SOURCE TEST REPORT
2020 COMPLIANCE EMISSIONS TESTING

PACKAGING CORPORATION OF AMERICA
FILER CITY, MICHIGAN

COPELAND REACTOR (EUCOPELAND+DISTANK)

Prepared For:

Packaging Corporation of America
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For Submittal To:

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Document Number:	**M049AS-682987-RT-322**
Test Date:	**February 20, 2020**
Submittal Date:	**March 23, 2020**

STAC

ACCREDITED
TO ASTM D7036 ONLY
CERT #3925.01

MONTROSE
AIR QUALITY SERVICES

REVIEW AND CERTIFICATION

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: _____ Date: 03/23/2020

Name: Mason Sakshaug Title: Field 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: Matthew Young Date: 03/23/2020

Name: Matthew Young Title: District Manager

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1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

Packaging Corporation of American (PCA) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the Copeland Reactor (EUCOPELAND+DISTANK) at the PCA facility located in Filer City, Michigan. The tests were conducted to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-B3692-2015b and 40 CFR Part 63, Subpart MM.

The specific objectives were to:

- Verify the Hazardous Air Pollutants (HAPS) destruction efficiency (DE) of the regenerative thermal oxidizer (RTO) controlling emissions from EUCOPELAND+DISTANK. Per the permit, HAPS are as measured by total hydrocarbons (THC) reported as carbon.
- Conduct the test program with a focus on safety.

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

TABLE 1-1
SUMMARY OF TEST PROGRAM

Test Date(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
2/20/2020	EUCOPELAND+DISTANK Inlet Duct	THC	EPA 25A w/ non-methane cutter	3	60
2/20/2020	EUCOPELAND+DISTANK Exhaust Stack	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	6-7
2/20/2020	EUCOPELAND+DISTANK Exhaust Stack	O_2, CO_2	EPA 3	3	30
2/20/2020	EUCOPELAND+DISTANK Exhaust Stack	Moisture	EPA 4	3	30
2/20/2020	EUCOPELAND+DISTANK Exhaust Stack	THC	EPA 25A w/ non-methane cutter	3	60

To simplify this report, a list of Units and Abbreviations is included in Appendix C.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-3. The tests were conducted according to the test plan (protocol) dated January 8, 2020 that was submitted to and approved by the EGLE.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUCOPELAND+DISTANK
FEBRUARY 20, 2020

Parameter/Units	Average Results	Emission Limits
Total Non-Methane Hydrocarbons, as Carbon (HAPS) at Inlet		
lb/hr	687.9	--
Total Non-Methane Hydrocarbons, as Carbon (HAPS) at Exhaust		
lb/hr	52.1	--
HAPS Destruction Efficiency		
%	92.4	90

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	PCA 2246 Udell Street Filer City, MI 49634	
Project Contact:	Sara Kaltunas	Dyllan Walker
Role:	Environmental Manager	Environmental Engineer
Company:	PCA	PCA
Telephone:	231-723-9951 ext. 465	231-723-1434
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Agency Information

Regulatory Agency:	EGLE	EGLE
Agency Contact:	Karen Kajiya-Mills	Rob Dickman
Telephone:	517-284-6780	
Email:	kajiya-millsk@michigan.gov	DICKMANR@michigan.gov

Regulatory Agency:	EGLE
Agency Contact:	Jeremy Howe
Telephone:	231-878-6687
Email:	HoweJ1@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Matthew Young	Mason Sakshaug
Title:	District Manager	Field Project Manager
Telephone:	248-548-8070	248-548-8070
Email:	myoung@montrose-env.com	msakshaug@montrose-env.com

Test personnel and observers are summarized in Table 1-3.

TABLE 1-3
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
Mason Sakshaug	Montrose	Field Project Manager, QI
Jack Hoard	Montrose	Field Project Manger/CEMS, QI
Walter T. Mummert, III	Montrose	Field Project Manager/CEMS, QI
Michael Nummer	Montrose	Field Technician

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The Copeland Reactor at the PCA facility is a fluidized bed design, which recovers sodium carbonate from the spent pulping liquor, or black liquor. Black liquor is fired into the Copeland Reactor at approximately 50% solids. Organic material in the liquor burns and the resultant sodium forms sodium carbonate pellets. Pellets are drawn off to maintain the proper fluidized bed height.

