EXECUTIVE SUMMARY

Chase Young Environmental Testing Inc (CYET) was retained by United States Gypsum Company (USG) SRN:B3518 to conduct a compliance emissions test program on the EU-75 exhaust stack at 10090 West Jefferson Avenue in River Rouge, Michigan 48218 in Wayne County. The emissions test program was conducted on October 25-26, 2023, and was performed in accordance with CYET project number 231655 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

The test program was conducted to determine compliance with Permit to Install (PTI) No. 75-21 issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). The results of the test program are presented in Table 1.

Table 1
Overall Emission Summary
Test Date: October 25-26, 2023

Source	Parameter	Reporting Units	Test Result	Limit	Emission Limit Reference
EU-75	FPM	gr/dscf	0.001	0.040	PTI 75-21 40 CFR 60 Subpart UUU
	FPM	gr/dscf	0.001	0.010	PTI 75-21
	$PM_{2.5}$	gr/dscf	0.003	0.009	PTI 75-21 40 CFR 52.21 (PSD)
	VE	Opacity %	0	<10	40 CFR 60 Subpart UUU

FPM = Filterable Particulate Matter (Method 5)
$PM_{2.5}$ is reported as combined results of Method 5 and 202

CYET ChaseYoung Environmental Testing

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Appendix D Equipment Calibration
Appendix E Example Calculations
Appendix F Laboratory Analytical Results
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Appendix H EGLE AQD Test Plan Acceptance Letter

1. Introduction

Chase Young Environmental Testing Inc (CYET) was retained by United States Gypsum Company (USG) SRN:B3518 to conduct a compliance emissions test program on the EU-75 exhaust stack at 10090 West Jefferson Avenue in River Rouge, Michigan 48218 in Wayne County. The emissions test program was conducted on October 25-26, 2023, and was performed in accordance with CYET project number 231655 Emission Test Plan as well as the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Air Quality Division (AQD) acceptance letter.

The test program was conducted to determine compliance with Permit to Install (PTI) No. 75-21 issued by the Michigan department of Environment, Great Lakes, and Energy (EGLE). The results of the test program are presented in Table 1.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on October 25-26, 2023, at the USG facility located in River Rouge, MI

1.b Purpose of Testing

AQD issued Permit to Install (PTI) No. 75-21 to USG on October 5, 2021. PTI No. 75-21 limits emissions of PM, $PM_{2.5}$, and visible emissions from EU-75. See Table 1 (section 5a and Appendix A) for emission limits.

1.c Source Description

The new perlite expansion system consists of perlite ore bin, expansion furnace, and coater. Emissions are controlled by bin vent/separator (EU-74), cyclone and baghouse (EU-75), and vacuum receiver (EU-76).

Figure 1 presents the test port and traverse/sampling point locations used.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Brent Wyatt
Environmental Coordinator
United States Gypsum Company
313-624-4232
bnwyatt@usg.com

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

Table 2
Test Personnel

Name, Title, and Email	Affiliation	Telephone
Mr. Brent Wyatt Environmental Coordinator bnwyatt@usg.com	United States Gypsum Company Detroit Plant 891 10090 West Jefferson Avenue River Rouge, Michigan 48218	(313) 624-4232
Mr. Johnnie Robinson Environmental Coordinator jrobinson@usg.com	United States Gypsum Company Detroit Plant 891 10090 West Jefferson Avenue River Rouge, Michigan 48218	(313) 624-4278
Mr. Brandon Chase Senior Environmental Engineer bchase@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(248) 506-0107
Mr. Matthew Young Senior Project Manager myoung@cyetinc.com	CYET 28744 Groveland Street Madison Heights, MI 48071	(586) 744-9133
Mr. Andrew Riley Environmental Quality Analyst Rileya8@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(586) 565-7379
Mr. Jonathon Lamb Environmental Quality Analyst Lambj1@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(313) 348-2527

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

2.a Operating Data

Process data monitored during the emissions test program include:

- Perlite Ore, Ton/hour

Process operating data is included in Appendix G.

