FINAL REPORT

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ZFS ITHACA, LLC

SRN: P0788
ITHACA, MICHIGAN

SOURCE TESTING REPORT: SRN: P0788 EUDC, EUMEALGRINDING, EUPELLETIZING, EUPREP AND EUEXTRACTION

RWDI #2304326

August 7, 2023

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by ZFS Ithaca, LLC (ZFS) to complete the emission sampling program at the ZFS facility located at 1266 E Washington Road, Ithaca, Michigan. The testing program included the following sources:

- meal dryer-cooler operations (EUDC);
- soybean meal grinding operations (EUMEALGRINDING);
- soybean hull pelletizing system (EUPELLETIZING);
- soybean preparation process (EUPREP); and
- soybean oil extraction process (EUEXTRACTION).

The testing was required per State of Michigan Department of Environment, Great Lakes and Energy (EGLE) Permit to Install (PTI) 20-17E. Testing took place on June 13-14, 2023.

The testing program covered the following:

- Particulate Matter (USEPA Method 5 or 17 and USEPA Method 202) for EUDC, EUMEALGRINDING, EUPELLETIZING, and EUPREP
- Total gaseous non-methane organic emissions (TGNMO) (also referred to as VOCs in report) via USEPA Method 25 for EUDC and EUEXTRACTION

Executive Table i: Results Summary

Source	Parameter	Concentration & Emission Rate				
		Run 1	Run 2	Run 3	Average	Permit Limit
EUDC	Particulate Matter (lb/hr)	1.71	1.21	0.90	**1.27**	**N/A**
	Particulate Matter (PM_{10} lb/hr)					**4.00**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**3.20**
	Particulate Matter (gr/dscf)	0.004	0.002	0.002	**0.003**	**0.033**
	TGNMO as Hexane (lb/hr)	24.19	21.21	20.71	**22.04**	**30.25**
EUMEALGRINDING	Particulate Matter (lb/hr)	0.25	0.11	0.15	**0.17**	**0.80**
	Particulate Matter (PM_{10} lb/hr)					**0.80**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**0.80**
	Particulate Matter (gr/dscf)	0.003	0.001	0.002	**0.002**	**0.005**
EUPELLETIZING	Particulate Matter (lb/hr)	0.08	0.07	0.06	**0.07**	**1.60**
	Particulate Matter (PM_{10} lb/hr)					**0.80**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**0.80**
	Particulate Matter (gr/dscf)	0.003	0.003	0.002	**0.003**	**0.026**
EUPREP	Particulate Matter (lb/hr)	2.65	2.64	2.16	**2.48**	**16.17**
	Particulate Matter (PM_{10} lb/hr)					**9.44**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**8.09**
	Particulate Matter (gr/dscf)	0.0033	0.0033	0.0027	**0.0031**	**0.0153**
EUEXTRACTION	TGNMO as Hexane (lb/hr)	0.40	0.45	0.46	**0.44**	**14.30**

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1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by ZFS Ithaca, LLC (ZFS) to complete the emission sampling program at the ZFS facility located at 1266 E Washington Road, Ithaca, Michigan. The testing program included the following sources:

- meal dryer-cooler operations (EUDC);
- soybean meal grinding operations (EUMEALGRINDING);
- soybean hull pelletizing system (EUPELLETIZING);
- soybean preparation process (EUPREP); and
- soybean oil extraction process (EUEXTRACTION).

The testing was required per State of Michigan Department of Environment, Great Lakes and Energy (EGLE) Permit to Install (PTI) 20-17E. Testing took place on June 13-14, 2023.

The testing program covered the following:

- Particulate Matter (USEPA Method 5 or 17 and USEPA Method 202) for EUDC, EUMEALGRINDING, EUPELLETIZING, and EUPREP
- Total gaseous non-methane organic emissions (TGNMO) (also referred to as VOCs in report) via USEPA Method 25 for EUDC and EUEXTRACTION

1.1 Location and Dates of Testing

The test program was completed on June 13th and 14th, 2023 at the ZFS Ithaca facility.

1.2 Description of Source

ZFS Ithaca, LLC is a processing plant for soybeans. Descriptions of each emission unit being tested are below:

EUDC

EUDC is made up of three (3) meal dryers and one (1) meal cooler. This equipment is used to dry and cool the meal after soybean oil extraction. Each dryer and cooler has its own cyclone to control particulate emissions. Emissions from each cyclone are routed to a common stack, SVDC.

EUMEALGRINDING

EUMEALGRINDING is the process used to grind meal to the various sizes. It consists of three (3) hammermills, and emissions are controlled by a baghouse.

EUPELLETIZING

EUPELLETIZING is the process in which hulls are made into pellets. Equipment includes a system to pelletize hulls as well as a cooler. Emissions from EUPELLETIZING are controlled by a cyclone.

1.3 Personnel Involved in Testing

Table 1.3.1: Testing Personnel

Brandon LaRosa Environmental Engineer BrandonL@zfsinc.com	**ZFS Ithaca, LLC** 1266 E Washington Road Ithaca, MI 48847	(616) 879-1715
Kimberly James EHS Manager Kimberly.James@zfsinc.com		(989) 449-6105
Regina Angellotti Environmental Quality Analyst AngellottiR1@michigan.gov	**EGLE** Cadillac Place, Suite 2-300 3058 West Grand Blvd. Detroit, MI 48202	
Brad Bergeron Senior Project Manager Brad.Bergeron@rwdi.com	**RWDI USA LLC** 2239 Star Court Rochester Hills, MI 48309	(248) 817-9888
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Mike Nummer Senior Field Technician Mike.Nummber@rwdi.com		
Ben Durham Senior Field Technician Ben.Durham@rwdi.com		
Kate Strang Field Technician Kate.Strang@rwdi.com		
Cade Smith Field Technician Cade.Smith@rwdi.com		

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

Refer to **Section 1.2** for a description of the process.