Exhaust gases are conveyed to two parallel cyclones, then to a venturi scrubber, and a separator vessel equipped with a demister section before being exhausted to a wet electrostatic precipitator (WESP) followed by an RTO to reduce HAPS emissions from the Copeland Reactor.

2.2 FLUE GAS SAMPLING LOCATIONS

Information regarding the sampling locations are presented in Table 2-1.

TABLE 2-1
SAMPLING LOCATIONS

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
RTO Inlet Duct	--	--	--	Gaseous: 1
RTO SV-102 Exhaust Stack	79.0	144.0 / 1.8	360.0 / 4.0	Flow: 16 (8/port); Gaseous: 1

Due to safety concerns for taking certain measurements at the pressurized inlet system and with the approval of EGLE, only THC sampling was performed at the RTO Inlet. For the purpose of this test, RTO Inlet Duct flow rates were assumed to be equal to the gas stream flow rate measured at the RTO SV-102 Exhaust Stack.

The sampling location at the RTO SV-102 Exhaust Stack did not meet EPA Method 1, Section 11.1.1 criteria, which requires that the sample ports be located at a position at least two stack diameters downstream and a half diameter upstream from any flow disturbance. The sampling location at the RTO SV-102 Exhaust stack was 1.8 equivalent diameters downstream from the nearest flow disturbance. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendix A for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the Copeland Reactor and air pollution control devices were operating at the conditions required by the permit. The reactor was tested when firing 65 gallons per minute (gpm) of black liquor.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B. Data collected includes the following parameters:

- RTO temperature
- Black Liquor Solids production rate, lb/min and ton/hr
- Liquor Feed Rate to gun, gpm

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

The sample port and traverse point locations are detailed in Appendix A.

3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer. The measurements are made at traverse points specified by EPA Method 1.

3.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

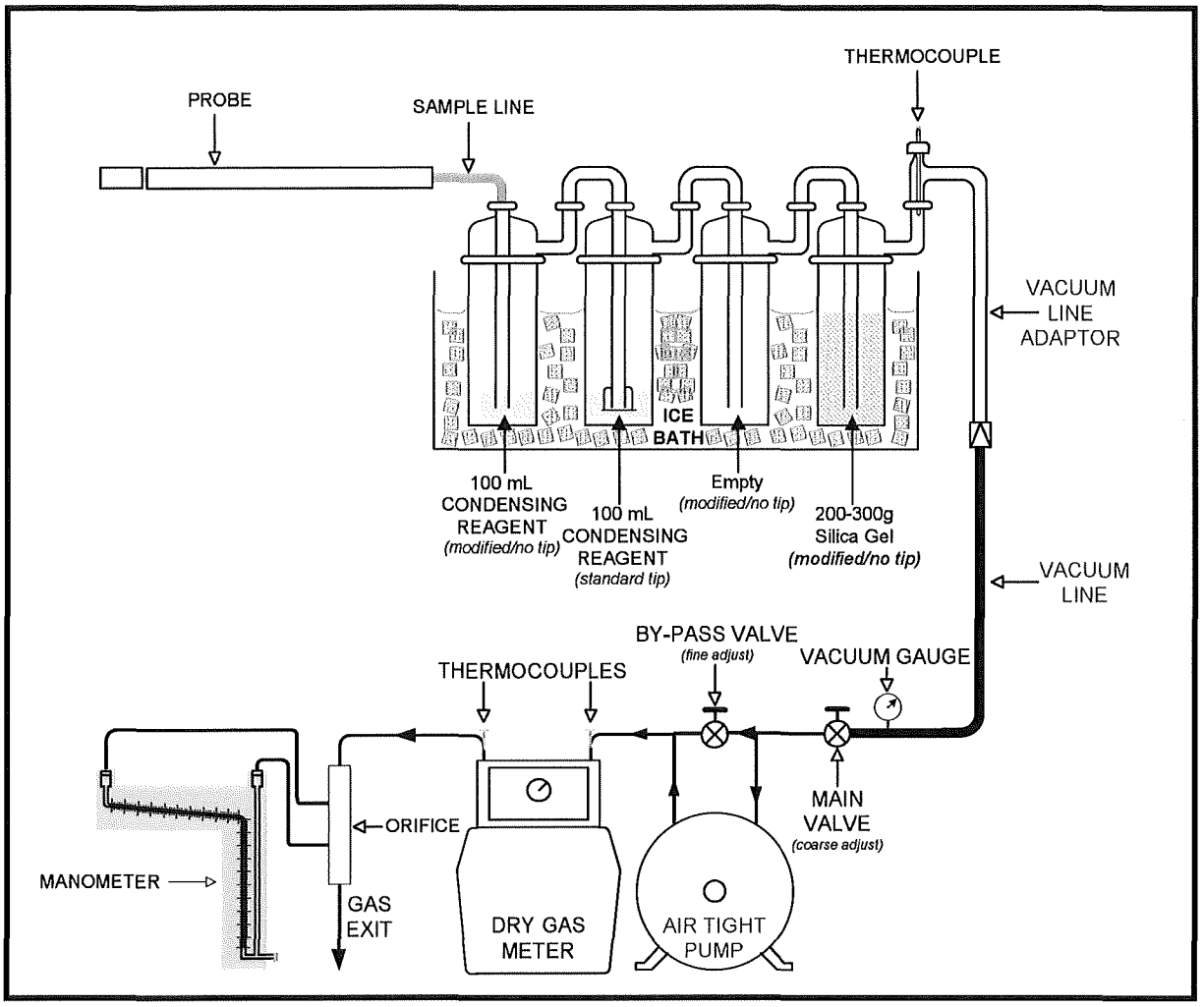
EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is to measure the percent O_2 and CO_2 in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2 and percent O_2 using either an Orsat or a Fyrite analyzer. The second choice is to use stoichiometric calculations to calculate dry molecular weight. The third choice is to use an assigned value of 30.0, in lieu of actual measurements, for processes burning natural gas, coal, or oil.