2.b Applicable Permit

The applicable permit for this emissions test program is PTI No. 75-21.

2.c Results

The overall results of the emission test program as well as emission limits are summarized by Table 1 (see Section 5.a, and Appendix A). Detailed emission rates are presented in Table 3 in Appendix A.

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

USG operates under renewable operating permit MI-ROP-B3518-2021 issued July 12, 2021. On October 5, 2021 the EGLE issued PTI 75-21, which includes EU-75 as part of the perlite expansion process. The new perlite expansion system consists of perlite ore bin, expansion furnace, and coater. Emissions are controlled by bin vent/separator (EU-74), cyclone and baghouse (EU-75), and vacuum receiver (EU-76).

3.b Process Flow Diagram

Due to the simplicity of the process, a process flow diagram is not necessary.

3.c Raw and Finished Materials

The type of raw materials used in the expansion furnace controlled by EU-75 is perlite.

3.d Process Capacity

The rated capacity of the process in ton/hr of perlite ore is confidential information and will not be included in this test report but will be provided to EGLE at their request.

3.e Process Instrumentation

Process data monitored during the emissions test program include:

- Ore feed rate (ton/hour); and
- Baghouse pressure drop (inches of water)

Process operating data is included in Appendix G.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

Sampling and analysis procedures followed the methods codified at 40 CFR 60, Appendix A and 40 CFR 63, Appendix A:

- Method 1 - *"Sample and Velocity Traverses for Stationary Sources"* was used to determine the sampling locations and the stack traverse points.
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"* was used to determine average exhaust gas velocity.
- Method 3 - *"Gas Analysis for Determination of Dry Molecular Weight" (Fyrite Method)* was used to evaluate the molecular weight of the exhaust gas.
- Method 4 - *"Determination of Moisture Content in Stack Gases"* was used to determine the moisture content of the exhaust gas.
- Method 5 - *"Determination of Particulate Emissions from Stationary Sources"* was used to determine the concentration of particulate in the exhaust gas.
- Method 202 – *"Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources Stationary Sources"* was used to determine the concentration of particulate in the exhaust gas.
- Method 9 - *"Visual Determination of The Opacity of Emissions from Stationary Source"* was used to determine the opacity.

USEPA Method 1 was utilized to determine the necessary sampling points in which to collect the air pollutants. This method is applicable to sources that are not cyclonic or swirling, and the duct diameter is greater than 12 inches. The sample locations were verified to meet at least 2 duct diameters downstream, and at least 0.5 duct diameters upstream of any flow disturbances.

The test team verified the absence of cyclonic flow in the field. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the direction of flow and the axis of the duct. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. The EU-75 exhaust stack did not indicate cyclonic flow.

USEPA Method 2 was utilized to measure exhaust gas velocity pressures and temperatures utilizing an S-type pitot tube equipped with a thermocouple, and an inclined manometer.

The S-Type Pitot tube dimensions were verified to be within the specified limits of Method 2 Figure 2-2, Therefore a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned. All thermocouple systems used during testing used the alternative Method 2 thermocouple calibration procedures specified in ALT-011 to ensure that the temperature of each thermocouple and reference thermometer agree to within ± 2 °F.

The sampling apparatus was setup onsite, noting that the manometer is level and zeroed continuously throughout sampling. A pre- and post-test leak check of the system was performed by reaching at least 3" H_2O on both the impact and static pressure sides of the S-type pitot tube, and closing off the system. The system leak check passes when the pressure remains stable for a minimum of 15 seconds. The velocity head and temperature are then measured at each sampling point specified by USEPA Method 1.

Molecular weight determinations were evaluated using the Fyrite® procedure. The equipment used for this evaluation consists of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers (O_2 and CO_2). A grab sample of the exhaust gas was analyzed for each test run.

The Fyrite analyzers are audited monthly by collecting a known concentration of O_2 and CO_2 (protocol 1 gas cylinder) in a tedlar bag and analyzing using the fyrite. Three consecutive samples are measured and must agree with the protocol 1 gas cylinder values within $\pm$0.5%.

