

FINAL REPORT

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ZEELAND FARM SERVICES INC.

ZEELAND, MICHIGAN

**SOURCE TESTING REPORT: SRN: M4204
SOYBEAN PROCESSING PARTICULATE MATTER:**

RWDI #2304323

December 12, 2023

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by Zeeland Farm Services, Inc (ZFS) to complete the emission sampling program at the Zeeland facility located at 2468 84th Ave, Zeeland, Michigan. The testing program included testing from the EUDRYING, EUHANDLING, and EUHANDLING2 sources. The testing was required per Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit MI-ROP-M4204-2018b.

The test program was completed on October 17 and 18, 2023 at the Zeeland facility.

Executive Table i: Results Summary

Source	Unit	Concentration & Emission Rate				Limit
		Run 1	Run 2	Run 3	Average	
EUDRYING	PM 2.5 lb/hr	0.20	0.15	0.13	0.16 0.80 (Five Stacks Combined)	<i>10.12 for Five stacks Combined</i>
	PM 10 lb/hr	0.22	0.19	0.16	0.19 0.95 (Five Stacks Combined)	<i>12.65 for Five Stacks Combined</i>
	PM lb/1000 lbs of exhaust gas (dry)	0.004	0.004	0.003	0.004	0.03
EUHANDLING (PIT2)	PM 2.5 lb/hr	0.09	0.08	0.07	0.08	0.69
	PM 10 lb/hr	0.09	0.08	0.07	0.08	0.86
	PM lb/1000 lbs of exhaust gas (dry)	0.0015	0.0013	0.0012	0.0014	0.019
	PM grams/dscm	0.0018	0.0016	0.0014	0.0016	0.023
EUHANDLING2 (PIT3)	PM 2.5 lb/hr	0.03	0.02	0.03	0.03	0.41
	PM 10 lb/hr	0.03	0.02	0.03	0.03	0.51
	PM lb/1000 lbs of exhaust gas (dry)	0.0011	0.0009	0.0007	0.0009	0.019
	PM grams/dscm	0.0013	0.0010	0.0008	0.0011	0.023

All measured levels for EUDRYING, EUHANDLING and EUHANDLING2 were less than their respective Limits outlined in the Renewable Operating Permit.



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2 SUMMARY OF RESULTS

2.1 Operating Data

The following is the applicable process data collected during the testing for each source. All process data can be found in **Appendix A**:

- **EUDRYING**
 - Soybeans processed (bushels per hour)
- **EUHANDLING**
 - Baghouse differential pressure, normal range is greater than 0" w.c.
 - Soybeans received (tons)
- **EUHANDLING2**
 - Baghouse differential pressure, normal range is greater than 0" w.c.
 - Soybeans received (tons)

2.2 Applicable Permit Number

The testing was required per Michigan EGLE MI-ROP-M4204-2018b.

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

EUHANDLING and EUHANDLING2 are each controlled by a separate a baghouse and an oil spray application system.

EUDRYING is controlled by five (5) cyclone fans, one cyclone per stack. Per the test plan, testing was conducted on one representative stack, SVCIMBRIA3, the middle stack.

3.2 Process Flow Sheet or Diagram

Stack figures with dimensions, upstream and downstream distances, and point selection can be found in the **Figures** section. A process diagram can be made available upon request.

3.3 Type and Quantity of Raw and Finished Materials

Section 1.2 provides a detailed description of each of the different processes being tested.



3.4 Rated Capacity and Efficiency

EUDRYING has a maximum capacity of approximately 3,000 bushels per hour. EUHANDLING has a maximum capacity of 10,000 bushels per hour. EUHANDLING2 has a maximum capacity of 8,000 bushels per hour

3.1 Process Instrumentation Monitored During the Test

There are no monitoring processes in place for the tested sources.

3.2 Maintenance on Equipment in Last Three Months

Only routine maintenance per the Preventative Maintenance Plan has been conducted.

4 SAMPLING AND ANALYTICAL PROCEDURES

The emission test program utilized the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A)

- Method 1 – Sample and Velocity Traverses for Stationary Sources
- Method 2 – Determination of Stack Gas Velocity and Volumetric Flowrate
- Method 3A – Determination of Molecular Weight of Dry Stack Gases
- Method 4 – Determination of Moisture Content in Stack Gases
- Method 5 – Determination of Particulate Matter from Stationary Sources
- Method 201A - Determination of PM10 and PM2.5 Emissions from Stationary Sources
- Method 202 – Determination of Condensable Particulate Matter from Stationary Sources



4.1 Stack Velocity, Temperature, and Volumetric Flow Rate

The exhaust velocities and flow rates were determined following U.S. EPA Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer or digital manometer. Volumetric flow rates were determined following the equal area method as outlined in U.S. EPA Method 2. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a calibrated digital temperature indicator. A cyclonic flow check was performed on each source.

The dry molecular weight of the stack gas was determined following calculations outlined in U.S. EPA Method 3A, "Gas Analysis for the Determination of Dry Molecular Weight." A bag sample was taken throughout each test and then analyzed by an O₂/CO₂ Servomex analyzer.

Stack moisture content was determined through direct condensation and according to U.S. EPA Method 4, "Determination of Moisture Content of Stack Gases" and was done along with the particulate matter testing.

4.2 Particulate Matter

For USEPA Method 5, the particulate matter was withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ±14 °C (248 ±25 °F). The PM mass, which includes any material that condenses at or above the filtration temperature, was determined gravimetrically after the removal of uncombined water. The sampling train consisted of the following: nozzle (stainless steel or glass), probe liner (borosilicate or quartz) with heating system, glass fiber filter, modified GS impinger with 100 ml of water, standard GS impinger with 100 ml of water, empty modified GS impinger, silica gel impinger, and the metering system. At the end of each test a leak check was performed. The filter and probe/nozzle acetone rinses were sent to the laboratory for gravimetric analysis.

