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COMPLIANCE STACK EMISSION TEST REPORT

WYANDOTTE DISPERSIONS AND RESINS PLANT (FG-RTO)

Determination of Total Gaseous Organics Destruction Efficiency

Utilizing US EPA Methods 1, 2, 3, 4, and 25A

Test Date(s): November 26, 2019
Facility ID: B4359
Source Location: Wyandotte, Michigan
Permit: EGLE Permit-to-Install No. 113-07B

Prepared For:

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TABLE OF CONTENTS

SECTION **PAGE**

LIST OF TABLES

LIST OF FIGURES

TEST RESULTS SUMMARY

Source Name:	**Wyandotte Dispersions and Resins Plant (WYDR)**	
Source ID Number:	**FG-RTO**	
Control Device:	**RTO**	
Source ID Number:	**SV-RTO**	
Test Date:	**November 26, 2019**	
Sampling Location:	**Inlet Duct**	**Exhaust Stack**
TGO DE (%)	**-**	**95**
Permit Limit - TGO DE (%)	*-*	*98*
Emission Results Above Permit Limit	*YES*	*YES*
TGO Emissions (lb/hr as propane)	**14.1**	**0.76**
Permit No.	**EGLE Permit-to-Install No. 113-07B**	

REVIEW AND CERTIFICATION

The results of the Compliance Test conducted on November 26, 2019 are a product of the application of the United States Environmental Protection Agency (US EPA) Stationary Source Sampling Methods listed in 40 CFR Part 60, Appendix A, that were in effect at the time of this test.

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: [signature] Date: 1-23-2020

Name: Matthew Young Title: Client Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: [signature] Date: 1-23-2020

Name: Randal Tysar Title: District Manager

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The BASF Corporation (State Registration Number: B4359), located in Wyandotte, Michigan, contracted Montrose Air Quality Services, LLC (Montrose) of Detroit, Michigan, to conduct compliance stack emission testing for their Wyandotte Dispersions and Resins (WYDR) Plant (FG-RTO). Table 1.1 displays the associated emission units.

Testing was performed to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes and Energy (EGLE) Permit-to-Install (PTI) No. 113-07B. The testing was performed on November 26, 2019.

Simultaneous sampling was performed at the WYDR regenerative thermal oxidizer (RTO) (SV-RTO) Inlet Duct and at the WYDR RTO Exhaust Stack to determine the total gaseous organics (TGO) destruction efficiency (DE) of the RTO associated with the Dispersions and Resins Plant. Testing was performed during operations at or near maximum capacity. During this test, emissions from WYDR emission units were controlled by an RTO.

The test methods that were conducted during this test were US EPA Methods 1, 2, 3, 4, and 25A.

1.2 KEY PERSONNEL

The key personnel who coordinated this test program (and their phone numbers) were:

- Jordan Thompson, Senior EHS Specialist, BASF Corporation, 734-324-6102
- Todd Zynda, Environmental Engineer, EGLE, 313-456-2761
- David Patterson, Environmental Quality Analyst, EGLE, 517-241-7469
- Regina Angelotti, Environmental Quality Analyst (EQA), EGLE, 313-418-0895
- Matthew Young QSTI, Client Project Manager, Montrose, 248-548-7980

TABLE 1.1
ASSOCIATED WYDR FG-RTO EMISSION UNITS

UNIT/GROUP ID	UNIT DESCRIPTION
FG-RAWMATLS	Raw material storage tanks (EUJONTK-0001 thru EUJONTK-0016)
FG-EMULSIONS	Emulsion Polymer Production including four emulsion reactor trains comprised of a reactor and monomer scale, co-feed, and hold tanks (EUJONEMULTRAIN1 thru EUJONEMULTRAIN4), a reactor vent knockout tank D-0881; one monomer powerfeed tank D-0800, raw material tanks D-0801, D-0841, D-0842, D0843, D0861, D0862; and cleaner tank D-0884 (EUJONEMULTANKS)
EUJONSGOTRAIN1 EUJONSGOTRAIN2 EUJONSGOTRAIN3 EUJONSGOTRAIN4	Solid/liquid Resin Reactor Trains No. 1 thru No. 4 - Each includes a reactor, a monomer batching scale tank, a monomer feeding scale tank, a continuous recycle tank, a purge tank, an evaporator, and a process condenser.
EUSGOCOOLBELT	Three polymer cooling belts.
EUSGOOTHER	SGO blending tanks D-1116, D-1171, and D-1181; vent knockout tank D-1056; post-WFE addition tanks D-1091 and D-1095; raw material tanks D-1002 and D-1003; and inhibitor tank D-1004.
EUJONRESINCUT1	Two resin cutting/blending vessels, two process condensers, and two water scrubbers.
EUJONPRODD-0937	Low pressure resin cut storage tank No. 37.
EUJONPRODD-0938	Low pressure resin cut storage tank No. 38.
EUJONPRODD-1141	Polyol storage tank D-1141.
EUJONPRODD-1142	Polyol storage tank D-1142.
EUJONPRODD-1143	Polyol storage tank D-1143.
EUJONPRODD-1144	Polyol storage tank D-1144.
FG-DRUMMING	Product filling.
FG-OTHER	Hydroxyl waste tank D-1053; acid-functional waste tank D-1054; cleaner tanks D-1061, D-1062, and D-1063; hazardous waste storage tanks D-1081 and D-1082.

2.0 SUMMARY AND DISCUSSION OF TEST RESULTS

2.1 OBJECTIVES AND TEST MATRIX

The purpose of this test was to determine the TGO DE of the RTO associated with the Dispersions and Resins Plant during operations at or near maximum capacity. Testing was performed to satisfy the emissions testing requirements pursuant to EGLE PTI No. 113-07B.