3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

The typical sampling system is detailed in Figure 3-1.

FIGURE 3-1
US EPA METHOD 4 DETACHED SAMPLING TRAIN



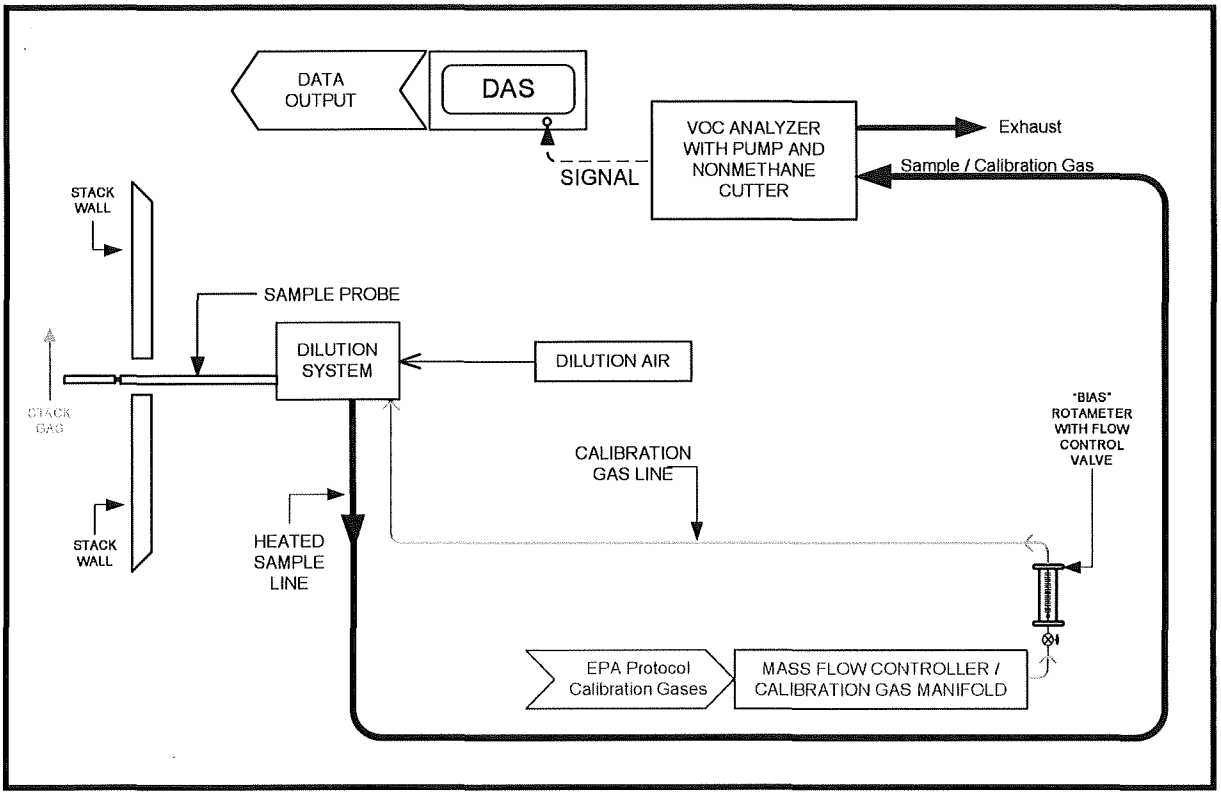
3.1.5 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line 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.

