Compliance Test Report for Air Emission Testing at Weyerhaeuser 4111 West Four Mile Grayling, Michigan

Volume 1 of 2

Weyerhaeuser

State Registration No. B7302
Renewable Operating Permit MI-ROP-B7302-2016a

Prepared for

Weyerhaeuser
Grayling, Michigan

Bureau Veritas Project No. 11016-000215.00

January 4, 2017

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Bureau Veritas North America, Inc.
22345 Roethel Drive
Novi, Michigan 48375
248.344.2661
www.us.bureauveritas.com/hse

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MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Weyerhaeuser NR Company   County: Crawford

Source Address: 4111 West Four Mile Road   City: Grayling

AQD Source ID (SRN): B7302   RO Permit No.: MI-ROP-B7302-2016a   RO Permit Section No.: C and D

Please check the appropriate box(es):

☐ **Annual Compliance Certification** **(General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From ______ To ______

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification** **(General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From ______ To ______

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From na To na

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Air Emissions Test Report to evaluate compliance with RTO and Biofilters efficiency. This form shall certify that the testing was conducted in accordance with the Oct. 11, 2016 approved test plan and that the facility operating conditions were in compliance with permit conditions or at the maximum routing operating conditions for the facility.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete, and that any observed, documented or known instances of noncompliance have been reported as deviations, including situations where a different or no monitoring method is specified by the RO Permit.

Rina Allen	Mill Manager	989-348-3401
Name of Responsible Official (print or type)	Title	Phone Number

Rina Allen	1/4/17
Signature of Responsible Official	Date

* Photocopy this form as needed.

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Executive Summary

Weyerhaeuser retained Bureau Veritas North America, Inc. to perform air emission compliance testing at the EUPRESSLINE Biofilter, FGDRYERS, EUIBW, and EUCOEN emission sources at the Weyerhaeuser facility in Grayling, Michigan.

The purpose of the emission test program was to evaluate compliance with (1) the national emission standards for plywood and composite wood products (PCWP) regulation (40 CFR Part 63, Subpart DDDD), and (2) Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B7302-2016a, effective March 8, 2016, for the EUPRESSLINE Biofilter, FGDRYERS, EUIBW, and EUCOEN emission sources.

The testing followed United States Environmental Protection Agency (USEPA) reference methods at the following locations:

- EUPRESSLINE Biofilter for particulate matter less than 10 microns (PM_{10}) by Methods 17 and 202, formaldehyde emission and removal efficiency by Method 320, and carbon monoxide (CO) by Method 10.

  Relative accuracy of the volatile organic compound (VOC) continuous emission rate monitoring system (CERMS) at the exhaust stack was also measured by Method 25A, and Performance Specifications (PS) PS-6 and PS-8.

- FGDRYERS, while the regenerative thermal oxidizer (RTO) operates with both chambers, for PM_{10} by Methods 5 and 202, formaldehyde by Method 18, sulfur dioxide (SO_2) by Method 6C, nitrogen oxides (NO_x) by Method 7E, and total hazardous air pollutant (HAP) destruction efficiency—measured as total hydrocarbon (THC)—by Method 25A.

  Relative accuracy of the CO CERMS, by Method 10, PS-4, and PS-6, and relative accuracy of the VOC CERMS, by Method 25A, PS-6, and PS-8, at the FGDRYERS RTO exhaust stack were also measured.

- FGDRYERS, while the RTO operates with one chamber bypassed, for PM_{10} by Methods 5 and 202, CO by Method 10, NO_x by Method 7E, SO_2 by Method 6C, and formaldehyde by Method 18.

- EUIBW for NO_x by Method 7E and CO by Method 10.

- EUCOEN, while SVCOEN vents to atmosphere, for NO_x by Method 7E and CO by Method 10.

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.

Detailed results are presented in Tables 1 through 16 after the Tables Tab of this report. The following tables summarize the emissions results from testing performed November 8 through 16, 2016.

EUPRESSLINE Biofilter (SVBIOFILTER) Results

Parameter		Result			Average	Permit Limit
		Run 1	Run 2	Run 3		
Formaldehyde concentration (mg/dscm)	Inlet	7.9	6.5	6.7	**7.0**	-
	Outlet	0.62	0.62	0.50	0.58	6.2
Formaldehyde mass emission rate (lb/hr)	Inlet	3.5	2.6	2.7	**2.9**	-
	Outlet	0.24	0.24	0.20	0.23	2.3
Formaldehyde mass removal efficiency (%)		93.0	90.8	92.8	92.2	≥90
PM_{10} (gr/dscf)	Inlet	0.0069	0.0067	0.0056	**0.0064**	-
	Outlet	0.0094	0.0048	0.0037	0.0060	0.010
PM_{10} (lb/hr)	Inlet	6.6	6.5	5.5	6.2	24.7
	Outlet	7.4	4.1	3.2	4.9	8.4
PM_{10} mass removal efficiency (%)		-12.1	36.9	41.8	**22.2**	-
CO (ppmv)	Outlet	5.1	4.4	3.9	4.5	26
CO (lb/hr)	Outlet	2.3	1.9	1.8	2.0	11.4
Media bed temperature, 15-minute average (°F)		81.1	81.4	81.5	**81.3**	-

PM_{10} is sum of filterable particulate matter (Method 17) and condensable particulate matter (Method 202).
mg/dscm: milligram per dry standard cubic meter
lb/hr: pound per hour
gr/dscf: grain per dry standard cubic foot
ppmv: part per million by volume

FGDRYERS WESP and RTO (SVRTOSTACK) Results

Parameter	Result Run 1	Result Run 2	Result Run 3	Average	Permit Limit
RTO Two-Chamber Operation					
Inlet WESP VOCs (lb/hr, as carbon)	66	148	76	97	-
Outlet RTO VOCs (lb/hr, as carbon)	5.2	9.1	6.4	6.9	18.6
RTO total HAP (measured as THC/VOC as carbon) reduction efficiency (%)	92.2	93.9	91.5	92.5	≥90
Outlet RTO PM_{10} (gr/dscf)	0.0051	0.0036	0.0043	0.0043	0.030
Outlet RTO PM_{10} (lb/hr)	4.1	3.4	4.3	4.0	29.8
Outlet RTO PM_{10} (lb/MMBtu)	0.023	0.016	0.019	0.019	0.10
Outlet RTO SO_2 (lb/hr)	0.41	0.032	0.033	0.16	5
Outlet RTO NO_x (lb/hr)	17.71	18.68	26.81	21.07	23.15
Outlet RTO CO (lb/hr) †	86.4	51.6	104.2	80.8	147.3
Outlet RTO formaldehyde (lb/hr)	0.16	1.3	<0.12	0.53	2.4
RTO One-Chamber Operation					
Outlet RTO PM_{10} (gr/dscf)	0.0043	0.0046	0.0070	0.0053	0.057
Outlet RTO PM_{10} (lb/hr)	4.4	4.9	6.7	5.3	56.6
Outlet RTO NO_x (lb/hr)	16.35	19.30	18.09	**17.91**	-
Outlet RTO CO (lb/hr)	106	105	140	117	343.7
Outlet RTO SO_2 (lb/hr)	2.5	0.048	0.017	**0.86**	-
Outlet RTO formaldehyde (lb/hr)	0.65	0.78	0.50	0.64	-
Media bed temperature, 15-minute average (°F)	1,426	1,435	1,435	1,432	>1,422

PM_{10} is sum of filterable particulate matter (Method 5) and condensable particulate matter (Method 202).
gr/dscf: grain per dry standard cubic foot
lb/hr: pound per hour
† Measured by Weyerhaeuser's continuous emission rate monitor (CERM) by averaging data during RATA runs 1-3, 4-6, and 8-10.

Executive Summary

Relative Accuracy Test Audit Results

Parameter	Average RM Result	Average CEMS Result	Difference between CEMS and RM	Relative Accuracy (%)	Performance Specification
EUPRESSLINE (Biofilter)					
VOCs (lb/hr as carbon)	21.80	20.82	0.98	6.5	≤20% RM
FGDRYERS (RTO)					
VOCs (lb/hr as carbon)	3.60	4.04	-0.44	4.0	≤10% AS
CO (lb/hr)	77.99	80.77	-2.77	6.5	≤20% RM
CEMS: continuous emission monitoring system lb/hr: pound per hour RM: Reference Method AS: Applicable Standard					

EUIBW Thermal Oil Heater (SVIBW) Results

Parameter	Result			Average	Permit Limit
	Run 1	Run 2	Run 3		
NO_x (lb/hr)	1.1	0.66	0.90	0.87	1.9
CO (lb/hr)	0.31	0.19	0.10	0.20	2.3
lb/hr: pound per hour					

EUCOEN Thermal Oil Heater (SVCOEN) Results

Parameter	Result			Average	Permit Limit
	Run 1	Run 2	Run 3		
NO_x (lb/hr)	2.5	2.4	2.3	2.4	5.0
CO (lb/hr)	0.35	0.22	0.10	0.22	3.4
lb/hr: pound per hour					

1.0 Introduction

1.1 Summary of Test Program

Weyerhaeuser retained Bureau Veritas North America, Inc. to perform compliance air emissions testing at the EUPRESSLINE Biofilter, FGDRYERS, EUIBW, and EUCOEN emission sources at the Weyerhaeuser facility in Grayling, Michigan.

The testing followed United States Environmental Protection Agency (USEPA) reference methods at the following locations:

- EUPRESSLINE Biofilter for particulate matter less than 10 microns (PM_{10}) by Methods 17 and 202, formaldehyde emission and removal efficiency by Method 320, and carbon monoxide (CO) by Method 10.

  Relative accuracy (RA) of the volatile organic compound (VOC) continuous emission rate monitoring system (CERMS) at the exhaust stack was also measured by Method 25A, Performance Specifications (PS) PS-6 and PS-8.

- FGDRYERS, while the regenerative thermal oxidizer (RTO) operates with both chambers, for PM_{10} by Methods 5 and 202, formaldehyde by Method 18, sulfur dioxide (SO_2) by Method 6C, nitrogen oxides (NO_x) by Method 7E, and total hazardous air pollutant (HAP) destruction efficiency—measured as total hydrocarbon (THC)—by Method 25A.

  RA of the CO CERMS, by Method 10, PS-4, and PS-6, and RA of the VOC CERMS, by Method 25A, PS-6, and PS-8, at the FGDRYERS RTO exhaust stack were also measured.

- FGDRYERS, while the RTO operates with one chamber bypassed, for PM_{10} by Methods 5 and 202, CO by Method 10, NO_x by Method 7E, SO_2 by Method 6C, and formaldehyde by Method 18.

- EUIBW for NO_x by Method 7E and CO by Method 10.

- EUCOEN, while SVCOEN vents to atmosphere, for NO_x by Method 7E and CO by Method 10.

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.

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
C_m	=	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.

Table 1-1 summarizes the sources, parameters, and test dates.

Table 1-1
Emission ID, Description, Location, Pollutants Measured, and Test Dates

Emission Unit ID	Unit Description	Sampling Location	Pollutants Measured	Test Date (2016)
EUPRESSLINE Biofilter	This emission unit covers the storage of dried flakes from the dryers, through the blending, forming, and pressing to form the board. The Biofilter and total enclosure, control the emissions from the press portion of this emission unit. Cyclones and baghouses control the emissions from the blending and forming portions.	SVBIOFILTER Inlet SVBIOFILTER Outlet	PM_{10} Formaldehyde Carbon monoxide VOC RATA	November 15-16
FGDRYERS: EUDRYER1, EUDRYER2, EUDRYER3, EUDRYER4	Within the flexible group FGDRYERS, these are 4 wood flake dryers. The heat source is a wood-fueled, suspension burner rated at 40-MMBtu/hr with an auxiliary gas start-up burner and a natural gas ring burner rated at 40 MMBtu/hr. Controlled by a Wet Electrostatic Precipitator (WESP) followed by a Regenerative Thermal Oxidizer (RTO).	SVRTO Outlet	While the RTO operates with both chambers PM_{10} Formaldehyde Sulfur dioxide Carbon monoxide Nitrogen oxides Total HAPs as carbon CO and VOC RATA	November 8-9
			While the RTO operates with one chamber PM_{10} Formaldehyde Sulfur dioxide Carbon monoxide Nitrogen oxides	November 10
EUIBW	The No. 2 thermal oil heater has a burner manufactured by IBW. It is a 40-MMBtu/hr natural gas burner that exhausts directly to atmosphere through its own stack. The hot oil is used to heat the presses, building, and during the winter, the water vat used to thaw and clean the logs as they enter the process.	SVIBW Outlet	Nitrogen oxides Carbon monoxide	November 11
EUCOEN	The No. 1 thermal oil heater has a burner manufactured by Coen. This burner is rated at 50 MMBtu/hr when fired with wood dust and/or 40 MMBtu/hr with natural gas.	SVCOEN Outlet	Nitrogen oxides Carbon monoxide	November 11

1.2 Purpose of Testing

The purpose of the emission test program was to evaluate compliance with the national emission standards for plywood and composite wood products (PCWP) regulation (40 CFR Part 63, Subpart DDDD) and Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B7302-2016a, effective March 8, 2016, for the EUPRESSLINE Biofilter, FGDRYERS, EUIBW, and EUCOEN emission sources. The permit emission limits evaluated during this test program are presented in Table 1-2.

Table 1-2
Permit Limits

Parameter	Units	Permit Limit
EUPRESSLINE Biofilter (SVBIOFILTER)		
Outlet formaldehyde concentration	mg/dscm	6.2
Outlet formaldehyde mass emission rate	lb/hr	2.3
Formaldehyde removal efficiency	%	90
Inlet PM_{10}	lb/hr	24.7
Outlet PM_{10}	gr/dscf	0.010
Outlet PM_{10}	lb/hr	8.4
Outlet CO	ppmv	26
Outlet CO	lb/hr	11.4
FGDRYERS RTO (SVRTOSTACK)	**Two-Chamber Operation**	
Outlet RTO PM_{10}	gr/dscf	0.030
Outlet RTO PM_{10}	lb/hr	29.8
Outlet RTO PM_{10}	lb/MMBtu	0.10
Outlet RTO SO_2	lb/hr	5
Outlet RTO NO_x	lb/hr	23.15
Outlet RTO formaldehyde	lb/hr	2.4
Outlet CO (lb/hr) *	lb/hr	147.3
Outlet RTO VOC *	lb/hr, as carbon	18.6
Total Hazardous Air Pollutant reduction measured as total hydrocarbons (i.e., VOCs as carbon)	%	$\leq$90
FGDRYERS RTO (SVRTOSTACK)	**One-Chamber Operation**	
Outlet RTO PM_{10}	gr/dscf	0.057
Outlet RTO PM_{10}	lb/hr	56.6
Outlet RTO CO *	lb/hr	343.7

Table 1-2
Permit Limits

Parameter	Units	Permit Limit
Thermal Oil Heater (SVIBW, EUIBW)		
Outlet NO_x	lb/hr	1.9
Outlet CO	lb/hr	2.3
Thermal Oil Heater (EUCOEN)		
Outlet NO_x	lb/hr	5.0
Outlet CO	lb/hr	3.4

PM_{10} is sum of filterable particulate matter (Method 5 or 17) and condensable particulate matter (Method 202).
gr/dscf: grain per dry standard cubic foot
mg/dscm: milligram per dry standard cubic meter
ppmv: part per million by volume
lb/hr: pound per hour

The specific objectives of the relative accuracy test audit (RATA) testing were:

EUPRESSLINE Biofilter

- Measure the RA of the VOC CERMS against the reference methods at the EUPRESSLINE Biofilter. In accordance with 40 CFR 60, Appendix F, the RATA was calculated in units of the applicable emissions standard, VOC lb/hr as carbon. The allowable relative accuracy based on PS-6 is no greater 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 when the measured emissions are less than 50% of the applicable standard (19.5 lb/hr as carbon).

FGDRYERS RTO

- Measure the RA of the CO and VOC CERMS against the reference methods at the FGDRYERS RTO. In accordance with 40 CFR 60, Appendix F, the RATA was calculated in units of the applicable emissions standard, lb VOC/hr as carbon and lb CO/hr. The allowable relative accuracy based on PS-6 is no greater 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 when the measured emissions are less than 50% of the applicable standard (18.6 lb VOC/hr as carbon; 147.3 lb CO/hr during 2-unit RTO operation; or 343.7 lb CO/hr during 1-unit RTO operation).

1.3 Key Personnel

Mr. David Kawasaki, Air Quality Consultant II with Bureau Veritas, led the emission testing program. Weyerhaeuser personnel provided process coordination and recorded operating parameters. The testing program was witnessed by Mr. David Patterson and Ms. Gloria Torello with MDEQ. Contact information for these individuals is presented in Table 1-3.

Table 1-3
Key Personnel

Permittee	Emission Testing Company
Weyerhaeuser 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 248.344.2661 Facsimile 248.344.2656
Kathi Moss Environmental Manager Telephone 989.348.3475 kathi.moss@weyerhaeuser.com	David Kawasaki, QSTI Air Quality Consultant II Telephone 248.344.3081 david.kawasaki@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	**MDEQ – Air Quality Division** **Technical Programs Unit** Gaylord Field Office 2100 West M-32 Gaylord, Michigan 49735-9282 Telephone 989.705.3410 Facsimile 989.731.6181
David Patterson Environmental Quality Analyst Telephone 517.284.6782 pattersond2@michigan.gov	Gloria Torello Environmental Quality Analyst Telephone 989.705.3410 torellog@michigan.gov

2.0 Source and Sampling Locations

2.1 Process Description

Weyerhaeuser manufactures oriented-strand board (OSB) at its 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 shreds the logs into thin wood chips (flakes). The flakes are conveyed to a storage bin where they are fed into four wood-fired dyers. The dryers remove moisture from the flakes to a product-specific content. The flakes exit the dryers and are sorted according to size using shaker screens.

The fine flakes are collected and used as fuel in the dryers and RTOs. The larger flakes are conveyed to a blending area where wax and resins are added for adhesion purposes. The flakes are then layered, at different angles for strength, onto an 8-foot-wide conveyor belt. The layered flakes are cut into 8-foot-by-24-foot sections and formed into mats. The mats are stacked and the press is used to heat and compact the flakes 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. The OSB is cut, labeled, and prepared for shipment.

The testing was performed under representative operating conditions. Operating parameters recorded during testing are included in Appendix E.

2.2 Control Equipment Description

As part of the manufacturing process, emissions are generated by wood debarking and stranding, conveyance, drying, binding and pressing, milling, and painting (sides of wood). Weyerhaeuser 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.

The VOC CERMS installed on the EUPRESSLINE Biofilter and the VOC and CO CERMS on the FGDRYERS RTO exhaust were used to evaluate continuous compliance with permit limits.

2.2.1 EUPRESSLINE 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 followed by 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).

2.2.2 FGDRYERS RTOs

North and south RTOs are used to control VOC and HAP 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 Lundberg E-Tube WESP. The WESP is designed to remove particulate matter from the flue gas prior to incineration by two RTOs.

The two Megtec RTOs were evaluated during this emissions test program.

At the RTOs, valves alternate the flow direction through each of the RTO chambers. Each chamber contains heat exchange media that alternately heat 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 RTO stack (SVRTOSTACK).

2.2.3 EUIBW Thermal Oil Heater

The No. 2 thermal oil heater has a burner manufactured by IBW. It is a 40-MMBtu/hr natural gas burner which exhausts directly to atmosphere through its own stack (SVIBW). The hot oil is used to heat the presses, building, and during the winter the water vat used to thaw and clean the logs as they enter the process.