The specific test objectives for this test are as follows:

- Simultaneously measured the concentrations of TGO at the WYDR RTO Inlet Duct and at the WYDR RTO Exhaust Stack.
- Simultaneously measure the actual and dry standard volumetric flowrate of the stack gas at the WYDR RTO Inlet Duct and at the WYDR RTO Exhaust Stack.
- Utilize the above variables to determine the TGO DE of the RTO associated with the Dispersions and Resins Plant during operations at or near maximum capacity.

Table 2.1 presents the sampling matrix log for this test.

2.2 FIELD TEST CHANGES AND PROBLEMS

With the prior approval of Regina Angelotti (EGLE) and Dave Patterson (EGLE), a single moisture run was performed at the WYDR RTO Exhaust Stack and US EPA Method 18 was not performed.

2.3 PRESENTATION OF RESULTS

During each run, a single sampling train was utilized at the WYDR RTO Inlet Duct and two sampling trains were utilized at the WYDR RTO Exhaust Stack to determine the TGO DE of the RTO associated with the Dispersions and Resins Plant.

At the inlet, the sampling train measured the gas stream concentration of TGO, and grab samples were taken to determine gas stream dry molecular weight. Volumetric flowrate was measured during each concentration run.

At the exhaust, one sampling train measured the gas stream moisture content, the second sampling train measured the concentration of TGO, and grab samples were taken to determine gas stream dry molecular weight. Volumetric flowrate was measured during each concentration run.

Table 2.2 displays the TGO DE of the RTO associated with the Dispersions and Resins Plant during operations at or near maximum capacity.

The graphs that present the raw, uncorrected concentration data measured in the field by the US EPA Method 25A sampling systems at the WYDR RTO Inlet Duct and WYDR RTO Exhaust Stack are located in the Field Data section of the Appendix.

TABLE 2.1
SAMPLING MATRIX OF TEST METHODS UTILIZED

Date	Run No.	Sampling Location	US EPA METHODS 1/2 (Flow)	US EPA METHOD 3 (Dry Molecular Wt.)	US EPA METHOD 4 (%H_2O)	US EPA METHOD 25A (TGO)
			Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)	Sampling Time / Duration (min)
11/26/2019	1	WYDR RTO Inlet Duct	10:03 - 10:09 / 6	10:10 - 10:20 / 10	-	9:22 - 10:22 / 60
11/26/2019	2	WYDR RTO Inlet Duct	10:53 - 10:58 / 5	11:35 - 11:45 / 10	-	10:50 - 11:50 / 60
11/26/2019	3	WYDR RTO Inlet Duct	12:40 - 12:48 / 8	12:50 - 13:00 / 10	-	12:10 - 13:10 / 60
11/26/2019	1	WYDR RTO Exhaust Stack	9:25 - 9:35 / 10	9:45 - 9:55 / 10		9:22 - 10:22 / 60
11/26/2019	2	WYDR RTO Exhaust Stack	11:10 - 11:21 / 11	11:20 - 11:30 / 10	9:22 - 9:52 / 30	10:50 - 11:50 / 60
11/26/2019	3	WYDR RTO Exhaust Stack	12:20 - 12:31 / 11	12:30 - 12:40 / 10		12:10 - 13:10 / 60

All times are Eastern Standard Time.

TABLE 2.2
EMISSION RESULTS

Parameter	WYDR RTO Inlet Duct				WYDR RTO Exhaust Stack			
	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
TGO Destruction Efficiency (%)	-	-	-	-	95.1	94.7	93.7	94.5
TGO Emissions (lb/hr as propane)	15.8	14.8	11.6	14.1	0.77	0.79	0.73	0.76
TGO Concentration (ppmvd as propane)	364.6	366.8	335.1	355.5	17.4	18.7	17.4	17.9
Stack Gas Average Flow Rate (acfm)	7,146	6,700	5,683	6,510	9,086	8,461	8,289	8,612
Stack Gas Average Flow Rate (scfm)	6,474	6,093	5,182	5,916	6,913	6,475	6,364	6,584
Stack Gas Average Flow Rate (dscfm)	6,377	6,001	5,104	5,827	6,809	6,378	6,269	6,485
Stack Gas Average Velocity (fpm)	2,275	2,133	1,809	2,072	1,864	1,736	1,700	1,767
Stack Gas Average Static Pressure (in-H_2O)	7.10	7.10	7.10	7.10	0.03	0.03	0.03	0.03
Stack Gas Average Temperature (°F)	122	120	118	120	220	216	214	217
Stack Gas Percent by Volume Moisture (%H_2O)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Measured Stack Inner Diameter (in)*	24.00				39.0 X 18.0			
Percent by Volume Carbon Dioxide in Stack Gas (%-dry)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Percent by Volume Oxygen in Stack Gas (%-dry)	20.90	20.90	20.90	20.90	20.90	20.90	20.90	20.90
Percent by Volume Nitrogen in Stack Gas (%-dry)	79.10	79.10	79.10	79.10	79.10	79.10	79.10	79.10

* The WYDR RTO Exhaust Stack was rectangular in shape.

3.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

3.1 PROCESS DESCRIPTION AND OPERATION

The BASF Corporation's Wyandotte Dispersions and Resins Plant (Joncryl Polymer Plant) was in operation for this test event. The WYDR has an emulsion polymer batch production capacity of 241,000,000 pounds per year and a continuous resin production capacity of 142,000,000 pounds per year.

The Dispersions and Resins Plant is located on the northeastern quadrant of the Wyandotte site. BASF Resins is a market leader in water-based styrene acrylic resins and emulsion polymers for the water-based ink, overprint varnish, and industrial coating markets. BASF also manufactures emulsion polymers for use in water-based industrial and consumer floor finishes.