4.3 Condensable Particulate Matter

For USEPA Method 202, the CPM was collected in dry impingers after filterable PM was collected on a filter maintained as specified in USEPA Method 201A. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter were then taken to dryness and weighed. The total of the impinger fractions and the CPM filter represents the CPM. This method eliminates the use of water as the collection media in impingers and includes the addition of a condenser followed by a water dropout impinger immediately after the final in-stack or heated filter. This method also includes the addition of one modified Greenburg Smith impinger (backup impinger) and a CPM filter following the water dropout impinger.

As stated in Method 202, the impinger portion need only be recovered and included as PM if the filtration temperature exceeds 85°F. EUHANDLING and EUHANDLING2 did not have a filtration temperatures exceeding 85°F. EUDRYING had a filtration temperature higher than 85°F, therefore Method 202 was followed for recovery of the condensable particulate portion.



4.4 PM10 and PM2.5

For USEPA Method 201A, to measure PM10 and PM2.5, a sample of gas is collected at a predetermined constant flow rate through an in-stack sizing device. The particle-sizing device separates particles with nominal aerodynamic diameters of 10 micrometers and 2.5 micrometers. After a sample is obtained, uncombined water was removed from the particulate, then gravimetric analysis was used to determine the particulate mass for each size fraction.

4.5 Description of Recovery and Analytical Procedures

All sample procedures following the prescribed methods of USEPA Method 1, 2, 3, 4, 5, 201a, and 202.

4.6 Sampling Port Description

All sampling ports meet USEPA Method 1 locations and can be found in the **Figures** Section.



5 TEST RESULTS AND DISCUSSION

5.1 Detailed Results

Detailed results for filterable particulate matter are provided in **Appendix B**.

Table 5.1.1: Results Summary Results Summary

Source	Unit	Concentration & Emission Rate				Limit
		Run 1	Run 2	Run 3	Average	
EUDRYING	PM 2.5 lb/hr	0.20	0.15	0.13	0.16 0.80 (Five Stacks Combined)	<i>10.12 for Five Stacks Combined</i>
	PM 10 lb/hr	0.22	0.19	0.16	0.19 0.95 (Five Stacks Combined)	<i>12.65 for Five Stacks Combined</i>
	PM lb/1000 lbs of exhaust gas (dry)	0.004	0.004	0.003	0.004	0.03
EUHANDLING (PIT2)	PM 2.5 lb/hr	0.09	0.08	0.07	0.08	0.69
	PM 10 lb/hr	0.09	0.08	0.07	0.08	0.86
	PM lb/1000 lbs of exhaust gas (dry)	0.0015	0.0013	0.0012	0.0014	0.019
	PM grams/dscm	0.0018	0.0016	0.0014	0.0016	0.023
EUHANDLING2 (PIT3)	PM 2.5 lb/hr	0.03	0.02	0.03	0.03	0.41
	PM 10 lb/hr	0.03	0.02	0.03	0.03	0.51
	PM lb/1000 lbs of exhaust gas (dry)	0.0011	0.0009	0.0007	0.0009	0.019
	PM grams/dscm	0.0013	0.0010	0.0008	0.0011	0.023

All measured levels for EUDRYING, EUHANDLING and EUHANDLING2 were less than their respective Limits outlined in the Renewable Operating Permit.

The detailed results can be found in the following Appendix:

- **Appendix B** – Particulate Matter
- **Appendix C** – O₂ and CO₂

5.2 Variations in Testing Procedures

There were no variations in planned testing procedures.



5.3 Process Upset Conditions During Testing

ZFS representatives were monitoring the process during testing to ensure that the process was operating under normal conditions.

5.4 Audit Samples

This test did not require any audit samples.

5.5 Process Data

Process data can be found in **Appendix A**.

5.6 Particulate, O₂/CO₂, Flows and Moisture

Results can be found in **Appendices B, C, and D**.

5.7 Field Data Sheets

Results can be found in **Appendix D**.

5.8 Calibration Data

Calibration can be found in **Appendix E**.

5.9 Laboratory Data

Laboratory data can be found in **Appendix F**. Filterable particulate matter was analyzed gravimetrically in RWDI's laboratory. All USEPA Method 202 data was analyzed by Bureau Veritas at their laboratory in Mississauga, Ontario. The USEPA Method 25 samples were analyzed by M25Lab, Inc. at their lab in Hendersonville, North Carolina.

5.10 Example Calculations

Example calculations can be found in **Appendix G**.

5.11 Source Testing Plan and Approval Letter

Copies of the Source Testing Plan and Approval Letter from EGLE can be found in **Appendix H**.

