Relative Accuracy Test Audit and Pollutant Destruction Efficiency of the FGDRYERS RTO and EUPRESSLINE Biofilter

Weyerhaeuser

Weyerhaeuser Company
4111 West Four Mile Road
Grayling, Michigan

State Registration No. B7302
Renewable Operating Permit MI-ROP-B7302-2010a

Prepared for
Weyerhaeuser Company
Grayling, Michigan

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Weyerhaeuser Company retained Bureau Veritas North America, Inc. to conduct compliance air emissions testing at the EUPRESSLINE Biofilter and FGDRYERS regenerative thermal oxidizer (RTO) sources at the Weyerhaeuser Company facility located at 4111 West Four Mile Road in Grayling, Crawford County, Michigan. The objectives of the testing were to:

- Measure the relative accuracy of the volatile organic compound (VOC) continuous emission rate monitoring system (CERMS) at the EUPRESSLINE Biofilter exhaust stack.
- Measure the relative accuracy of the carbon monoxide (CO) and VOC CERMS at the FGDRYERS RTO exhaust stack.
- Evaluate the total hazardous air pollutant (HAP) destruction efficiency—measured as total hydrocarbon (THC)—of the FGDRYERS RTO and establish the minimum RTO firebox combustion temperature.

The purpose of the testing was to evaluate the accuracy of the CERMS required by 40 CFR Part 60, Appendix F, "Quality Assurance Procedures" and Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B7302-2010a, effective April 20, 2010. Testing for the THC removal efficiency of the FGDRYERS RTO was performed as a requirement of 40 CFR 60, Subpart DDDD, National Emissions Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products," as incorporated in the ROP, because the southern RTO was recently replaced.

In this report the term VOC and THC are used interchangeably because the applicable ROP and test methods reference VOC whereas the federal requirements of 40 CFR 60, Subpart DDDD, "National Emission Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products," reference THC.

The testing was completed in accordance with United States Environmental Protection Agency (USEPA) Reference Methods 1 through 4, 10, 25A, and 205, and Performance Specifications (PS) 4, 6 and 8. The relative accuracy (RA) of the CERMS was calculated in units of the applicable emission standard.

The testing was conducted on December 8 through 10, 2015, and consisted of (1) three 60-minute test runs at the FGDRYERS RTO source for THC pollutant destruction efficiency and (2) a minimum of nine 21-minute test runs at the outlet of the EUPRESSLINE Biofilter and FGDRYERS RTO to measure volumetric flowrate and VOC concentrations and evaluate CERMS relative accuracy. Carbon monoxide concentrations and mass emission rates were measured at the outlet of the FGDRYERS RTO source to evaluate the CO CERMS relative accuracy.

Detailed results are presented in Tables 1 through 5 after the Tables Tab of this report. The results of the testing are summarized below.

Relative Accuracy Test Audit Results

Date (2015)	Parameter	Unit	Average Reference Method (RM) Result	Average CERMS Result	Difference between CERMS and RM	Relative Accuracy (RA) (%)	RA Performance Specification (%)
EUPRESSLINE (Biofilter)							
Dec. 8	VOC	lb/hr as carbon	13.05	13.13	-0.08	**3.7**	≤20 RA
FGDRYERS (RTO)							
Dec. 9	VOC	lb/hr, as carbon	55.22	47.44	7.78	**22.2**	≤20 RA
Dec. 9	CO	lb/hr	155.76	132.11	23.65	**8.0**	≤10 RA
Dec. 10	VOC	lb/hr, as carbon	5.63	4.92	0.71	**9.9**	≤10 RA

CERMS: continuous emission rate monitoring system
lb/hour: pound per hour
RTO: regenerative thermal oxidizer
VOC: volatile organic compound
CO: carbon monoxide

The RA of the FGDRYERS RTO VOC (PS8) and flowrate (PS6) CERMS RATA tests performed December 9, 2015, were within the allowable performance specification limits; however, the RA calculated in units of the applicable standard, lb VOC/hr, as carbon, exceeded the ≤20% RA criterion. The RATA on December 9, 2015, was performed during initialization and start-up of the new south RTO. Therefore, additional RATA tests were performed on December 10, 2015. The RA results of these tests indicate the CERMS is operating in compliance with performance specification limits.

The VOC and CO measurements demonstrate the facility's CERMS are operating within allowable relative accuracy limits.

FGDRYERS RTO VOC Destruction Efficiency Testing Results

Date (2015)	Source ID	Parameter	Units	Average Result	Emission Limit
Dec. 10	FGDRYERS (RTO)	VOC destruction efficiency	%	**90.8**	≥90
		Average operating temperature	°F	**1,352**	Not Applicable

RTO: regenerative thermal oxidizer
VOC: volatile organic compound

The VOC DE measurements demonstrate the FGDRYERS RTO source is operating within the permit limit at a minimum firebox temperature of 1,352°F.

1.0 Introduction

Weyerhaeuser Company retained Bureau Veritas North America, Inc. to conduct compliance air emissions testing for the EUPRESSLINE Biofilter and FGDRYERS regenerative thermal oxidizer (RTO) sources at the Weyerhaeuser Company facility located at 4111 West Four Mile Road in Grayling, Crawford County, Michigan. The objectives of the testing were to:

- Measure the relative accuracy of the volatile organic compound (VOC) continuous emission rate monitoring system (CERMS) at the EUPRESSLINE Biofilter exhaust stack.
- Measure the relative accuracy of the carbon monoxide (CO) and VOC CERMS at the FGDRYERS RTO exhaust stack.
- Evaluate the total hazardous air pollutant (HAP) destruction efficiency—measured as total hydrocarbon (THC) —of the FGDRYERS RTO and establish the minimum RTO firebox combustion temperature.

The purpose of the testing was to evaluate the accuracy of the CERMS required by 40 CFR Part 60, Appendix F, "Quality Assurance Procedures" and Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B7302-2010a, effective April 20, 2010. Weyerhaeuser is renewing the ROP. Testing for the THC removal efficiency of the FGDRYERS RTO was performed as a requirement of 40 CFR 60, Subpart DDDD, National Emissions Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products," as incorporated in the ROP because the southern RTO was recently replaced.

In this report the term VOC and TCH are used interchangeably because the applicable ROP and test methods reference "VOC" whereas the federal requirements of 40 CFR 60, Subpart DDDD, "National Emission Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products," reference "THC."

Relative Accuracy (RA) means the absolute mean difference between the gas concentration, flow, or emission rate measured by the monitor and the value measured using the reference method (RM), plus the 2.5%-error confidence coefficient of a series of tests, divided by the mean of the RM test runs:

$$RA = 100\frac{\left|\overline{(C_{RM} - C_m)}\right| + t_{\alpha,n-1}\left(\frac{S_d}{\sqrt{n}}\right)}{\overline{C_{RM}}}$$

where:

RA	=	% relative accuracy
C_{RM}	=	parameter measured by reference method
Cm	=	parameter measured by CEMS or CERMS (i.e., the monitor)
$\overline{\lvert C_{RM} - C_m \rvert}$	=	absolute value of mean of the differences between C_{RM} and C_m for the valid test runs
$\overline{C_{RM}}$	=	mean of test run parameter measured by reference method (mean of RM test runs)
$t_{\alpha,n-1}$	=	t value with $\alpha = 0.025$, which is a confidence level of 97.5%
S_d	=	standard deviation of the differences between C_{RM} and C_m
n	=	number of measurements (i.e., test runs)

The confidence coefficient (CC) is:

$$CC = t_{\alpha,n-1}\left(\frac{S_d}{\sqrt{n}}\right)$$

The 2.5%-error confidence coefficient is calculated using a t value corresponding to the 97.5% confidence level.