For the purpose of this test, dual FIAs were utilized to measure THC (as propane) and CH_4 (as methane).

The typical sampling system is detailed in Figure 3-2.

FIGURE 3-2
US EPA METHOD 25A (DILUTION) WITH SAMPLING TRAIN



3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

Run 1 was voided, and an additional run (Run 4) was performed. See Section 5.2 for details.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Tables 4-1 and 4-2. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

TABLE 4-1
HAPS EMISSIONS RESULTS -
EUCOPELAND+DISTANK RTO INLET DUCT

Run Number	2	3	4	Average
Date	2/20/2020	2/20/2020	2/20/2020	--
Time	11:15-12:15	13:00-14:00	14:45-15:45	--
Flue Gas Parameters				
volumetric flow rate, scfm	66755	66869	62914	65513
Total Gaseous Organics as Carbon (TGO)				
ppmvw	9978.2	9782.7	9558.4	9773.1
Methane as Carbon (CH_4)				
ppmvw	4174.9	4166.1	4148.8	4163.3
Total Non-Methane Hydrocarbons, as Carbon (HAPS)				
ppmvw	5803.3	5616.6	5409.5	5609.8
lb/hr	742.3	702.5	636.6	693.8

TABLE 4-2
HAPS DE AND EMISSIONS RESULTS -
EUCOPELAND+DISTANK RTO SV-102 EXHAUST STACK

Run Number	2	3	4	Average
Date	2/20/2020	2/20/2020	2/20/2020	--
Time	11:15-12:15	13:00-14:00	14:45-15:45	--
Process Data				
Black liquor solids, tons/hr	8.441	8.317	8.288	8.349
RTO Temperature (°F)	1696	1693	1679	1689
Flue Gas Parameters				
O_2, % volume dry	7.50	9.00	9.00	8.50
CO_2, % volume dry	9.50	8.00	9.00	8.83
flue gas temperature, °F	192.2	212.2	184.5	196.3
moisture content, % volume	46.53	49.84	48.71	48.36
volumetric flow rate, scfm	66755	66869	62914	65513
Total Gaseous Organics as Carbon (TGO)				
ppmvw	1002.4	954.4	950.8	969.2
Methane as Carbon (CH_4) ppmvw	558.9	544.3	528.3	543.8
Total Non-Methane Hydrocarbons, as Carbon (HAPS)				
ppmvw	443.5	410.1	422.5	425.4
lb/hr	55.4	51.3	49.7	52.1
HAPS Destruction Efficiency				
%	92.5	92.7	92.2	92.5

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter box and sampling train used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes met the applicable QA/QC criteria.

Fyrite analyzer audits were performed during this test in accordance with EPA Method 3, Section 10.1 requirements. The results were within ± 0.5% of the respective audit gas concentrations.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks, except as noted in Section 5.2.

