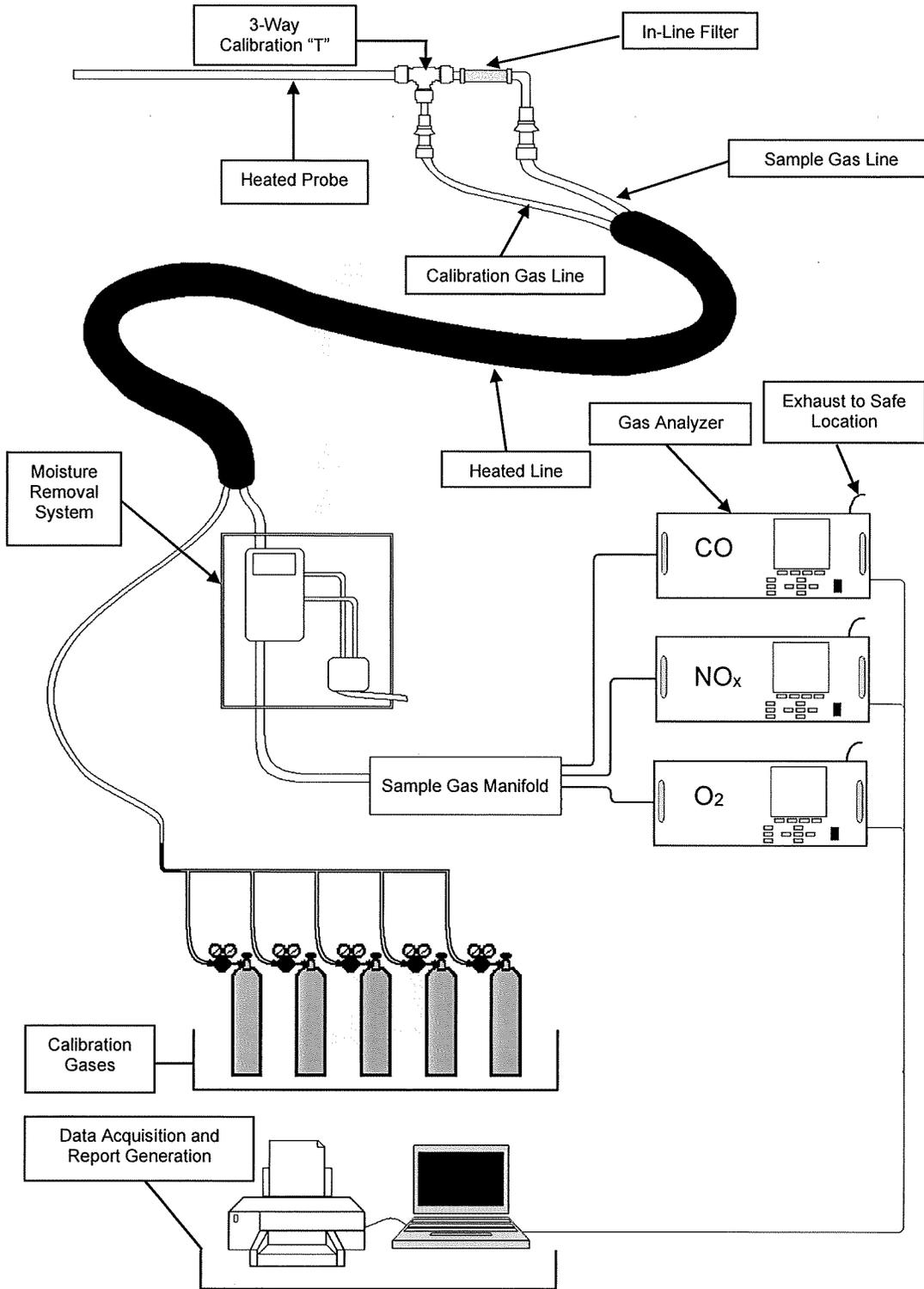
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



USEPA Method 5/202- Filterable/Condensable Particulate Matter



USEPA Methods 3A, 7E, and 10 Extractive Gaseous Sampling Diagram



USEPA Method 25A – Total Gaseous Organic Compound Sample Train