The testing was conducted December 8 through 10, 2015. The testing was completed in accordance with United States Environmental Protection Agency (USEPA) Reference Methods 1 through 4, 10, 25A, and 205, and Performance Specifications 4, 6 and 8.

1.1 Summary of Test Program

The Weyerhaeuser Company facility manufactures oriented-strand board (OSB) comprised of dry wood strands, resin, and wax pressed under high temperature and pressure. Air emissions from the wood strand drying process are controlled by a WESP and FGDRYERS RTO. Air emissions from the board press operations are controlled by the EUPRESSLINE Biofilter . Air emissions were measured from the EUPRESSLINE Biofilter and FGDRYERS RTO sources during this test program.

The testing was conducted on December 8 through 10, 2015 and consisted of three 60-minute test runs at the FGDRYERS RTO source for THC pollutant destruction efficiency testing and a minimum of nine 21-minute test runs at the outlet of the EUPRESSLINE Biofilter and FGDRYERS RTO to measure volumetric flowrate and VOC concentrations to evaluate CERMS relative accuracy. Carbon monoxide concentrations and mass emission rates were measured at the outlet of the FGDRYERS RTO source to evaluate the CO CERMS relative accuracy.

Table 1-1 summarizes the source identification, description, test parameters, and test dates.

Table 1-1
Source ID, Unit Description, Parameters, and Test Dates

Source ID	Unit Description	Pollutant to be Measured	Test Date
FGDRYERS RTO inlet	Inlet to wet electrostatic precipitator and RTO	VOC DE	December 10, 2015
FGDRYERS RTO outlet	SVRTOSTACK	VOC DE	December 10, 2015
		Flowrate, CO, and VOC RATA	December 9 and 10, 2015
EUPRESSLINE Biofilter outlet	SVBIOFILTER	Flowrate, VOC RATA	December 8, 2015

RTO: Regenerative Thermal Oxidizer
RATA: Relative Accuracy Test Audit
VOC: volatile organic compound
CO: carbon monoxide

1.2 Purpose of Testing

The testing was performed to evaluate the accuracy of the VOC CEMS of the EUPRESSLINE Biofilter, THC destruction efficiency of the FGDRYERS RTO, and accuracy of the VOC and CO CEMS as required by 40 CFR Part 60, Appendix F, "Quality Assurance Procedures," 40 CFR 60, Subpart DDDD, National Emissions Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products," and MDEQ ROP MI-ROP-B7302-2010a, effective April 20, 2010.

1.3 Contact Information

Contact information is listed in Table 1-2. Mr. Thomas Schmelter, Senior Project Manager with Bureau Veritas led the emission testing program. Ms. Kathi Moss, Environmental, Health, and Safety Manager, with Weyerhaeuser Company provided process coordination and arranged for facility operating parameters to be recorded. The testing was witnessed by Mr. David Patterson, Environmental Quality Analyst with the MDEQ.

Table 1-2
Contact Persons

Permitee	Emission Testing Company
Weyerhaeuser Company 4111 West Four Mile Road Grayling, Michigan 49738 Telephone 989.348.3475 Facsimile 989.348.8226	Bureau Veritas North America, Inc. 22345 Roethel Drive Novi, Michigan 48375 Telephone 248.344.1770 Facsimile 248.344.2656
Kathi Moss Environmental, Health, and Safety Manager Telephone 989.348.3475 kathi.moss@weyerhaeuser.com	Thomas Schmelter, QSTI Senior Project Manager Telephone 248.344.3003 thomas.schmelter@us.bureauveritas.com
Michigan Department of Environmental Quality	
MDEQ – Air Quality Division Technical Programs Unit Constitution Hall, 2nd Floor, South 525 West Allegan Street Lansing, Michigan 48909-7760 Telephone 517.335.3082 Facsimile 517.241.3571	
David Patterson Environmental Quality Analyst Telephone 517.284.6782 pattersond2@michigan.gov	

2.0 Source and Sampling Locations

2.1 Process Description

Weyerhaeuser Company manufactures oriental strand board (OSB) at the facility in Grayling, Michigan. Wood logs are sorted by species and stored in the wood yard. Logs are transferred to heated vats to clean and thaw (in winter months) the wood. The wood logs are conveyed from the vats to a debarking machine that removes the outer layers of the logs. A strand machine then shreds the logs into thin wood chips (strands). The strands are conveyed to a storage bin where they are fed into four wood-fired dyers. The dryers remove moisture from the strands to achieve product-specific moisture content. Air emissions from this process are directed to the WESP and regenerative thermal oxidizers for pollution control. The strands exit the dryers and are sorted according to size using shaker screens.

The fine strands are collected and used as fuel for process heaters. The larger strands are conveyed to a blending area where wax and resins are added for adhesion purposes. The strands are layered, at different angles for strength, onto an 8-foot-wide conveyor belt. The layered strands are cut into 8-foot-by-24-foot sections and formed into mats. The mats are stacked and a press is used to heat and compact the strands to form OSB. Depending on the thickness of the product (i.e., 7/16 or 3/8 inch) up to 16 mats can be compacted in less than 4 minutes. Air emissions from the board press operations are controlled by a biofilter system. The OSB is cut, labeled, and prepared for shipment.

In the MDEQ Intent-to-Test Plan approval letter, dated November 20, 2015, MDEQ provided Weyerhaeuser Company guidance on the site data to be included in the test report. The site typically performs destruction efficiency testing at the press and the dryers but since media was not replaced in the Biofilter, DE testing will not be required at the press until 2016. Data requested under the DE section of the approval letter is applicable to the press DE but not for the dryer testing, specifically, tons of finished product (tons of dried wood processed) and EUPRESSLINE Biofilter media temperature. Therefore, tons of finished product and Biofilter media temperature was not gathered during press testing. The data is available electronically and can be provided to the agency, if requested.

Tables 2-1 and 2-2 summarize the wood species and dryer processing rates during testing. Finished products and press processing rates during testing are summarized in Table 2-3. Refer to Appendix E for process data collected during this test program.

Table 2-1
Wood Species Processed During the FGDRYERS RTO RATA Testing

Wood Species	FGDRYERS RTO December 10, 2015
	%
Aspen	50
Pine	20
Soft maple	20
Hard maple	5
Basswood	5

Table 2-2
Wood Dryer Process Rates

Date	Run	Average Total Wood Dried (ton per hour)	Average Dryer Feed Rate (%)
Dec. 9, 2015	RATA 1 through 12	-	80
Dec. 10, 2015	VOC DE 1 through 3	53.57	-
Dec. 10, 2015	RATA 1 through 9	-	83

Table 2-3
Finished Product and Press Process Rates

Date	Run	Product Thickness (inch)	Average Formline Speed (foot per minute)
Dec. 8, 2015	RATA 1 through 12	5/8, 23/32, and 7/16	103
Dec. 10, 2015	VOC DE 1 through 3	7/16 and 23/32	-

2.2 Control Equipment

As part of the manufacturing process, air emissions are generated by wood debarking and stranding, conveyance, drying, binding and pressing, milling, and painting (sides of wood). Weyerhaeuser Company operates pollution control equipment to control the discharge of pollutants to the atmosphere. The biofilter, wet electrostatic precipitator (WESP), and RTOs control emissions from the drying and pressing operations.