2.2.4 EUCOEN Thermal Oil Heater

The No. 1 thermal oil heater has a burner manufactured by Coen. This burner is rated at 50 MMBtu/hr when fired with wood dust and/or 40 MMBtu/hr with natural gas. The heat from this thermal oil heater is used to enhance the heat in EUPRESSLINE. The exhaust may be bypassed to its own stack (SVCOEN) when operated on natural gas only.

The EUCOEN source was tested while burning natural gas and exhausting through SVCOEN during this test program.

When firing wood and wood dust, the exhaust is directed through the dryers and WESP and RTO.

2.3 Flue Gas Sampling Locations

Refer to Figure 1 in the Appendix for a site map of the facility identifying the source locations and Figures 2-1 through 2-5 for photographs of the sampling locations. Figures 2 through 7, located after the Figures tab of this report, depict the source sampling ports and traverse point locations. Descriptions of each source sampling location are presented in Sections 2.3.1 through 2.3.6.

2.3.1 EUPRESSLINE Biofilter Inlet

Two sampling ports oriented at 90° to one another are located in a straight section of an 84-inch-internal-diameter duct. The sampling ports are located:

- Approximately 12.2 feet (1.7 duct diameters) from the nearest downstream disturbance.
- Approximately 49.1 feet (7.0 duct diameters) from the nearest upstream disturbance.

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

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

Figure 2-1. EUPRESSLINE Biofilter Inlet and Outlet Sampling Locations

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2.3.2 EUPPRESSLINE Biofilter Outlet

Two sampling ports oriented at 90° to one another are located in a straight section of an 84-inch-internal-diameter duct. The sampling ports are located:

- Approximately 60 feet (8.6 duct diameters) from the nearest downstream disturbance.
- Approximately 70 feet (10 duct diameters) from the nearest upstream disturbance.

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

A photograph of the EUPRESSLINE Biofilter inlet and outlet sampling locations is presented in Figure 2-1. Figure 3 in the Appendix depicts the EUPRESSLINE Biofilter outlet sampling port and traverse point locations.

2.3.3 WESP Inlet

Two sampling ports orientated at 90° to one another are located in a straight section of a 106-inch-internal-diameter duct. The sampling ports are located:

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

The sampling ports are accessible via man lift. Only the horizontal port was used for flow measurements due to access limitations and safety concerns.

A photograph of the WESP Inlet sampling location is presented in Figure 2-2. Figure 4 in the Appendix depicts the WESP inlet sampling port and traverse point locations.

Figure 2-2. WESP Inlet Sampling Location

2.3.4 FGDRYERS RTO Outlet

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

- Approximately 40 feet (4.6 duct diameters) from the nearest downstream disturbance.
- Approximately 30 feet (3.4 duct diameters) from the nearest upstream disturbance.

The sampling ports are accessible by elevator to the top floor of the Dryer Building and stairs to the SVRTOSTACK catwalk.

A photograph of the FGDRYERS RTO outlet sampling location is presented in Figure 2-3. Figure 5 in the Appendix depicts the FGDRYERS RTO outlet sampling ports and traverse point locations.

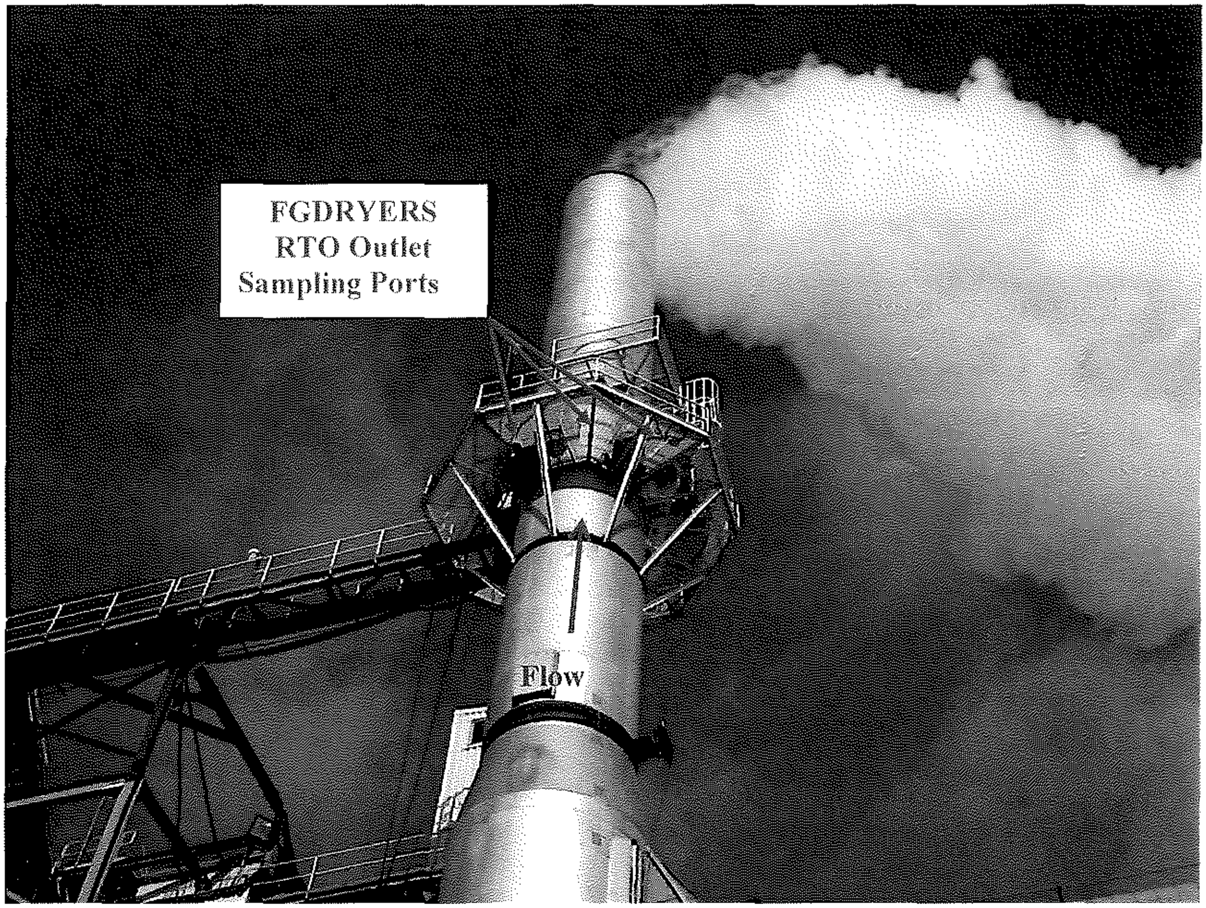

Figure 2-3. FGDRYERS RTO Outlet Sampling Location

2.3.5 EUIBW Thermal Oil Heater

The EUIBW thermal oil heater exhausts to the atmosphere through a vertical 59-inch-internal-diameter exhaust stack equipped with two sampling ports. The sampling ports are located:

- Approximately 16 feet (3.3 duct diameters) from the nearest downstream disturbance.
- Approximately 30 feet (6.1 duct diameters) from the nearest upstream disturbance.

The sampling ports are accessible via a platform extending from the building.

A photograph of the EUIBW outlet sampling location is presented in Figure 2-4. Figure 6 in the Appendix depicts the EUIBW outlet sampling ports and traverse point locations.

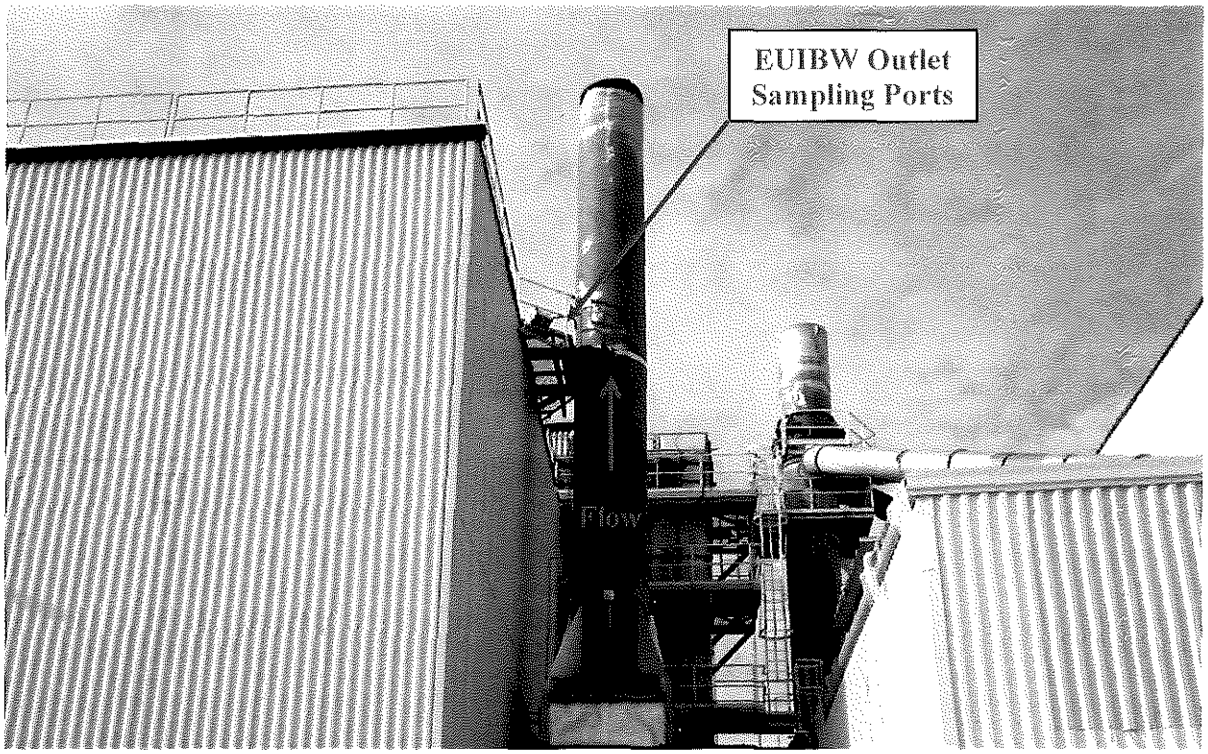

Figure 2-4. EUIBW Outlet Sampling Location

2.3.6 EUCOEN Thermal Oil Heater

The EUCOEN thermal oil heater exhausts to the atmosphere through a vertical 59-inch-internal-diameter exhaust stack equipped with four sampling ports. The sampling ports are located:

- Approximately 15 feet (3 duct diameters) from the nearest downstream disturbance.
- Approximately 5 feet (1 duct diameters) from the nearest upstream disturbance.

Because several ducts enter the exhaust stack just before the sampling ports, the sampling port locations do not meet the requirements of USEPA Method 1. Testing at the EUCOEN source was completed for engineering purposes. A twelve point traverse was conducted throughout sampling.

The sampling ports are accessible via a platform extending from the building. A photograph of the EUCOEN outlet sampling location is presented in Figure 2-5. Figure 7 in the Appendix depicts the EUCOEN outlet sampling ports and traverse point locations.

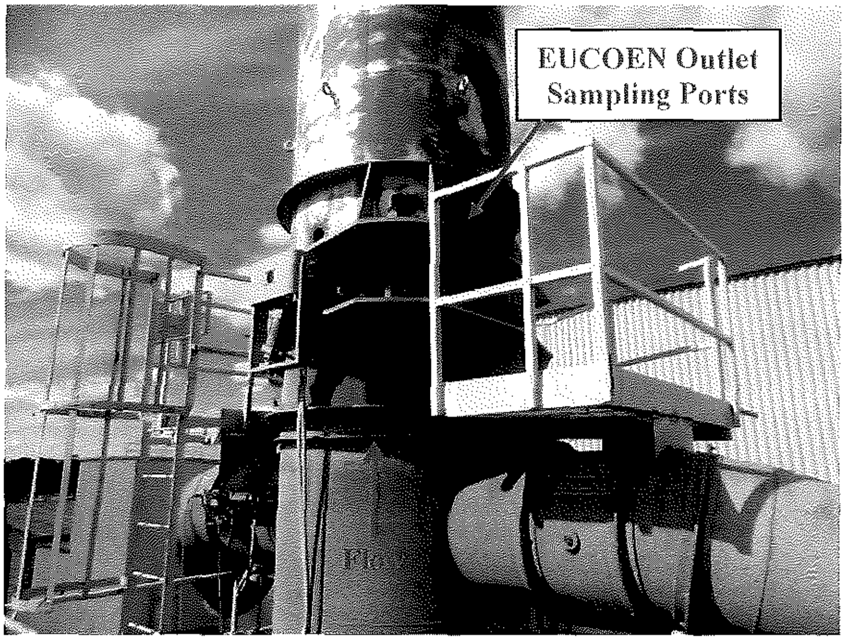

Figure 2-5. EUCOEN Outlet Sampling Location

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 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 is removed from the sample 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 and Test Matrix

The purpose of the emission test program was to evaluate compliance with (1) the national emission standards for PCWP regulation (40 CFR Part 63, Subpart DDDD), and (2) MDEQ ROP MI-ROP-B7302-2016a, effective March 8, 2016, for the EUPRESSLINE Biofilter, FGDRYERS, EUIBW, and EUCOEN emission sources.

Tables 3-1 through 3-4 present the sampling and analytical test matrix.

Table 3-1
EUPRESS Biofilter Test Matrix

Date 2016	Run	Start Time	Stop Time	Sampling Method	Parameter
Nov. 15	1 inlet	9:40	10:40	18	Formaldehyde
Nov. 15	2 inlet	11:02	12:02	18	
Nov. 15	3 inlet	12:16	13:16	18	
Nov. 15	1 outlet	8:55 9:40 8:55	9:55 10:40 9:16	10 18 25A, PS-6, PS-8	CO Formaldehyde VOC RATA
Nov. 15	2 outlet	10:25 11:02 9:40	11:25 12:02 10:01	10 18 25A, PS-6, PS-8	
Nov. 15	3 outlet	11:35 12:16 10:25	12:35 13:16 10:46	10 18 25A, PS-6, PS-8	
Nov. 15	4 outlet	10:54	11:15	25A, PS-6, PS-8	VOC RATA
Nov. 15	5 outlet	11:25	11:46	25A, PS-6, PS-8	
Nov. 15	6 outlet	11:54	12:15	25A, PS-6, PS-8	
Nov. 15	7 outlet	12:24	12:45	25A, PS-6, PS-8	
Nov. 15	8 outlet	12:57	13:18	25A, PS-6, PS-8	
Nov. 15	9 outlet	13:27	13:48	25A, PS-6, PS-8	
Nov. 15	10 outlet	13:56	14:17	25A, PS-6, PS-8	
Nov. 16	1 inlet	9:09	10:32	17/202	PM_{10}
Nov. 16	2 inlet	10:52	12:25	17/202	
Nov. 16	3 inlet	12:49	14:52	17/202	
Nov. 16	1 outlet	9:49	11:19	17/202	
Nov. 16	2 outlet	11:47	13:15	17/202	
Nov. 16	3 outlet	13:42	15:09	17/202	

Table 3-2
FGDRYERS WESP and RTO Test Matrix

Date 2016	Run	Start Time	Stop Time	Sampling Method	Parameter	Comment
Nov. 8	1 WESP Inlet	9:35	10:35	25A	Total HAP	RTO Two-Chamber Operation
Nov. 8	2 WESP Inlet	11:35	12:35			
Nov. 8	3 WESP Inlet	13:22	14:22			
Nov. 8	1 RTO outlet	8:15 9:35	10:00 10:35	5/202 6C, 7E, 25A, 205	PM_{10} NO_x, SO_2, Total HAP	
Nov. 8	2 RTO outlet	10:30 11:35	11:53 12:35	5/202 6C, 7E, 25A, 205		
Nov. 8	3 RTO outlet	12:18 13:22	13:39 14:22	5/202 6C, 7E, 25A, 205		
Nov. 9	1 RTO outlet	9:00	10:00	18	Formaldehyde	
Nov. 9	2 RTO outlet	16:50	17:50			
Nov. 9	3 RTO outlet	17:50	18:50			
Nov. 9	1 RTO outlet	9:00	9:21	10, PS-4, PS-6 25A, PS-6, PS-8	CO RATA VOC RATA	
Nov. 9	2 RTO outlet	9:40	10:01			
Nov. 9	3 RTO outlet	15:19	15:40			
Nov. 9	4 RTO outlet	15:51	16:12			
Nov. 9	5 RTO outlet	16:21	16:42			
Nov. 9	6 RTO outlet	16:50	17:11			
Nov. 9	7 RTO outlet	17:20	17:41			
Nov. 9	8 RTO outlet	17:50	18:11			
Nov. 9	9 RTO outlet	18:22	18:43			
Nov. 9	10 RTO outlet	18:53	19:14			
Nov. 10	1 RTO outlet	7:39 8:20 7:52	9:03 9:20 8:52	5/202 6C, 7E, 10 18	PM_{10} SO_2, NO_x, CO Formaldehyde	RTO One-Chamber Operation
Nov. 10	2 RTO outlet	9:25 9:40 8:55	10:51 10:40 9:55	5/202 6C, 7E, 10 18		
Nov. 10	3 RTO outlet	11:12 11:00 9:57	12:32 12:00 10:57	5/202 6C, 7E, 10 18		

Table 3-3
EUIBW Thermal Oil Heater Test Matrix

Date 2016	Run	Start Time	Stop Time	Sampling Method	Parameter
Nov. 11	1	9:16	10:22	1-4, 7E, 10, 205	Flowrate, NO_x, CO
Nov. 11	2	10:34	11:34		
Nov. 11	3	11:41	12:41		

Table 3-4
EUCOEN Thermal Oil Heater Test Matrix

Date 2016	Run	Start Time	Stop Time	Sampling Method	Parameter	Comment
Nov. 11	1	13:45	14:45	1-4, 7E, 10, 205	Flowrate, NO_x, CO	
Nov. 11	2	14:54	15:54			
Nov. 11	3	16:04	17:45			Data lost for last 19 minutes of run. Analyzer was accidentally disconnected from data acquisition recording system.

3.2 Field Test Changes and Issues

Representatives of Weyerhaeuser and Bureau Veritas discussed field test changes and issues with the MDEQ. These changes were all approved by the MDEQ and are summarized in Sections 3.2.1 through 3.2.3

3.2.1 EUCOEN Outlet Test Run 3 (NO_x and CO)

During Test Run 3 for NO_x and CO at the EUCOEN outlet source, the connection between the analyzers and the data acquisition system (DAS) was unintentionally disconnected for the last 19 minutes of the test run. As a result, the duration for Test Run 3 was shortened from 60 minutes to 41 minutes. Testing at the EUCOEN source was completed for engineering purposes.

3.2.2 EUPRESSLINE Biofilter Outlet Test Run 1 (PM - Post-Test Leak Check)

At the end of Test Run 1 for PM_{10} at the EUPRESSLINE Biofilter outlet source, the glass liner of the sampling probe struck the steel sampling port while the probe was being removed from the sampling location. The glass liner cracked and, as a result, failed the post-test leak check. This issue was discussed with MDEQ representative, David Patterson, while onsite and Mr. Patterson approved use of the test run. A replacement liner was used for the subsequent rest runs.