An EPA Method 205 field evaluation of the calibration gas dilution system was conducted. The dilution accuracy and precision QA specifications were met.

5.2 QA/QC DISCUSSION

The Run 1 post-test calibration drift check performed for the FIA used at the RTO Inlet Duct did not meet EPA Method 25A, Section 9.0 requirements. Therefore, Run 1 was voided, the analyzer was recalibrated, and an additional run (Run 4) was performed. Run 1 data has been saved to the Appendix A.4.

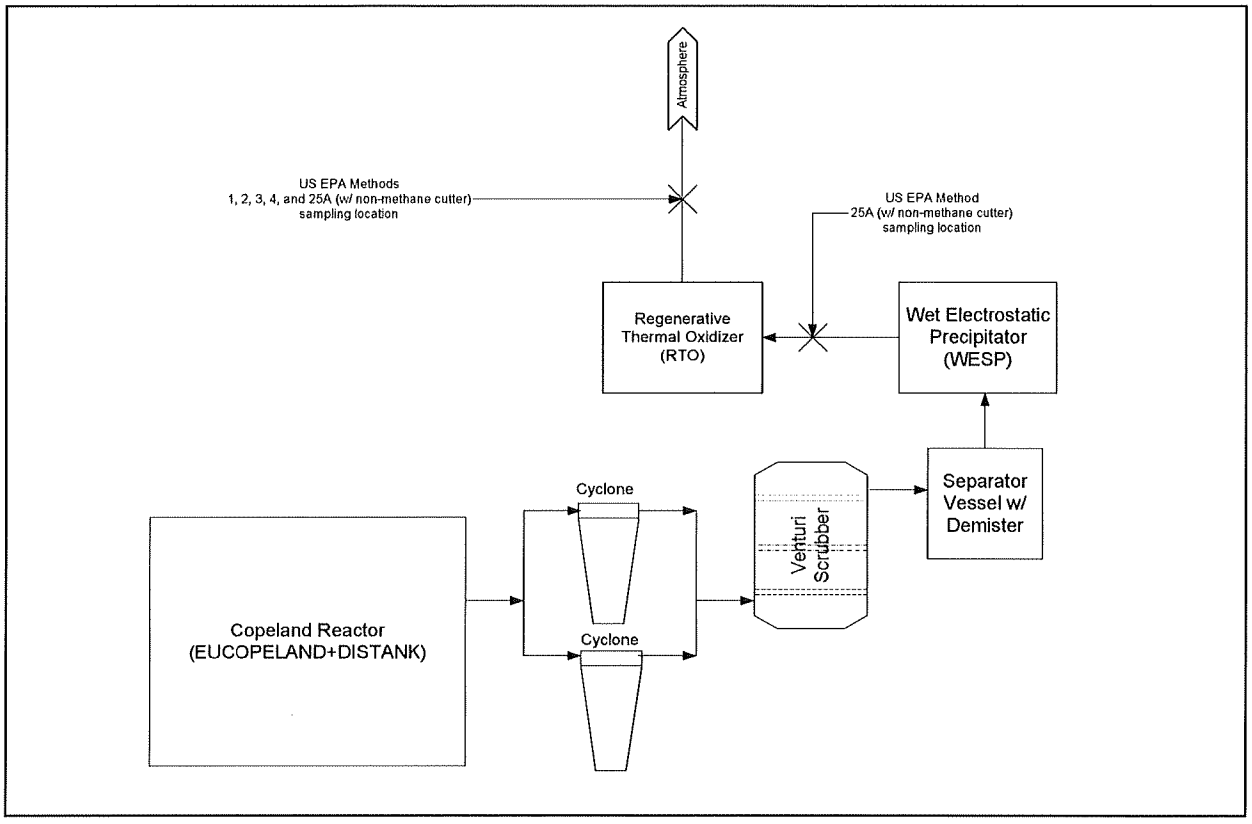
5.3 QUALITY STATEMENT

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 included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).