CEMS (i.e., VOC ppm) and CERMS installed on the EUPRESSLINE Biofilter and FGDRYERS RTO exhaust stacks are used to evaluate continuous compliance with permit limits.

2.2.1 Dryers and RTOs

North and south RTOs are used to control HAP and VOC emissions from four wood-fired strand dryers and a Coen® burner. Emissions from each dryer and the Coen® burner exhaust to a combined single duct leading to a WESP. The WESP was recently installed and is designed to remove particulate matter from the flue gas prior to incineration by two RTOs.

Air emission from the strand dryer system enters the WESP via the inlet quench ducting. An induced draft fan (located downstream of the WESP unit) draws process gas into the inlet quench duct and through the WESP. Recycled process water is sprayed into the strand dryer process gas stream along the inlet quench ductwork in order to saturate the gas stream and prevent buildup of condensable particulate matter on the inside of the ductwork. The "quenching" of the gas lowers its temperature thus condensing a portion of the vaporous hydrocarbons into liquid droplets that are captured by the WESP. The sprays also create a scrubbing effect to remove the larger particles in the gas stream.

The gas stream then enters the bottom of the WESP. Directional baffles and a distribution plate in the bottom of the unit are used to distribute the gas as it flows upward into multiple collection tubes. As the gas travels through the collection tubes, the gas traverses a series of high-intensity corona charging fields originating from electrode disks. In these fields, a very high electrostatic discharge of negative ions is imposed on the particles in the gas stream. As the gas flows farther up the collection tube, the charged particles migrate towards and onto the positively grounded tube walls removing them from the gas stream.

The collected particulate matter is removed from the collection tube walls by periodically flushing the collection tubes with water. The flush water is delivered by a spray system located above the collection tubes. Next, the gas stream passes through the outlet plenum at the top of the WESP unit and exits the WESP. The gas stream flows into the outlet duct and is transported to the RTOs for further treatment.

At the RTOs, valves alternate the flow direction through each of the RTO chambers. Each chamber contains heat exchange media that alternately heats the emissions entering one

combustion chamber and absorbs heat from the emissions exiting the other combustion chamber. Supplemental heat is supplied in the combustion chambers with a gas burner. An induced draft fan transports the emissions through the RTOs, which discharges to the atmosphere via the FGDRYERS RTO (SVRTOSTACK).

A new Megtec RTO was installed to the south of the existing system in October 2015. This RTO required a manufacture inspection to troubleshoot a valve issue and was bypassed during testing performed on December 9, 2015. The existing northern Salem Engineering RTO and the new Megtec RTO were operating during the testing on December 10, 2015.

The average firebox combustion chamber temperatures measured during the VOC DE testing are summarized in Table 2-4.

Table 2-4
Average RTO Firebox Temperatures During the VOC DE Testing

Test Run	Average Temperature (°F)
1	1,397
2	1,365
3	1,500
Average	**1,421**

The average of the three minimum 15-minute firebox temperatures recorded during the three VOC DE test runs was 1,352°F.

Refer to Appendix E for process data collected during this test program.

2.2.2 Press and Biofilter

The biofilter controls VOC and HAP emissions from the press portion of emission unit EUPRESSLINE. The press heats and compacts alternating layers of fine and coarse wood strands and binders into the OSB. Emissions from the press are captured within the total building enclosure and directed to a humidifier and then to a two-chamber biofilter. The biofilter contains Douglas fir mulch and lime (pH balancer) that provide a microbial environment for pollutant removal. Treated emissions from the two biofilter chambers discharge to a single stack (SVBIOFILTER).

Refer to Appendix E for process data collected during this test program.

2.3 Flue Gas Sampling Locations

Figure 1 after the Figures Tab of this report depicts the site and locations of the sources tested. Figures 2 through 4, behind the Figures Tab of this report, depict the EUPRESSLINE Biofilter and FGDRYERS RTO sampling ports and traverse point locations. Descriptions of each source sampling location are presented in Sections 2.3.1 through 2.3.4

2.3.1 EUPRESSLINE Biofilter Outlet

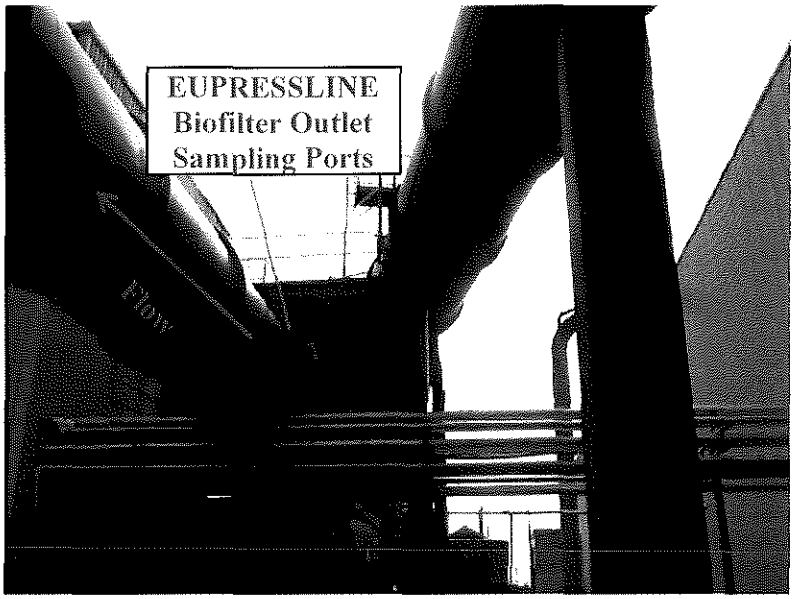
The EUPRESSLINE Biofilter exhaust was sampled in an 84-inch-internal-diameter duct that has two sampling ports. The outlet sampling ports are located:

- 70 feet (10 diameters) from the nearest disturbance upstream of the port.
- 60 feet (8.6 diameters) from the nearest disturbance downstream of the ports.

The ports were accessible via grating above the control room housing the biofilter CEMS and CERMS equipment.

Figure 2 in the Appendix depicts the EUPRESSLINE Biofilter outlet sampling port and traverse point locations. A photograph of the EUPRESSLINE Biofilter outlet sampling location is presented in Figure 2-1.

Figure 2-1. EUPRESSLINE Biofilter Outlet Sampling Locations



2.3.2 WESP Inlet/RTO Inlet

The strand dryer process particulate matter air emissions were measured in the quench duct upstream of the WESP and RTO control devices. This duct provides a single sampling location for these emissions prior to entering the WESP and RTOs. Two sampling ports orientated at 90° to one another are located in a straight section of this 106-inch-internal-diameter duct. For safety reasons, the single port located in the horizontal plane was accessed during testing. The ports are accessible by man-lift and located:

- Approximately 31 feet (3.5 diameters) from the nearest upstream disturbance.
- Approximately 22 feet (2.5 diameters) from the nearest downstream disturbance.

Figure 3 in the Appendix depicts the WESP inlet sampling location. A photograph of the WESP inlet sampling location is presented in Figure 2-2.