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TABLES

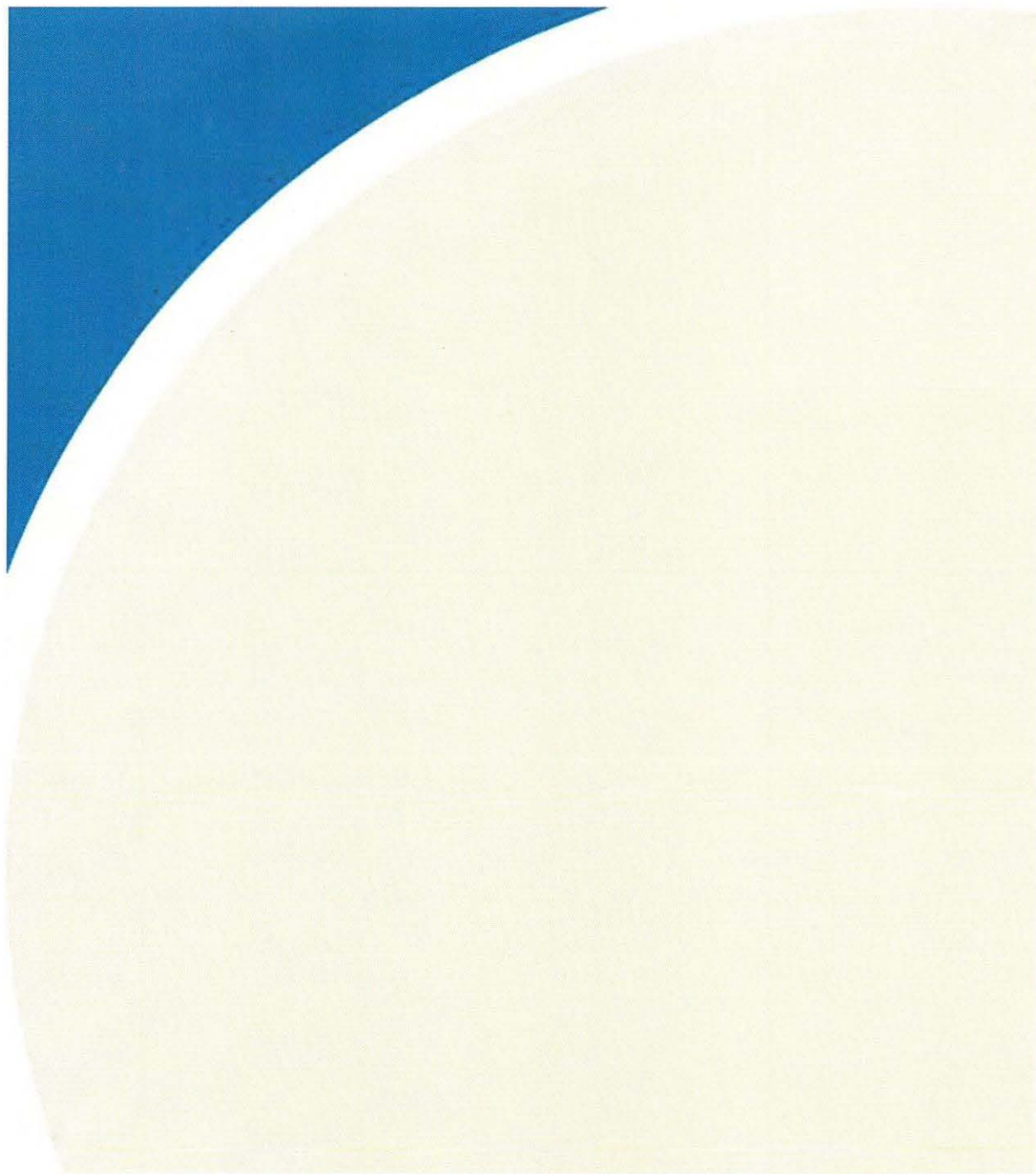


Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
EUDRYING	3	Velocity, Temperature, and Flow Rate	U.S. EPA ^[1] Methods 1,2, and 4
	3	PM / PM ₁₀ / PM _{2.5}	U.S. EPA [1] Method 201a/202
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A
EUHANDLING (PIT2)	3	Velocity, Temperature, and Flow Rate	U.S. EPA ^[1] Methods 1, 2, and 4
	3	PM / PM ₁₀ / PM _{2.5}	U.S. EPA [1] Method 5
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A
EUHANDLING2 (PIT3)	3	Velocity, Temperature, and Flow Rate	U.S. EPA ^[1] Methods 1, 2, and 4
	3	PM / PM ₁₀ / PM _{2.5}	U.S. EPA [1] Method 5
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A

Notes:

[1] U.S. EPA - United States Environmental Protection Agency

Table 2: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time	Filter ID / Tank ID
EUDRYING				
Blank	17-Oct-23	-	-	47-218
Test #1	17-Oct-23	7:30 AM	10:37 AM	47-213
Test #2	17-Oct-23	11:15 AM	2:22 PM	47-202
Test #3	17-Oct-23	2:53 PM	5:59 PM	47-219
EUHANDLING (PIT2)				
Blank	17-Oct-23	--	--	A-336
Test #1	17-Oct-23	11:39 AM	1:15 PM	A-331
Test #2	17-Oct-23	2:20 PM	3:53 PM	A-330
Test #3	18-Oct-23	7:53 AM	9:30 AM	A-332
EUHANDLING2 (PIT3)				
Blank	17-Oct-23	--	--	A-336
Test #1	18-Oct-23	9:02 AM	12:33 PM	A-339
Test #2	18-Oct-23	12:57 PM	2:37 PM	A-338
Test #3	18-Oct-23	3:30 PM	5:08 PM	A-337

Table 3A: Sampling Summary - Flow Characteristics - EUDRYING

Stack Gas Parameter	Unit	Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		17-Oct-23	17-Oct-23	17-Oct-23	
Stack Temperature	°F	94	81	82	86
Moisture	%	2.7%	2.0%	2.6%	2.4%
Velocity	ft/s	31.3	30.8	31.1	31.1
Referenced Flow Rate	CFM	14,142	14,365	14,366	14,291
Sampling Isokinetic Rate	%	98.0	96.0	96.0	96.7

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 3B: Sampling Summary - Flow Characteristics - EUHANDLING (PIT2)