- EUDC is controlled by four (4) cyclones.
- EUMEALGRINDING is controlled by a baghouse.
- EUPELLETIZING is controlled by a cyclone.
- EUPREP is controlled by multiple baghouses and cyclones.
- EUEXTRACTION is controlled by a mineral oil absorption system (MOS).

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

The rated capacity for the equipment tested is as follows:

- **EUDC**
  - All 4 cyclones combined are designed to handle 17,900 CFM.
- **EUMEALGRINDING**
  - Baghouse is designed to handle 19,500 CFM
- **EUPELLETIZING**
  - Cyclone is designed to handle 9,500 CFM

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. Flowrates were taken with the particulate matter testing.

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 O_2/CO_2 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 Filterable Particulate Matter

Particulate matter ($PM/PM_{10}/PM_{2.5}$) was withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ±14 °C (248 ±25 °F), or an in-stack filter using Method 17. The FPM mass was determined gravimetrically. Method 5 acetone rinse and filters were analyzed by RWDI's in-house laboratory.

4.3 Condensable Particulate Matter

The CPM was collected in dry impingers after filterable PM was collected on a filter maintained using Method 5 or Method 17. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter were dried and weighed; the total of the impinger fractions and the CPM filter represents the CPM. Method 202 analysis was completed by Bureau Veritas at their laboratory in Mississauga, Ontario.

4.4 Total Gaseous Non-Methane Organics (TGNMO)

The stack was sampled using modified USEPA Method 25. Sample gas was introduced into a specially prepared stainless-steel, pre-evacuated canister. A pump-ventilated sampling line was used during sample collection as pressurized sampling requires an additional pump to provide positive pressure to the sample canister. A sample of air was drawn through a sampling train comprised of components that regulate the rate and duration of sampling into the pre-evacuated and passivated canister. After the air sample was collected, the canister valve was closed, an identification tag was attached to the canister, and the canister was transported to the M25Lab, Inc. laboratory in Hendersonville, North Carolina for analysis. The probe and filter box were not heated due to safety concerns as discussed as a modification in the Test Plan. Results for TGNOCs were provided as Hexane.

Source	Parameter	Concentration & Emission Rate				
		Run 1	Run 2	Run 3	Average	Permit Limit
EUPREP	Particulate Matter (lb/hr)	2.65	2.64	2.16	**2.48**	**16.17**
	Particulate Matter (PM_{10} lb/hr)					**9.44**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**8.09**
	Particulate Matter (gr/dscf)	0.0033	0.0033	0.0027	**0.0031**	**0.0153**
EUEXTRACTION	TGNMOC as Hexane (lb/hr)	0.40	0.45	0.46	**0.44**	**14.30**

5.1.1 Discussion of Results

The detailed results can be found in the following Appendix:

- **Appendix B –** Particulate Matter
- **Appendix C –** TGNMO
- **Appendix D –** O_2 and CO_2

5.2 Variations in Testing Procedures

Due to the presence of the storage and use of hexane at the EUDC source, the area is designated as intrinsically safe. Normally, Method 25 is a heated method but due to safety concerns, no power or electricity is allowed inside the intrinsically safe zone. Method 17 was used in lieu of Method 5 for the same reasons (cannot heat probe or filter box). All other electrical necessities were outside the intrinsically safe zone. This was discussed in the original test plan submission as a modification.

In the original test plan, VOCs were to be measured by TO-15, but after discussions with EGLE, Method 25 was used instead.

Due to moisture on the 1st filter from Test 1 on EUDC, once the vacuum increased, RWDI stopped the test, completed an interim leak check, replaced the filter, leak checked again and continued testing. Ms. Angellotti from EGLE was present at site during this variation from the original test plan.

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.