Figure 2-2. WESP Inlet Sampling Location

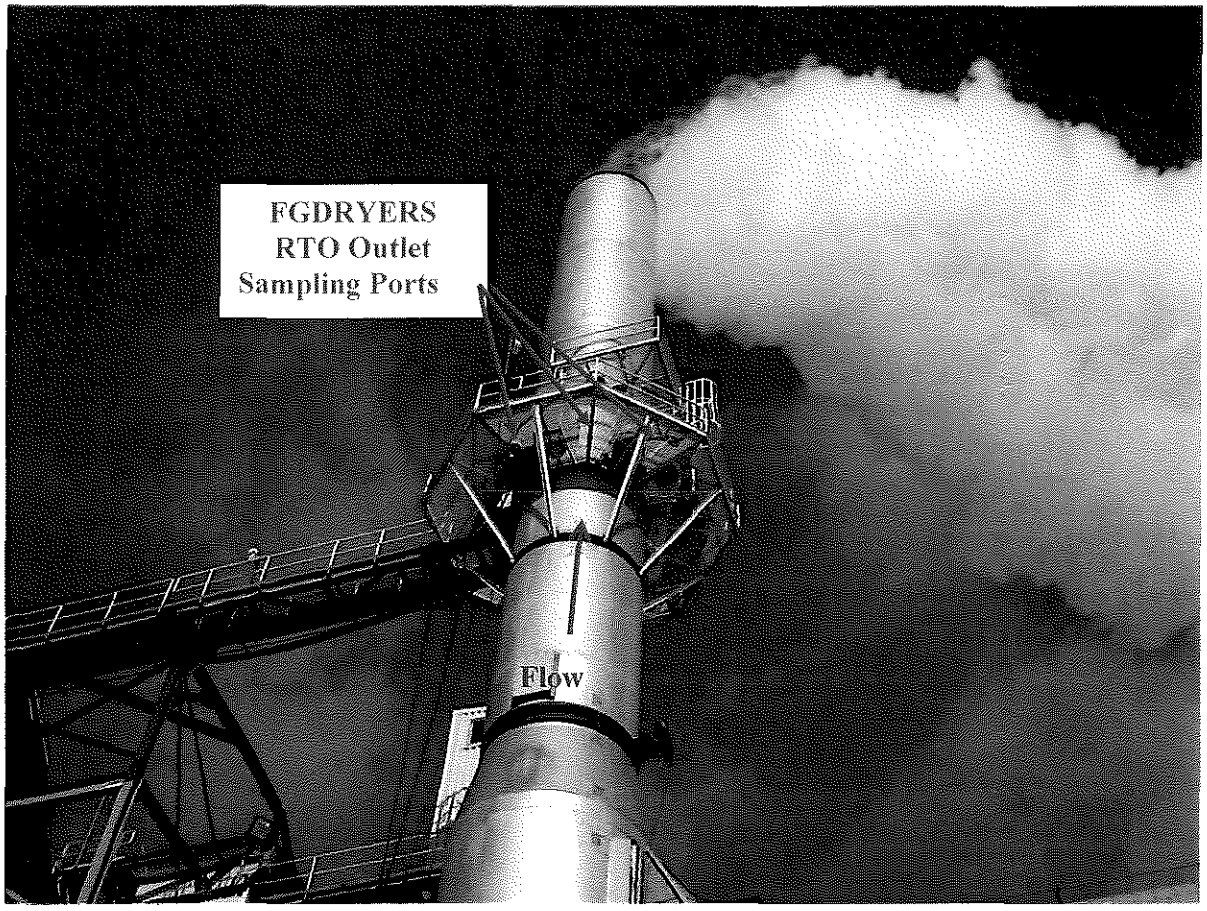
2.3.3 FGDRYERS RTO Outlet

The FGDRYERS RTO source exhausts to atmosphere through a vertical 105-inch-diameter exhaust stack equipped with four sampling ports. The ports are located:

- Approximately 30 feet (3.4 duct diameters) from the nearest upstream disturbance.
- Approximately 40 feet (4.6 duct diameters) from the nearest downstream disturbance (i.e., the stack exit).

The ports are accessible by elevator to the top floor of the Dryer Building and stairs to the SVRTOSTACK catwalk. Figure 4 in the Appendix depicts the FGDRYERS RTO outlet sampling ports and traverse point locations. A photograph of the FGDRYERS RTO outlet sampling location is presented in Figure 2-3.

Figure 2-3. FGDRYERS RTO Outlet Sampling Location



2.4 Process Sampling Locations

Process sampling was not required during this test program. A process sample is a sample that is analyzed for operational parameters, such as calorific value of a fuel (e.g., natural gas, coal), organic compound content (e.g., paint coatings), or composition (e.g., polymers).

2.5 Continuous Emission Rate Monitoring Systems

Description and identification of the instrumentation operated by Weyerhaeuser Company to monitor source emission rates are presented in Sections 2.5.1 and 2.5.2.

2.5.1 EUPRESSLINE Biofilter Outlet

The VOC monitor is a California Analytical Instruments, Inc., model 600 HFID serial number B05011. The system extracts sample gas through a heated sample probe and heated filter connected to the monitor by a heated sample line. The VOC analyzer measures total hydrocarbons using a flame ionization detector (FID). The VOC monitor operates on a single range/span of 0 to100 parts per million (ppm).

The flowrate monitor is a Teledyne UltraFlow Model 150, serial number 1501355. The air flowrate is measured by ultrasonic methods. The flow monitoring system uses 20% oxygen and 0% carbon dioxide for the flowrate calculations.

2.5.2 FGDRYERS RTO Outlet

The VOC monitor is a California Analytical Instruments, Inc., model 600 HFID serial number B05009. The system extracts sample gas through a heated sample probe and heated filter connected to the monitor by a heated sample line. The VOC analyzer measures total hydrocarbons using a FID. The VOC monitor operates on a dual range span: 0 to 100 ppm and 0 to 1,000 ppm.

The CO monitor is a California Analytical Instruments, Inc., model 601 serial number B06014-M. The system extracts sample gas through a heated sample probe and heated filter connected to the gas conditioning system by a heated sample line. Moisture in the sample is removed before the sample is analyzed. The CO analyzer measures carbon monoxide concentration by non-dispersive infrared analysis. The analyzer has a span of 0 to 500 ppm.

The flowrate monitor is a Teledyne UltraFlow Model 150, serial number 1501354. The air flowrate are measured by ultrasonic methods. The flowrate monitoring system uses 20% oxygen and 1% carbon dioxide for the flowrate calculations.

3.0 Summary and Discussion of Results

3.1 Objectives

The testing was performed to evaluate (1) the accuracy of the VOC CEMS of the EUPRESSLINE Biofilter, (2) THC removal efficiency of the FGDRYERS RTO, and (3) accuracy of the VOC and CO CEMS as required by 40 CFR Part 60, Appendix F, "Quality Assurance Procedures" and MDEQ ROP MI-ROP-B7302-2010a, effective April 20, 2010. The specific objectives of the testing were:

EUPRESSLINE Biofilter

- Measure the relative accuracy of the VOC CERMS against the reference methods at the EUPRESSLINE Biofilter. In accordance with 40 CFR 60, Appendix F, the Relative Accuracy was calculated in units of the applicable emissions standard, VOC lb/hr as carbon. The allowable relative accuracy based on Performance Specification 6 (continuous emission rate monitoring systems) is no greater than 20 percent of the mean value of the RM's test data in terms of the units of the emission standard, or 10 percent of the applicable standard (19.5 lb/hr as carbon).

FGDRYERS RTO

- Measure the relative accuracy of the CO and VOC CERMS at the FGDRYERS RTO against the reference methods. In accordance with 40 CFR 60, Appendix F, the RA was calculated in units of the applicable emissions standard, lb VOC/hr as carbon and lb CO/hr. The relative accuracy based on Performance Specification 6 must be less than 20% of the mean value of the RM's test data in terms of the units of the emission standard, or 10% of the applicable standard (18.6 lb VOC/hr as carbon; 147.3 lb CO/hr).