3.2.3 Particulate Matter Sampling Method Change

As stated in Bureau Veritas' Intent-to-Test Plan, dated October 11, 2016, PM_{10} testing at the EUPRESSLINE Biofilter inlet and outlet and the FGDRYERS RTO outlet sampling locations was proposed to be conducted using USEPA Method 201A. However, the sampling ports installed at these two source locations were too small to allow insertion of the USEPA Method 201A filter heads. While onsite testing, Bureau Veritas contacted MDEQ to discuss using

USEPA Methods 5 and 17 in lieu of USEPA Method 201A and MDEQ approved the method change. The use of USEPA Methods 5 and 17 provides a conservative result for PM_{10} because it collects all particulate matter, not just particulate matter less than 10 microns.

3.3 Results

The average concentrations and emission rates are compared to the applicable emission limits in Tables 3-5 through 3-9. Detailed results are presented in Tables 1 through 16 in the Tables tab of this report. Graphs of the measured concentrations are presented in the Graphs tab of this report. Sample calculations are presented in Appendix B.

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Table 3-5
EUPRESSLINE Biofilter (SVBIOFILTER) Results

Parameter		Result Run 1	Run 2	Run 3	Average	Permit Limit
Formaldehyde concentration (mg/dscm)	Inlet	7.9	6.5	6.7	**7.0**	-
	Outlet	0.62	0.62	0.50	0.58	6.2
Formaldehyde mass emission rate (lb/hr)	Inlet	3.5	2.6	2.7	**2.9**	-
	Outlet	0.24	0.24	0.20	0.23	2.3
Formaldehyde mass removal efficiency (%)		93.0	90.8	92.8	92.2	≥90
PM_{10} (gr/dscf)	Inlet	0.0069	0.0067	0.0056	**0.0064**	-
	Outlet	0.0094	0.0048	0.0037	0.0060	0.010
PM_{10} (lb/hr)	Inlet	6.6	6.5	5.5	6.2	24.7
	Outlet	7.4	4.1	3.2	4.9	8.4
PM_{10} mass removal efficiency (%)		-12.1	36.9	41.8	**22.2**	-
CO (ppmv)	Outlet	5.1	4.4	3.9	4.5	26
CO (lb/hr)	Outlet	2.3	1.9	1.8	2.0	11.4
Media bed temperature, 15-minute average (°F)		81.1	81.4	81.5	**81.3**	-

PM_{10} is sum of filterable particulate matter (Method 17) and condensable particulate matter (Method 202).
mg/dscm: milligram per dry standard cubic meter
lb/hr: pound per hour
gr/dscf: grain per dry standard cubic foot
ppmv: part per million by volume

Table 3-6
FGDRYERS WESP and RTO (SVRTOSTACK) Results

Parameter	Result			Average	Permit Limit
	Run 1	Run 2	Run 3		
RTO Two-Chamber Operation					
Inlet WESP VOC (lb/hr, as carbon)	66	148	76	**97**	-
Outlet RTO VOC (lb/hr, as carbon)	5.2	9.1	6.4	6.9	18.6
RTO total HAP (measured as THC/VOC as carbon) reduction efficiency (%)	92.2	93.9	91.5	92.5	≥90
Outlet RTO PM_{10} (gr/dscf)	0.0051	0.0036	0.0043	0.0043	0.030
Outlet RTO PM_{10} (lb/hr)	4.1	3.4	4.3	4.0	29.8
Outlet RTO PM_{10} (lb/MMBtu)	0.023	0.016	0.019	0.019	0.10
Outlet RTO SO_2 (lb/hr)	0.41	0.032	0.033	0.16	5
Outlet RTO NO_x (lb/hr)	17.71	18.68	26.81	21.07	23.15
Outlet RTO CO (lb/hr) †	86.4	51.6	104.2	80.8	147.3
Outlet RTO formaldehyde (lb/hr)	0.16	1.3	<0.12	0.53	2.4
RTO One-Chamber Operation					
Outlet RTO PM_{10} (gr/dscf)	0.0043	0.0046	0.0070	0.0053	0.057
Outlet RTO PM_{10} (lb/hr)	4.4	4.9	6.7	5.3	56.6
Outlet RTO NO_x (lb/hr)	16.35	19.30	18.09	**17.91**	-
Outlet RTO CO (lb/hr)	106	105	140	117	343.7
Outlet RTO SO_2 (lb/hr)	2.5	0.048	0.017	**0.86**	-
Outlet RTO formaldehyde (lb/hr)	0.65	0.78	0.50	0.64	-
Media bed temperature, 15-minute average (°F)	1,426	1,435	1,435	1,432	>1,422

PM_{10} is sum of filterable particulate matter (Method 5) and condensable particulate matter (Method 202).
gr/dscf: grain per dry standard cubic foot
lb/hr: pound per hour
† Measured by Weyerhaeuser's continuous emission rate monitor (CERM) by averaging data during RATA Runs 1-3, 4-6, and 8-10.

Table 3-7
Relative Accuracy Test Audit Results

Parameter	Average RM Result	Average CEMS Result	Difference between CEMS and RM	Relative Accuracy (%)	Performance Specification
EUPRESSLINE (Biofilter)					
VOCs (lb/hr as carbon)	21.80	20.82	0.98	6.5	≤20% RM
FGDRYERS (RTO)					
VOCs (lb/hr as carbon)	3.60	4.04	-0.44	4.0	≤10% AS
CO (lb/hr)	77.99	80.77	-2.77	6.5	≤20% RM

CEMS: continuous emission monitoring system
lb/hr: pound per hour
RM: Reference Method
AS: Applicable Standard

Table 3-8
EUIBW Thermal Oil Heater (SVIBW) Results

Parameter	Result			Average	Permit Limit
	Run 1	Run 2	Run 3		
NO_x (lb/hr)	1.1	0.66	0.90	0.87	1.9
CO (lb/hr)	0.31	0.19	0.10	0.20	2.3

lb/hr: pound per hour

Table 3-9
EUCOEN Thermal Oil Heater (SVCOEN) Results

Parameter	Result			Average	Permit Limit
	Run 1	Run 2	Run 3		
NO_x (lb/hr)	2.5	2.4	2.3	2.4	5.0
CO (lb/hr)	0.35	0.22	0.10	0.22	3.4

lb/hr: pound per hour

4.0 Sampling and Analytical Procedures

Bureau Veritas measured emissions in accordance with the procedures specified in USEPA's Standards of Performance for New Stationary Sources. The sampling and analytical methods used during this test program are listed in Table 4-1.

Table 4-1
Sampling and Analytical Test Methods

USEPA Sampling Method	Parameter	Analysis
1 and 2	Gas stream volumetric flowrate	Field measurement, S-type Pitot tube
3	Molecular weight	Fyrite analyzer
4	Moisture content	Gravimetric
5	Filterable particulate matter	Gravimetric
6C	Sulfur dioxide	Ultraviolet
7E	Nitrogen oxides	Chemiluminescence
10	Carbon Monoxide	Nondispersive infrared
17	Filterable particulate matter less than 10 microns	Gravimetric
18 and TO-11	Formaldehyde	Gas chromatography
25A	Volatile organic compounds	Flame ionization detector
202	Condensable particulate matter	Gravimetric
205	Calibration gas dilutions	Field instrument verification
320	Formaldehyde	Fourier transform infrared spectroscopy

4.1 Emission 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 location and the number of traverse points for sampling and the measurement of velocity profiles. Figures 2 through 7 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, calibrated in accordance with Method 2, Section 10.0, were used during testing. Because the dimensions of the Pitot tubes met the requirements outlined in Method 2, Section 10.1, and were within the specified limits, the baseline Pitot tube coefficient of 0.84 (dimensionless) was assigned. The digital manometer and thermometer are calibrated using calibration standards that are traceable to National Institute of Standards and Technology (NIST). Refer to Appendix A for the Pitot tube inspection sheets.

Cyclonic Flow Check. Bureau Veritas evaluated whether cyclonic flow was present at the sampling locations.

Cyclonic flow is defined as a flow condition with an average null angle greater than 20°. The direction of flow was determined by aligning the Pitot tube to obtain zero (null) velocity head readings—the direction would be parallel to the Pitot tube face openings or perpendicular to the null position. By measuring the angle of the Pitot tube face openings in relation to the stack walls when a null angle is obtained, the direction of flow was measured. The absolute average of the flow direction angles at each sampling location was less than 20°, thus the flue gas flow is considered to be non-cyclonic.

Field data sheets are included in Appendix C. Computer-generated field data sheets are included in Appendix D.

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)

Before testing, moisture content was estimated using previous test data, psychrometric charts, and/or saturation vapor pressure tables. This estimate was used in conjunction with preliminary velocity head and temperature data to (1) calculate flue gas velocity and ideal nozzle diameter, and (2) establish isokinetic sampling rates.

The moisture content of the WESP inlet was determined using psychrometric charts. For some test runs at the EUPRESSLINE Biofilter inlet and outlet and the FGDRYERS RTO outlet sources, moisture content of the flue gas was measured using the reference method outlined in Section 2 of Method 4, "Determination of Moisture Content in Stack Gases" in conjunction with USEPA Method 202 sampling train. For the remaining test runs at the EUPRESSLINE Biofilter inlet and outlet and the FGDRYERS RTO outlet sources, as well as, for test runs at the EUIBW and EUCOEN sources, moisture content was measured gravimetrically following USEPA Method 4 guidelines.

Bureau Veritas' modular USEPA Method 4 stack sampling system consisted 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 4-2 situated in a chilled ice bath.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Table 4-2
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 to measure that the sample train leak rate was less than 0.02 cubic feet per minute (cfm). The sampling 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 within 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 4-1 depicts the USEPA Method 4 sampling train.

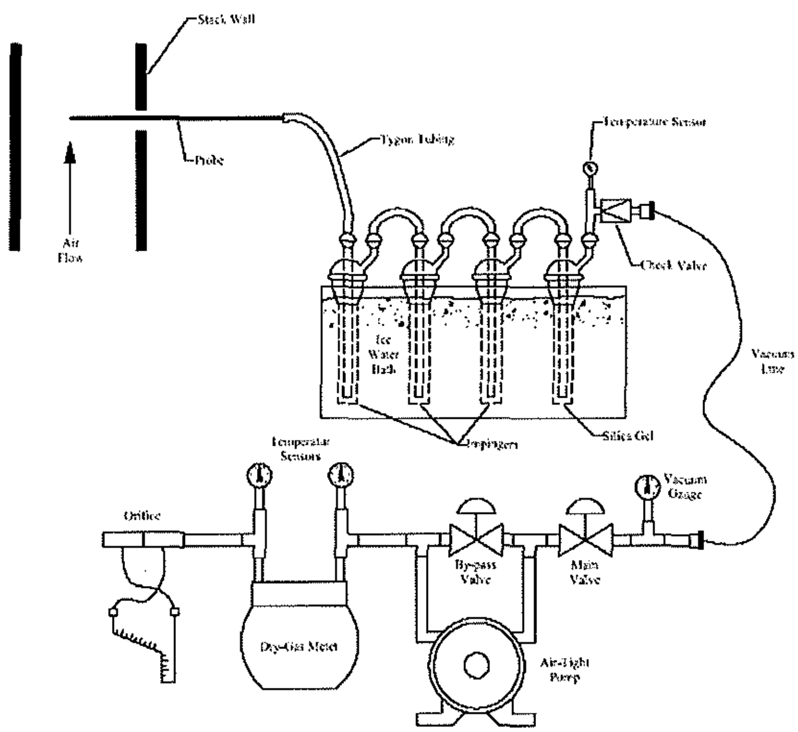

Figure 4-1. USEPA Method 4 Sampling Train

4.1.4 Filterable and Condensable Particulate Matter (USEPA Methods 5, 17, and 202)

USEPA Methods 5, "Determination of Particulate Matter Emissions from Stationary Sources" or 17, "Determination of Particulate Matter Emissions from Stationary Sources," and 202, "Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources," were used to measure particulate matter emissions at the Weyerhaeuser facility. USEPA

Methods 5 and 17 measure filterable particulate matter (FPM), while the Method 202 train collects condensable particulate matter (CPM).

CPM is defined as material that is in vapor phase at stack conditions, but that condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid FPM immediately after discharge from the stack. Method 202 collects CPM using a water-dropout impinger, modified Greenburg-Smith impinger, and a Teflon filter.

The sum of the Method 5 or Method 17 (FPM) and Method 202 (CPM) mass collected represent total particulate matter, which will be used as a conservative measurement of particulate matter with diameter less than 10 microns (PM_{10}).

USEPA Methods 5 and 202

Bureau Veritas' modular Methods 5 and 202 isokinetic stack sampling system consists of the following (in order from the stack to the control case):

- A stainless steel button-hook nozzle.
- A heated (248±25°F) stainless steel probe.
- A desiccated and pre-weighed 83-millimeter-diameter glass fiber filter (manufactured to at least 99.95% efficiency (<0.05 % penetration) for 0.3-micron dioctyl phthalate smoke particles) in a heated (248±25°F) filter box.
- An EPA Method 23-type stack gas condenser with water recirculation pump.
- A set of four GS impingers with the configuration shown in Table 4-3.
- A second (back-half) CPM Teflon filter inserted between the second and third impingers and maintained at a temperature between 65 and 85°F.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Figure 4-2 depicts the USEPA Methods 5 and 202 sampling train.

Table 4-3
USEPA Method 202 Impinger Configuration

Impinger Order (Upstream to Downstream)	Impinger Type	Impinger Contents	Amount of Contents
1	Modified – dropout	Empty	0 milliliter
2	Modified	Empty	0 milliliter
CPM Filter			
3	Modified	HPLC water	100 milliliter
4	Modified	Silica gel desiccant	~200-300 grams

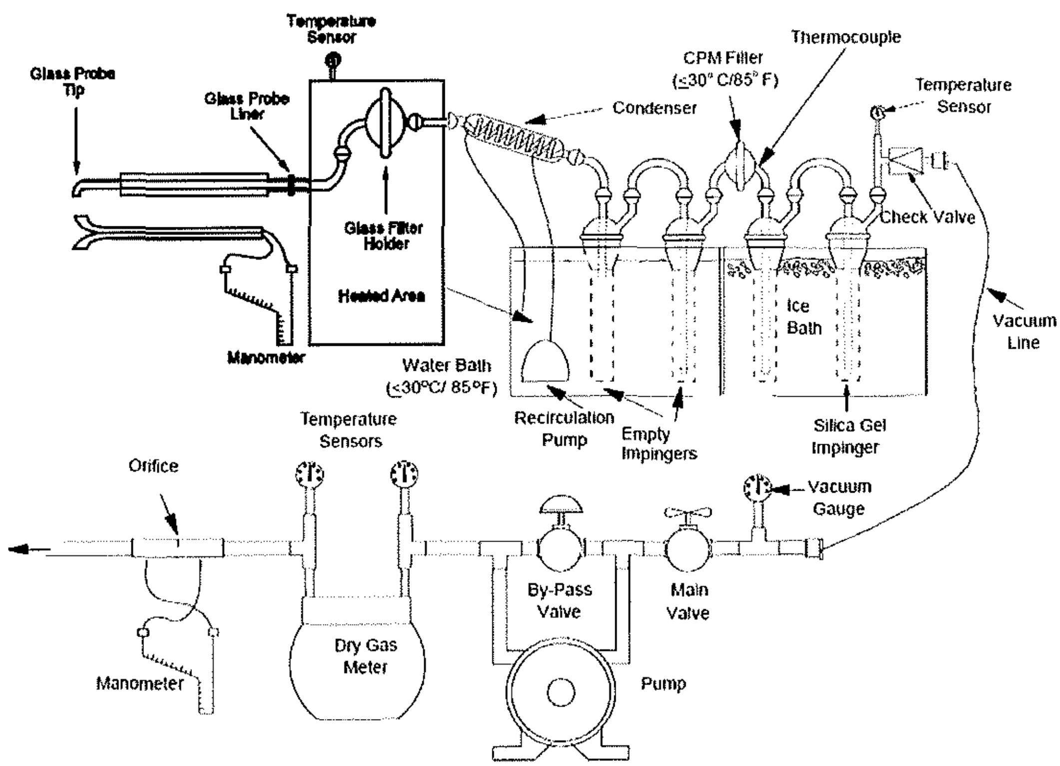

Figure 4-2. USEPA Methods 5 and 202 Sampling Train

USEPA Methods 17 and 202

Bureau Veritas' modular isokinetic Method 17 stack sampling system is similar to the USEPA Method 5 and 202 sample train with the following modification to the probe and filter:

- A desiccated and pre-weighed 47-millimeter diameter glass fiber filter (manufactured to at least 99.95% efficiency (<0.05 % penetration) for 0.3-micron dioctyl phthalate smoke particles) situated in a stainless-steel in-stack filter holder.
- A rigid borosilicate glass-lined sampling probe.

Figure 4-3 depicts the USEPA Methods 17 and 202 sampling train.

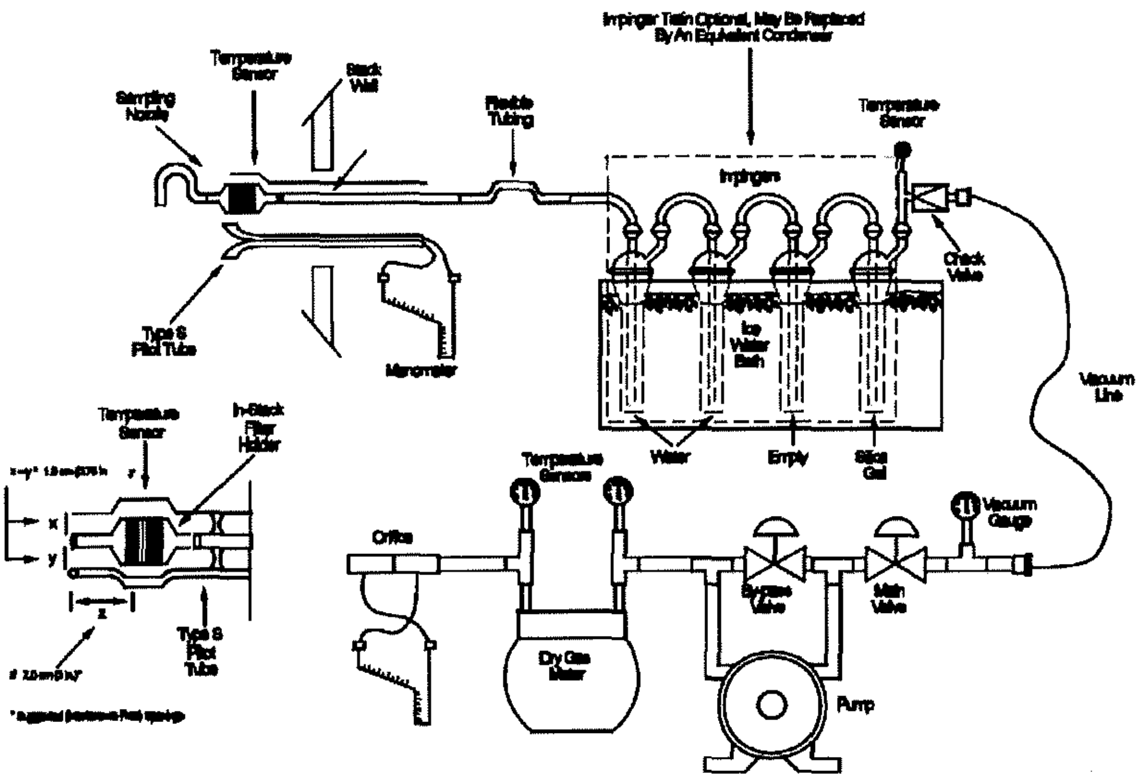

Figure 4-3. USEPA Methods 17 and 202 Sampling Train

Before testing, a preliminary velocity traverse was performed and a calculated nozzle size that would allow isokinetic sampling at an ideal average rate of 0.75 cubic feet per minute. Bureau Veritas selected a pre-cleaned stainless steel nozzle with an inner diameter that approximates the calculated ideal value. The nozzle was measured with calipers across three cross-sectional chords to evaluate the inside diameter. The nozzle was rinsed and brushed with acetone and connected to the stainless steel probe or filter holder.