TABLES

Table 1: Summary of Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
EUDC	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1-4
	3	PM / PM_{10} / $PM_{2.5}$	U.S. EPA [1] Method 17/202
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A
	3	TGNMO	U.S. EPA [1] Method 25
EUMEALGRINDING	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 5/202
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A
EUPELLETIZING	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 5/202
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A
EUPREP	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 5/202
	3	Oxygen / Carbon Dioxide	U.S. EPA [1] Method 3A
EUEXTRACTION	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1, 2 and 4
	3	TGNMO	U.S. EPA [1] Method 25
	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
EUDC - Particulate Matter				
Blank	13-Jun-23	-	-	47-216
Test #1	13-Jun-23	9:43 AM	11:32 AM	47-211/47-209
Test #2	13-Jun-23	12:03 PM	1:07 PM	47-212
Test #3	13-Jun-23	1:37 PM	2:41 PM	47-208
EUDC - TGNMO				
Test #1	13-Jun-23	9:43 AM	11:19 AM	176
Test #2	13-Jun-23	12:03 PM	1:07 PM	170
Test #3	13-Jun-23	1:37 PM	2:41 PM	177
EUMEALGRINDING - Particulate Matter				
Blank	13-Jun-23	--	--	A-325
Test #1	13-Jun-23	8:42 AM	9:48 AM	A-326
Test #2	13-Jun-23	10:15 AM	11:19 AM	A-327
Test #3	13-Jun-23	11:45 AM	12:49 PM	A-328
EUPELLETIZING - Particulate Matter				
Blank	13-Jun-23	--	--	A-325
Test #1	14-Jun-23	9:18 AM	10:24 AM	A-329
Test #2	14-Jun-23	11:20 AM	12:26 PM	A-171
Test #3	14-Jun-23	1:15 PM	2:21 PM	A-228
EUPREP - Particulate Matter				
Blank	13-Jun-23	--	--	A-325
Test #1	14-Jun-23	9:23 AM	11:28 AM	A-220
Test #2	14-Jun-23	12:04 PM	1:25 PM	A-229
Test #3	14-Jun-23	2:30 PM	3:39 PM	A-227
EUEXTRACTION - TGNMO				
Test #1	14-Jun-23	8:46 AM	9:46 AM	120
Test #2	14-Jun-23	10:18 AM	11:18 AM	179
Test #3	14-Jun-23	11:47 AM	12:47 PM	124

Table 3A: Sampling Summary - Flow Characteristics - EUDC

Stack Gas Parameter	Unit	Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		13-Jun-23	13-Jun-23	13-Jun-23	
Stack Temperature	°F	134	133	133	133
Moisture	%	19.5%	12.1%	14.6%	15.4%
Velocity	ft/s	50.5	48.2	47.7	48.8
Referenced Flow Rate	CFM	49,582	51,688	49,774	50,348
Sampling Isokinetic Rate	%	106.6	99.5	101.5	102.5

Notes:

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

Table 3E: Sampling Summary - Flow Characteristics - EUEXTRACTION

Stack Gas Parameter	Unit	Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		14-Jun-23	14-Jun-23	14-Jun-23	
Stack Temperature	°F	90	89	91	90
Moisture	%	1.8%	1.9%	1.8%	1.8%
Velocity	ft/s	6.7	7.2	7.6	7.2
Referenced Flow Rate	CFM	128	137	145	137

Notes:

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

Table 4: Summary of Results - Particulate Matter and TGNMO Results

Source	Parameter	Concentration & Emission Rate				
		Test 1	Test 2	Test 3	Average	Permit Limit
EUDC	Particulate Matter (lb/hr)	1.71	1.21	0.90	**1.27**	**N/A**
	Particulate Matter (PM_{10} lb/hr)					**4.00**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**3.20**
	Particulate Matter (gr/dscf)	0.004	0.003	0.002	**0.003**	**0.033**
	TGNMO as Hexane (lb/hr)	24.19	21.21	20.71	**22.04**	**30.25**
EUMEALGRINDING	Particulate Matter (lb/hr)	0.25	0.11	0.15	**0.17**	**0.80**
	Particulate Matter (PM_{10} lb/hr)					**0.80**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**0.80**
	Particulate Matter (gr/dscf)	0.003	0.001	0.002	**0.002**	**0.005**
EUPELLETIZING	Particulate Matter (lb/hr)	0.08	0.07	0.06	**0.07**	**1.60**
	Particulate Matter (PM_{10} lb/hr)					**0.80**
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	Particulate Matter (gr/dscf)	0.003	0.003	0.002	**0.003**	**0.026**
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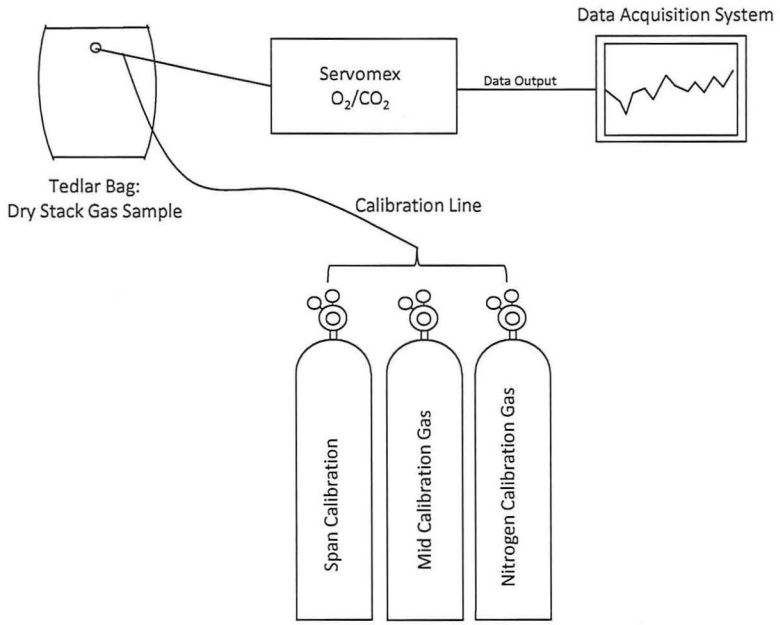
	Particulate Matter (PM_{10} lb/hr)					**9.44**
	Particulate Matter ($PM_{2.5}$ lb/hr)					**8.09**
	Particulate Matter (gr/dscf)	0.0033	0.0033	0.0027	**0.0031**	**0.0153**
EUEXTRACTION	TGNMO as Hexane (lb/hr)	0.40	0.45	0.46	**0.44**	**14.30**