Stack Gas Parameter	Unit	Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		17-Oct-23	17-Oct-23	18-Oct-23	
Stack Temperature	°F	58	61	53	57
Moisture	%	0.7%	1.2%	1.0%	1.0%
Velocity	ft/s	71.9	69.6	69.1	70.2
Referenced Flow Rate	CFM	13,380	12,810	12,934	13,041
Sampling Isokinetic Rate	%	97.7	98.8	99.0	98.5

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 3C: Sampling Summary - Flow Characteristics - EUHANDLING2 (PIT3)

Stack Gas Parameter	Unit	Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		18-Oct-23	18-Oct-23	18-Oct-23	
Stack Temperature	°F	65	74	77	72
Moisture	%	0.4%	1.3%	1.3%	1.0%
Velocity	ft/s	74.3	73.0	77.8	75.0
Referenced Flow Rate	CFM	6,300	6,034	6,394	6,243
Sampling Isokinetic Rate	%	98.0	99.4	100.9	99.4

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 4: Summary of Results - Particulate Matter Results

Source	Parameter	Concentration & Emission Rate				
		Test 1	Test 2	Test 3	Average	Permit Limit
EUDRYING	Particulate Matter (PM _{2.5} lb/hr)	0.20	0.15	0.13	0.16 0.80 for 5 Stacks Combined	10.12 (for 5 stacks combined)
	Particulate Matter (PM ₁₀ lb/hr)	0.22	0.19	0.16	0.19 0.95 for 5 stacks combined	12.65 (for 5 stacks combined)
	Particulate Matter (lb/1000lbs of exhaust gas, dry)	0.004	0.004	0.003	0.004	0.03
EUHANDLING (PIT2)	Particulate Matter (PM _{2.5} lb/hr)	0.09	0.08	0.07	0.08	0.69
	Particulate Matter (PM ₁₀ lb/hr)					0.86
	Particulate Matter (lb/1000lbs of exhaust gas, dry)	0.0015	0.0013	0.0012	0.0014	0.019
	Particulate Matter (gr/dscm ²)	0.0018	0.0016	0.0014	0.0016	0.023
EUHANDLING2 (PIT3)	Particulate Matter (PM _{2.5} lb/hr)	0.03	0.02	0.02	0.03	0.41
	Particulate Matter (PM ₁₀ lb/hr)					0.51
	Particulate Matter (lb/1000lbs of exhaust gas, dry)	0.0011	0.0009	0.0007	0.0009	0.019
	Particulate Matter (gr/dscm ²)	0.0013	0.0010	0.0008	0.0011	0.023

FIGURES

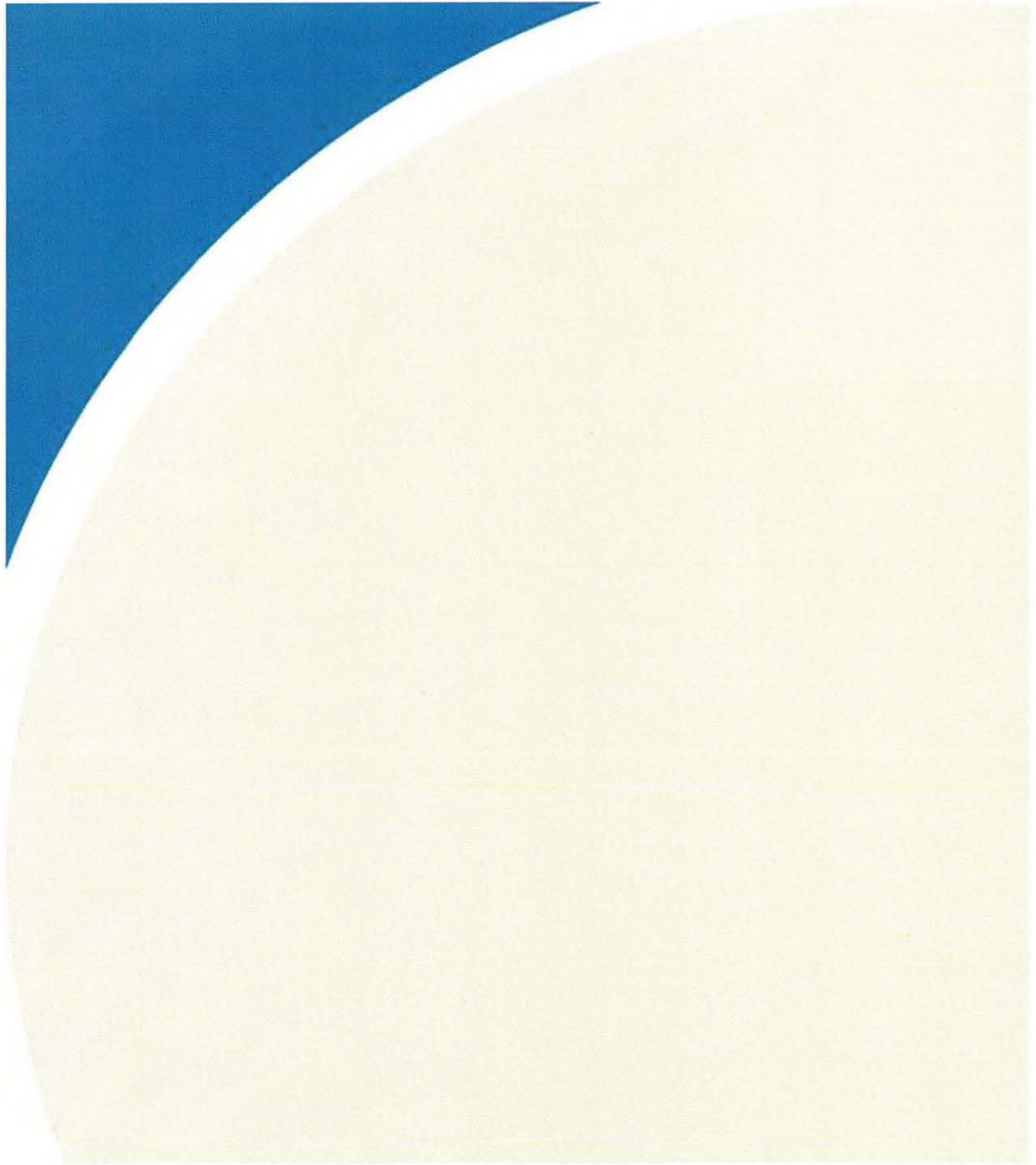
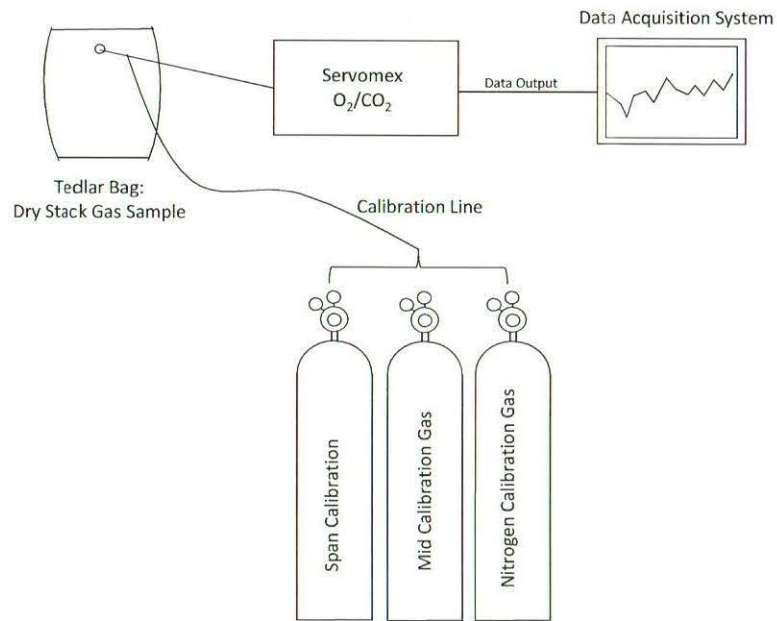