The impact and static pressure openings of the Pitot tube were leak-checked at or above a velocity head of 3.0 inches of water for more than 15 seconds. The sampling train was leak-checked by capping the nozzle tip and applying a vacuum of approximately 15 inches of mercury to the sampling train. The dry-gas meter was monitored (for ~1 minute) to measure that the sample train leakage rate was less than 0.02 cubic feet per minute. The sample probe was then inserted into the sampling port to begin sampling.

Ice was placed around Impingers 3 and 4. The Method 5 probe and filter temperatures were allowed to stabilize at 248±25 °F before each test run. After the desired operating conditions were coordinated with the facility, testing was initiated. Stack parameters (e.g., flue velocity, temperature) were monitored to establish the isokinetic sampling rate within ±10 % for the duration of the test.

At the conclusion of a test run and the post-test leak check, the sampling train was disassembled and the impingers and filter were transported to the recovery area. The filter was recovered using Teflon-lined tweezers and placed in a Petri dish, sealed with Teflon tape, and labeled as FPM Container 1. The nozzle, probe, and the front half of the filter holder assembly were brushed and, at a minimum, rinsed six times with acetone to recover particulate matter. The acetone rinses were collected in pre-cleaned sample containers, sealed with Teflon tape, and labeled as FPM Container 2.

Before recovery of the Method 202 train and immediately after the conclusion of the test, the impinger train was purged with filtered 99.9% pure nitrogen gas to remove dissolved sulfur dioxide gases from the impingers. The nitrogen purge flowrate was 14 liters per minute for 1 hour. The nitrogen purge was only conducted if water condensed in the first two impingers.

At the conclusion of the nitrogen purge, the mass of liquid collected in each impinger was measured using an electronic scale accurate to ±0.5 gram. The data were used to calculate the moisture content of the sampled flue gas.

The contents of the first two impingers were collected in a glass sample container labeled as "CPM Container 1, aqueous liquid impinger contents."

The back of the filter-holder, glass-lined probe, condenser, Impingers 1 and 2, front-half of the CPM filter holder, and all connecting glassware were rinsed twice with HPLC water and the recovery rinsate was added to CPM Container 1. Following the HPLC water rinse, the back of the filter-holder, probe extension, condenser, Impingers 1 and 2, front-half of the CPM filter holder, and all connecting glassware were rinsed with acetone and then rinsed twice with hexane. The acetone and hexane rinses were collected in a glass sample container labeled as "CPM Container 2, organic rinses."

The CPM filter was recovered using Teflon-lined tweezers and placed in a container; the container was sealed with Teflon tape, and labeled as "CPM Container 3, CPM filter sample."

The mass of condensate collected in Impingers 3 and 4 was measured to calculate the moisture content of the flue gas; the contents of these impingers were not recovered.

Method 5, 17, and 202 sample containers, including a field train blank, field train proof blank, acetone, HPLC water, and hexane reagent blanks were transported to the laboratory for analysis.

4.1.5 Sulfur Dioxide, Nitrogen Oxides, and Carbon Monoxide (USEPA Methods 6C, 7E, and 10)

USEPA Method 6C, "Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure);" Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrument Analyzer Procedure);" and Method 10 "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrument Analyzer Procedure)" were used to measure SO_2, NO_x, and CO concentrations. Flue gas was continuously sampled from the stack and conveyed to an ultraviolet absorption, chemiluminescence, and infrared analyzer for SO_2, NO_x, and CO concentration measurements. Flue gas was extracted from the stack through:

- A stainless steel probe.
- Heated Teflon sampling 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.
- SO_2, NO_x, and CO gas analyzers.

Figure 4-4 depicts the USEPA Methods 6C, 7E, and 10 sampling trains. Data were recorded at 1-second intervals on a computer equipped with data acquisition software.

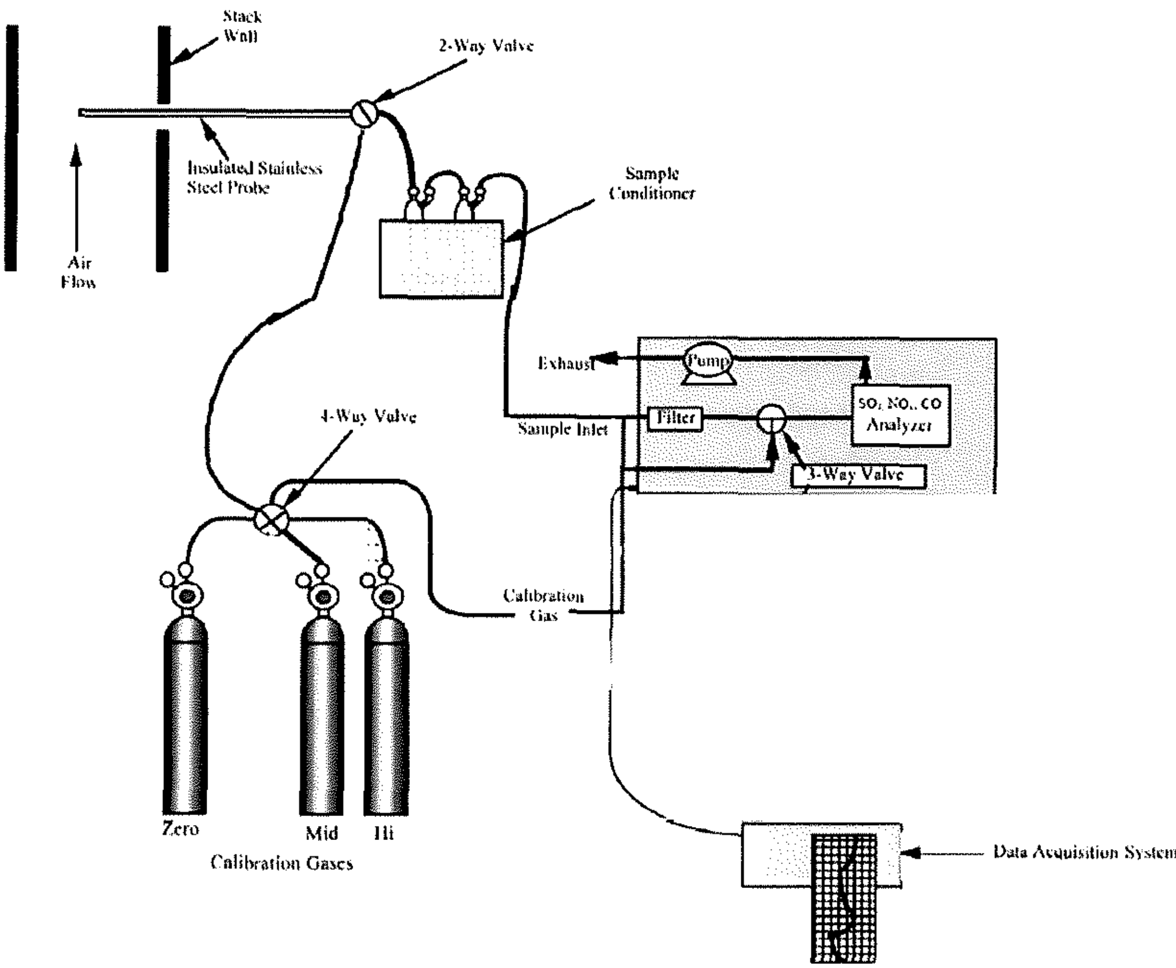

Figure 4-4. USEPA Methods 6C, 7E, and 10 Sampling Train

Prior to testing, a 3-point stratification test was conducted at 17, 50, and 83% of the stack diameter for at least twice the response time to determine the minimum number of traverse points to be sampled.

The pollutant concentrations were measured using SO_2, NO_x, and CO gas analyzers calibrated with zero-, mid-, and high-level EPA-Traceability-Protocol-certified calibration gases. The mid-level gas was 40 to 60% of the high-level (also referred to as span) gas.

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 analyzers response was within ±5% of the introduced calibration gas concentrations. At the conclusion of each test run, an additional system-bias check was performed to evaluate the analyzer drift from the pre- and post-test system-bias checks. The system-bias check evaluated the analyzer drift against the ±3% quality assurance/quality control (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 60-minute test run.

An NO/NO_2 conversion check was performed by introducing an approximate 50 part per million (ppm) NO_2 calibration gas into the NO_x analyzer. The analyzer's NO_x concentration response was greater than 90% of the introduced NO_2 calibration gas concentration. The analyzer's NO/NO_2 conversion met the converter efficiency requirement of Section 13.5 of USEPA Method 7E.

4.1.6 Formaldehyde (USEPA Method 18)

Formaldehyde concentrations at the FGDRYERS RTO outlet were measured according to procedures outlined in USEPA Method 18, "Measurement of Gaseous Organic Compound Emissions by Gas Chromatography." Figure 4-5 depicts the USEPA Method 18 sampling train.

The sampling and analytical procedures followed guidelines in:

- USEPA, Compendium of Method TO-11, "Determination of Formaldehyde in Ambient Air Using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC) [Active Sampling Methodology]."

Impingers and sorbent tubes were used to sample formaldehyde following USEPA Method 18 / TO-11. The sampling train consisted of:

- A set of two impingers (with the configuration shown in Table 4-4) situated in an ice bath.
- Unspiked (normal) and spiked sorbent tubes for the targeted analyte.
- Critical orifices to set the sampling flowrate.
- Teflon® tubing connecting the critical orifices to a rotameter.

Table 4-4
USEPA Method 18 Impinger Configuration

Impinger	Type	Contents	Amount
1	Midget	Water	10 milliliters
2	Midget	Water	10 milliliters

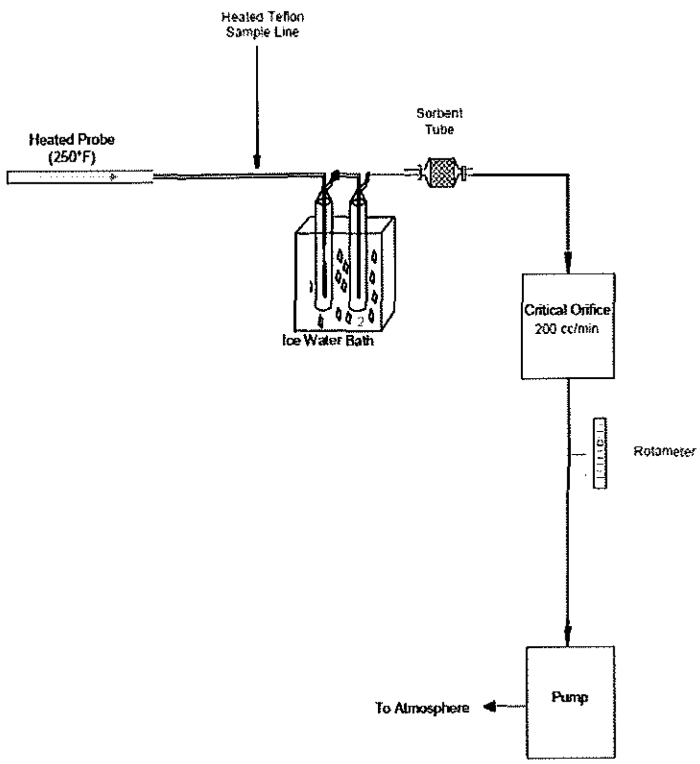

Figure 4-5. USEPA Method 18 Sampling Train

Flue gas passes through impingers and sorbent tubes positioned upstream of critical orifices (Gemini® twin-port sampler) that control flowrate during the collection of formaldehyde. The critical orifices are connected to a rotameter and sampling pump. The sampling flowrate was monitored with the rotameter.

A similar sampling train using spiked sorbent tubes was collocated and placed parallel to the unspiked sorbent tubes for QA/QC purposes.

Based on the expected concentrations and analytical detection limits, the USEPA Method 18 sampling trains were set up to collect approximately 12 L of sample, at a rate of 0.2 L per minute, for a 60-minute test run. The mass of formaldehyde on the spiked sample media was targeted to be 40 to 60% of the expected mass to be collected at each sampling location.

Prior to testing, the flowrate through each impinger and sorbent tube was measured using a rotameter and verified with a BIOS International DryCal® calibrator. The critical orifices were adjusted so that the sampling flowrate was within ±20% of the target sampling rate. The pre-test flowrate was recorded on a test run data sheet. After the sampling rate was measured, the sampling train was positioned to sample the flue gas. Flue gas was sampled through the impingers and into the sorbent tubes for 60 minutes per test run.

At the conclusion of each test run, the post-test sampling train flowrate was measured using the DryCal® calibrator. The average of the pre- and post-test flowrates was used to calculate the flue gas sample volume for the test duration. The contents of the impingers were recovered and the sorbent tube was capped and stored in a chilled cooler. The impinger and sorbent tube samples were analyzed. Laboratory analytical results are presented in Appendix F.

Because the mass was collected on co-located unspiked and spiked sorbent media, spike recovery calculations were completed for QA/QC information. The spike recovery calculation compares the concentration measured by the unspiked and spiked sorbent tubes and corrects the results based on the fraction of spiked compound recovered.

4.1.7 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. 109A and 3-300 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 methane. 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.

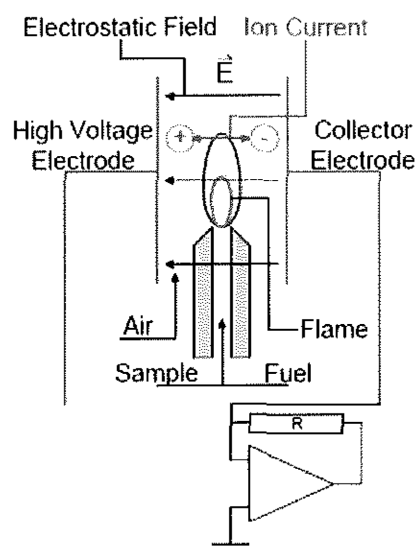

Figure 4-6. FID Flame Chamber

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 4-6.

For the RATA tests, the flue gas was withdrawn from three sampling 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 7-minute intervals during the 21-minute RATA tests.

Figure 4-7 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., methane) in equivalent units.

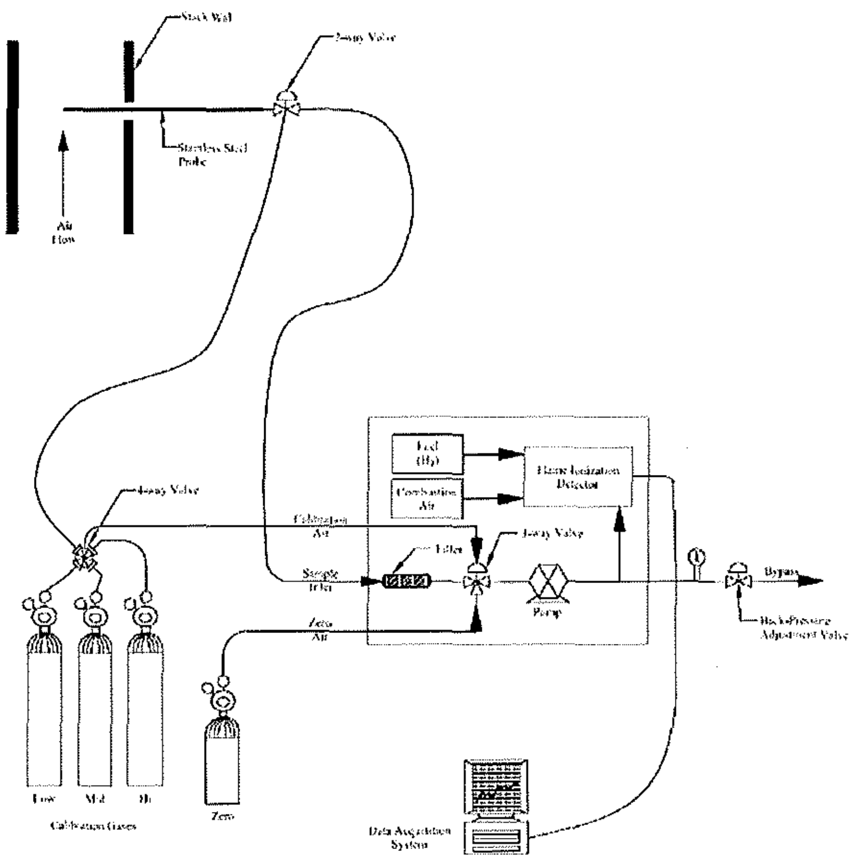

Figure 4-7. USEPA Method 25A Sampling Train

4.1.8 Gas Dilution (USEPA Method 205)

A gas dilution system was used to introduce known values of calibration gases into the SO_2, NO_X, CO, and VOC analyzers. The gas dilution system consisted of calibrated orifices. The system diluted a high-level calibration gas to within ±2% of predicted values.

Before the start of a testing, the gas divider dilutions were measured to be within 2% of predicted values. Two sets of dilutions of a high level calibration gas were performed. Subsequently, a certified mid-level calibration gas was introduced into the analyzer; the calibration gas concentration was within 10% of the dilution. Refer to Appendix A for the certified calibration gas certificates and gas dilution field calibration notes.

4.1.9 Formaldehyde (USEPA Method 320)

Formaldehyde emissions at the inlet and outlet of the EUPRESSLINE Biofilter were measured in accordance with USEPA Method 320, "Vapor Phase Organic & Inorganic Emissions by Extractive FTIR." Figure 4-8 depicts the FTIR sampling train.

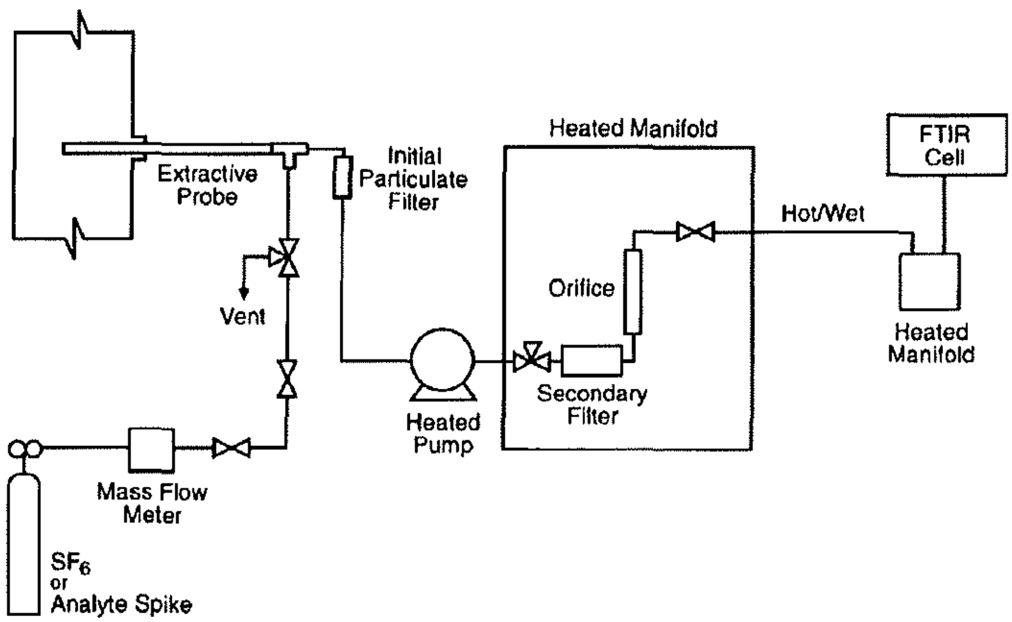

Figure 4-8. USEPA Method 320 Sampling Train

Gaseous samples were drawn from the ducts and transferred to MKS Instruments MultiGas 2030 (or equivalent) FTIR spectrometers. The samples passed through a heated probe, heated filter, and heated transfer line in route to the FTIRs. The probes, filters, transfer lines, and FTIRs were maintained at 191°C (375°F). The formaldehyde determination was made from a hot, wet sample. Samples continuously flowed through the FTIR and sampling system during testing. The FTIR scanned the sample approximately once per second. A data point consists of the co-addition of the scans, with a data point generated every minute.