- Evaluate the total HAP destruction efficiency (measured as THC) of the FGDRYERS RTO and establish the minimum RTO firebox combustion temperature. 40 CFR 60, Subpart DDDD and the permit requires 90% reduction of total HAP entering the RTO, measured as THC (as carbon).

3.2 Test Matrix

The emission testing was conducted to evaluate the objectives in Section 3.1. Table 3-1 presents the sampling and analytical test matrix.

Table 3-1
Test Matrix

Run	Start Time	Stop Time	Sampling Method	Sampling Parameter	Comment
EUPRESSLINE Biofilter Outlet – December 8, 2015					
1	8:05	8:26	USEPA Methods 1 through 4, 25A, PS6, and PS8	Volumetric flowrate, moisture content, VOCs	
2	8:36	8:57			
3	9:07	9:28			Test run omitted from VOC and flowrate RA calculations
4	9:37	9:58			
5	10:07	10:28			
6	10:39	11:00			
7	11:10	11:31			
8	11:39	12:00			
9	12:09	12:30			
10	12:38	12:59			Test run omitted from VOC RA calculation
11	13:08	13:29			Test run omitted from flowrate RA calculation
12	13:39	14:00			Test run omitted from VOC and flowrate RA calculations
FGDRYERS RTO Outlet – December 9, 2015					
1	8:41	9:02	USEPA Methods 1 through 4, 25A, 205, PS4, PS6, and PS8	Volumetric flowrate, moisture content, CO, and VOCs	Tests performed during 1 RTO operation
2	9:23	9:44			Test run omitted from VOC and flowrate RA calculations
3	10:40	11:01			
4	12:17	12:38			Test run omitted from CO and VOC RA calculations
5	14:21	14:42			Test run omitted from CO and flowrate RA calculations
6	14:52	15:13			Test run omitted from CO and VOC RA calculations
7	15:23	15:44			
8	16:03	16:24			Test run omitted from VOC and flowrate RA calculations
9	16:32	16:53			
10	17:03	17:24			
11	17:29	18:00			
12	18:08	18:29			
FGDRYERS RTO Inlet and Outlet – December 10, 2015					
1	9:30	10:30	USEPA Methods 1 through 4, 25A, and 205	Volumetric flowrate, moisture content, and VOCs	15-minute firebox temperature of 1363°F recorded
2	11:05	12:05			15-minute firebox temperatures of 1342 and 1350°F recorded
3	12:55	13:55			

Table 3-1
Test Matrix

Run	Start Time	Stop Time	Sampling Method	Sampling Parameter	Comment
FGDRYERS RTO Outlet – December 10, 2015					
1	14:55	15:16	USEPA Methods 1 through 4, 25A, 205, PS6, and PS8	Volumetric flowrate, moisture content, and VOCs	Tests performed with 2 RTOs operating
2	15:28	15:49			
3	15:59	16:20			
4	16:31	16:52			
5	17:01	17:22			
6	17:29	17:50			
7	17:57	18:18			
8	18:25	18:46			
9	18:52	19:13			

3.3 Field Test Changes and Issues

The air emissions testing was performed in accordance with the October 15, 2015, Intent-to-Test plan submitted to and approved by the MDEQ on November 20, 2015. Field test changes were not required to complete the emission testing. However, additional VOC and flowrate RATA tests were performed.

In the MDEQ Intent-to-Test Plan approval letter, dated November 20, 2015, MDEQ provided Weyerhaeuser Company guidance on the site data to be included in the test report. The site typically performs destruction efficiency testing at the press and the dryers but because media was not replaced in the Biofilter, DE testing will not be required at the press until 2016. Data requested under the DE section of the approval letter is applicable to the press DE but not for the dryer testing—specifically, tons of finished product (tons of dried wood processed) and EUPRESSLINE Biofilter media temperature. Therefore, the tons of finished product and Biofilter media temperature were not recorded during press testing. These data are available and can be provided, if requested.

3.3.1 Additional FGDRYERS RTO RATA Testing

The RA of the FGDRYERS RTO VOC (PS8) and flowrate (PS6) CERMS RATA tests performed December 9, 2015, were within the allowable performance specification limits; however, the RA calculated in units of the applicable standard, lb VOC/hr, as carbon, exceeded the ≤20% RA criterion. It should be noted that RATA tests on December 9, 2015, were performed during initialization and start-up of the new south RTO. Therefore, additional RATA tests were performed on December 10, 2015. The RA results of these tests indicate the CERMS is operating in compliance with performance specification limits.

Bureau Veritas has presented the VOC, CO, and flowate data in the Appendix of this report.

3.4 Results

The results of the testing are compared to the applicable emission limits in Tables 3-2 and 3-3. Detailed results are presented in Tables 1 through 5 after the Tables Tab of this report. Graphs of the measured concentrations are presented after the Graphs Tab of this report. Sample calculations are presented in Appendix B.

Table 3-2
Relative Accuracy Test Audit Results

Date (2015)	Parameter	Unit	Average Reference Method (RM) Results	Average CEMS Result	Difference between CEMS and RM	Relative Accuracy (RA) (%)	Performance Specification
EUPRESSLINE (Biofilter)							
Dec. 8	VOC	lb/hr as carbon	13.05	13.13	-0.08	**3.7**	≤20 RA
FGDRYERS (RTO)							
Dec. 9	VOC	lb/hr, as carbon	55.22	47.44	7.78	**22.2**	≤20 RA
Dec. 9	CO	lb/hr	155.76	132.11	23.65	**8.0**	≤10 RA
Dec. 10	VOC	lb/hr, as carbon	5.63	4.92	0.71	**9.9**	≤10 RA

CERMS: continuous emission rate monitoring system
lb/hour: pound per hour
RTO: regenerative thermal oxidizer
VOC: volatile organic compound
CO: carbon monoxide

The RA of the FGDRYERS RTO VOC (PS8) and flowrate (PS6) CEMS/CERMS RATA tests performed December 9, 2015 were within the allowable performance specification limits; however, the RA calculated in units of the applicable standard, lb VOC/hr, as carbon, exceeded the ≤20% RA criterion. Therefore, additional VOC and flowrate RATA tests were performed on December 10, 2015. The RA results of these tests indicate the CERMS is operating in compliance with performance specification limits.

The VOC and CO measurements demonstrate the facility's CERMS are operating within allowable relative accuracy limits.

Table 3-3
FGDRYERS RTO THC Removal Efficiency Testing Results

Date (2015)	Source ID	Parameter	Units	Average Result	Emission Limit
Dec. 10	FGDRYERS (RTO)	VOC destruction efficiency	%	**90.8**	≥90
		Average operating temperature	°F	**1,352**	-

RTO: regenerative thermal oxidizer
VOC: volatile organic compound
-: not applicable

The VOC DE measurements demonstrate the FGDRYERS RTO source is operating within the permit limit at a minimum firebox temperature of 1,352°F.

4.0 Sampling and Analytical Procedures

Bureau Veritas measured emissions in accordance with the procedures specified in 40 CFR 60, Appendixes A and B, and 40 CFR 63, Appendix A. The sampling and analytical methods used during this test program are listed in the following table.