FIGURES

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



USEPA Method 3A (Bag Sample)

ZFS Ithaca, LLC

Ithaca

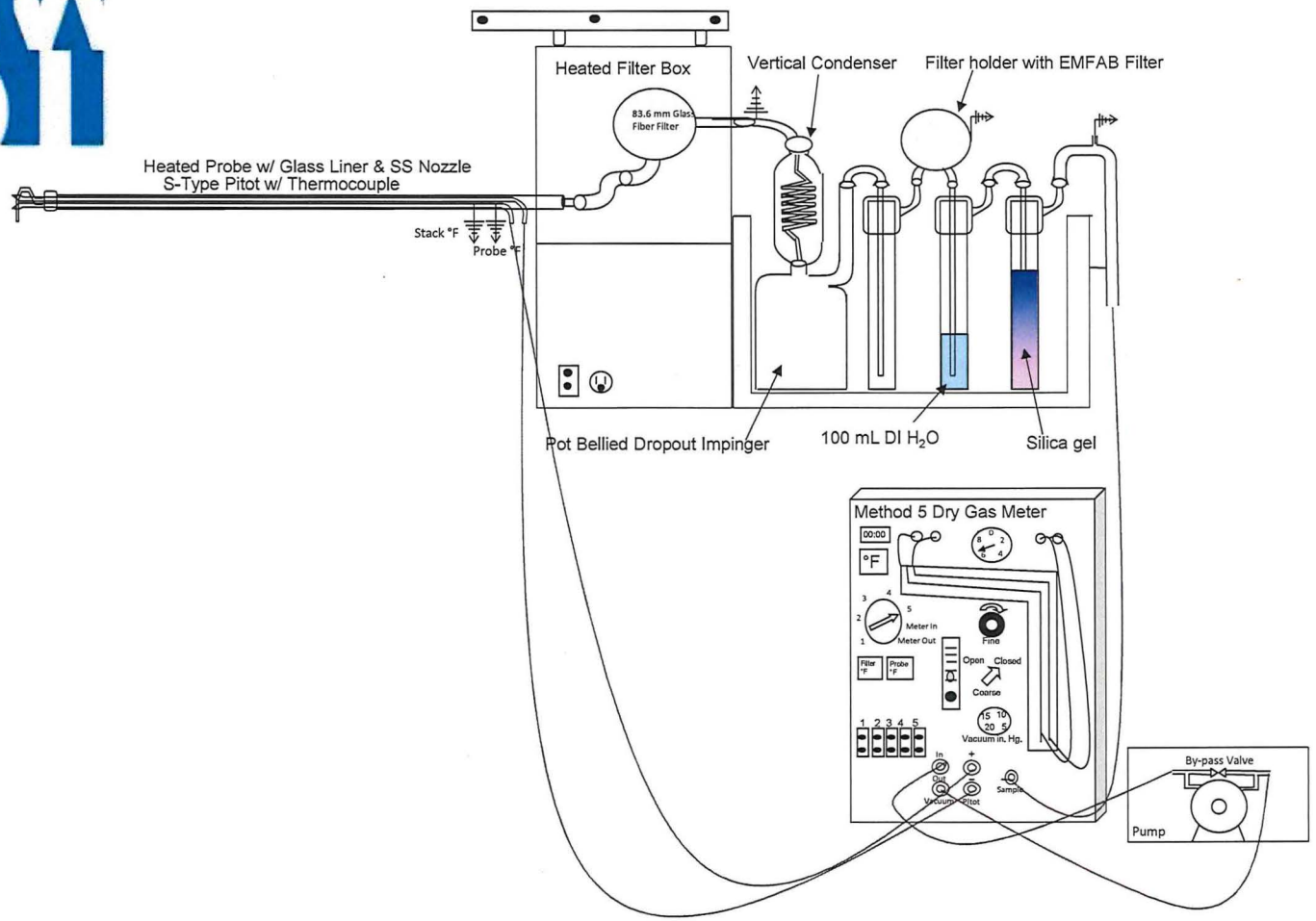
EUDC, EUMEALGRINDING, EUPELLETIZER, EUPREP, EUEXTRACTION

Ithaca, Michigan

Project No. 2304326

Date: June 13-14, 2023

Figure No. 2: USEPA Method 5/202



USEPA Method 5/202

ZFS Ithaca, LLC

Ithaca

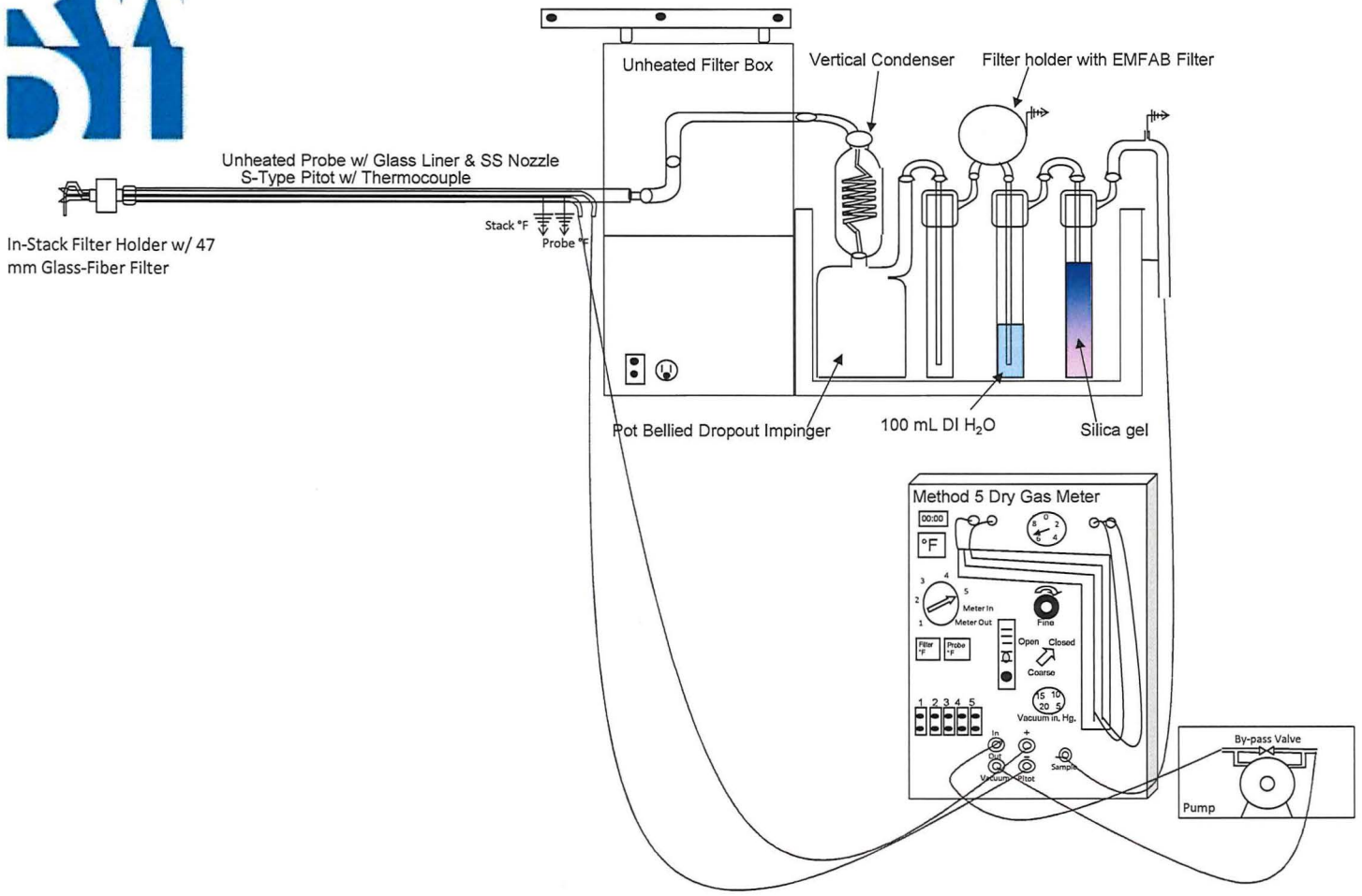