The equipment installed as part of the Dispersions and Resins Plant can be separated into eight categories as follows:

- Emulsion polymer production equipment,
- Solid grade resin production equipment,
- Polymer resin cutting/thinning equipment,
- Product drumming equipment,
- Raw material storage equipment,
- Product storage equipment,
- Ancillary equipment and operations, and
- Air pollutant emissions control systems.

The normal operating schedule for the Dispersions and Resins Plant is 24 hours per day, 7 days, per week, 365 days per year. The VOC emissions from "significant" process vents and storage tanks are controlled by a single RTO abatement system.

3.1.1 Emulsion Polymer Production

The emulsion production process is carried out in four parallel reactor trains. Each reactor train includes a monomer scale tank, a reactor co-feed tank, a reactor, and a hold tank. Monomers, water, chain transfer agents, cross-linkers, and surfactants are initially charged to the monomer scale tank and reactor. The contents of the monomer scale tank are fed to the reactor. There may also be other ingredients transferred to the reactor from the co-feed tank (e.g., water, initiators, resins, resin solutions, ammonia, and various process additives, including surfactants and reducing agents).

After all of the ingredients have been added, the contents of the reactor are transferred to a hold tank to complete polymerization reactions at required reaction conditions. After completion of the reaction in the hold tank, adjustments are made with ammonia, water, and process additives, including biocides, solvents, surfactants, and reducing agents, as necessary. The emulsion polymer product is then pumped through a common filtration system to product storage tanks.

Material Mass Balance for All Components

Water + Surfactants + Initiators + Monomers → Water + Surfactants + Emulsion Polymer

3.1.2 Solid/Liquid Grade Resin Production

Solid or liquid grade resins are produced using four continuous reactor trains. Monomers and other raw materials are precisely weighed into a monomer scale tank and then transferred to a monomer feed tank, which continuously feeds the reactor. The contents flow from the reactor into the evaporator, a heated negative-pressure separation system that vaporizes unreacted monomers and impurities produced in the reactor. The vapor stream is condensed to form a liquid stream, a portion of which is returned through the recycle tank to the reactor.

The polymer product is a solid at normal temperature and pressure but is at a temperature above its melting point when it exits the evaporator. The majority of this material is transferred to one of three cooling belts, with a water spray cooling their underside. At the end of the cooling belt, the now solid material is ground to size and transferred through a storage silo for bagging. A vapor collection hood captures vapors at the beginning of the cooling belt and exhausts these vapors to the RTO abatement system.

When producing liquid grade products, the products exiting the evaporator can be transferred to one of three product blend tanks. In the blend tanks, solvent, water, or other liquids may be added. From the blend tanks, the product can be transferred to product storage or sent directly to product drumming.

Material Mass Balance for All Components

Solvents + Initiators + Monomers → Solvents + Solid/Liquid Polymers

3.1.3 Polymer Resin Cutting

The Resin Cutting process is used for making resin cuts and water-based blends. Two jacketed cutting vessels are used to cut solid grade resins. The resin cuts primarily consist of hot water, alkaline liquid, and resin flake. The water is fed directly to the cutting vessel at or above the desired batch temperature. Bulk-stored alkaline liquids are either fed directly to the cutting vessel or are added from a scale tank.

Resin flake is added to the Resin Cutting vessel from "super sack" bags through a chute. Other materials may be added, and the contents may be blended with emulsion polymers produced by the emulsion reactors. An agitator then mixes the cutting vessel's contents. The cutting vessels and scale tank are vented to a water scrubber, and the scrubber's exhaust is vented to the RTO abatement system.

3.1.4 Product Drumming

Liquid products from the resin cutting and emulsion process are transferred to drums or totes by one of three semi-automatic product drumming lines. The liquid product is pumped from bulk storage tanks, process vessels, or process hold tanks to the drumming line. Liquids are added to the drum or tote by delivery hoses. Liquid resins are transferred to drums or totes on a separate drumming line. Vapors released from drumming lines are captured by a ventilation hood, and the exhaust from the hoods is routed to the RTO abatement system.

3.1.5 Raw Material Storage

Process raw materials may be stored in bulk storage tanks, drums, or "super sack" bags. Emissions from the use of raw materials received in drums or bags are negligible.

3.1.6 Product Storage

Process products are stored in bulk storage tanks. From the bulk storage tanks, the product may be transferred to tank trucks or to drum filling lines. Tanks with products containing "significant" amounts of VOC are vented to the RTO. Solid grade resins are stored in three product storage silos, each exempt from permitting pursuant to Michigan Rule 284(k).

3.1.7 Ancillary Equipment and Operations

Operation of the Dispersions and Resins Plant includes equipment and operations ancillary to polymer production, resin cutting, raw material and product storage, and product drumming. Included in these operations are:

- Solid product transfer and storage operations associated with three product storage silos;
- Solid grade resin grinding at the end of the cooling belt;
- Ventilation of particulate matter due to solid grade resin bagging operations;
- Small-scale solid raw material transfer operations (by hand) vented to a single common fabric filtration device;
- A hot oil system that is exempt from permitting;
- Chilled water systems that are exempt from permitting;

- Various raw material , product, and waste storage tanks that are exempt from permitting;
- Wastewater treatment and storage equipment that are exempt from permitting; and,
- Product transfer to tanker trucks or railcars.

Figure 3.1 depicts the process and sampling location schematic.

3.2 CONTROL EQUIPMENT DESCRIPTION

During this test, emissions from WYDR emission units were controlled by a Durr Systems RTO. To achieve extremely high levels of Destruction/Reduction Efficiency (DRE), the RTO uses high temperature, residence time, and turbulence to convert VOC to carbon dioxide and water vapor. The RTO harnesses the heat content of the pollutants to contribute to the purification process. Depending on the VOC concentration of the process exhaust stream, the RTO can achieve periods of self-sustaining operation, with no supplemental fuel input. Before releasing purified air, the RTO heat exchange media absorb the air's heat energy and use it to pre-heat the incoming, contaminated process exhaust.