Figure No. 1: USEPA Method 3A (Bag Sample) Schematic



USEPA Method 3A (Bag Sample)

ZFS Zeeland, Inc.

Zeeland

DRYING, EUHANDLING, EUHANDLING2

Zeeland, Michigan

Project No. 2304323

Date: October 17-18, 2023



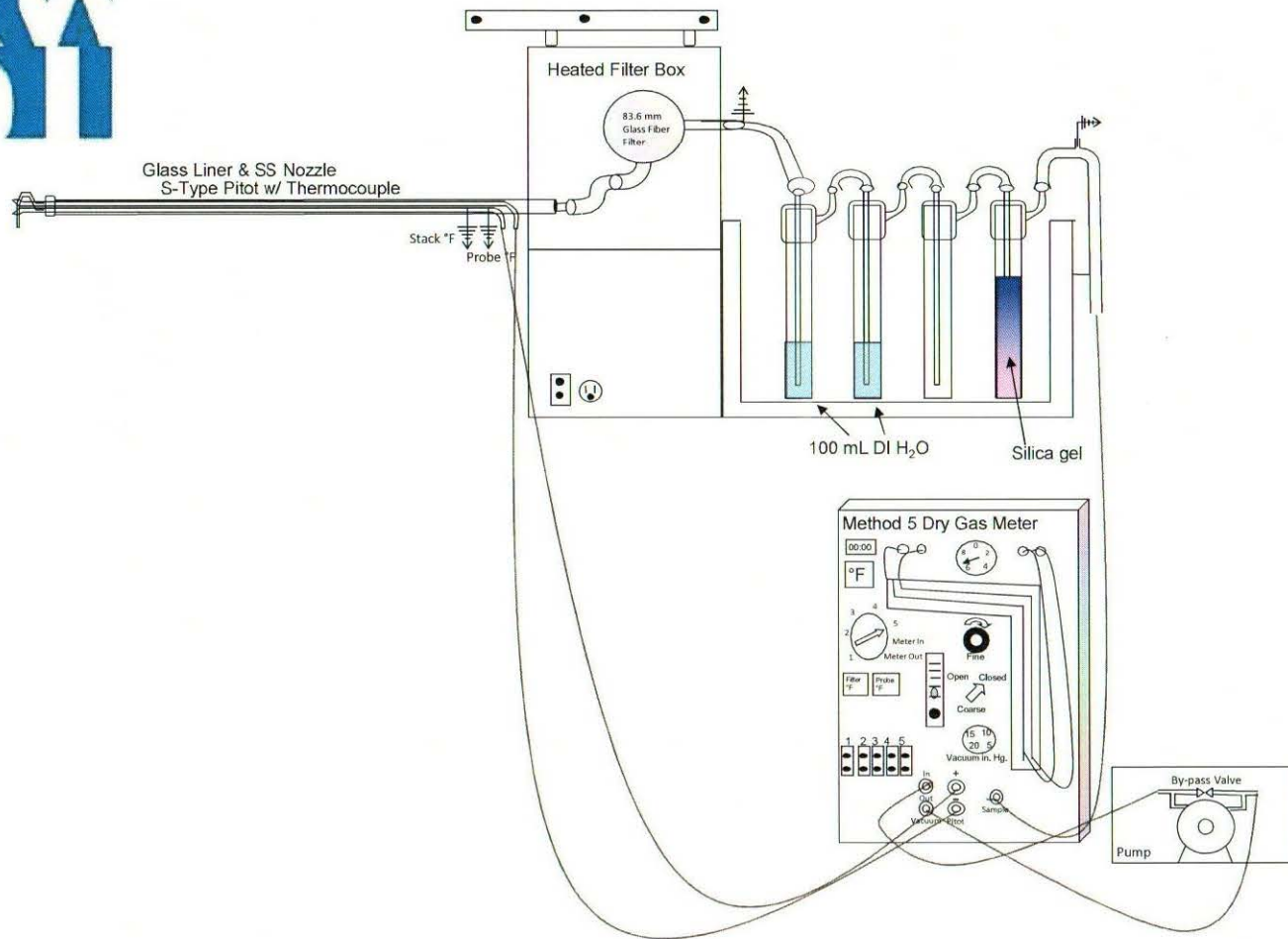
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Figure No. 2: USEPA Method 5/202