Table 4-1
Sampling and Analytical Test Methods

USEPA Sampling Method	Parameter	Analysis
1, 2, and PS6	Gas stream volumetric flowrate	Field measurement, S-type Pitot tube
3 and PS6	Molecular weight	Fyrite analyzer
4 and PS6	Moisture content	Gravimetric
10 and PS4	Carbon monoxide	Nondispersive infrared
25A and PS8	Volatile organic compounds	Flame ionization detector
205	Gas dilution	Field verification

4.1 Test Methods

4.1.1 Volumetric Flowrate (USEPA Methods 1 and 2)

Method 1, "Sample and Velocity Traverses for Stationary Sources," from the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A, was used to evaluate the sampling locations and the number of traverse points for sampling and the measurement of velocity profiles. Details of the sampling locations and number of velocity traverse points are presented in the Table 4-2.

Table 4-2
Sampling Location and Number of Traverse Points

Sampling Locations	Duct Diameter (inch)	Distance from Ports to Upstream Flow Disturbance (diameter)	Distance from Ports to Downstream Flow Disturbances (diameter)	Number of Ports Used	Traverse Points per Port	Total Points
EUPRESSLINE Biofilter Outlet	84	10	8.6	2	8	16
WESP/RTO Inlet	106	3.5	2.5	1	12	12
FGDRYERS RTO Outlet	105	3.4	4.6	2	8	16

Figures 1 through 4 in the Appendix depict the source locations and the source specific sampling locations and traverse points.

Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)," was used to measure flue gas velocity and calculate volumetric flowrate. S-type Pitot tubes and thermocouple assemblies were connected to an oil filled inclined or digital manometer and thermometer. Because the dimensions of the Pitot tubes met the requirements outlined in Method 2, Section 10, a baseline Pitot tube coefficient of 0.84 (dimensionless) was assigned.

The thermometers that were used are calibrated using standards which are traceable to National Institute of Standards (NIST). Refer to Appendix A for the Pitot tube calibration and inspection sheets. Sample calculations and field data sheets are included in Appendices B and C. Appendix D provides the computer generated data sheets.

4.1.2 Molecular Weight (USEPA Method 3)

Molecular weight was evaluated using Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." Flue gas was extracted from the stack through a probe positioned near the centroid of the duct and directed into a Fyrite® gas analyzer. The concentrations of carbon dioxide (CO_2) and oxygen (O_2) were then measured by chemical absorption with a Fyrite® gas analyzer to within ±0.5%. The average CO_2 and O_2 result of the grab samples were used to calculate molecular weight.

4.1.3 Moisture Content (USEPA Method 4)

At the outlet of the EUPRESSLINE Biofilter and FGDRYERS RTO exhaust sampling locations, moisture content was measured gravimetrically following USEPA Method 4, "Determination of Moisture Content in Stack Gases" guidelines. One 35-minute moisture test run was performed for every three 21-minute test runs during the RATA. One moisture test was performed during each THC destruction efficiency test. The moisture content of the saturated flue gas at the inlet to WESP was estimated based on the flue gas temperature using psychrometric charts and saturation vapor pressure tables. Bureau Veritas' modular USEPA Method 4 stack sampling system consists of:

- A stainless steel probe.
- Tygon® umbilical vacuum line connecting the probe to the impingers.
- A set of four Greenburg-Smith (GS) impingers with the configuration shown in Table 4-3 situated in a chilled ice bath.
- A length of sample line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Table 4-3
USEPA Method 4 Impinger Configuration

Impinger	Type	Contents	Amount
1	Modified	Water	~100 milliliters
2	Greenburg Smith	Water	~100 milliliters
3	Modified	Empty	0 milliliters
4	Modified	Silica desiccant	~300 grams

Prior to initiating a test run, the sampling train was leak-checked by capping the nozzle tip and applying a vacuum of approximately 15 inches of water to the sampling train. The dry-gas meter was then monitored for approximately 1 minute to measure that the sample train leak rate was less than 0.02 cubic feet per minute (cfm). The sample probe was then inserted into the sampling port near the centroid of the stack in preparation of sampling. Flue gas was then extracted at a constant rate from the stack, with moisture removed from the sample stream by the chilled impingers.

At the conclusion of the test run, a post-test leak check was conducted and the impinger train was carefully disassembled. The weight of liquid or silica gel in each impinger was measured with a scale capable of measuring ±0.5 grams. The weight of water collected within the impingers and volume of flue gas sampled were used to calculate the percent moisture content. Figure 5 depicts the USEPA Method 4 sampling train.

4.1.4 Carbon Monoxide (USEPA Method 10)

USEPA Method 10 "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrument Analyzer Procedure)" was used to measure carbon monoxide (CO) concentrations. Flue gas was continuously sampled from the stack and conveyed to an infrared analyzer for CO concentration measurements. Flue gas was extracted from the stack through:

- A stainless-steel probe.
- Heated Teflon sample line to prevent condensation.
- A chilled Teflon impinger train (equipped with a peristaltic pump) to remove moisture from the sampled gas stream prior to entering the analyzer.
- CO gas analyzer.

Refer to Figure 6 in the Appendix for a drawing of the USEPA Method 10 sampling train. Data was recorded at 1-second intervals on a computer equipped with data acquisition software.

Flue gas was withdrawn from three sample points located at 16.7%, 50%, and 83.3% of the diameter of the stack. The sampling probe was moved to a new sampling point at seven-minute intervals during the 21-minute RATA tests.

The pollutant concentration was measured using a CO gas analyzer calibrated with zero-, mid-, and high-EPA-Traceability-Protocol-certified calibration gas standards.

A calibration error check was performed by introducing zero-, mid-, and high-level calibration gases directly into the analyzer. The calibration error check was performed to verify the analyzer response was within ±2% of the calibration span of the analyzer. Prior to each test run, a system-bias test was performed where known concentrations of calibration gases were introduced at the probe tip to measure if the analyzer's response was within ±5% of the calibration gas span. At the conclusion of each test run, an additional system-bias check was performed to evaluate the analyzer percent drift from the pre- and post-test system-bias checks. The system-bias check evaluated the analyzer drift against the ±3% QA/QC requirement. The analyzer drift data was used to correct the measured flue gas concentrations. Recorded concentrations were averaged over the duration of each 21-minute test run.

4.1.5 Volatile Organic Compounds (USEPA Method 25A)

VOC concentrations were measured following USEPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." Samples were collected through a probe and heated sample line into the analyzer. Bureau Veritas used J.U.M. 3-300A, 3-500, and 109A model flame ionization detector based hydrocarbon analyzers.

A FID measures the average hydrocarbon concentration in part per million by volume (ppmv) of VOC as the calibration gas propane. The FIDs are fueled by 100% hydrogen, which generates a flame with a negligible number of ions. Flue gas is introduced into the FID and enters the flame chamber.

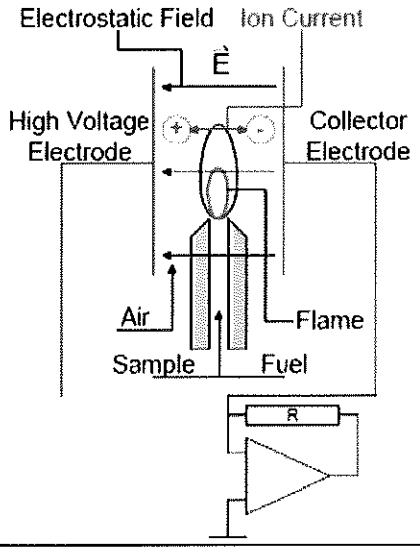


Figure 4-1. FID Flame Chamber

The combustion of flue gas generates electrically charged ions. The analyzer applies a polarizing voltage between two electrodes around the flame, producing an electrostatic field. Negatively charged ions, anions, migrate to a collector electrode, while positively charged ions, cations, migrate to a high-voltage electrode. The current between the electrodes is directly proportional to the hydrocarbon concentration in the sample. The flame chamber is depicted in Figure 4-1.