3.3 SAMPLING LOCATION(S)

3.3.1 WYDR RTO Inlet Duct

The WYDR RTO Inlet Duct had a measured inner diameter of 24.0-inches, was oriented in the horizontal plane, and was accessed from the ground. Two sampling ports were located 90° apart from one another at a location that met US EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 1.9° was measured. Therefore, the sampling location also met US EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate. A single point, located within the central 10% of the stack cross-sectional area, was utilized for TGO concentration determination. A second point was utilized to measure dry molecular weight.

3.3.2 WYDR RTO Exhaust Stack

The WYDR RTO Exhaust Stack was rectangular in shape with a measured width of 39-inches and a measured depth of 18-inches. The stack was oriented in the vertical plane and was accessed from a permanent platform. Four sampling ports were located equidistant from one another at a location that met US EPA Method 1, Section 11.1.1 criteria. Prior to emissions sampling, the stack was traversed to verify the absence of cyclonic flow. An average yaw angle of 0° was measured. Therefore, the sampling location also met US EPA Method 1, Section 11.4.2 criteria. During emissions sampling, the stack was traversed for stack gas volumetric flow rate. A single point, located within the central 10% of the stack cross-sectional area, was utilized for TGO concentration determination. A second point was utilized to measure dry molecular weight and moisture content.

Figures 3.2 and 3.3 schematically illustrate the traverse point and sample port locations utilized.

3.4 PROCESS SAMPLING LOCATION(S)

The US EPA Reference Test Methods performed did not specifically require that process samples were to be taken during the performance of this testing event. It is in the best knowledge of Montrose that no process samples were obtained and therefore no process sampling location was identified in this report.