USEPA Method 5

ZFS Zeeland, Inc.
Zeeland
EUHANDLING, EUHANDLING2
Zeeland, Michigan

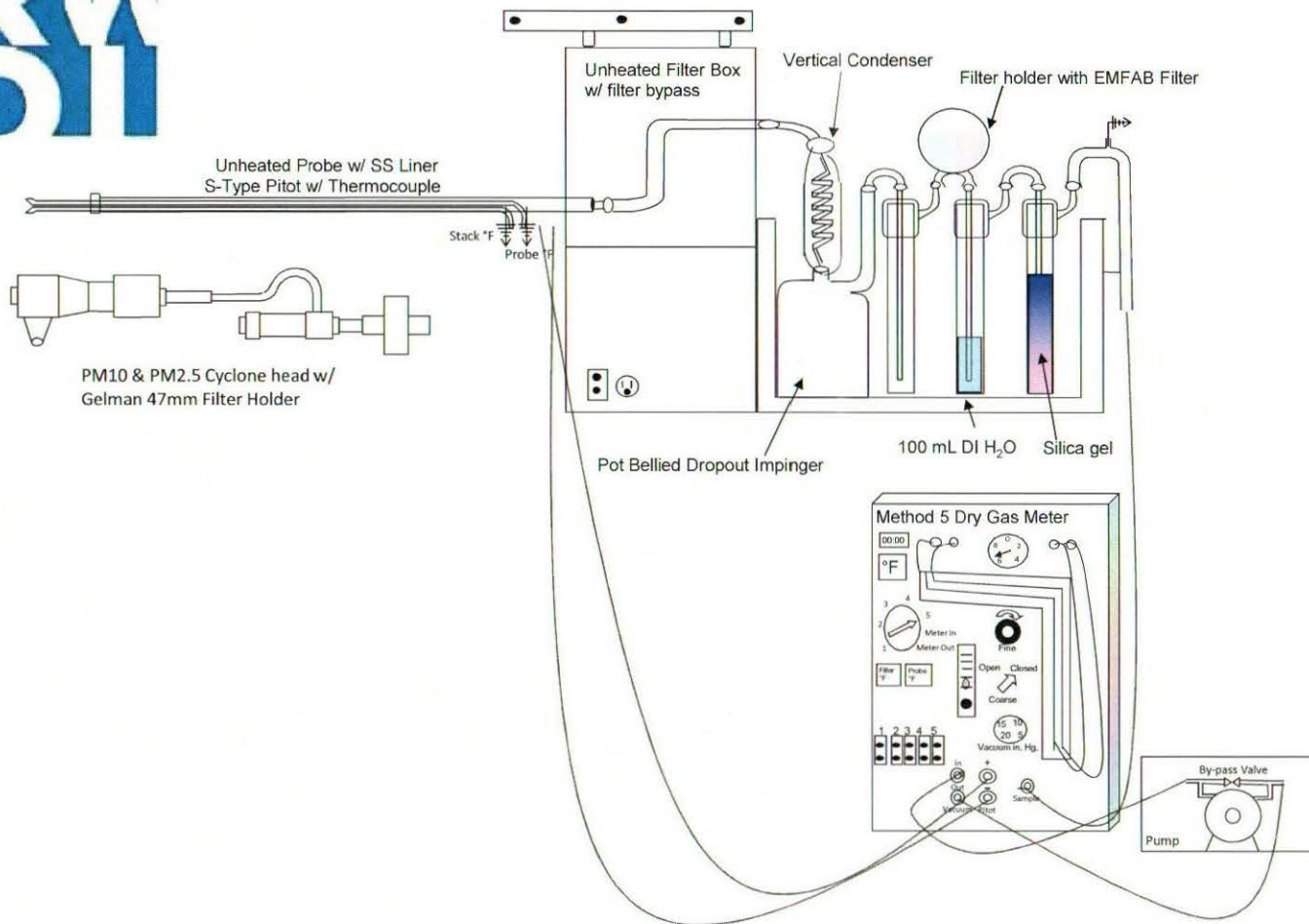
Project No. 2304323

Date: October 17-18, 2023





Figure No. 3: USEPA Method 201a/202



USEPA Method 201A / 202

ZFS Zeeland, Inc.
Zeeland