Exhaust gas moisture content was evaluated using USEPA Method 4. Exhaust gas was extracted as part of the Method 5/202 sampling train and passed through the impinger configuration (see Figure 2). Exhaust gas moisture content was then determined gravimetrically.

USEPA Methods 5/202 were used to measure both Filterable Particulate Matter (FPM) and Condensable Particulate Matter (CPM) to determine the Total Particulate Matter (TPM). A Nutech® Model 2010 modular isokinetic stack sampling system consisting of (1) a stainless steel nozzle, (2) a glass probe, (3) a tared 90mm glass fiber filter, (4) a vertical condenser, (5) an empty potbellied impinger, (6) an empty Greenburg-Smith (GS) impinger, (7) an unheated filter holder with 47mm Teflon filter (CPM Filter), (8) a second Greenburg-Smith (GS) impinger with 100 ml of H_2O, (9) and an impinger filled with approximately 300 grams of silica gel. Triplicate 120-minute test runs were conducted on the EU-75 exhaust stack.

The metering system is calibrated before and after the field test to confirm that the DGM calibration factor (Y) value has not changed by more than 5%. The field balance used onsite is checked daily using a certified 500g weight to ensure that the balance measures within $\pm$0.5g of the certified mass.

The sampling system was set up onsite, noting that the manometer is level and zeroed continuously throughout sampling. A pre- and post-test leak check of the system were performed by plugging the end of the sample probe and reaching a vacuum of 15 in. Hg. The system passes when the leakage rate of the dry gas meter is no greater than 0.020 cfm. A sample of the gas is obtained by inserting the probe and nozzle to each sampling point as per Method 1 and extracting the sample at isokinetic conditions ($\pm$ 10%). Probe and filter temperatures are maintained 248 $\pm$25 F for the duration of each test. The CPM filter is maintained between 68-85 F during the testing.

After the post-test leak check, the sampling train is disassembled, and the filter is collected into a petri dish. The nozzle, probe, and the front half of the filter holder assembly are brushed, and

triple rinsed with acetone and collected in a sample container. The impinger train is weighed, and then purged with nitrogen at 14 lpm for 1 hour. The back half of the filter holder and connecting lines, the vertical condenser, the potbelly impinger, the 1st GS impinger, and the front half of the CPM filter are then double rinsed with high purity deionized water and collected (container 1, aqueous liquid impinger contents). The same components are then single rinsed with acetone, and double rinsed with hexane and collected (container 2, organic rinses). The CPM filter is collected into a petri dish (container 3, CPM filter sample) Each container is labeled with the client, test location, test number, and test date. The container is sealed, and the liquid level is marked on the outside of the container. Blank samples of each reagent are collected onsite as per the method. All samples are logged using standard Chain of Custody procedures, and then transported to CYET's office and/or the contracted laboratory for analysis. A drawing of the sampling train used for the testing program is presented as Figure 2.

USEPA Method 9 was used to measure visible emissions. Triplicate 60-minute observations were performed on the EU-75 exhaust stack. All readings were 0.

4.b Recovery and Analytical Procedures

Recovery and analytical procedures are included in section 4.a.

4.c Sampling Ports

A diagram of the stack indicating traverse point and sampling locations and stack dimensions is included as Figure 1.

4.d Traverse Points

A diagram of the stack indicating traverse point and sampling locations and stack dimensions is included as Figure 1.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 1. Detailed results for the emissions test program are summarized by Table 3 in Appendix A.

Table 1
Overall Emission Summary
Test Date: October 25-26, 2023

Source	Parameter	Reporting Units	Test Result	Limit	Emission Limit Reference
EU-75	FPM	gr/dscf	0.001	0.040	PTI 75-21 40 CFR 60 Subpart UUU
	FPM	gr/dscf	0.001	0.010	PTI 75-21
	$PM_{2.5}$	gr/dscf	0.003	0.009	PTI 75-21 40 CFR 52.21 (PSD)
	VE	Opacity %	0	<10	40 CFR 60 Subpart UUU

FPM = Filterable Particulate Matter (Method 5)
$PM_{2.5}$ is reported as combined results of Method 5 and 202

5.b Discussion of Results

All test results are in compliance with permit limits.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance test program.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix D.