For the RATA tests, the flue gas was withdrawn from three sample points located at 16.7%, 50%, and 83.3% of the diameter of the stack. The sampling probe was moved to a new sampling point at seven-minute intervals during the 21-minute RATA tests.

Figure 7 depicts the USEPA Method 25A sampling train.

Using the voltage analog signal, measured by the FID, the concentration of volatile organic compounds was recorded by a data acquisition system (DAS). The average concentration of VOC is reported as the calibration gas (i.e., propane) in equivalent units.

4.1.6 Gas Dilution (USEPA Method 205)

A gas dilution system was used to introduce known values of calibration gases into the VOC analyzers. The gas dilution system consisted of calibrated mass flow controllers. The system diluted a high-level calibration gas to within ±2% of predicted values. This gas divider was capable of diluting gases at various increments.

Before the start of testing, the gas divider dilutions were verified to be within ±2% of predicted values. Three sets of dilutions of a high-level (301.7 ppmv propane) calibration gas were performed. Subsequently, a certified mid-level calibration gas (80.4 ppmv propane) was introduced into the analyzer; the calibration gas concentration was within ±10% of a dilution. Refer to Appendix A for the certified calibration gas certifications and the gas dilution field calibration. Table 4-4 presents the USEPA Method 205 gas dilution field verification measurements.

Table 4-4
Gas Dilution Field Verification

Expected Concentration	Acceptable Range[1]		Actual Concentration 1	Actual Concentration 2	Actual Concentration 3	Pass?
	Low	High				
(ppmv)	(ppmv)	(ppmv)	(ppmv)	(ppmv)	(ppmv)	
85	83.3	86.7	85.9	85.9	85.9	Yes
250	245.0	255.0	251.5	251.3	251.1	Yes
125	122.5	127.5	126.2	126.0	126.0	Yes

[1] Acceptable range is ±2% of the expected concentration

4.2 Procedures for Obtaining Process Data

Process data were recorded by Weyerhaeuser Company personnel. Refer to Section 2.1 and 2.2 for discussions of process and control device data and Appendix E for the operating parameters recorded during testing.

4.3 Sampling Identification and Custody

Gaseous pollutant concentrations were measured using analyzers processing the flue gas in real time; therefore, recovery and analytic procedures for laboratory samples were not necessary.

5.0 QA/QC Activities

Equipment used in this emissions test program passed quality assurance/quality control (QA/QC) procedures. Refer to Appendix A for equipment calibration and inspection sheets. Sample calculations are presented in Appendix B. Field data sheets are presented in Appendix C. Computer-generated Data Sheets are presented within Appendix D.

5.1 Pretest QA/QC Activities

Before testing, the sampling equipment was cleaned, inspected, and calibrated according to procedures outlined in the applicable USEPA sampling methods and USEPA's "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods."

5.2 QA/QC Audits

The results of select sampling and equipment QA/QC audits and the acceptable tolerance are presented in the following sections. Analyzer calibration and gas certification sheets are presented in Appendix A.

5.2.1 Instrument Analyzer QA/QC Audits

The instrument analyzer sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. The analyzers passed the applicable calibration criteria. Calibration gas selection, error, bias, and drift checks are included in Appendix A. The gas cylinders used to perform the RATA are summarized in Table 5-1.

Table 5-1
Calibration Gas Cylinder Information

Parameter	Gas Vendor	Cylinder Serial Number	Cylinder Value	Expiration Date
Zero Air	Airgas	CC201139	N/A	10/26/23
Carbon Monoxide (CO)	The American Gas Group	EB0022434	945 ppm	10/03/19
	Pangaea Gases, LLC	EB0033503	503.0 ppm	11/12/21
Hydrogen (H)	Airgas	CC20386 SG9151771BAL	99.999%	N/A
Methane (CH_4)	Airgas	CC169254	1,407 ppm	04/16/21
		CC100175	301.7 ppm	04/01/21
		CC19255	80.4 ppm	04/28/23
Nitrogen (N)	Pangaea Gases, LLC	CC183736	99.9995%	11/02/23
Propane (C_3H_8)	Airgas	CC443348	851.1 ppm	04/28/23
		EB00113535	85.60 ppm	04/28/23
		CC56826	51.30 ppm	10/12/23
		XC017507B	29.70 ppm	10/30/22

5.2.2 Dry-Gas Meter QA/QC Audits

The following table summarizes the dry-gas meter calibration checks in comparison to the acceptable USEPA tolerance. Dry-gas Meter Boxes 2 and 8 were used during this testing to measure moisture content. Refer to Appendix A for dry-gas meter calibrations. Table 5-2 summarizes the pre- and post-test dry gas meter calibration data.

Table 5-2
Dry-Gas Meter Calibration QA/QC Audit

Meter Box	Pre-test DGM Calibration Factor (Y) (dimensionless)	Post-Test DGM Calibration Factor (Y) (dimensionless)	Absolute Difference Between Pre- and Post-test DGM Calibrations	Acceptable Tolerance	Calibration Result
2	0.974 (10/12/15)	0.984 (12/17/15)	0.010	≤0.05	Valid
8	1.004 (06/11/15)	0.977 (12/17/15)	0.027	≤0.05	Valid

5.2.3 Thermocouple QA/QC Audits

Temperature measurements using thermocouples and digital pyrometers were compared to a reference temperature (i.e., ice water bath, boiling water bath) prior to testing to evaluate accuracy of the equipment. The thermocouples and pyrometers measured temperature within ±1.5% of reference temperatures and were within USEPA acceptance criteria. Thermocouple calibration sheets are presented in Appendix A.

5.3 QA/QC Blanks

Reagent and field train blanks were not applicable to this test program.

5.4 QA/QC Problems

No QA/QC problems were encountered during this test program.

Limitations

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Tables

Table 1
EUPRESSLINE Biofilter VOC (lb/hr) Relative Accuracy Test Audit Results
Weyerhaeuser Company
Grayling, Michigan
Bureau Veritas Project No. 11015-000214.00
Sampling Date: December 8, 2015

Run	Time	SCFM	Reference Method VOC ppmv, as propane	ppmv, as carbon	lb/hr, as carbon	CERM VOC lb/hr, as carbon	Difference lb/hr, as carbon
1	8:05-8:26	102,368	24.43	73.28	14.03	13.57	0.46
2	8:36-8:57	111,433	24.14	72.41	15.09	14.66	0.43
3	9:07-9:28	100,982	24.39	73.18	13.82	14.60	-0.78
4	9:37-9:58	102,254	21.39	64.17	12.27	12.93	-0.66
5	10:07-10:28	104,948	21.60	64.81	12.72	12.47	0.25
6	10:39-11:00	101,600	22.41	67.22	12.77	13.34	-0.57
7	11:10-11:31	100,065	18.20	54.60	10.22	10.95	-0.73
8	11:39-12:00	100,596	14.22	42.66	8.03	8.49	-0.46
9	12:09-12:30	104,616	18.28	54.85	10.73	10.65	0.08
10	12:38-12:59	99,696	36.50	109.49	20.41	21.14	-0.73
11	13:08-13:29	107,720	35.70	107.10	21.57	21.09	0.48
12	13:39-14:00	97,230	28.00	83.99	15.27	16.86	-1.59
Mean		103,955	22.26	66.79	13.05	13.13	-0.08
Standard Deviation							0.52
Confidence Coefficient							0.40