FIGURE 3.1
DISPERSIONS AND RESINS PLANT PROCESS AND SAMPLING LOCATION SCHEMATIC

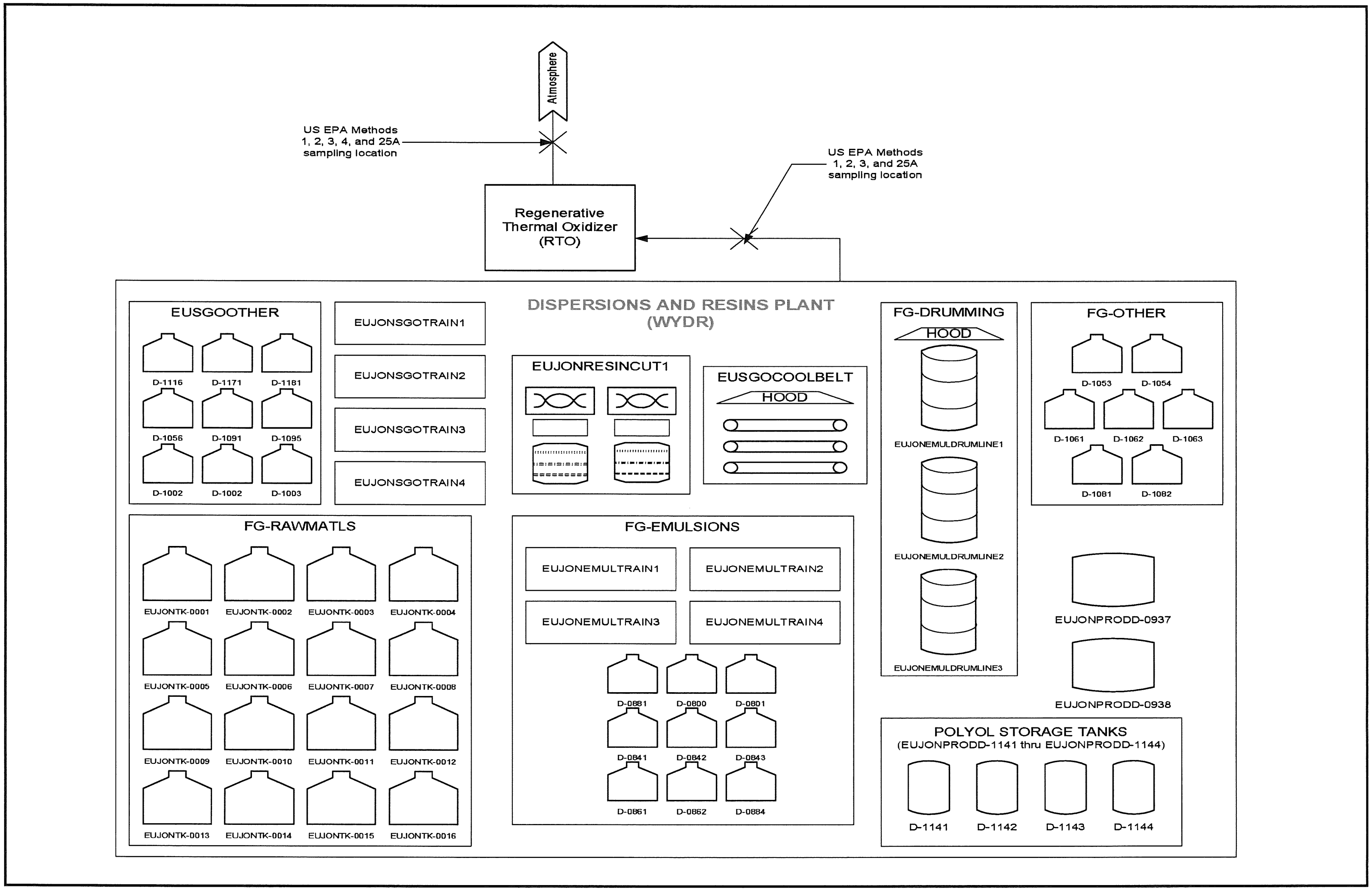

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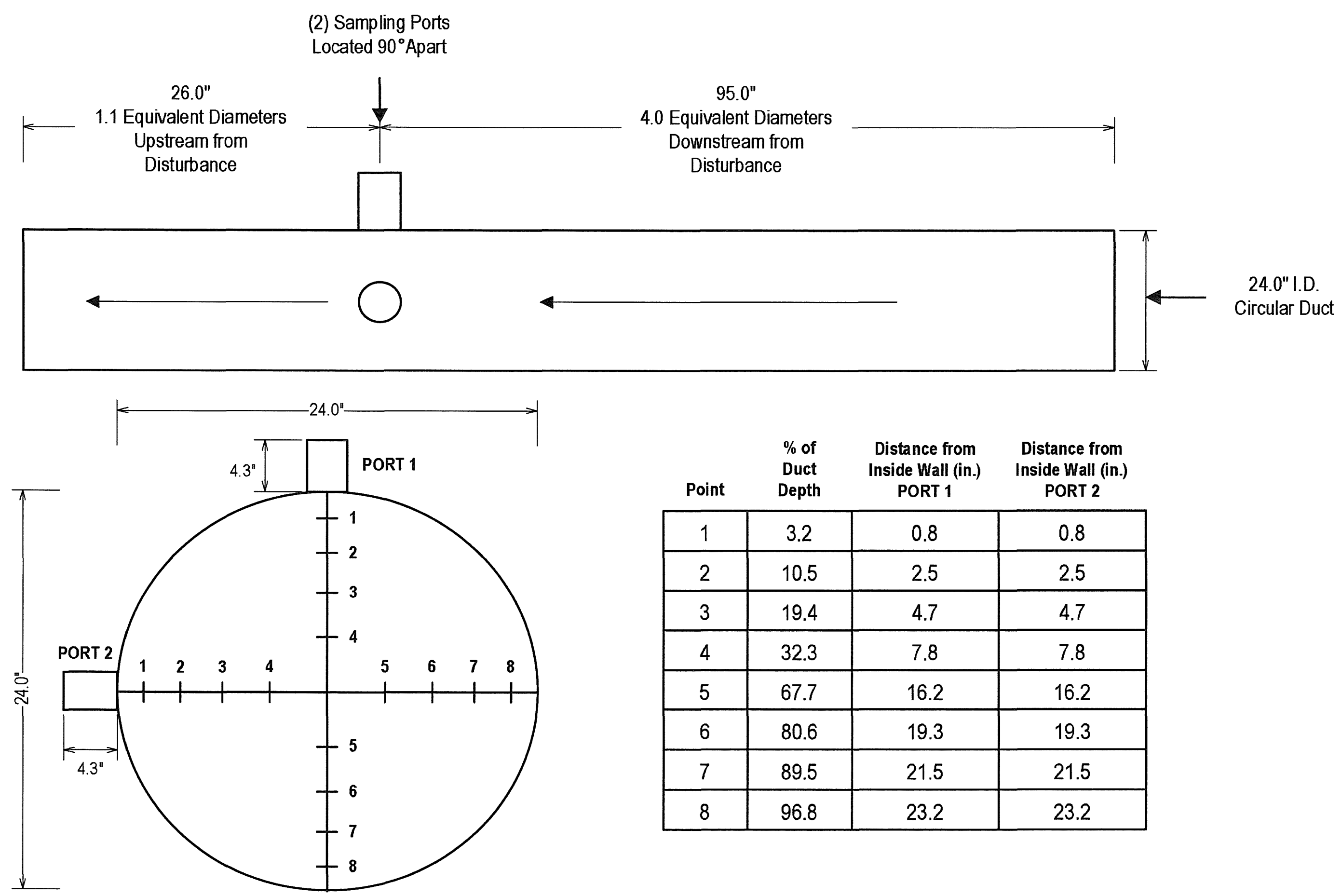
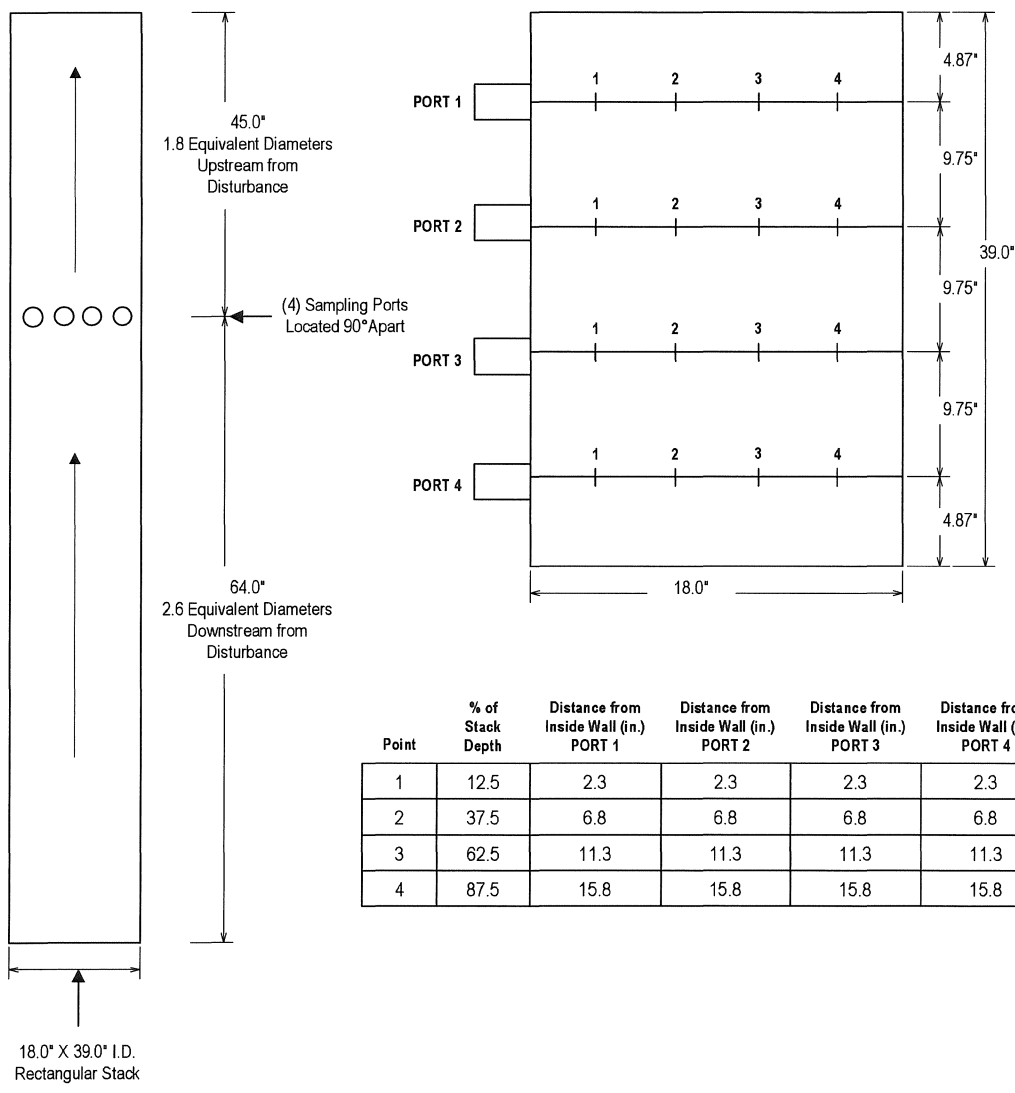
FIGURE 3.2
WYDR RTO INLET DUCT TRAVERSE POINT LOCATION DRAWING