5.i Sample Calculations

Sample calculations are provided in Appendix E.

5.j Field Data Sheets

Field documents relevant to the emissions test program are presented in Appendix C.

5.k Laboratory Data

Laboratory analytical results are provided in Appendix F.

MEASUREMENT UNCERTAINTY STATEMENT

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, CYET personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, CYET personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

REPORT SIGNATURES

CYET operated in conformance with the requirements of ASTM D7036-04 during this emissions test project and this emissions test report:

This report was prepared by: Brandon Chase

Brandon Chase
Senior Environmental Engineer

This report was reviewed by: M Y

Matthew Young
Senior Project Manager

Appendix A – Emission Results Tables

Table 1
Overall Emission Summary
Test Date: October 25-26, 2023

Source	Parameter	Reporting Units	Test Result	Limit	Emission Limit Reference
EU-75	FPM	gr/dscf	0.001	0.040	PTI 75-21 40 CFR 60 Subpart UUU
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FPM = Filterable Particulate Matter (Method 5)
$PM_{2.5}$ is reported as combined results of Method 5 and 202

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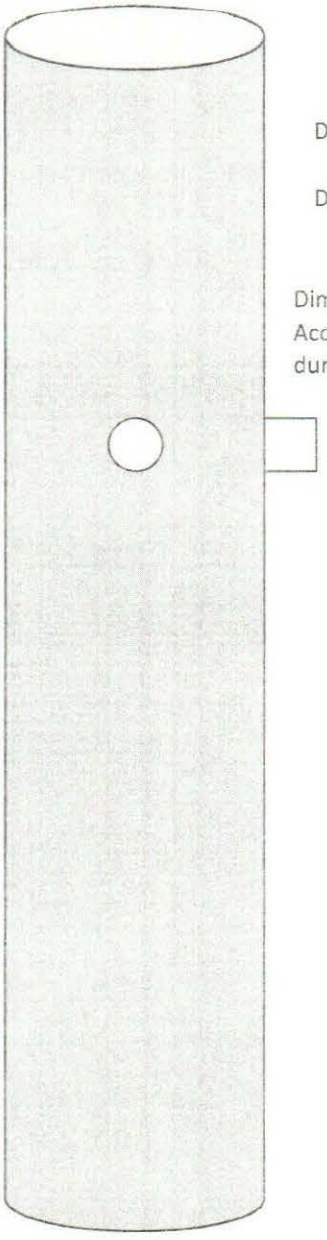
Mr. Andrew Riley Environmental Quality Analyst Rileya8@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(586) 565-7379
Mr. Jonathon Lamb Environmental Quality Analyst Lambj1@michigan.gov	Air Quality Division Michigan Dept of Environment, Great Lakes & Energy	(313) 348-2527