A calibration transfer standard (CTS) was analyzed before and after testing. Ethylene was used as the CTS. Acetaldehyde spiking was performed before and after each test run. Section 3.29 of USEPA Method 320 allows the use of a surrogate analyte for the purposes of analyte spiking. Acetaldehyde was chosen as the surrogate to formaldehyde for the following reasons

- Acetaldehyde shares many physical and chemical properties with formaldehyde. Formaldehyde is the C_1 aldehyde (CH_2O); acetaldehyde is the C_2 aldehyde (CH_3CHO).

- The cost of a formaldehyde gas standard is nearly ten times the cost of an acetaldehyde cylinder which elevates the total cost to the client.

- The expiration time of a formaldehyde standard is 6 months compared to a 12-month expiration time of the acetaldehyde standard; thus, the number of projects per gas cylinder is greater using acetaldehyde, which in turn lowers project cost.

4.2 Procedures for Obtaining Process Data

Process data were recorded by Weyerhaeuser personnel. Refer to Section 2.0 for discussions of process and control device data and Appendix E for the operating parameters recorded during testing.

4.3 Sampling Identification and Custody

Recovery and analytical procedures were applicable to the sampling methods used in this test program. Applicable chain-of-custody procedures followed guidelines outlined in ASTM D4840-99 (Reapproved 2010), "Standard Guide for Sample Chain-of-Custody Procedures." Detailed sampling and recovery procedures are described in Section 4.0. For each sample collected (i.e., filter, probe rinse, impinger contents), sample identification and custody procedures were completed as follows:

- Containers were sealed with Teflon tape to prevent contamination.
- Containers were labeled with test number, location, and test date.
- The level of fluid was marked on outside of sample containers to identify if leakage had occurred before delivery of the samples to the laboratory.
- Containers were placed in a cooler for storage if necessary.
- Samples were logged using guidelines outlined in ASTM D4840-99(2004), "Standard Guide for Sampling Chain-of-Custody Procedures."
- Samples were transported to the laboratory under chain of custody.

Chains of custody and laboratory analytical results are included in Appendix F.

5.0 QA/QC Activities

Equipment used in this emissions test program passed 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 and Principles" and, Volume III, "Stationary Source Specific Methods." Refer to Appendix A for inspection and calibration sheets.

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. Calibration measurements for pitot tubes 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.

5.2.2 Sampling Train QA/QC Audits

The sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. The following tables summarize the QA/QC audits conducted on each sampling train.

Table 5-1
EUPRESSLINE Biofilter Inlet Sampling Train QA/QC Audits

Parameter	Run 1	Run 2	Run 3	Method Requirement	Comment
Methods 17 and 202					
Average velocity pressure head (in H_2O)	0.89	0.92	0.97	>0.05 in $H_2O^{\dagger}$	Valid
Sampling train leak check Post-test	0 ft^3/min at 16 in Hg	0 ft^3/min at 15 in Hg	0.001 ft^3/min at 15 in Hg	<0.020 ft^3/min at vacuum greater than recorded during test run	Valid
Test run sampling vacuum (in Hg)	12 to 16	7 to 9	12 to 13		
Isokinetic Sampling Rate	99%	100%	106%	80-120%	Valid

† Manometer capable of reading 0 to 10 in H_2O acceptable for measuring differential pressure head above 0.05 in H_2O.

Table 5-2
EUPRESSLINE Biofilter Outlet Sampling Train QA/QC Audits

Parameter	Run 1	Run 2	Run 3	Method Requirement	Comment
Methods 17 and 202					
Average velocity pressure head (in H_2O)	0.57	0.67	0.66	>0.05 in $H_2O^{\dagger}$	Valid
Sampling train leak check Post-test	0 ft^3/min at 12 in Hg	0 ft^3/min at 15 in Hg	0 ft^3/min at 10 in Hg	<0.020 ft^3/min at vacuum greater than recorded during test run	Valid
Test run sampling vacuum (in Hg)	4 to 10	5 to 14	3 to 6		
Isokinetic Sampling Rate	98%	104%	98%	80-120%	Valid

† Manometer capable of reading 0 to 10 in H_2O acceptable for measuring differential pressure head above 0.05 in H_2O.

Table 5-3
FGDRYERS RTO Outlet (Two-Chamber Operation)
Sampling Train QA/QC Audits

Parameter	Run 1	Run 2	Run 3	Method Requirement	Comment
Methods 5 and 202					
Average velocity pressure head (in H_2O)	0.50	0.62	0.65	>0.05 in $H_2O^{\dagger}$	Valid
Sampling train leak check Post-test	0.015 ft^3/min at 8 in Hg	0 ft^3/min at 12 in Hg	0 ft^3/min at 8 in Hg	<0.020 ft^3/min at vacuum greater than recorded during test run	Valid
Test run sampling vacuum (in Hg)	1 to 6	6 to 10	4 to 7		
Isokinetic Sampling Rate	102%	101%	100%	80-120%	Valid

† Manometer capable of reading 0 to 10 in H_2O acceptable for measuring differential pressure head above 0.05 in H_2O.

Table 5-4
FGDRYERS RTO Outlet (One-Chamber Operation)
Sampling Train QA/QC Audits

Parameter	Run 1	Run 2	Run 3	Method Requirement	Comment
Methods 5 and 202					
Average velocity pressure head (in H_2O)	0.70	0.72	0.61	>0.05 in $H_2O^{\dagger}$	Valid
Sampling train leak check Post-test	0 ft^3/min at 13 in Hg	0 ft^3/min at 12 in Hg	0 ft^3/min at 10 in Hg	<0.020 ft^3/min at vacuum greater than recorded during test run	Valid
Test run sampling vacuum (in Hg)	3 to 12	8 to 12	3 to 5		
Isokinetic Sampling Rate	101%	102%	104%	80-120%	Valid

† Manometer capable of reading 0 to 10 in H_2O acceptable for measuring differential pressure head above 0.05 in H_2O.

5.2.3 Dry-Gas Meter QA/QC Audits

Table 5-5 summarizes the dry-gas meter calibration checks compared to the acceptable USEPA tolerance. Refer to Appendix A for complete DGM calibrations.

Table 5-5
Dry-Gas Meter Calibration Checks

Meter Box	Date Calibrated	Calibration Factor (Y) (dimensionless)	Acceptable Range	Calibration Result
2	Oct 12, 2016	0.979	0.97 - 1.03	Valid
3	Oct 12, 2016	0.988	0.97 - 1.03	Valid
8	Oct 11, 2016	0.974	0.97 - 1.03	Valid

5.2.4 Thermocouple QA/QC Audits

Temperature measurements using thermocouples and digital pyrometers were compared to reference temperatures to evaluate accuracy of the equipment. The thermocouples and pyrometers measured temperatures within ±1.5% (i.e., the USEPA acceptance criterion) of reference temperatures. Thermocouple and pyrometer calibration results are presented in the Appendix A.

5.3 Particulate Matter QA/QC Blanks

Reagent, field train recovery, and field train proof blanks were analyzed for the constituent of interest. The results of the blanks are presented in the Table 5-6. The blank results do not indicate significant contamination occurred in the field. Blank corrections were not applied.

Table 5-6
QA/QC Blanks

Sample Identification	Result (mg)	Comment
M5 Acetone Blank (RTO Outlet Two-Chamber Operation)	0.7	Reporting limit is 0.5 milligrams
M5 Acetone Blank (RTO Outlet One-Chamber Operation)	0.9	Reporting limit is 0.5 milligrams
M17 Acetone Blank (Biofilter Inlet)	1.1	Reporting limit is 0.5 milligrams
M17 Acetone Blank (Biofilter Outlet)	0.9	Reporting limit is 0.5 milligrams
M5 Filter Blanks	<0.3	Reporting limit is 0.3 milligrams
M17 Filter Blanks	<0.3	Reporting limit is 0.3 milligrams
M202 Acetone Field Reagent Blank #6	<1.0	Reporting limit is 1.0 milligrams
M202 Water Field Reagent Blank #7	1.1	Reporting limit is 0.5 milligrams
M202 Hexane Field Reagent Blank #8	<1.0	Reporting limit is 1.0 milligrams
M202 Field Train Proof Blank Inorganic #9	0.9	Consists of inorganic CPM recovered prior to first test run.
M202 Field Train Proof Blank Organic #10	<1.0	Consists of organic CPM recovered prior to first test run.
M202 (RTO Outlet Two-Chamber Operation) Field Train Recovery Blank	2.6	Consists of organic and inorganic CPM. Field sample weight blank corrections were not applied.
M202 (RTO Outlet One-Chamber Operation) Field Train Recovery Blank	3.2	Consists of organic and inorganic CPM. Field sample weight blank corrections were not applied.
M202 (Biofilter Inlet) Field Train Recovery Blank	2.6	Consists of organic and inorganic CPM. Field sample weight blank corrections were not applied.
M202 (Biofilter Outlet) Field Train Recovery Blank	2.4	Consists of organic and inorganic CPM. Field sample weight blank corrections were not applied.

5.4 QA/QC Problems

At the end of Test Run 1 for PM_{10} at the EUPRESSLINE Biofilter outlet source, the glass liner of the sampling probe struck the steel sampling port while the probe was being removed from the sampling location. The glass liner cracked and, as a result, failed the post-test leak check. This issue was discussed with MDEQ representative, David Patterson, while onsite and Mr. Patterson approved use of the test run. A replacement liner was used for subsequent test runs.

Some results for the particulate matter blanks had detectable levels of particulate matter. Results were not blank corrected due to the low detectable levels in the blanks.

No other QA/QC issues were encountered during this test program.

6.0 Limitations

The information and opinions rendered in this report are exclusively for use by Weyerhaeuser. Bureau Veritas North America, Inc. will not distribute or publish this report without consent of Weyerhaeuser except as required by law or court order. The information and opinions are given in response to a limited assignment and should be implemented only in light of that assignment. Bureau Veritas North America, Inc. accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report prepared by:

David Kawasaki, QSTI
Air Quality Consultant II
Health, Safety, and Environmental Services

This report reviewed by:

Derek R. Wong, Ph.D., P.E.
Director and Vice President
Health, Safety, and Environmental Services

Table 1

EUPRESSLINE Biofilter Formaldehyde Destruction Efficiency Results

Weyerhaeuser

Grayling, Michigan

Bureau Veritas Project No. 11016-000215.00

Sampling Date: November 15, 2016

Parameter		Units	Run 1	Run 2	Run 3	Average
Sampling Time			9:40-10:40	11:02-12:02	12:16-13:16	
Duration		min	60	60	60	60
Inlet	Gas Stream Volumetric Flowrate	scfm	118,052	107,732	107,223	111,002
	Formaldehyde Concentration	ppmv	6.3	5.2	5.4	5.6
	Formaldehyde Concentration	**mg/dscm**	**7.9**	**6.5**	**6.7**	**7.0**
	Formaldehyde Mass Emission Rate	**lb/hr**	**3.5**	**2.6**	**2.7**	**2.9**
Outlet	Gas Stream Volumetric Flowrate	scfm	104,362	103,247	104,240	103,950
	Formaldehyde Concentration	ppmv	0.50	0.50	0.40	0.47
	Formaldehyde Concentration	**mg/dscm**	**0.62**	**0.62**	**0.50**	**0.58**
	Formaldehyde Mass Emission Rate	**lb/hr**	**0.24**	**0.24**	**0.20**	**0.23**
Formaldehyde Destruction Efficiency		%	**93.0**	**90.8**	**92.8**	**92.2**

Molecular weight of formaldehyde 30.03 g/mole

Standard conditions 68°F and 29.92 in Hg. 24.04 is the volume of 1 mole at Standard conditions

scfm standard cubic feet per minute

ppmv part per million by volume

Table 2
EUPRESSLINE Biofilter Outlet CO Results
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016

Parameter	Units	Run 1	Run 2	Run 3	Average
Sampling Time		8:55-9:55	10:25-11:25	11:35-12:35	
Duration	min	60	60	60	60
Average Gas Stream Volumetric Flowrate	dscfm	101,646	99,316	104,685	101,882
CO Concentration (C_{avg})	ppmvd	5.9	5.7	5.1	5.6
Average Corrected CO Concentration (C_{gas})	ppmvd	5.1	4.4	3.9	4.5
CO Mass Emission Rate	**lb/hr**	**2.3**	**1.9**	**1.8**	**2.0**

ppmvd part per million by volume, dry
lb/hour: pound per hour
28.01 molecular weight of carbon monoxide, g/mole

Table 3 - EUPRESSLINE Biofilter Inlet Particulate Matter Results					
Facility		Weyerhaeuser			
Source Designation		Biofilter Inlet			
Test Date		Nov 16, 2016	Nov 16, 2016	Nov 16, 2016	
Meter/Nozzle Information		**Run 1**	**Run 2**	**Run 3**	**Average**
Meter Temperature, T_m	°F	65	63	68	65
Meter Pressure, P_m	in Hg	28.72	28.73	28.74	28.73
Measured Sample Volume, V_m	ft^3	61.41	62.88	68.85	64.38
Sample Volume, V_m	std ft^3	58.06	59.66	64.46	60.73
Sample Volume, V_m	std m^3	1.64	1.69	1.83	1.72
Condensate Volume, V_w	std ft^3	0.96	1.02	1.00	0.99
Gas Density, ρ_s	std lb/ft^3	0.0744	0.0744	0.0744	0.0744
Total weight of sampled gas	lb	4.392	4.514	4.934	4.613
Nozzle Size, A_n	ft^2	0.00032	0.00032	0.00032	0.00032
Isokinetic Variation, I	%	99	100	106	102
Stack Data					
Average Stack Temperature, T_s	°F	132	133	135	133
Molecular Weight Stack Gas-dry, M_d	lb/lb-mole	28.84	28.84	28.84	28.84
Molecular Weight Stack Gas-wet, M_s	lb/lb-mole	28.66	28.66	28.67	28.67
Stack Gas Specific Gravity, G_s		0.99	0.99	0.99	0.99
Percent Moisture, B_{ws}	%	1.63	1.68	1.53	1.61
Water Vapor Volume (fraction)		0.016	0.017	0.015	0.016
Pressure, P_s	in Hg	28.60	28.60	28.60	28.60
Average Stack Velocity, V_s	ft/sec	57.34	58.40	60.13	58.62
Area of Stack	ft^2	38.48	38.48	38.48	38.48
Exhaust Gas Flowrate					
Flowrate	ft^3/min, actual	132,398	134,861	138,833	135,364
Flowrate	ft^3/min, standard wet	112,846	114,848	117,709	115,134
Flowrate	ft^3/min, standard dry	111,007	112,920	115,903	113,277
Flowrate	m^3/min, standard dry	3,143	3,198	3,282	3,208
Collected Mass					
Particulate Matter Acetone Wash	mg	2.4	1.8	1.8	2.0
Particulate Matter Filter	mg	9.7	8.4	12	10.0
Total Filterable Particulate Matter (FPM)	mg	12.1	10.2	13.7	12.0
Inorganic CPM	mg	10.0	13.0	6.0	9.7
Organic CPM	mg	3.9	2.7	3.5	3.4
Total Condensable Particulate Matter (CPM)	mg	13.9	15.7	9.5	13.0
Total FPM and CPM	mg	26.0	25.9	23.2	25.0
Concentration					
Particulate Matter (FPM)	mg/dscf	0.21	0.17	0.21	0.20
Particulate Matter (FPM)	grain/dscf	0.0032	0.0026	0.0033	0.0030
Total Condensable Particulate Matter (CPM)	mg/dscf	0.24	0.26	0.15	0.22
Total Condensable Particulate Matter (CPM)	grain/dscf	0.004	0.0041	0.0023	0.0033
Total FPM and CPM	mg/dscf	0.45	0.43	0.36	0.41
Total FPM and CPM	grain/dscf	0.0069	0.0067	0.0056	0.0064
Mass Emission Rate					
Particulate Matter (FPM)	lb/hr	3.1	2.6	3.3	3.0
Total Condensable Particulate Matter (CPM)	lb/hr	3.5	3.9	2.3	3.2
Total FPM and CPM	lb/hr	6.6	6.5	5.5	6.2

Table 4 - EUPRESSLINE Biofilter Outlet Particulate Matter Results

Facility			**Weyerhaeuser**		
Source Designation			**Biofilter Outlet**		
Test Date		**Nov 16, 2016**	**Nov 16, 2016**	**Nov 16, 2016**	
Meter/Nozzle Information		**Run 1**	**Run 2**	**Run 3**	**Average**
Meter Temperature, T_m	°F	65	66	68	66
Meter Pressure, P_m	in Hg	28.63	28.65	28.65	28.64
Measured Sample Volume, V_m	ft^3	45.82	52.48	49.96	49.42
Sample Volume, V_m	std ft^3	43.59	49.85	47.29	46.91
Sample Volume, V_m	std m^3	1.23	1.41	1.34	1.33
Condensate Volume, V_w	std ft^3	1.08	1.39	0.50	0.99
Gas Density, ρ_s	std lb/ft^3	0.0742	0.0741	0.0746	0.0743
Total weight of sampled gas	lb	3.314	3.797	3.626	3.579
Nozzle Size, A_n	ft^2	0.00029	0.00029	0.00029	0.00029
Isokinetic Variation, I	%	98	104	98	100
Stack Data					
Average Stack Temperature, T_s	°F	82	82	83	82
Molecular Weight Stack Gas-dry, M_d	lb/lb-mole	28.84	28.84	28.84	28.84
Molecular Weight Stack Gas-wet, M_s	lb/lb-mole	28.58	28.55	28.73	28.62
Stack Gas Specific Gravity, G_s		0.99	0.99	0.99	0.99
Percent Moisture, B_{ws}	%	2.41	2.71	1.05	2.05
Water Vapor Volume (fraction)		0.024	0.027	0.010	0.021
Pressure, P_s	in Hg	28.57	28.57	28.57	28.57
Average Stack Velocity, V_s	ft/sec	44.07	47.75	47.21	46.35
Area of Stack	ft^2	38.48	38.48	38.48	38.48
Exhaust Gas Flowrate					
Flowrate	ft^3/min, actual	101,759	110,266	109,017	107,014
Flowrate	ft^3/min, standard wet	94,601	102,546	101,256	99,468
Flowrate	ft^3/min, standard dry	92,324	99,772	100,197	97,431
Flowrate	m^3/min, standard dry	2,614	2,825	2,837	2,759
Collected Mass					
Particulate Matter Acetone Wash	mg	3.2	1.5	1.7	2.1
Particulate Matter Filter	mg	<0.3	5.7	4.1	3.4
Total Filterable Particulate Matter (FPM)	mg	3.5	7.2	5.8	5.5
Inorganic CPM	mg	22.0	6.6	4.6	11.1
Organic CPM	mg	<1.0	1.7	<1.0	1.2
Total Condensable Particulate Matter (CPM)	mg	23.0	8.3	5.6	12.3
Total FPM and CPM	mg	26.5	15.5	11.4	17.8
Concentration					
Particulate Matter (FPM)	mg/dscf	0.080	0.14	0.12	0.12
Particulate Matter (FPM)	grain/dscf	0.0012	0.0022	0.0019	0.0018
Total Condensable Particulate Matter (CPM)	mg/dscf	0.53	0.17	0.12	0.27
Total Condensable Particulate Matter (CPM)	grain/dscf	0.0081	0.0026	0.0018	0.0042
Total FPM and CPM	mg/dscf	0.61	0.31	0.24	0.39
Total FPM and CPM	grain/dscf	0.0094	0.0048	0.0037	0.0060
Mass Emission Rate					
Particulate Matter (FPM)	lb/hr	1.0	1.9	1.6	1.5
Total Condensable Particulate Matter (CPM)	lb/hr	6.4	2.2	1.6	3.4
Total FPM and CPM	lb/hr	7.4	4.1	3.2	4.9