EUDRYING
Zeeland, Michigan

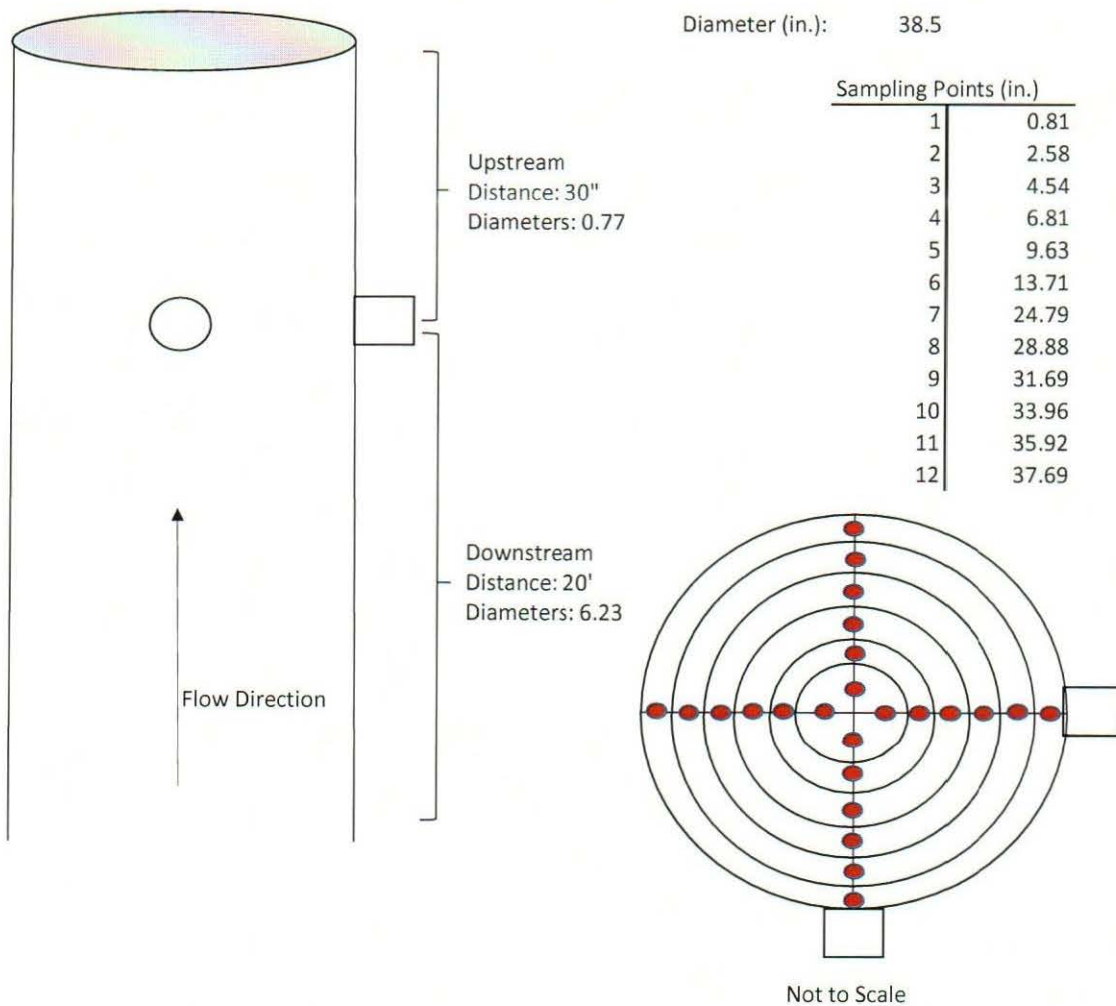
Project No. 2304323

Date: October 17-18, 2023





Figure No. 4: EUDRYING Emissions Stack Diagram



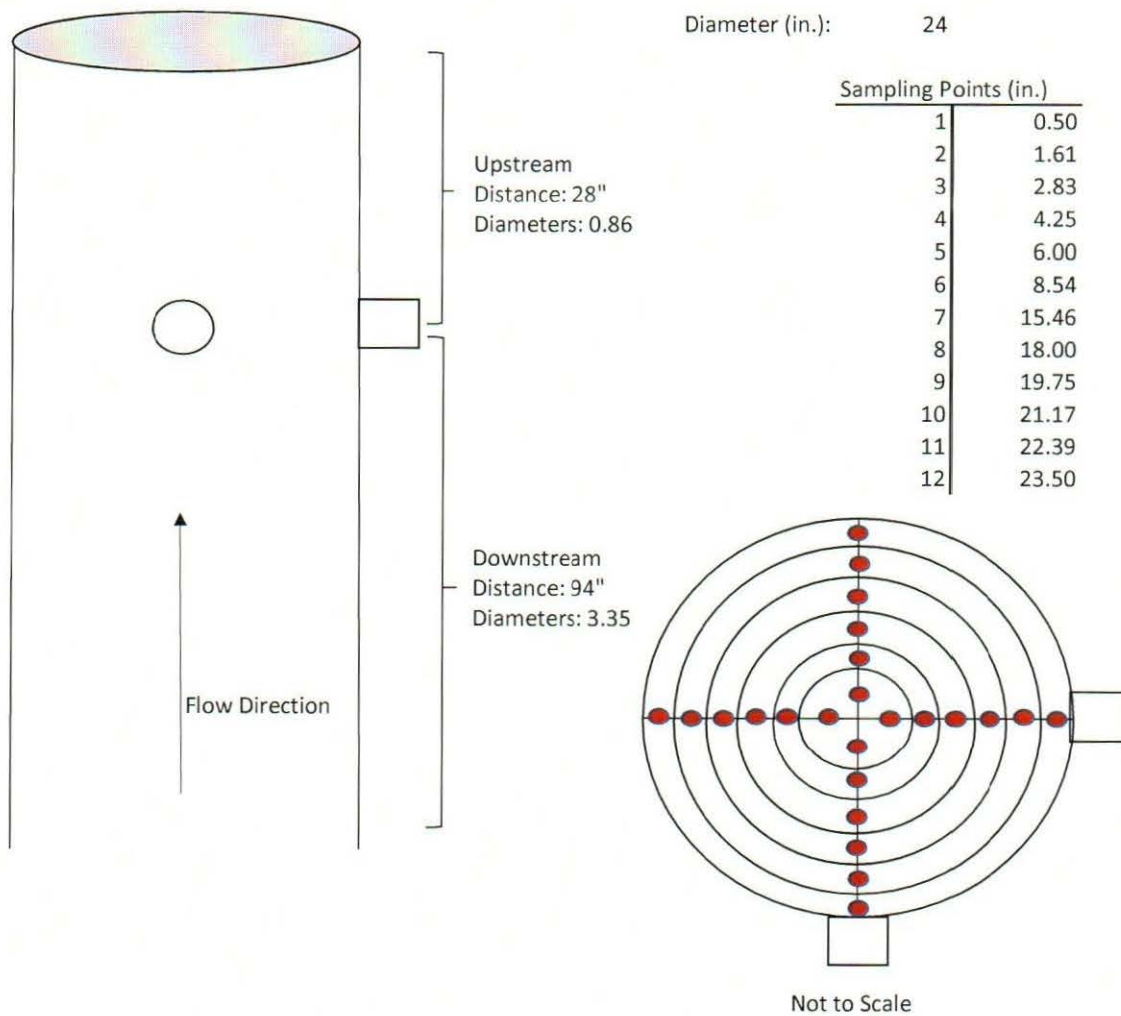
EUDRYING
ZFS Zeeland, Inc.
Zeeland
Zeeland, Michigan