Table 3
EU-75 Particulate Matter Emission Rates

Client	USG			
Source	EU-75			
Test Information				
Test Number	1	2	3	
Test Date	10/26/2023	10/26/2023	10/26/2023	
Run Start Time	9:00	12:02	14:43	
Run Finish Time	11:08	14:11	16:54	
Net Traverse Points	24	24	24	
Net Run Time, Minutes	120	120	120	
Meter/Nozzle Information				
Meter Temperature Tm (F)	77.2	81.4	83.0	80.5
Meter Pressure - Pm (in. Hg)	29.7	29.7	29.6	29.7
Measured Sample Volume (Vm)	119.2	126.3	122.5	122.7
Sample Volume (Vm-Std ft^3)	118.5	124.8	120.2	121.1
Sample Volume (Vm-Std m^3)	3.35	3.53	3.40	3.43
Condensate Volume (Vw-std)	4.314	4.206	4.592	4.371
Gas Density (Ps(std) lbs/ft^3) (wet)	0.0735	0.0736	0.0735	0.0736
Gas Density (Ps(std) lbs/ft^3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	9.03	9.48	9.17	9.23
Total weight of sampled gas (m g lbs) (dry)	8.83	9.28	8.96	9.02
Nozzle Size - An (sq. ft.)	0.000552	0.000552	0.000552	0.000552
Isokinetic Variation - I	98.6	99.1	100.2	99.3
Stack Data				
Average Stack Temperature - Ts (F)	271.8	277.1	276.8	275.3
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.5	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.983	0.983	0.983	0.983
Percent Moisture (Bws)	3.51	3.27	3.68	3.49
Water Vapor Volume (fraction)	0.0351	0.0327	0.0368	0.0349
Pressure - Ps ("Hg)	29.5	29.4	29.4	29.4
Average Stack Velocity -Vs (ft/sec)	44.1	46.5	44.6	45.1
Area of Stack (ft^2)	3.4	3.4	3.4	3.4
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	9,023	9,497	9,113	9,211
Flowrate ft^3 (Standard Wet)	6,409	6,693	6,411	6,504
Flowrate ft^3 (Standard Dry)	6,164	6,474	6,175	6,278
Flowrate m^3 (standard dry)	175	183	175	178
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	4.0	5.0	4.6	4.5
Organic Condensible Particulate	1.4	1.0	1.0	1.1
Inorganic Condensible Particulate	23.0	18.0	24.0	21.7
Condensible Blank Correction	1.6	1.6	1.6	1.6
Total Condensible Particulate	22.8	17.4	23.4	21.2
Total Filtersble and Condensible Particulate	26.8	22.4	28.0	25.7
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	1.2	1.4	1.4	1.3
gr/dscf	0.001	0.001	0.001	0.001
Filterable Particulate Emission Rate				
lb/ hr	0.03	0.03	0.03	0.03
Condensible Particulate Concentration				
lb/1000 lb (wet)	0.006	0.004	0.006	0.005
lb/1000 lb (dry)	0.006	0.004	0.006	0.005
mg/dscm (dry)	6.8	4.9	6.9	6.2
gr/dscf	0.003	0.002	0.003	0.003
Condensible Particulate Emission Rate				
lb/ hr	0.16	0.12	0.16	0.15
Total Particulate Concentration				
lb/1000 lb (wet)	0.007	0.005	0.007	0.006
lb/1000 lb (dry)	0.007	0.005	0.007	0.006
mg/dscm (dry)	8.0	6.3	8.2	7.5
gr/dscf	0.003	0.003	0.004	0.003
Total Particulate Emission Rate				
lb/ hr	0.19	0.15	0.19	0.18

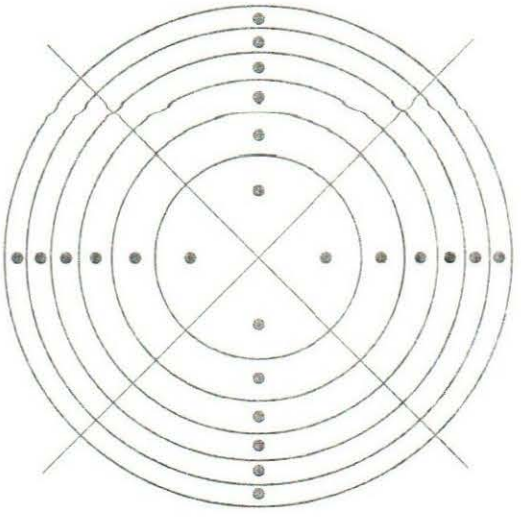
Revision 1
6-19-2022 - BC

Appendix B – Figures



Diameter	25 inches
Upstream	24 inches
Downstream	72 inches
Upstream	0.96 diameters
Downstream	2.88 diameters

Dimensions are estimated
Accurate measurements will be taken during the test program



Traverse Point #	Distance (inches)
1	0.53
2	1.68
3	2.95
4	4.43
5	6.25
6	8.90
7	16.10
8	18.75
9	20.58
10	22.05
11	23.33
12	24.48