Table 5

EUPRESSLINE Biofilter VOC (lb/hr) Relative Accuracy Test Audit Results

Weyerhaeuser

Grayling, Michigan

Bureau Veritas Project No. 11016-000215.00

Sampling Date: November 15, 2016

		Reference Method VOC				CERM VOC	Difference
Run	Time	SCFM	ppmv, as propane	ppmv, as carbon	lb/hr, as carbon	lb/hr, as carbon	lb/hr, as carbon
1	8:55-9:16	101,274	31.11	93.34	17.68	17.56	0.12
2	9:40-10:01	104,304	31.87	95.62	18.65	16.73	1.92
3	10:25-10:46	104,420	45.37	136.10	26.57	23.69	2.88
4	10:54-11:15	102,019	48.66	145.97	27.85	26.61	1.24
5	11:25-11:46	101,625	39.96	119.89	22.78	22.04	0.74
6	11:54-12:15	104,870	42.53	127.60	25.02	23.42	1.60
7	12:24-12:45	104,501	39.37	118.11	23.08	22.30	0.78
8	12:57-13:18	103,979	34.46	103.37	20.10	18.98	1.12
9	13:27-13:48	103,043	32.25	96.75	18.64	17.81	0.83
10	13:56-14:17	103,465	38.65	115.94	22.43	21.97	0.46
Mean		103,231	37.65	112.95	21.80	20.82	0.98
Standard Deviation							0.56
Confidence Coefficient							0.43

Applicable Standard (Permit Limit) 19.5 lb/hr, as carbon

Average RM value (permit limit used if <50% of standard) 21.80 lb/hr, as carbon

Relative Accuracy 6.5 %

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

Test run omitted from RATA calculations

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Table 6

FGDRYERS RTO VOC Destruction Efficiency Results – Two-Chamber Operation

Weyerhaeuser

Grayling, Michigan

Bureau Veritas Project No. 11016-000215.00

Sampling Date: November 8, 2016

Parameter		Units	Run 1	Run 2	Run 3	Average
Sampling Time			9:35-10:35	11:35-12:35	13:22-14:22	
Duration		min	60	60	60	60
Minimum 15-minute Average RTO Firebox Temperature†		°F	1,426	1,435	1,435	1,432
Inlet	Gas Stream Volumetric Flowrate	scfm	161,203	161,678	151,354	158,078
	VOC Concentration	ppmv, as methane	172	371	213	252
	Corrected VOC Concentration (C_{gas})	ppmv, as methane	165	368	201	245
	VOC Mass Emission Rate	**lb/hr, as carbon**	**67**	**149**	**76**	**97**
Outlet	Gas Stream Volumetric Flowrate	scfm	124,768	143,722	147,576	138,689
	VOC Concentration	ppmv, as methane	17	26	18	20
	Corrected VOC Concentration (C_{gas})	ppmv, as methane	17	25	17	20
	VOC Mass Emission Rate	**lb/hr, as carbon**	**5.2**	**9.1**	**6.4**	**6.9**
RTO VOC Destruction Efficiency		%	**92.2**	**93.9**	**91.5**	**92.5**

Molecular weight of methane (used to calculate emissions as carbon) 16.04 g/mole

Standard conditions 68°F and 29.92 in Hg

scfm standard cubic feet per minute

ppmv part per million by volume

† Average of the four 15-minute firebox temperatures recorded during the three tests.

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Table 7

FGDRYERS RTO Outlet NO_x and SO_2 Results – Two-Chamber Operation

Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016

	Units	Run 1	Run 2	Run 3	Average
Sampling Time		9:35-10:35	11:35-12:35	13:22-14:22	
Duration	min	60	60	60	60
Average Gas Stream Volumetric Flowrate	dscfm	94,524	112,165	115,866	107,519
NO_x Concentration (C_{avg})	ppmvd	25	23	31	26
Average Corrected NO_x Concentration (C_{gas})†	**ppmvd**	**26**	**23**	**32**	**27**
NO_x Mass Emission Rate	**lb/hr**	**17.71**	**18.68**	**26.81**	**21.07**
SO_2 Concentration (C_{avg})	ppmvd	0.7	0.3	0.3	0.4
Average Corrected SO_2 Concentration (C_{gas})†	**ppmvd**	**0.44**	**0.029**	**0.028**	**0.17**
SO_2 Mass Emission Rate	**lb/hr**	**0.41**	**0.032**	**0.033**	**0.16**

† corrected for analyzer drift
ppmvd part per million by volume, dry
lb/hour pound per hour
64.07 molecular weight of sulfur dioxide, g/mole
46.01 molecular weight of nitrogen dioxide, g/mole

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Table 8 - FGDRYERS RTO Outlet Particulate Matter Results – Two-Chamber Operation

Facility	**Weyerhaeuser**				
Source Designation	**RTO Outlet**				
Test Date		**Nov 8, 2016**	**Nov 8, 2016**	**Nov 8, 2016**	
Meter/Nozzle Information		**Run 1**	**Run 2**	**Run 3**	**Average**
Meter Temperature, T_m	°F	58	57	55	57
Meter Pressure, P_m	in Hg	30.23	30.29	30.29	30.27
Measured Sample Volume, V_m	ft^3	31.15	36.55	37.14	34.94
Sample Volume, V_m	std ft^3	31.70	37.34	38.08	35.70
Sample Volume, V_m	std m^3	0.90	1.06	1.08	1.01
Condensate Volume, V_w	std ft^3	10.14	10.51	10.42	10.36
Gas Density, ρ_s	std lb/ft^3	0.0695	0.0701	0.0703	0.0700
Total weight of sampled gas	lb	2.906	3.356	2.752	3.005
Nozzle Size, A_n	ft^2	0.0003089	0.0003089	0.0003089	0.0003089
Isokinetic Variation, I	%	102	101	100	101.07
Stack Data					
Average Stack Temperature, T_s	°F	237	231	233	234
Molecular Weight Stack Gas-dry, M_d	lb/lb-mole	29.56	29.56	29.56	29.56
Molecular Weight Stack Gas-wet, M_s	lb/lb-mole	26.76	27.02	27.08	26.95
Stack Gas Specific Gravity, G_s		0.92	0.93	0.93	0.93
Percent Moisture, B_{ws}	%	24.24	21.96	21.49	22.56
Water Vapor Volume (fraction)		0.242	0.220	0.215	0.226
Pressure, P_s	in Hg	30.14	30.18	30.18	30.17
Average Stack Velocity, V_s	ft/sec	45.34	51.68	53.21	50.08
Area of Stack	ft^2	60.13	60.13	60.13	60.13
Exhaust Gas Flowrate					
Flowrate	ft^3/min, actual	163,580	186,460	191,962	180,668
Flowrate	ft^3/min, standard wet	124,768	143,722	147,576	138,689
Flowrate	ft^3/min, standard dry	94,524	112,165	115,866	107,519
Flowrate	m^3/min, standard dry	2,677	3,176	3,281	3,045
Collected Mass					
Particulate Matter Acetone Wash	mg	2.2	3.5	5.2	3.6
Particulate Matter Filter	mg	2.0	0.8	1.1	1.3
Total Filterable Particulate Matter (FPM)	mg	4.2	4.3	6.3	4.9
Inorganic CPM	mg	4.0	3.3	3.4	3.6
Organic CPM	mg	2.3	<1	<1.0	1.4
Total Condensable Particulate Matter (CPM)	mg	6.3	4.3	4.4	5.0
Total FPM and CPM	mg	10.5	8.6	10.7	9.9
Concentration					
Particulate Matter (FPM)	mg/dscf	0.13	0.12	0.17	0.14
Particulate Matter (FPM)	grain/dscf	0.0020	0.0018	0.0026	0.0021
Total Condensable Particulate Matter (CPM)	mg/dscf	0.20	0.12	0.12	0.14
Total Condensable Particulate Matter (CPM)	grain/dscf	0.0031	0.0018	0.0018	0.0022
Total FPM and CPM	mg/dscf	0.33	0.23	0.28	0.28
Total FPM and CPM	grain/dscf	0.0051	0.0036	0.0043	0.0043
Mass Emission Rate					
Particulate Matter (FPM)	lb/hr	1.7	1.7	2.5	2.0
Particulate Matter (FPM)	lb/MMBtu	0.0090	0.0078	0.011	0.0094
Total Condensable Particulate Matter (CPM)	lb/hr	2.5	1.7	1.8	2.0
Total Condensable Particulate Matter (CPM)	lb/MMBtu	0.014	0.0078	0.0079	0.010
Total FPM and CPM	lb/hr	4.1	3.4	4.3	4.0
Total FPM and CPM	lb/MMBtu	0.023	0.016	0.019	0.019

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Table 9

FGDRYERS RTO Outlet Formaldehyde Results – Two-Chamber Operation

Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016

Parameter	Run 1		Run 2		Run 3		Average
	1 Normal	1 Spike	2 Normal	2 Spike	3 Normal	3 Spike	
Sampling Start Time	9:00		16:50		17:50		
Sample Duration (min)	60		60		60		60
Sampling Conditions							
Stack Flowrate (dscfm)	112,100		108,760		107,167		109,342
Ambient Temperature (°F)	39		47		46		44
Ambient Temperature (°C)	4		8		7.8		7
Saturated Partial Pressure of Water Vapor (in Hg)	0.23		0.32		0.31		0.29
Saturated Partial Pressure of Water Vapor (mm Hg)	5.9		8.2		7.9		7.3
Atmospheric Pressure (in Hg)	30.3		30.1		30.1		30.2
Atmospheric Pressure (mm Hg)	769.6		765.6		765.6		766.9
Sampling Rate							
Pre-Sampling Flowrate (cc/min)	206.4	197.1	190.5	225.8	218.4	247.6	214.3
Post-Sampling Flowrate (cc/min)	185.9	182.8	197.5	236.3	246.7	261.1	218.4
Sampling Flowrate Pre-test to Post-test Change (%) (Criterion is <20%)	9.9	7.3	3.7	4.7	12.9	5.5	7.3
Average Sampling Flowrate (cc/min)	196.2	189.9	194.0	231.1	232.5	254.4	216.3
Average Sampling Flowrate (dry standard l/min)	0.209	0.202	0.201	0.240	0.242	0.265	0.226
Sample Volume (l)	11.8	11.4	11.6	13.9	14.0	15.3	13.0
Sample Volume (l, dry standard)	12.5	12.1	12.1	14.4	14.5	15.9	13.6
Impinger							
Mass of Condensate Collected (g)	3.8	2.4	3.5	3.1	3.1	4.7	3.4
Pre-weight of Sample Container (g)	28.5	29.1	28.5	28.4	28.7	28.0	28.5
Post-weight of Sample Container (g)	71.4	72.1	71.0	71.3	72.1	70.6	71.4
Mass of Water Sample (g)	42.9	43.0	42.5	43.0	43.4	42.6	42.9
Volume of Water Sample (ml)	43.0	43.1	42.6	43.0	43.5	42.7	43.0
Concentration of Formaldehyde in Water Sample (μg/l)	<100	<100	880	170	<100	1,300	442
Mass of Formaldehyde in Condensate (μg)	<4.3	<4.3	37	7.3	<4.3	56	19
Sorbent Tube							
Formaldehyde Mass (μg)	0.56	15	1.0	14	<0.1	13.0	7.3
Formaldehyde Spike Mass (μg)	-	15	-	15	-	15	15
Formaldehyde Concentration (mg/dscm)	0.045	-	0.08	-	<0.0069	-	0.045
Formaldehyde Spike Recovery, R (Criterion is 0.70≤R≤1.30)	-	0.96	-	0.85	-	0.86	**0.89**
Total							
Formaldehyde Mass in Impinger and Sorbent Tube (μg)†	4.9		39		<4.5		16
Formaldehyde Concentration (mg/dscm)†	0.39		3.2		<0.31		1.3
Formaldehyde Concentration (ppmvd)†	0.31		2.6		<0.25		1.0
Formaldehyde Mass Emission Rate (lb/hr)†	**0.16**		**1.3**		**<0.12**		**0.53**

† Corrected for spike recovery following USEPA Method 18.
dscfm = dry standard cubic foot per minute
cc/min = cubic centimeter per minute
l = liter
μg/l = microgram per liter
μg = microgram
mg/dscm = milligram per dry standard cubic meter
ppmv = part per million by volume
lb/hr = pound per hour

Table 10
FGDRYERS RTO VOC (lb/hr) Relative Accuracy Test Audit Results – Two-Chamber Operation
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016

Run	Time	Reference Method VOC SCFM	ppmv, as propane	ppmv, as carbon	lb/hr, as carbon	CERM VOC lb/hr, as carbon	Difference lb/hr, as carbon
1	9:00-9:21	143,949	5.46	16.37	4.41	5.56	-1.15
2	9:40-10:01	145,361	5.50	16.50	4.49	5.34	-0.85
3	15:19-15:40	135,937	3.10	9.30	2.36	2.80	-0.44
4	15:51-16:12	138,538	2.49	7.46	1.93	2.67	-0.74
5	16:21-16:42	139,561	1.80	5.40	1.41	2.49	-1.08
6	16:50-17:11	147,702	4.14	12.43	3.43	3.69	-0.26
7	17:20-17:41	145,976	6.37	19.12	5.22	5.07	0.15
8	17:50-18:11	145,538	5.34	16.02	4.36	4.48	-0.12
9	18:22-18:43	146,775	5.97	17.92	4.92	5.31	-0.39
10	18:53-19:14	146,036	5.18	15.54	4.24	4.48	-0.24
Mean		143,492	4.43	13.30	3.60	4.04	-0.44
Standard Deviation							0.39
Confidence Coefficient							0.30

Applicable Standard (Permit Limit) 18.6 lb/hr, as carbon

Average RM value (permit limit used if <50% of standard) 18.6 lb/hr, as carbon

Relative Accuracy 4.0 %

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 11
FGDRYERS RTO CO (lb/hr) Relative Accuracy Test Audit Results – Two-Chamber Operation
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: December 9, 2016

Run	Time	Reference Method CO				CERM CO	Difference
		DSCFM	ppmvd, measured	ppmvd, corrected	lb/hr	lb/hr	lb/hr
1	9:00-9:21	112,100	189.7	197.1	96.43	103.50	-7.07
2	9:40-10:01	113,200	193.9	201.7	99.66	104.77	-5.11
3	15:19-15:40	108,422	102.9	109.1	51.62	50.99	0.63
4	15:51-16:12	110,498	69.9	73.6	35.51	36.15	-0.64
5	16:21-16:42	111,313	64.4	67.6	32.86	32.28	0.58
6	16:50-17:11	108,760	162.0	173.7	82.46	86.50	-4.04
7	17:20-17:41	107,489	261.3	280.3	131.50	140.71	-9.21
8	17:50-18:11	107,167	202.6	216.6	101.31	107.98	-6.67
9	18:22-18:43	113,736	203.3	216.7	107.59	108.34	-0.75
10	18:53-19:14	113,163	181.6	191.3	94.48	96.38	-1.90
Mean		110,929	152.3	160.8	77.99	80.77	-2.77
Standard Deviation							3.02
Confidence Coefficient							2.32

Applicable Standard (Permit Limit)	147.3 lb/hr
Average RM value (permit limit used if <50% of standard)	78.0 lb/hr
Relative Accuracy	6.5 %

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 12

FGDRYERS RTO Outlet NO_x, CO, and SO_2 Results — One-Chamber Operation

Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 10, 2016

	Units	Run 1	Run 2	Run 3	Average
Sampling Time		8:20-9:20	9:40-10:40	11:00-12:00	
Duration	min	60	60	60	60
Average Gas Stream Volumetric Flowrate	dscfm	118,407	123,894	111,993	118,098
NO_x Concentration (C_{avg})	ppmvd	19	21	22	20
Average Corrected NO_x Concentration (C_{gas})†	**ppmvd**	**19**	**22**	**23**	**21**
NO_x Mass Emission Rate	**lb/hr**	**16.35**	**19.30**	**18.09**	**17.91**
CO Concentration (C_{avg})	ppmvd	194	184	270	216
Average Corrected CO Concentration (C_{gas})†	**ppmvd**	**205**	**195**	**287**	**229**
CO Mass Emission Rate	**lb/hr**	**106**	**105**	**140**	**117**
SO_2 Concentration (C_{avg})	ppmvd	2.5	0.3	0.3	1.0
Average Corrected SO_2 Concentration (C_{gas})†	**ppmvd**	**2.1**	**0.039**	**0.015**	**0.73**
SO_2 Mass Emission Rate	**lb/hr**	**2.5**	**0.048**	**0.017**	**0.86**

† corrected for analyzer drift

ppmvd part per million by volume, dry

lb/hour pound per hour

64.07 molecular weight of sulfur dioxide, g/mole

46.01 molecular weight of nitrogen dioxide, g/mole

Table 13 - FGDRYERS RTO Outlet Particulate Matter Results – One-Chamber Operation