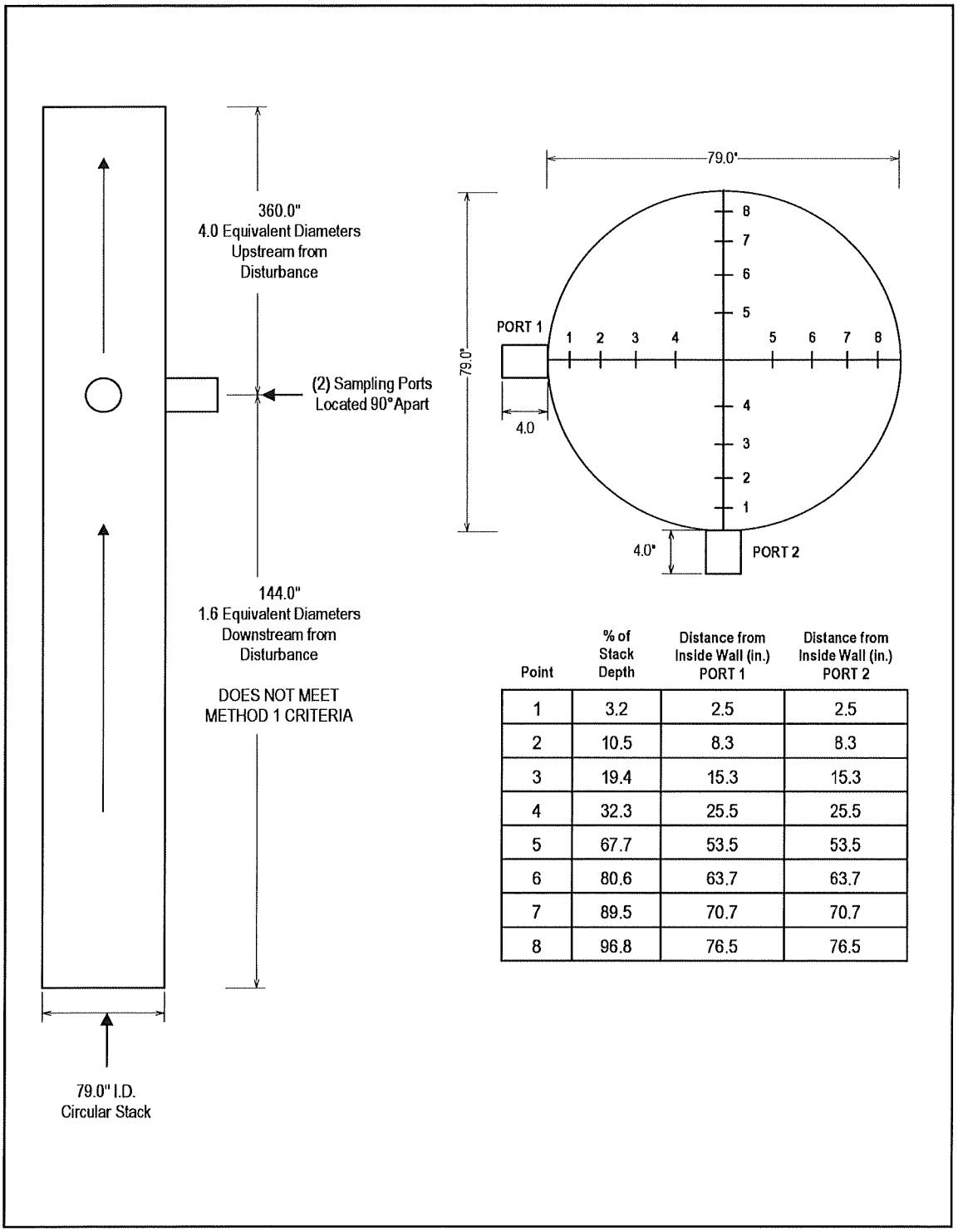
APPENDIX A
FIELD DATA AND CALCULATIONS

Appendix A.1
Sampling Locations

COPELAND REACTOR (EUCOPELAND+DISTANK) SAMPLING LOCATION SCHEMATIC

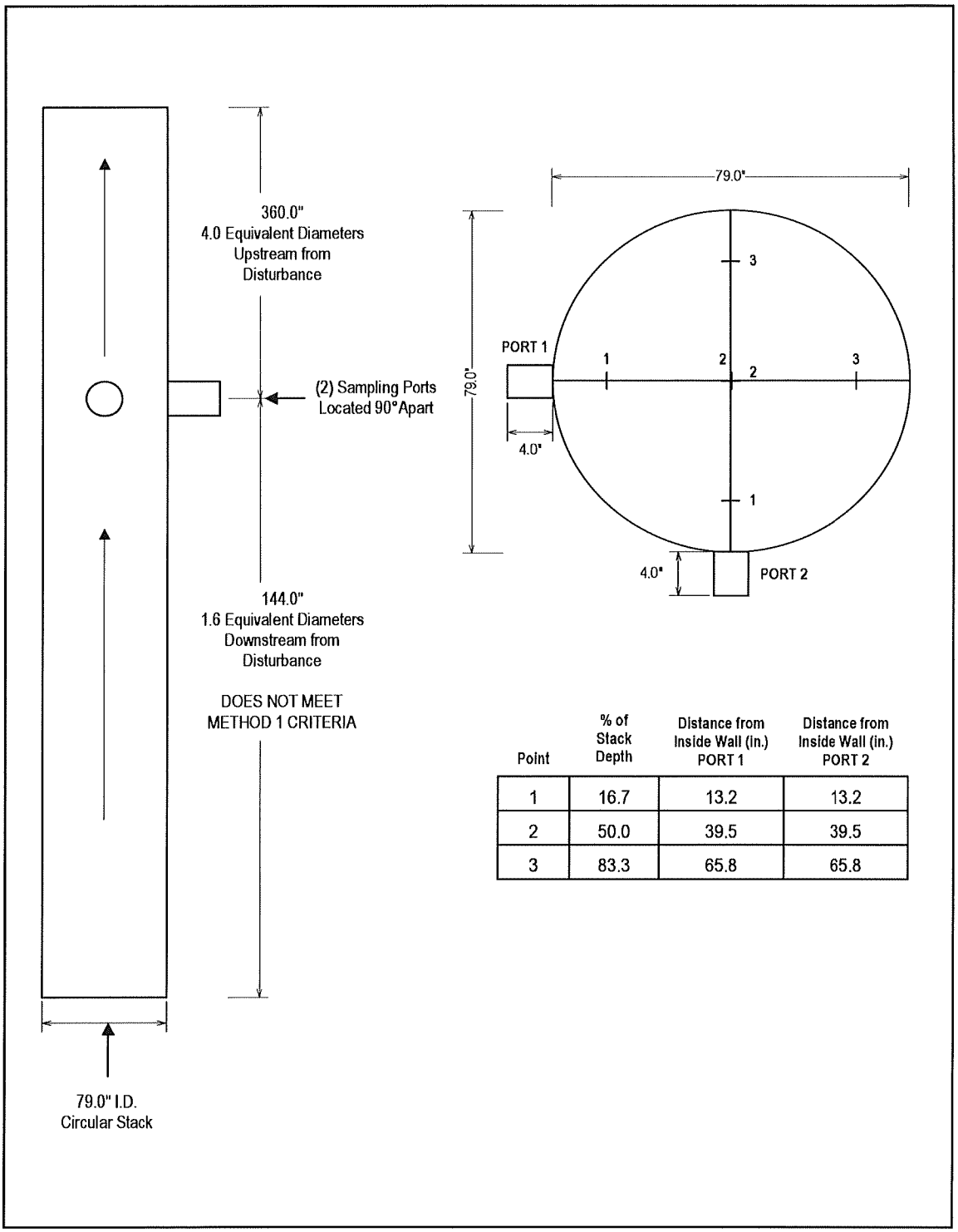


RTO SV-102 EXHAUST FLOW TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	2.5	2.5
2	10.5	8.3	8.3
3	19.4	15.3	15.3
4	32.3	25.5	25.5
5	67.7	53.5	53.5
6	80.6	63.7	63.7
7	89.5	70.7	70.7
8	96.8	76.5	76.5

RTO SV-102 EXHAUST CEMS TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	16.7	13.2	13.2
2	50.0	39.5	39.5
3	83.3	65.8	65.8