EUMEALGRINDING, EUPELLETIZER, EUPREP

Ithaca, Michigan

Project No. 2304326

Date: June 13-14, 2023

Figure No. 3: USEPA Method 17/202



USEPA Method 17/202

ZFS Ithaca, LLC

Ithaca

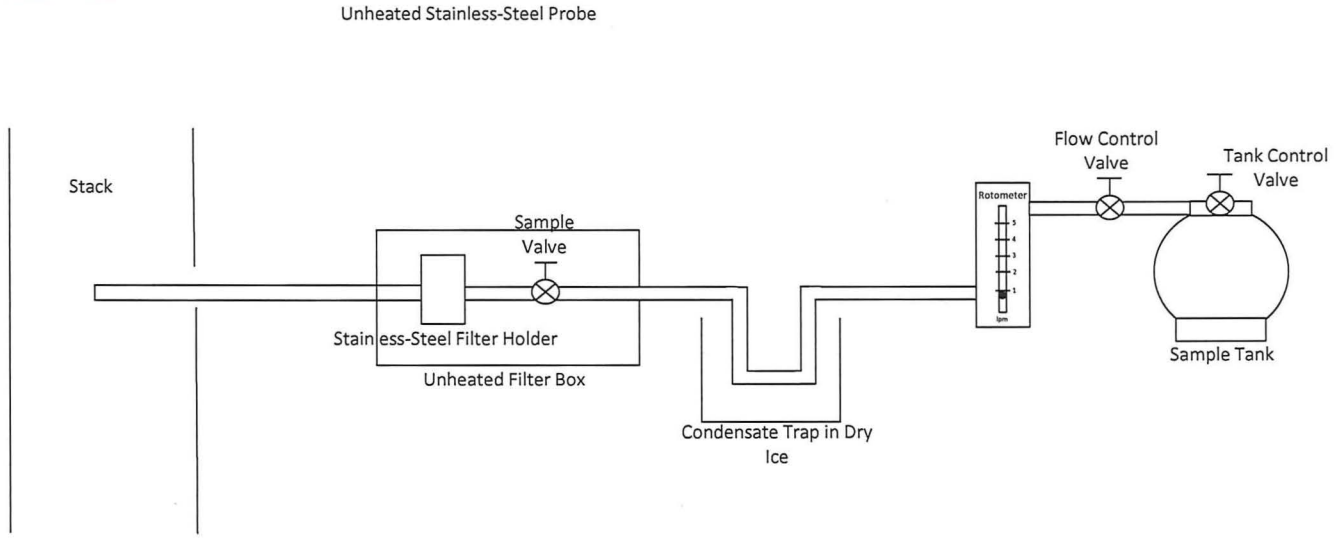
EUDC

Ithaca, Michigan

Project No. 2304326

Date: June 13-14, 2023

Figure No. 4: USEPA Method 25



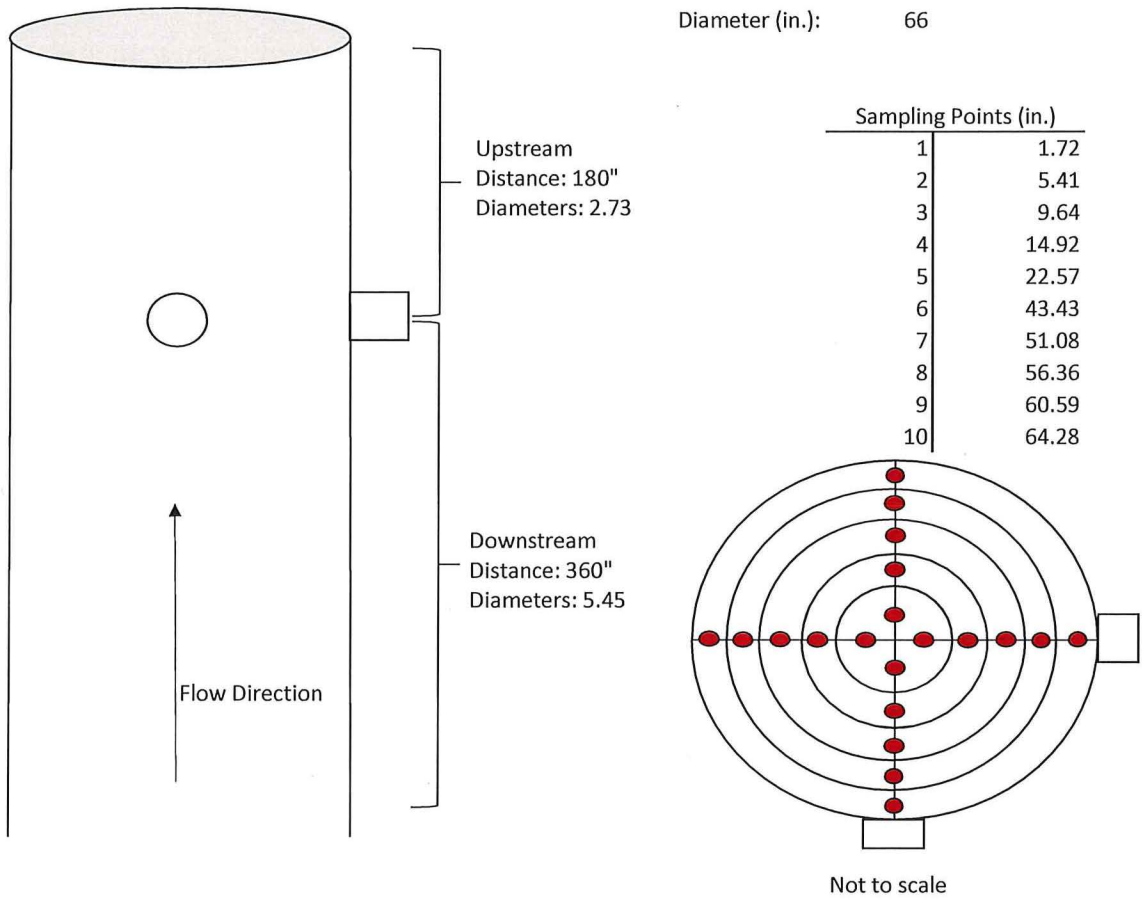
USEPA Method 25