Facility			**Weyerhaeuser**		
Source Designation			**RTO Outlet**		
Test Date		**Nov 10, 2016**	**Nov 10, 2016**	**Nov 10, 2016**	
Meter/Nozzle Information		**Run 1**	**Run 2**	**Run 3**	**Average**
Meter Temperature, T_m	°F	46	57	66	56
Meter Pressure, P_m	in Hg	30.02	30.03	30.29	30.12
Measured Sample Volume, V_m	ft^3	38.06	41.12	38.27	39.15
Sample Volume, V_m	std ft^3	39.41	41.65	38.41	39.83
Sample Volume, V_m	std m^3	1.12	1.18	1.09	1.13
Condensate Volume, V_w	std ft^3	11.49	12.03	12.15	11.89
Gas Density, ρ_s	std lb/ft^3	0.0700	0.0700	0.0695	0.0698
Total weight of sampled gas	lb	3.561	3.758	2.746	3.355
Nozzle Size, A_n	ft^2	0.00031	0.00031	0.00031	0.00031
Isokinetic Variation, I	%	101	102	104	103
Stack Data					
Average Stack Temperature, T_s	°F	204	194	198	198
Molecular Weight Stack Gas-dry, M_d	lb/lb-mole	29.56	29.56	29.56	29.56
Molecular Weight Stack Gas-wet, M_s	lb/lb-mole	26.95	26.97	26.78	26.90
Stack Gas Specific Gravity, G_s		0.93	0.93	0.92	0.93
Percent Moisture, B_{ws}	%	22.57	22.41	24.03	23
Water Vapor Volume (fraction)		0.226	0.224	0.240	0.230
Pressure, P_s	in Hg	29.90	29.90	30.18	29.99
Average Stack Velocity, V_s	ft/sec	53.33	54.81	50.46	52.87
Area of Stack	ft^2	60.13	60.13	60.13	60.13
Exhaust Gas Flowrate					
Flowrate	ft^3/min, actual	192,400	197,742	182,056	190733
Flowrate	ft^3/min, standard wet	152,928	159,669	147,421	153339
Flowrate	ft^3/min, standard dry	118,407	123,894	111,993	118098
Flowrate	m^3/min, standard dry	3,353	3,508	3,171	3344
Collected Mass					
Particulate Matter Acetone Wash	mg	5.9	4.4	3.6	4.6
Particulate Matter Filter	mg	2.0	4.9	4.1	3.7
Total Filterable Particulate Matter (FPM)	mg	7.9	9.3	7.7	8.3
Inorganic CPM	mg	2.2	2.2	7.1	3.8
Organic CPM	mg	<1.0	<1	2.6	1.5
Total Condensable Particulate Matter (CPM)	mg	3.2	3.2	9.7	5.4
Total FPM and CPM	mg	11.1	12.5	17.4	13.7
Concentration					
Particulate Matter (FPM)	mg/dscf	0.20	0.22	0.20	0.2
Particulate Matter (FPM)	grain/dscf	0.0031	0.0034	0.0031	0.0032
Total Condensable Particulate Matter (CPM)	mg/dscf	0.081	0.077	0.25	0.14
Total Condensable Particulate Matter (CPM)	grain/dscf	0.0013	0.0012	0.0039	0.0021
Total FPM and CPM	mg/dscf	0.28	0.30	0.45	0.34
Total FPM and CPM	grain/dscf	0.0043	0.0046	0.0070	0.0053
Mass Emission Rate					
Particulate Matter (FPM)	lb/hr	3.1	3.7	3.0	3.3
Total Condensable Particulate Matter (CPM)	lb/hr	1.3	1.3	3.7	2.1
Total FPM and CPM	lb/hr	4.4	4.9	6.7	5.3

Table 14

FGDRYERS RTO Outlet Formaldehyde Results – One-Chamber Operation

Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 10, 2016

Parameter	Run 1		Run 2		Run 3		Average
	1 Normal	1 Spike	2 Normal	2 Spike	3 Normal	3 Spike	
Sampling Start Time	7:52		8:55		9:57		
Sample Duration (min)	60		60		60		60
Sampling Conditions							
Stack Flowrate (dscfm)	118,407		123,894		123,894		122,065
Ambient Temperature (°F)	44		51		59		51
Ambient Temperature (°C)	6		11		15.0		11
Saturated Partial Pressure of Water Vapor (in Hg)	0.28		0.37		0.50		0.38
Saturated Partial Pressure of Water Vapor (mm Hg)	7.1		9.5		12.7		9.8
Atmospheric Pressure (in Hg)	29.9		29.9		29.8		29.9
Atmospheric Pressure (mm Hg)	760.0		758.4		756.7		758.4
Sampling Rate							
Pre-Sampling Flowrate (cc/min)	198.9	221.3	209.2	244.8	275.4	243.1	232.1
Post-Sampling Flowrate (cc/min)	226.7	220.5	210.2	247.9	254.7	240.2	233.4
Sampling Flowrate Pre-test to Post-test Change (%) (Criterion is <20%)	14.0	0.4	0.4	1.3	7.5	1.2	4.1
Average Sampling Flowrate (cc/min)	212.8	220.9	209.7	246.4	265.1	241.7	232.8
Average Sampling Flowrate (dry standard l/min)	0.221	0.230	0.214	0.251	0.264	0.241	0.237
Sample Volume (l)	12.8	13.3	12.6	14.8	15.9	14.5	14.0
Sample Volume (l, dry standard)	13.3	13.8	12.8	15.1	15.8	14.4	14.2
Impinger							
Mass of Condensate Collected (g)	2.2	2.2	1.1	4.2	4.3	8.1	3.7
Pre-weight of Sample Container (g)	29.7	29.6	29.5	29.4	29.3	29.6	29.5
Post-weight of Sample Container (g)	72.3	71.9	72.0	71.8	71.4	72.0	71.9
Mass of Water Sample (g)	42.6	42.3	42.5	42.3	42.1	42.4	42.4
Volume of Water Sample (ml)	42.7	42.4	42.5	42.4	42.2	42.5	42.5
Concentration of Formaldehyde in Water Sample (μg/l)	450	450	480	13,000	380	21,000	5,960
Mass of Formaldehyde in Condensate (μg)	19	19	20	551	16	892	253
Sorbent Tube							
Formaldehyde Mass (μg)	0.19	14.0	1.0	14	0.7	13	7.2
Formaldehyde Spike Mass (μg)	-	15	-	15	-	15	15
Formaldehyde Concentration (mg/dscm)	0.014	-	0.08	-	0.046	-	0.046
Formaldehyde Spike Recovery, R (Criterion is 0.70≤R≤1.30)	-	0.92	-	0.86	-	0.82	**0.87**
Total							
Formaldehyde Mass in Impinger and Sorbent Tube (μg)†	19		22		17		19
Formaldehyde Concentration (mg/dscm)†	1.5		1.7		1.1		1.4
Formaldehyde Concentration (ppmvd)†	1.2		1.3		0.86		1.1
Formaldehyde Mass Emission Rate (lb/hr)†	**0.65**		**0.78**		**0.50**		**0.64**

† Corrected for spike recovery following USEPA Method 18.
dscfm = dry standard cubic foot per minute
cc/min = cubic centimeter per minute
l = liter
μg/l = microgram per liter
μg = microgram
mg/dscm = milligram per dry standard cubic meter
ppmv = part per million by volume
lb/hr = pound per hour

Table 15

EUIBW Outlet NO_x and CO Results

Weyerhaeuser

Grayling, Michigan

Bureau Veritas Project No. 11016-000215.00

Sampling Date: November 11, 2016

Parameter	Units	Run 1‡	Run 2	Run 3	Average
Sampling Time		9:16-10:22	10:34-11:34	11:41-12:41	
Duration	min	66	60	60	62
Average Gas Stream Volumetric Flowrate	dscfm	6,647	4,335	5,775	5,586
NO_x Concentration (C_{avg})	ppmvd	22	21	21	21
Average Corrected NO_x Concentration (C_{gas})†	ppmvd	22	21	22	22
NO_x Mass Emission Rate	**lb/hr**	**1.1**	**0.66**	**0.90**	**0.87**
CO Concentration (C_{avg})	ppmvd	11	11	7.1	9.6
Average Corrected CO Concentration (C_{gas})†	ppmvd	11	10	3.8	8.2
CO Mass Emission Rate	**lb/hr**	**0.31**	**0.19**	**0.10**	**0.20**

† corrected for analyzer drift

‡ Data not recorded during 9:58-10:03

ppmvd part per million by volume, dry

lb/hour pound per hour

28.01 molecular weight of carbon monoxide, g/mole

46.01 molecular weight of nitrogen dioxide, g/mole

Table 16

EUCOEN Outlet NOx and CO Results

Weyerhaeuser

Grayling, Michigan

Bureau Veritas Project No. 11016-000215.00

Sampling Date: November 11, 2016

Parameter	Units	Run 1	Run 2	Run 3‡	Average
Sampling Time		13:45-14:45	14:54-15:54	16:04-17:45	
Duration	min	60	60	60	60
Average Gas Stream Volumetric Flowrate	dscfm	8,261	7,923	8,254	8,146
NO_x Concentration (C_{avg})	ppmvd	42	42	39	41
Average Corrected NO_x Concentration (C_{gas})†	ppmvd	43	43	38	41
NO_x Mass Emission Rate	**lb/hr**	**2.5**	**2.4**	**2.3**	**2.4**
CO Concentration (C_{avg})	ppmvd	9.8	6.6	2.7	6.4
Average Corrected CO Concentration (C_{gas})†	ppmvd	9.8	6.4	2.8	6.3
CO Mass Emission Rate	**lb/hr**	**0.35**	**0.22**	**0.10**	**0.22**

† corrected for analyzer drift

‡ Run 3 of NOx consists of 41 minutes instead of 60 minutes due to DAS recording issue

ppmvd part per million by volume, dry

lb/hour pound per hour

28.01 molecular weight of carbon monoxide, g/mole

46.01 molecular weight of nitrogen dioxide, g/mole

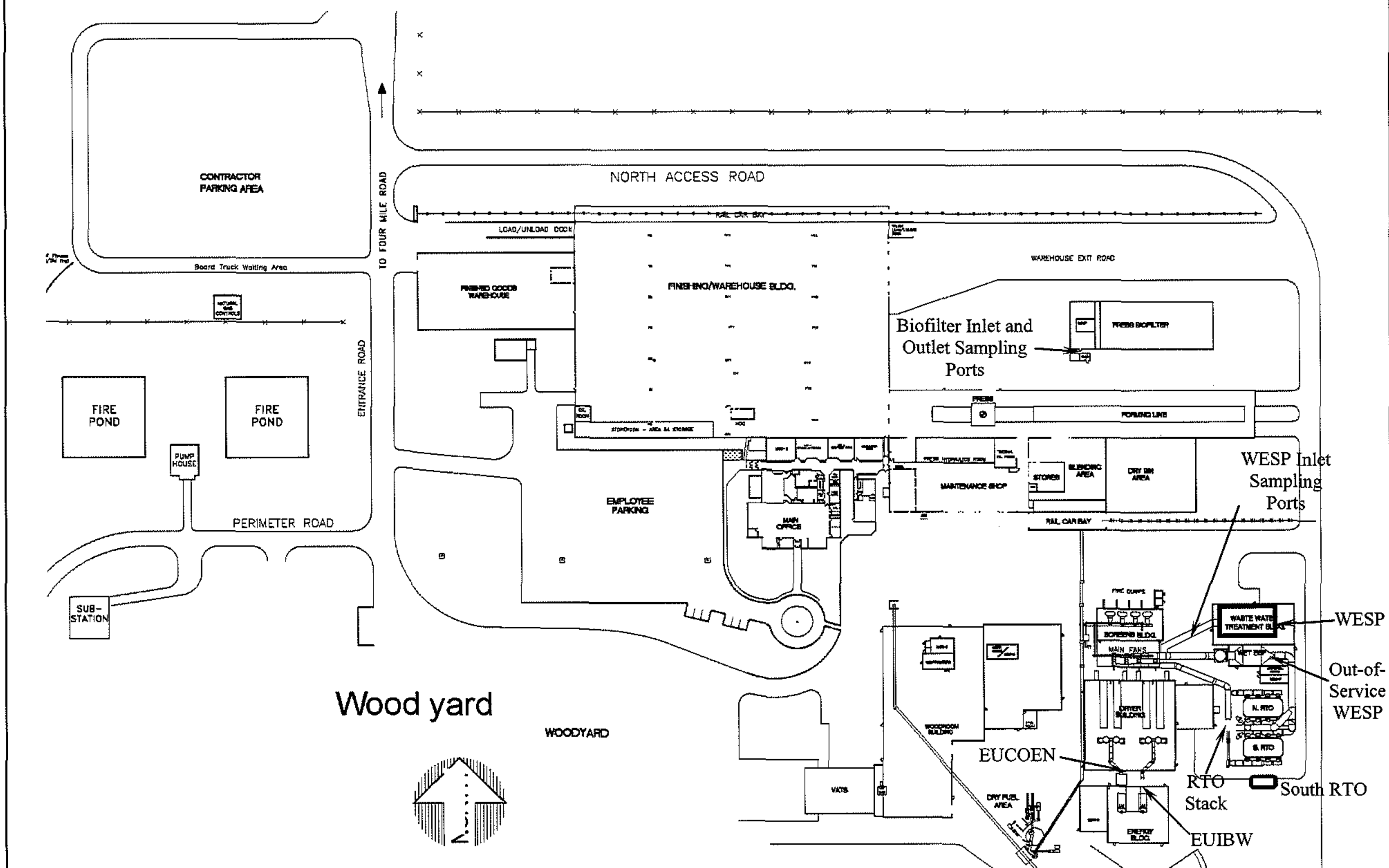
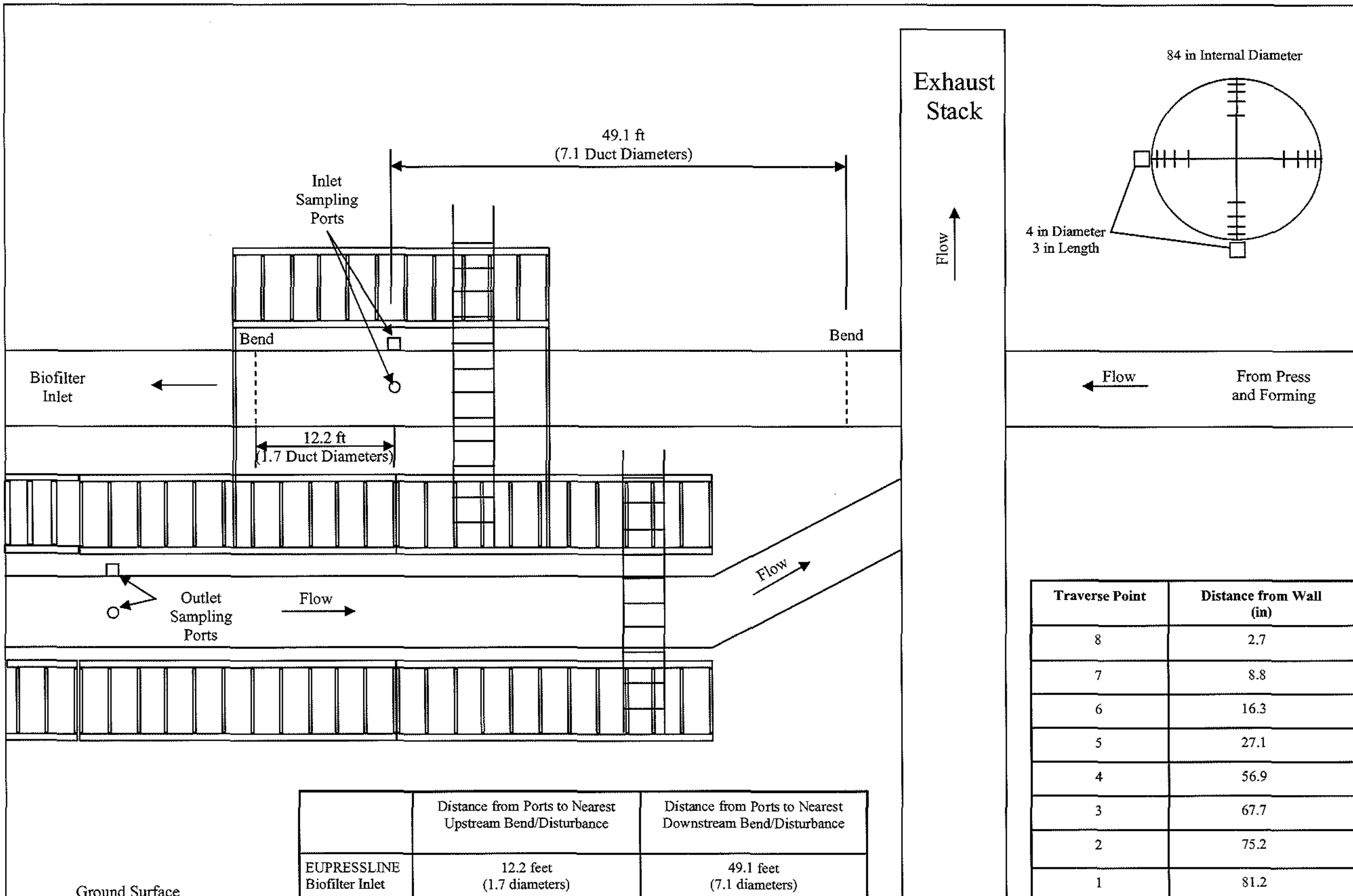


Figure 1
Site Map

BUREAU VERITAS 1828

Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00	Last Revision: November 18, 2016



	Distance from Ports to Nearest Upstream Bend/Disturbance	Distance from Ports to Nearest Downstream Bend/Disturbance
EUPRESSLINE Biofilter Inlet	12.2 feet (1.7 diameters)	49.1 feet (7.1 diameters)

Traverse Point	Distance from Wall (in)
8	2.7
7	8.8
6	16.3
5	27.1
4	56.9
3	67.7
2	75.2
1	81.2

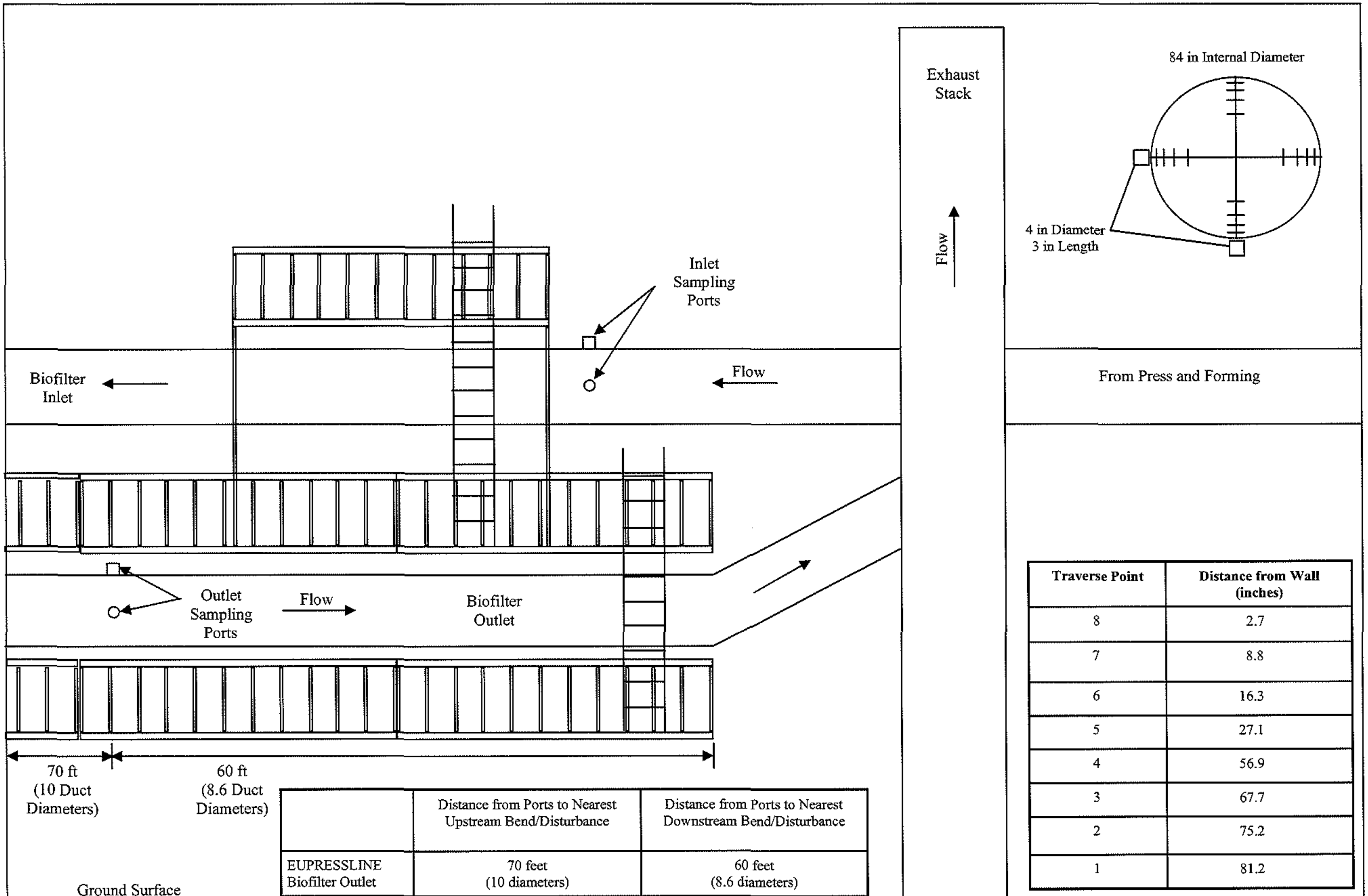
Figure 2
EUPRESSLINE Biofilter Inlet Sampling Ports and Traverse Point Locations