Date:
17-Oct-23

RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309



Figure No. 5: EUHANDLING (PIT2) Emissions Stack Diagram



EUHANDLING (PIT2)
ZFS Zeeland, Inc.
Zeeland
Zeeland, Michigan

Date:
October 17-18, 2023

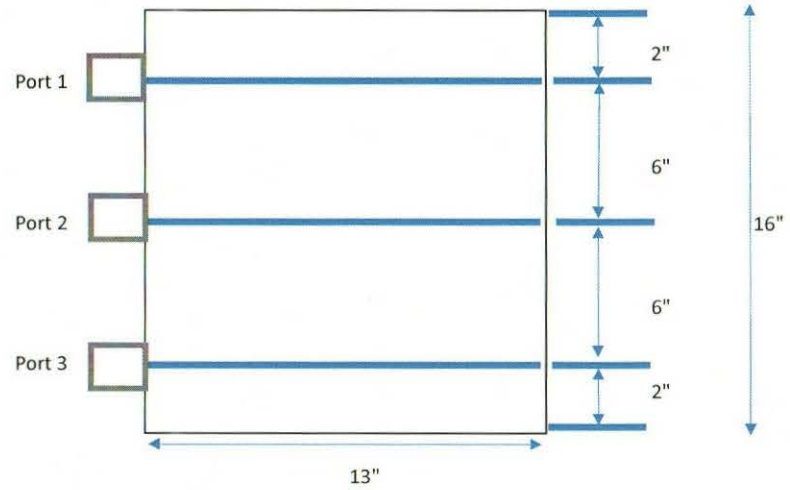
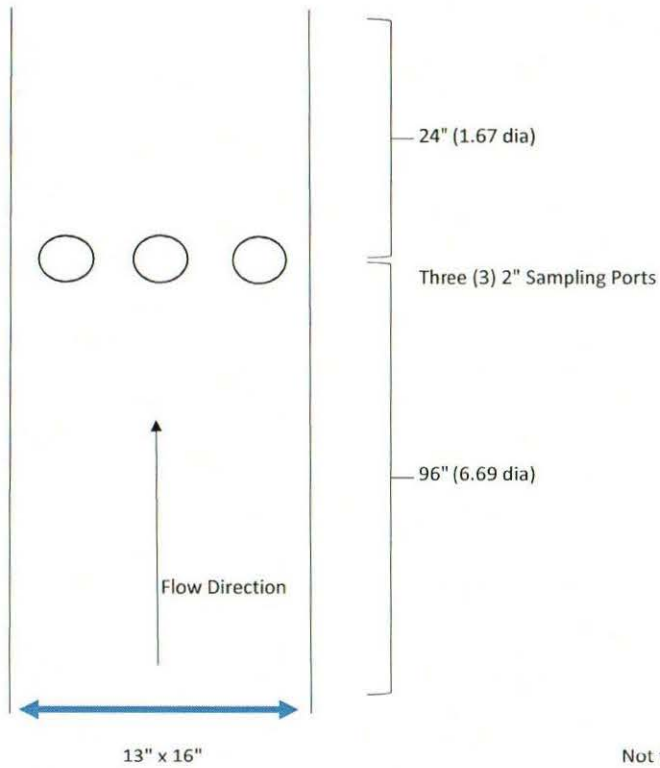
RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309



Figure No. 6: EUHANDLING2 (PIT3) Emissions Stack Diagram

Diameter: 13" x 16"
 Effective Diameter: 14.34

Point	Distance from inside Wall		
	Port 1	Port 2	Port 3
1	1.1	1.1	1.1
2	3.3	3.3	3.3
3	5.4	5.4	5.4
4	7.6	7.6	7.6
5	9.8	9.8	9.8
6	11.9	11.9	11.9



Not to scale