ZFS Ithaca, LLC
Ithaca
EUDC, EUEXTRACTION
Ithaca, Michigan

Project No. 2304326

Date: June 13-14, 2023

Figure No. 5: EUDC Emissions Stack Diagram

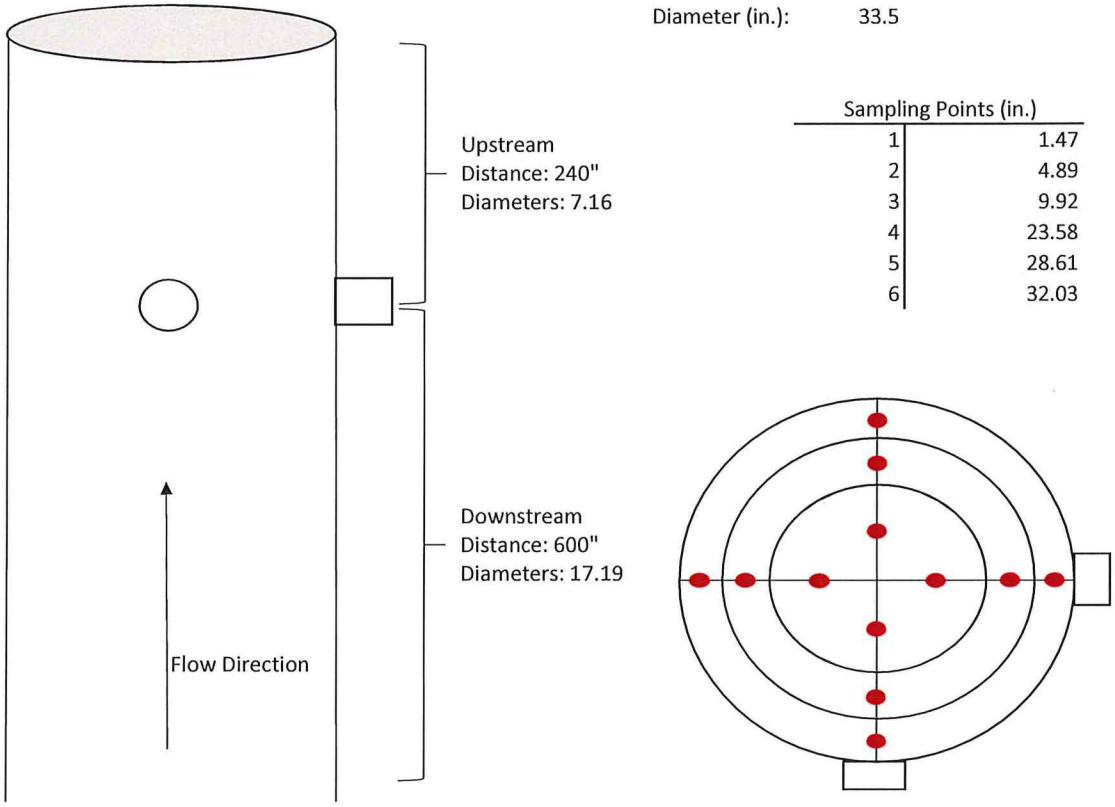


EUDC
ZFS Ithaca, LLC
Ithaca
Ithaca, Michigan

Date:
June 13-14, 2023

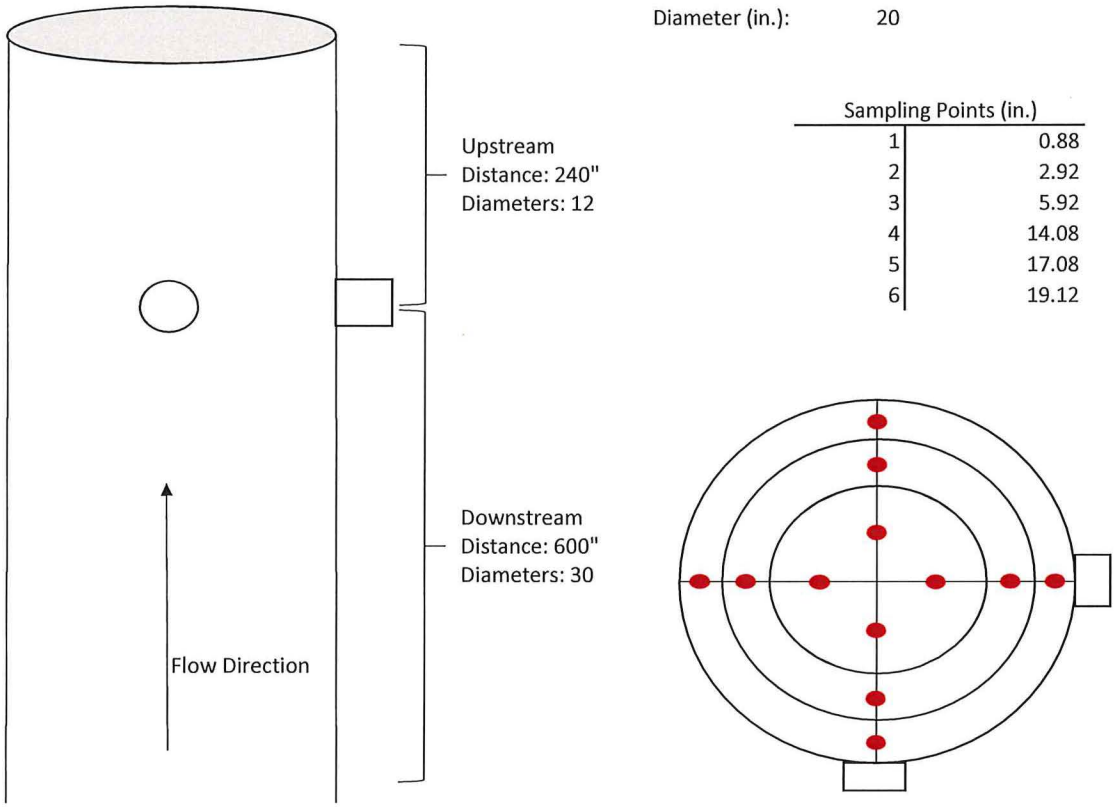
RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309

Figure No. 6: EUMEALGRINDING Emissions Stack Diagram



EUMEALGRINDING ZFS Ithaca, LLC Ithaca Ithaca, Michigan	Date: June 13-14, 2023	**RWDI USA LLC** 2239 Star Court Rochester Hills, MI 48309

Figure No. 7: EUPELLETIZING Emissions Stack Diagram



Diameter (in.): 20

Sampling Points (in.)	
1	0.88
2	2.92
3	5.92
4	14.08
5	17.08
6	19.12

Not to scale

EUPELLETIZING
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Ithaca
Ithaca, Michigan