Point	% of Duct Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	0.8	0.8
2	10.5	2.5	2.5
3	19.4	4.7	4.7
4	32.3	7.8	7.8
5	67.7	16.2	16.2
6	80.6	19.3	19.3
7	89.5	21.5	21.5
8	96.8	23.2	23.2

FIGURE 3.3
WYDR RTO EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2	Distance from Inside Wall (in.) PORT 3	Distance from Inside Wall (in.) PORT 4
1	12.5	2.3	2.3	2.3	2.3
2	37.5	6.8	6.8	6.8	6.8
3	62.5	11.3	11.3	11.3	11.3
4	87.5	15.8	15.8	15.8	15.8

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

4.1.1 US EPA Method 1: "Sample and Velocity Traverses for Stationary Sources"

Principle: To aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source, a measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. A traverse point is then located within each of these equal areas. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.2 US EPA Method 2: "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"

Principle: The average gas velocity in a stack is determined from the gas density and from measurement of the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.3 US EPA Method 3: "Gas Analysis for the Determination of Dry Molecular Weight"

Principle: A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2, percent O_2, and if necessary, for percent CO. For dry molecular weight determination, either an Orsat or a Fyrite analyzer may be used for the analysis. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.4 US EPA Method 4: "Determination of Moisture Content in Stack Gases"

Principle: A gas sample is extracted at a constant rate from the source; moisture is removed from the sample stream and determined either volumetrically or gravimetrically. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

4.1.5 US EPA Method 25A: "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer"

Principle: A gas sample is extracted from the source through a heated sample line, if necessary, and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents. Performance specifications and test procedures are provided to ensure reliable data. This method was utilized in its entirety as per the procedures outlined in 40 CFR Part 60, Appendix A.

The sampling trains utilized during this testing project are depicted in Figures 4.1 and 4.2.

4.2 PROCEDURES FOR OBTAINING PROCESS DATA

Process data was recorded by BASF Corporation personnel utilizing their typical record keeping procedures. Recorded process data was provided to Montrose personnel at the conclusion of this test event. The process data is located in the Appendix.