Figure 1
EU-75 Exhaust Stack Diagram

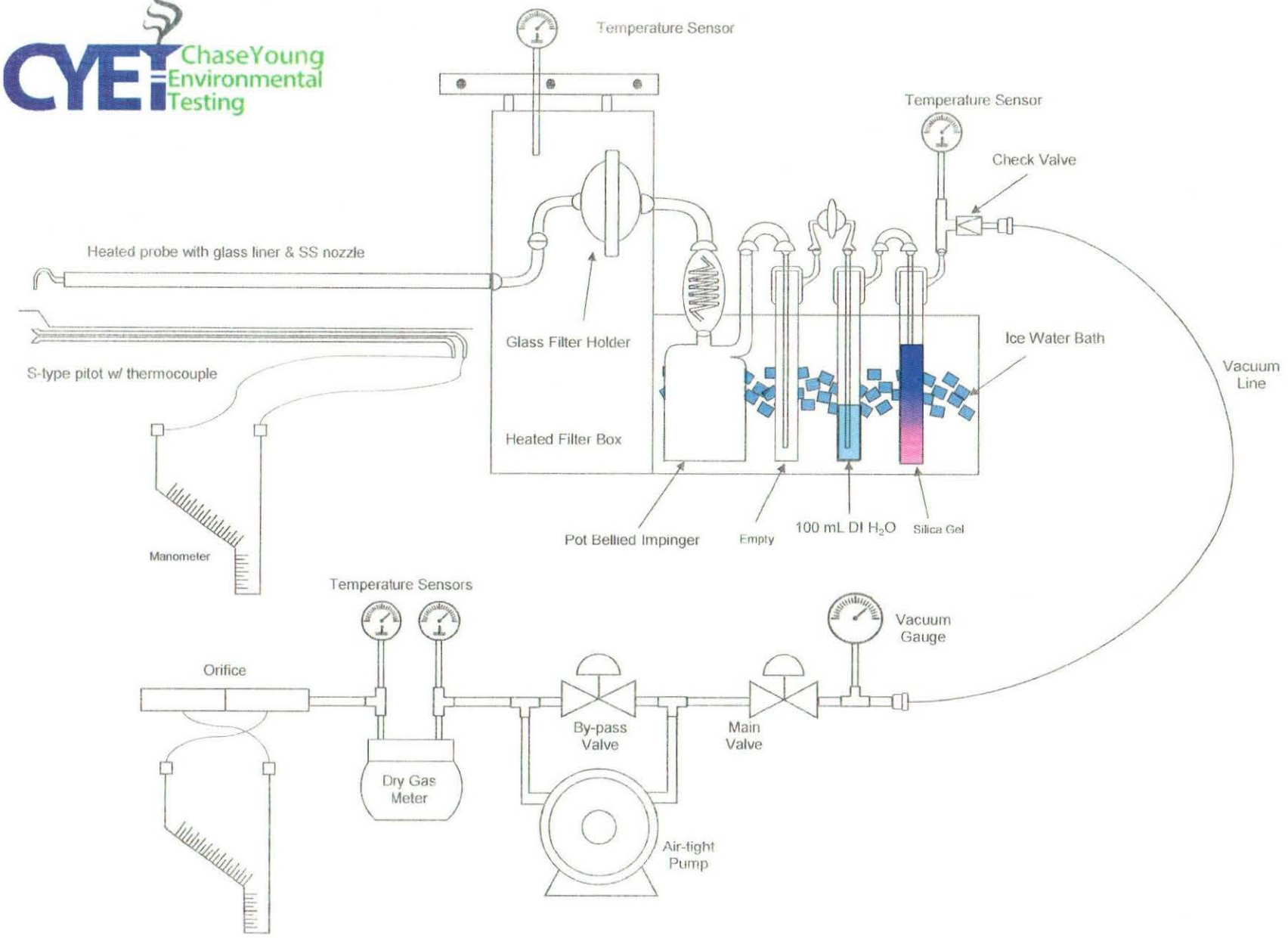


Figure 2

USEPA Method 5/202 Sampling Train