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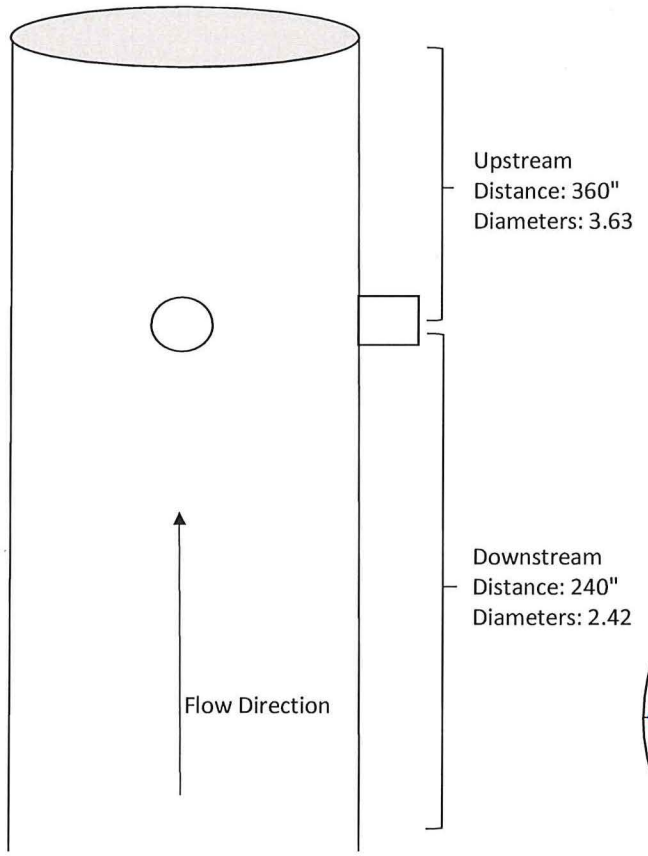
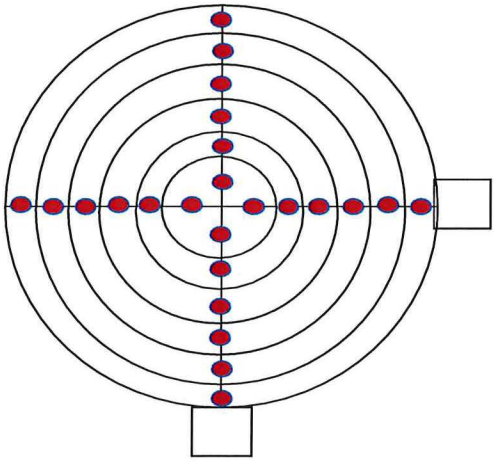
Figure No. 8: EUPREP Emissions Stack Diagram



Diameter (in.): 99

Sampling Points (in.)	
1	2.08
2	6.63
3	11.68
4	17.52
5	24.75
6	35.24
7	63.76
8	74.25
9	81.48
10	87.32
11	92.37
12	96.92



Not to Scale

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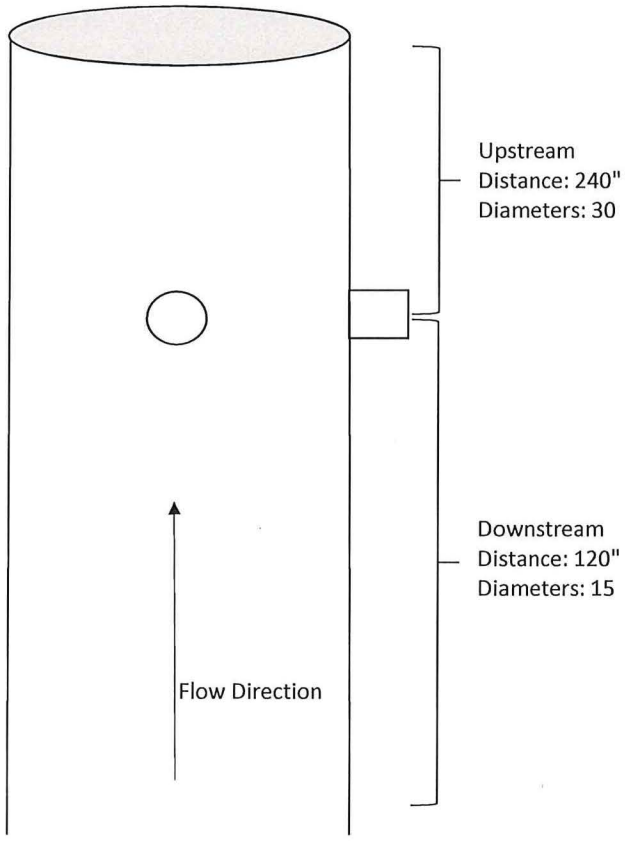
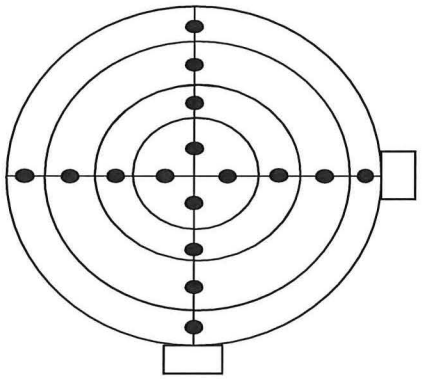
Figure No. 9: EUEXTRACTION Emissions Stack Diagram



Diameter (in.): 8

Sampling Points	(in.)
1	0.26
2	0.84
3	1.55
4	2.58
5	5.42
6	6.45
7	7.16
8	7.74



Not to scale

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