FIGURE 4.1
US EPA METHOD 4 SAMPLING TRAIN SCHEMATIC

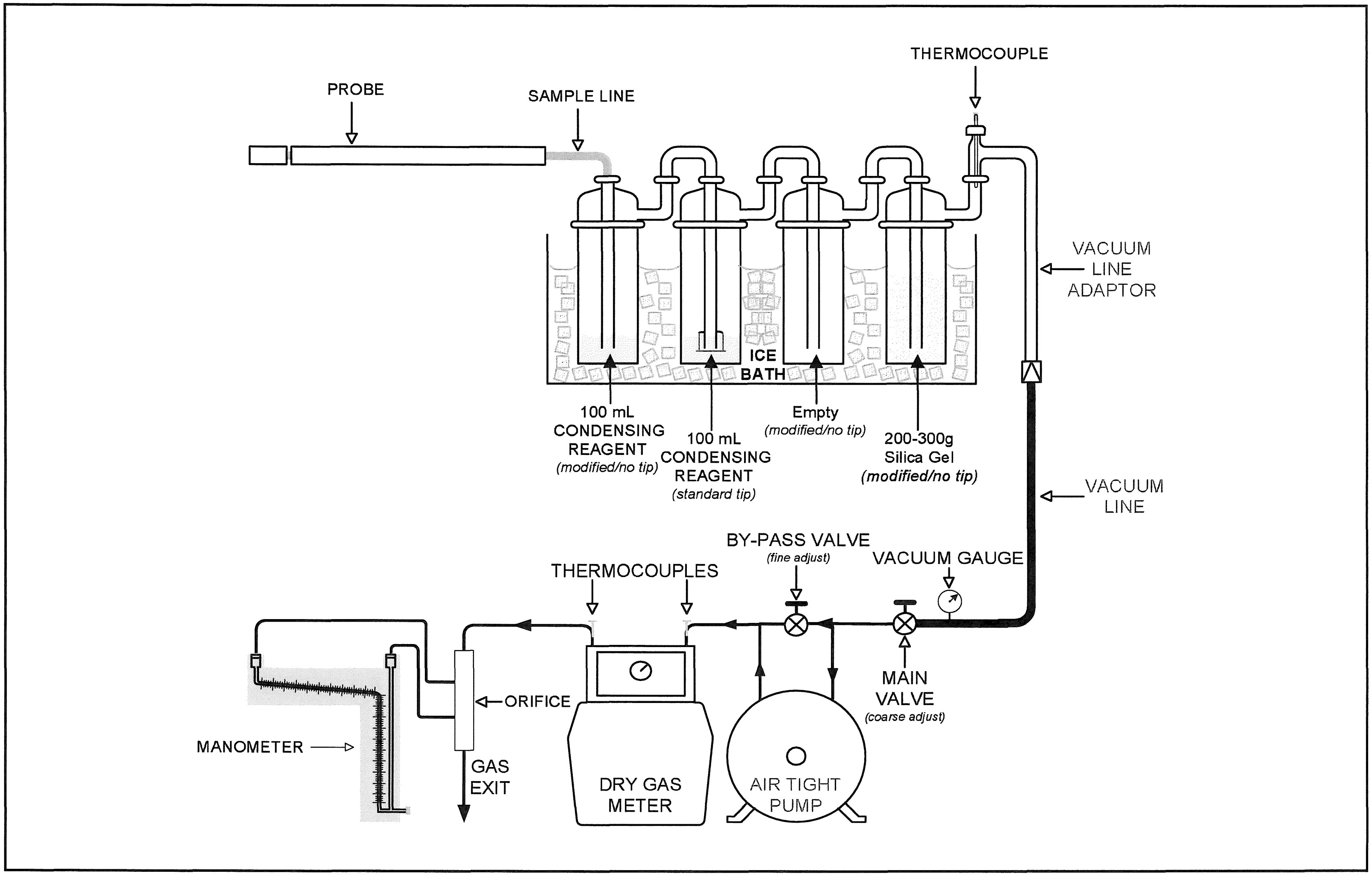
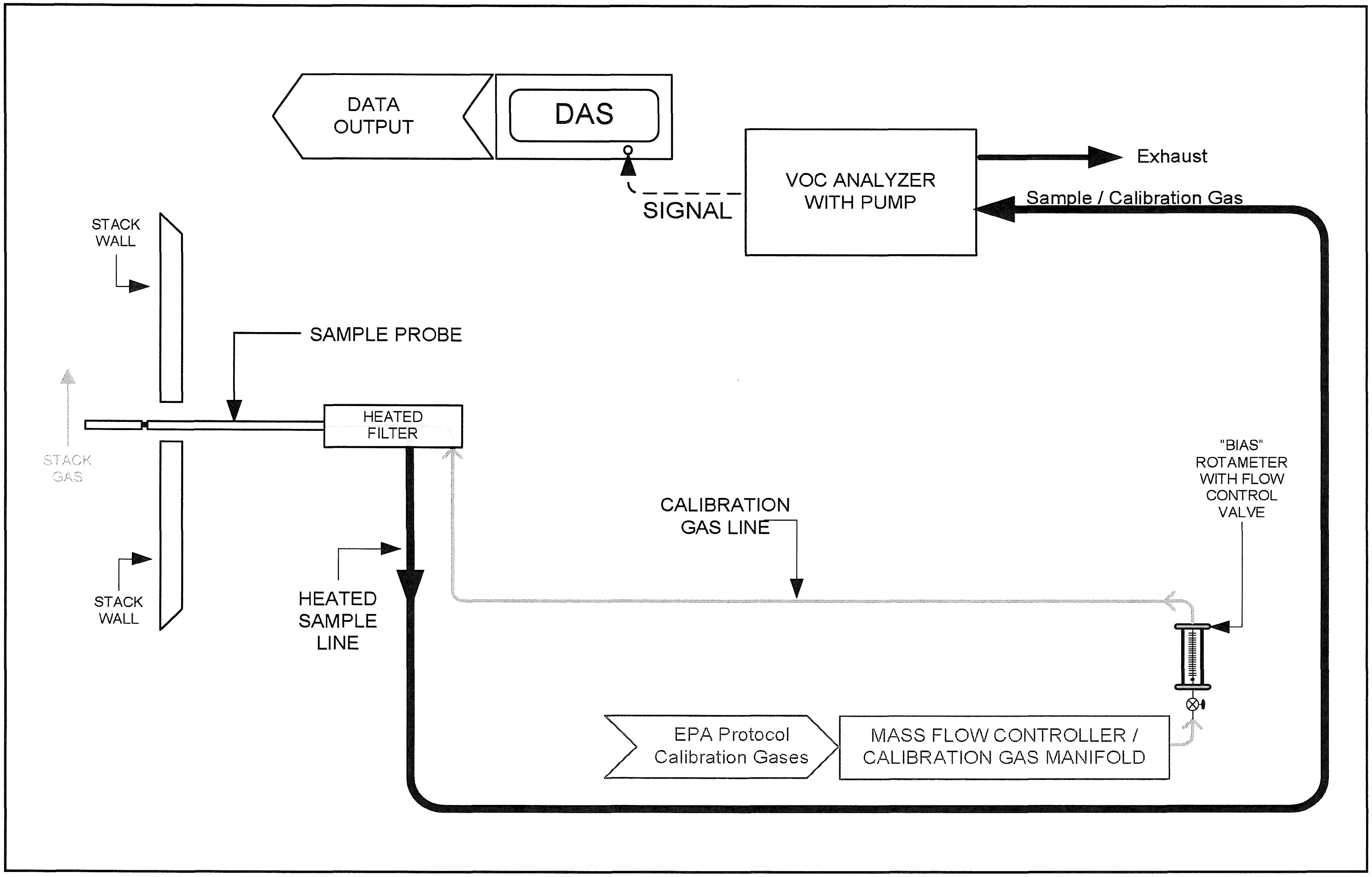


FIGURE 4.2
US EPA METHOD 25A SAMPLING TRAIN SCHEMATIC



5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA AUDITS

Tables 5.1 to 5.5 illustrate the QA audits that were performed during this test.