Applicable Standard (Permit Limit)	19.5 lb/hr, as carbon
Average RM value (permit limit used if <50% of standard)	13.05 lb/hr, as carbon
Relative Accuracy	3.7 %

PS-6 Relative Accuracy Performance Specification — **The RA of the CERMS must be no greater than 20 percent**

Test run omitted from RATA calculations

Table 2
FGDRYERS RTO VOC (lb/hr) Relative Accuracy Test Audit Results
Weyerhaeuser Company
Grayling, Michigan
Bureau Veritas Project No. 11015-000214.00
Sampling Date: December 9, 2015

Run	Time	SCFM	Reference Method VOC ppmv, as propane	ppmv, as carbon	lb/hr, as carbon	CERM VOC lb/hr, as carbon	Difference lb/hr, as carbon
1	8:41-9:02	174,638	78.82	236.46	77.22	63.43	13.79
2	9:23-9:44	181,427	88.84	266.53	90.42	89.70	0.72
3	10:40-11:01	141,313	66.89	200.66	53.02	48.29	4.74
4	12:17-12:38	138,743	114.93	344.80	89.46	44.65	44.81
5	14:21-14:42	152,489	64.01	192.03	54.76	40.73	14.02
6	14:52-15:13	146,329	79.56	238.67	65.31	47.32	17.99
7	15:23-15:44	142,001	69.36	208.09	55.26	39.25	16.00
8	16:03-16:24	143,968	87.78	263.33	70.89	52.66	18.23
9	16:32-16:53	153,334	60.00	180.01	51.62	45.45	6.16
10	17:03-17:24	156,364	42.89	128.68	37.63	38.11	-0.48
11	17:39-18:00	129,409	56.54	169.63	41.05	33.03	8.02
12	18:08-18:29	128,867	49.86	149.57	36.04	28.95	7.09
Mean		151,093	64.14	192.41	55.22	47.44	7.78
Standard Deviation							5.84
Confidence Coefficient							4.49

Applicable Standard (Permit Limit)	19.5 lb/hr, as carbon
Average RM value (permit limit used if <50% of standard)	55.2 lb/hr, as carbon
Relative Accuracy	22.2 %

PS-6 Relative Accuracy Performance Specification — **The RA of the CERMS must be no greater than 20 percent**

Test run omitted from RATA calculations

Table 3
FGDRYERS RTO CO (lb/hr) Relative Accuracy Test Audit Results
Weyerhaeuser Company
Grayling, Michigan
Bureau Veritas Project No. 11015-000214.00
Sampling Date: December 9, 2015

Run	Time	DSCFM	Reference Method CO ppmvd, measured	ppmvd, corrected	lb/hr	CERM CO lb/hr	Difference lb/hr
1	8:41-9:02	133,066	294.4	294.7	171.19	148.88	22.32
2	9:23-9:44	138,239	370.6	362.7	218.87	197.16	21.71
3	10:40-11:01	107,674	300.9	287.9	135.32	108.14	27.18
4	12:17-12:38	100,514	475.9	468.4	201.12	134.06	67.06
5	14:21-14:42	110,472	534.5	543.6	262.12	208.55	53.57
6	14:52-15:13	106,010	452.2	454.8	210.47	175.32	35.15
7	15:23-15:44	104,589	323.9	321.8	146.91	119.09	27.82
8	16:03-16:24	106,038	356.2	354.8	164.20	134.89	29.31
9	16:32-16:53	112,936	269.9	269.3	132.77	118.97	13.79
10	17:03-17:24	156,364	223.2	222.3	151.70	127.55	24.15
11	17:39-18:00	97,956	372.6	370.5	158.41	130.99	27.42
12	18:08-18:29	97,546	289.5	287.7	122.49	103.32	19.17
Mean		117,156	311.2	308.0	155.76	132.11	23.65
Standard Deviation							4.99
Confidence Coefficient							3.83

Applicable Standard (Permit Limit)	343.7 lb/hr
Average RM value (permit limit used if <50% of standard)	343.7 lb/hr
Relative Accuracy	8.0 %

PS-6 Relative Accuracy Performance Specification — **The RA of the CERMS must be no greater than 10 percent**

Test run omitted from RATA calculations

Table 4

FGDRYERS RTO VOC Destruction Efficiency Results

Weyerhaeuser Company

Grayling, Michigan

Bureau Veritas Project No. 11015-000214.00

Sampling Date: December 10, 2015

Parameter		Units	Run 1	Run 2	Run 3	Average
Sampling Time			9:30-10:30	11:05-12:05	12:55-13:55	
Duration		min	60	60	60	60
Minimum 15-minute Average RTO Firebox Temperature†		°F				1,352
Inlet	Gas Stream Volumetric Flowrate	scfm	131,165	140,215	135,699	135,693
	VOC Concentration	ppmv, as methane	336.9	180.6	270.6	262.7
	Corrected VOC Concentration (C_{gas})	ppmv, as methane	334.0	166.5	263.3	254.6
	VOC Mass Emission Rate	**lb/hr, as carbon**	**109.2**	**58.2**	**89.1**	**85.5**
Outlet	Gas Stream Volumetric Flowrate	scfm	142,001	142,195	135,302	139,832
	VOC Concentration	ppmv, as methane	27.6	20.8	16.8	21.7
	Corrected VOC Concentration (C_{gas})	ppmv, as methane	27.2	20.7	16.3	21.4
	VOC Mass Emission Rate	**lb/hr, as carbon**	**9.6**	**7.3**	**5.5**	**7.5**
RTO VOC Destruction Efficiency		**%**	**91.2**	**87.4**	**93.8**	**90.8**

Molecular weight of methane (used to calculate emissions as carbon) 16.00 g/mole

Standard conditions 68°F and 29.92 in Hg

scfm standard cubic feet per minute

ppmv part per million by volume

† average is the average of the three minimum 15-minute firebox temperatures recorded during the three tests

Table 5
FGDRYERS RTO VOC (lb/hr) Relative Accuracy Test Audit Results
Weyerhaeuser Company
Grayling, Michigan
Bureau Veritas Project No. 11015-000214.00
Sampling Date: December 10, 2015

Run	Time	SCFM	Reference Method VOC ppmv, as propane	Reference Method VOC ppmv, as carbon	Reference Method VOC lb/hr, as carbon	CERM VOC lb/hr, as carbon	Difference lb/hr, as carbon
1	14:55-15:16	145,248	0.53	1.58	0.43	3.75	-3.32
2	15:28-15:49	132,524	6.88	20.63	5.11	5.01	0.10
3	15:59-16:20	138,298	9.26	27.78	7.18	5.94	1.24
4	16:31-16:52	143,238	6.64	19.93	5.34	4.24	1.09
5	17:01-17:22	140,706	7.83	23.49	6.18	4.67	1.51
6	17:29-17:50	138,352	7.95	23.84	6.17	5.15	1.02
7	17:57-18:18	148,469	8.84	26.51	7.36	5.75	1.60
8	18:25-18:46	146,031	7.44	22.33	6.10	4.74	1.36
9	18:52-19:13	148,364	8.20	24.61	6.83	5.03	1.80
Mean		142,359	7.06	21.19	5.63	4.92	0.71
Standard Deviation							1.59
Confidence Coefficient							1.22

Applicable Standard (Permit Limit)	19.5 lb/hr, as carbon
Average RM value (permit limit used if <50% of standard)	19.5 lb/hr, as carbon
Relative Accuracy	9.9 %

PS-6 Relative Accuracy Performance Specification — **The RA of the CERMS must be no greater than 10 percent**