All meter boxes and sampling trains used during sampling performed within the requirements of their respective methods as is shown in Tables 5.1 and 5.2. All post-test leak checks were well below the applicable limit. Minimum metered volumes were also met where applicable.

Table 5.3 displays the US EPA Method 3 Fyrite Audits which were performed during this test in accordance with US EPA Method 3, Section 10.1 requirements. As shown, all Fyrite analyzer results were within ±0.5% of the respective Audit Gas concentrations.

Table 5.4 illustrate the FIA calibration audits which were performed during this test (and integral to performing US EPA Method 25A correctly) were, except where noted, within the Measurement System Performance Specifications of ±3% of span for the Zero and Calibration Drift Checks, and ±5% of the respective cylinder concentrations for the Calibration Error Checks.

Table 5.5 displays the US EPA Method 205 field evaluation of the calibration gas dilution system utilized during this test event. As shown, the average concentration output at each dilution level was within ±2% of the predicted value. The average concentration output of the direct inject gas was also within ±2% of the certified concentration.

5.2 QA/QC PROBLEMS

No QA/QC problems occurred during this test event.

5.3 QUALITY STATEMENT

Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is presented in the report appendices.

TABLE 5.1
US EPA METHOD 4 SAMPLING TRAIN AUDIT RESULTS

Parameter	Run 1
Sampling Location	**WYDR RTO Exhaust Stack**
Post-Test Leak Rate Observed (cfm)	0.000
Applicable Method Allowable Leak Rate (cfm)	0.020
Acceptable	Yes
Volume of Dry Gas Collected (dscf)	24.711
Recommended Volume of Dry Gas Collected (dscf)	21.000
Acceptable	Yes

TABLE 5.2
US EPA METHOD 4 DRY GAS METER (DGM) AUDIT RESULTS

Parameter	Run 1
Sampling Location	**WYDR RTO Exhaust Stack**
Pre-Test DGM Calibration Factor (Y)	1.0000
Average Post-Test DGM Calibration Check Value (Yqa)	0.9816
Post-Test DGM Calibration Check Value Difference From Pre-Test Calibration Factor (%)	1.84%
Applicable Method Allowable Difference (%)	5.00%
Acceptable	Yes

TABLE 5.3
US EPA METHOD 3 FYRITE AUDIT

Audit Date	**October 28, 2019**	
Audit Gas	**%CO_2**	**%O_2**
Audit Gas Concentration (%)	**10.1**	**10.1**
Fyrite Response 1 (%)	10.0	10.0
Fyrite Response 2 (%)	10.0	10.0
Fyrite Response 3 (%)	10.0	10.0
Average (%)	10.0	10.0
Average Within ±0.5%	Yes	Yes

Audit Gas Cylinder Number: XC012017B

TABLE 5.4
US EPA METHOD 25A ANALYZER CALIBRATION AND QA

	WYDR RTO Inlet Duct					
FIA ANALYZER	RUN 1	Acceptable	RUN 2	Acceptable	RUN 3	Acceptable
Analyzer Span During Test Run (ppmv as propane)	895.5	YES	895.5	YES	895.5	YES
Average Stack Gas Concentration (ppmv as propane)	359.1	YES	361.3	YES	330.0	YES
Zero Drift (% of Span)	0.70	YES	0.20	YES	0.39	YES
Calibration Drift for Mid-Level Gas (% of Span)	0.80	YES	1.27	YES	-0.41	YES
Calibration Error for Low-Level Gas (% of Cal. Gas Tag Value)	0.24	YES	0.24	YES	0.24	YES
Calibration Error for Mid-Level Gas (% of Cal. Gas Tag Value)	0.24	YES	0.24	YES	0.24	YES

	WYDR RTO Exhaust Stack					
FIA ANALYZER	RUN 1	Acceptable	RUN 2	Acceptable	RUN 3	Acceptable
Analyzer Span During Test Run (ppmv as propane)	90.3	YES	90.3	YES	90.3	YES
Average Stack Gas Concentration (ppmv as propane)	17.1	YES	18.5	YES	17.2	YES
Zero Drift (% of Span)	2.34	YES	0.11	YES	1.57	YES
Calibration Drift for Mid-Level Gas (% of Span)	1.04	YES	-1.02	YES	-0.03	YES
Calibration Error for Low-Level Gas (% of Cal. Gas Tag Value)	0.17	YES	0.17	YES	0.17	YES
Calibration Error for Mid-Level Gas (% of Cal. Gas Tag Value)	-0.66	YES	-0.66	YES	-0.66	YES

TABLE 5.5
US EPA METHOD 205 GAS DILUTION SYSTEM QA

Analyzer Serial Number: 3737
Dilution System Serial Number: 2750806
CGD Mass Flow Controllers Used: 1 and 2

	Dilution Level 1	Dilution Level 2	Direct Inject Gas
Calibration Tag Value (ppm):	895.5	895.5	90.33
Dilution Ratio:	8.98	4.48	-
Predicted Diluted Value (ppm):	99.70	200.00	-
Injection 1 Response (ppm):	101.20	203.27	90.99
Injection 2 Response (ppm):	100.70	200.59	88.67
Injection 3 Response (ppm):	100.55	199.65	90.16
Average Response (ppm):	100.82	201.17	89.94
Difference From Predicted (%):	-1.12	-0.58	0.43
Acceptable (YES/NO):	yes	yes	yes