BUREAU VERITAS

Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00

Last Revision
November 18, 2016



	Distance from Ports to Nearest Upstream Bend/Disturbance	Distance from Ports to Nearest Downstream Bend/Disturbance
EUPRESSLINE Biofilter Outlet	70 feet (10 diameters)	60 feet (8.6 diameters)

Traverse Point	Distance from Wall (inches)
8	2.7
7	8.8
6	16.3
5	27.1
4	56.9
3	67.7
2	75.2
1	81.2

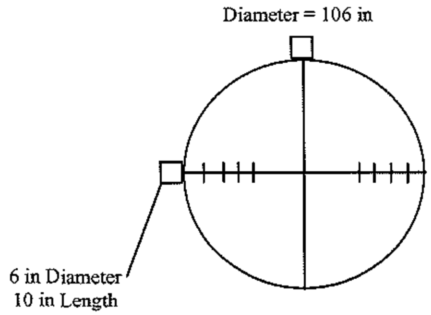
Figure 3
EUPRESSLINE Biofilter Outlet Sampling Ports and Traverse Point Locations

BUREAU VERITAS

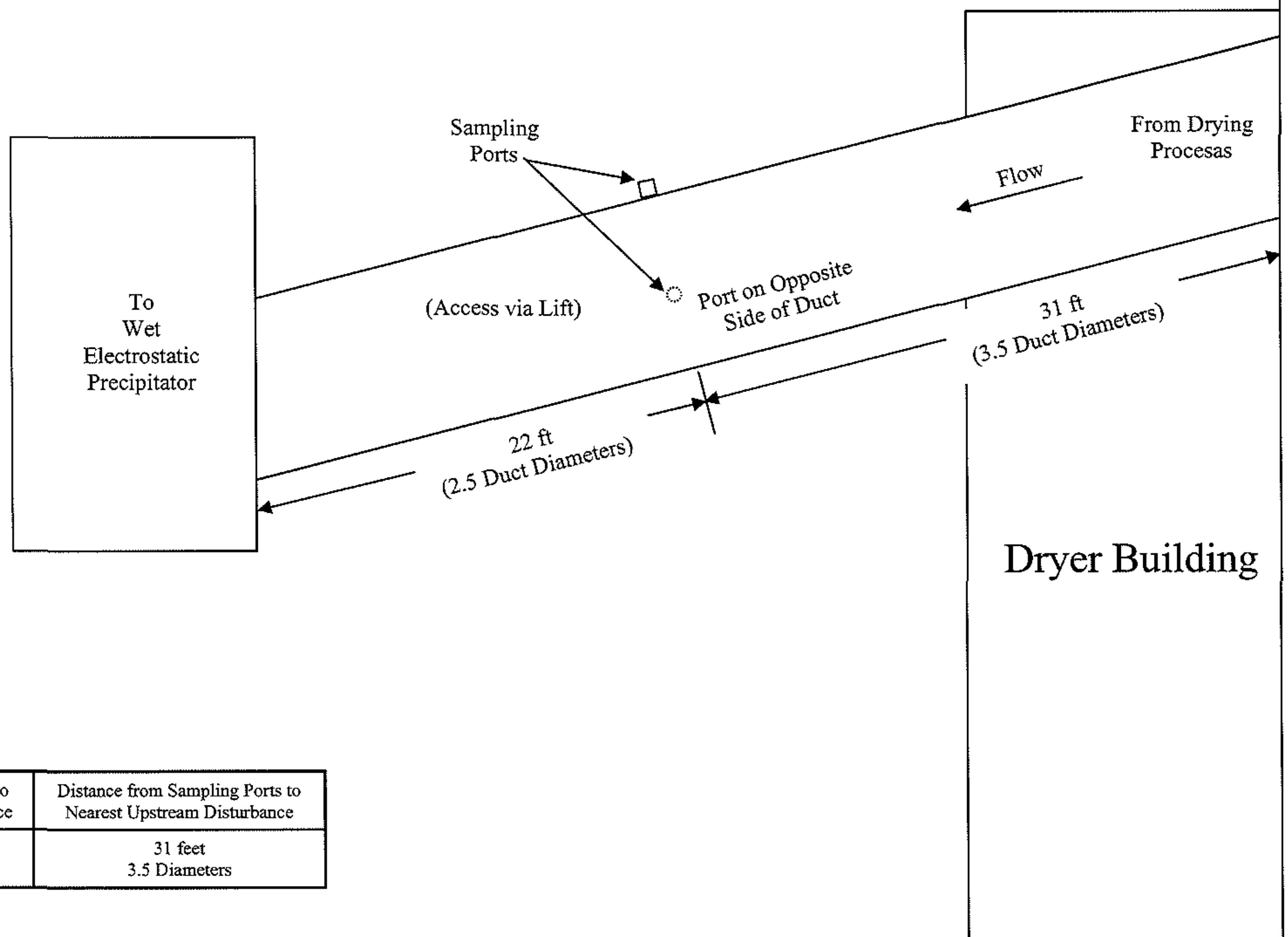
Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00

Last Revision
November 18, 2016



Traverse Point	Distance from Wall (in)
8	3.39
7	11.13
6	20.56
5	39.29
4	71.76
3	85.44
2	99.87
1	102.61

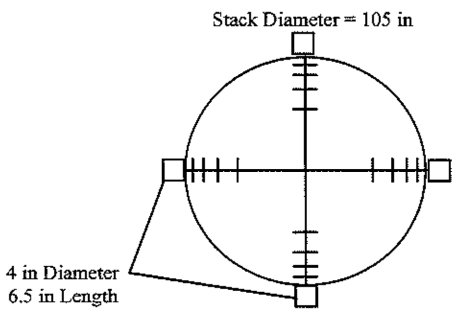


	Distance from Sampling Ports to Nearest Downstream Disturbance	Distance from Sampling Ports to Nearest Upstream Disturbance
WESP Inlet	22 feet 2.5 Diameters	31 feet 3.5 Diameters

Figure 4
WESP Inlet Sampling Ports and Traverse Point Locations

Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00 | Last Revision: December 16, 2016



Traverse Point	Distance from Wall (in)
8	3.4
7	11.0
6	20.4
5	33.9
4	71.1
3	84.6
2	94.0
1	101.6

	Distance from Ports to Nearest Upstream Bend/Disturbance	Distance from Ports to Nearest Downstream Bend/Disturbance
FGDRYERS-RTO OUTLET	30 feet (3.4 diameters)	40 feet (4.6 diameters)

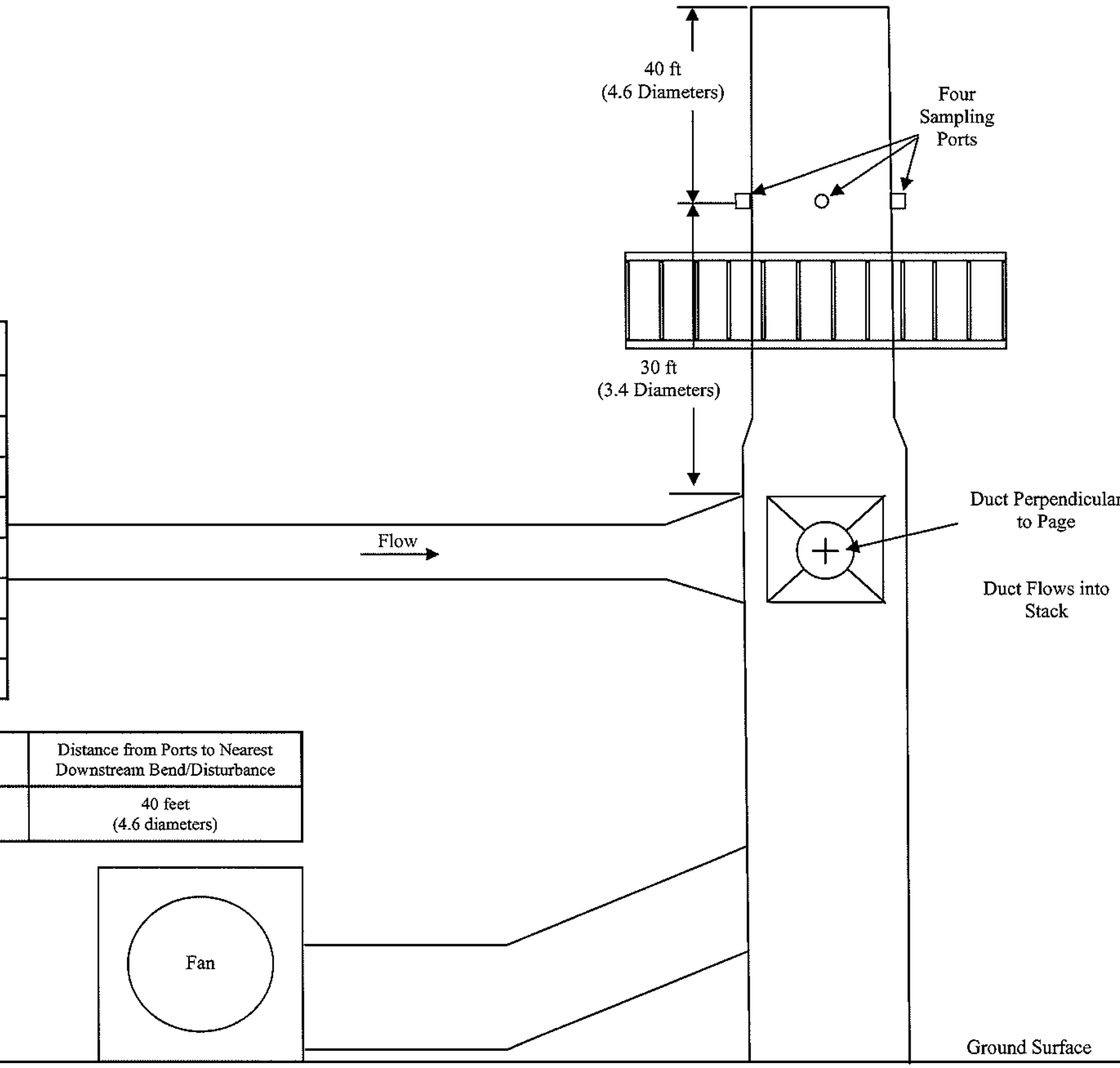


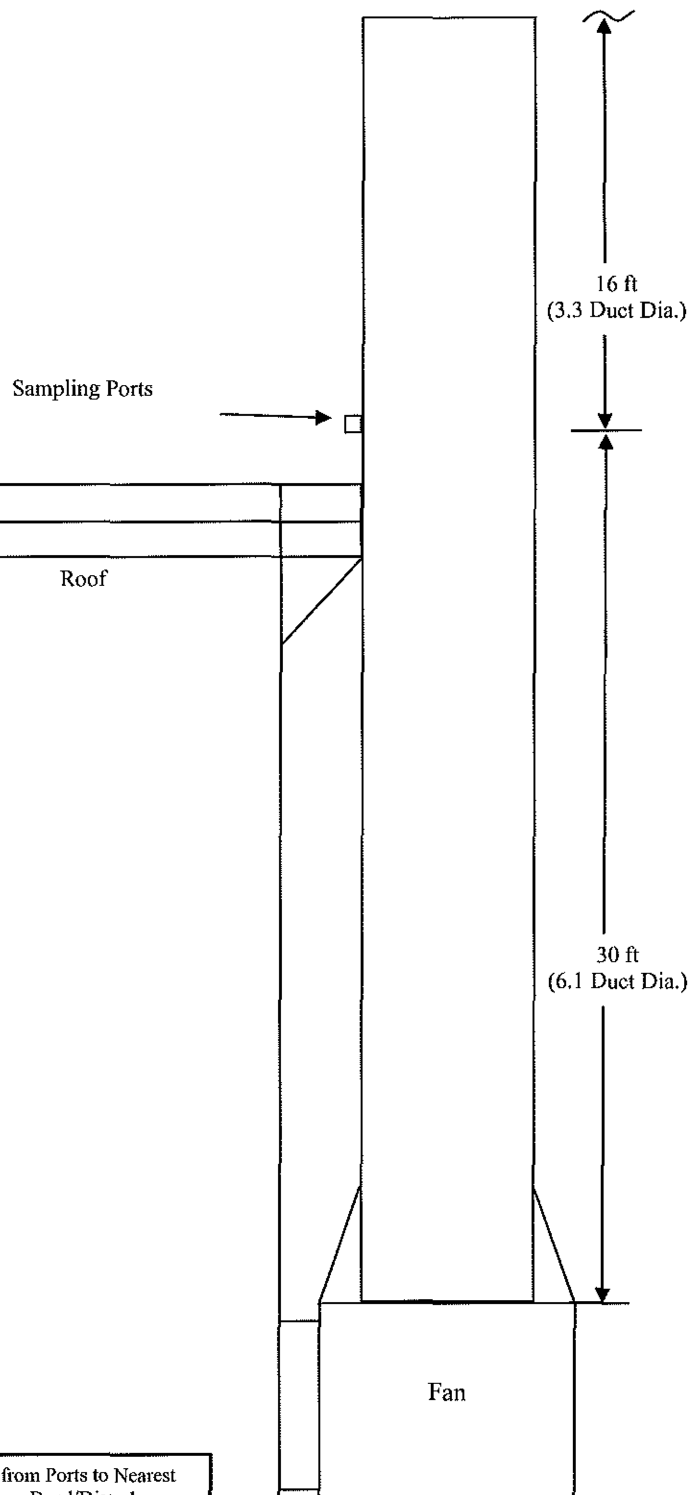
Figure 5
FGDRYERS RTO Outlet Sampling Ports and Traverse Point Locations

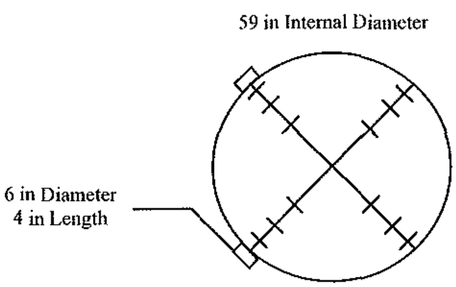
BUREAU VERITAS 1828

Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00

Last Revision
December 16, 2016





Traverse Point	Distance from Stack Wall (inches)
6	56.5
5	50.4
4	41.5
3	17.6
2	8.7
1	2.6

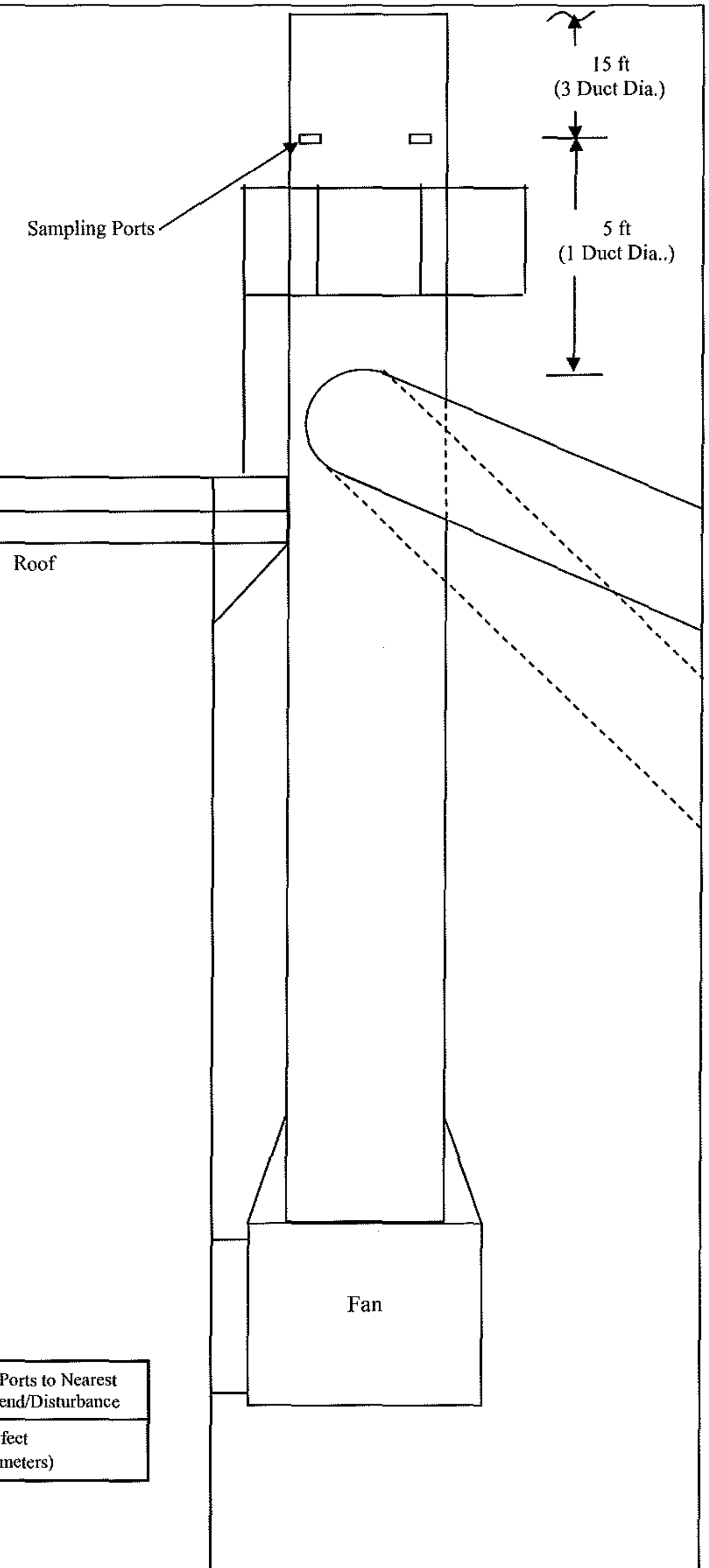
	Distance from Ports to Nearest Upstream Bend/Disturbance	Distance from Ports to Nearest Downstream Bend/Disturbance
EUIBW Outlet	30 feet (6.1 Diameters)	16 feet (3.3 Diameters)

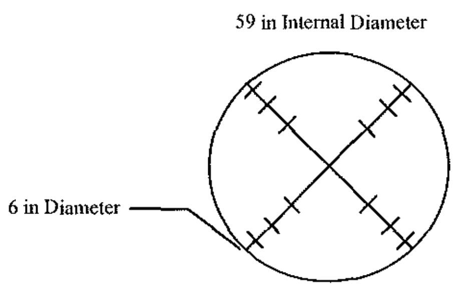
Figure 6
EUIBW Sampling Ports and Traverse Point Locations

BUREAU VERITAS

Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00 | Last Revision: December 16, 2016





Traverse Point	Distance from Stack Wall (Inches)
6	56.5
5	50.4
4	41.5
3	17.6
2	8.7
1	2.6

	Distance from Ports to Nearest Up-stream Bend/Disturbance	Distance from Ports to Nearest Downstream Bend/Disturbance
EUCOEN Outlet	5 feet (1 Diameter)	15 feet (3 Diameters)

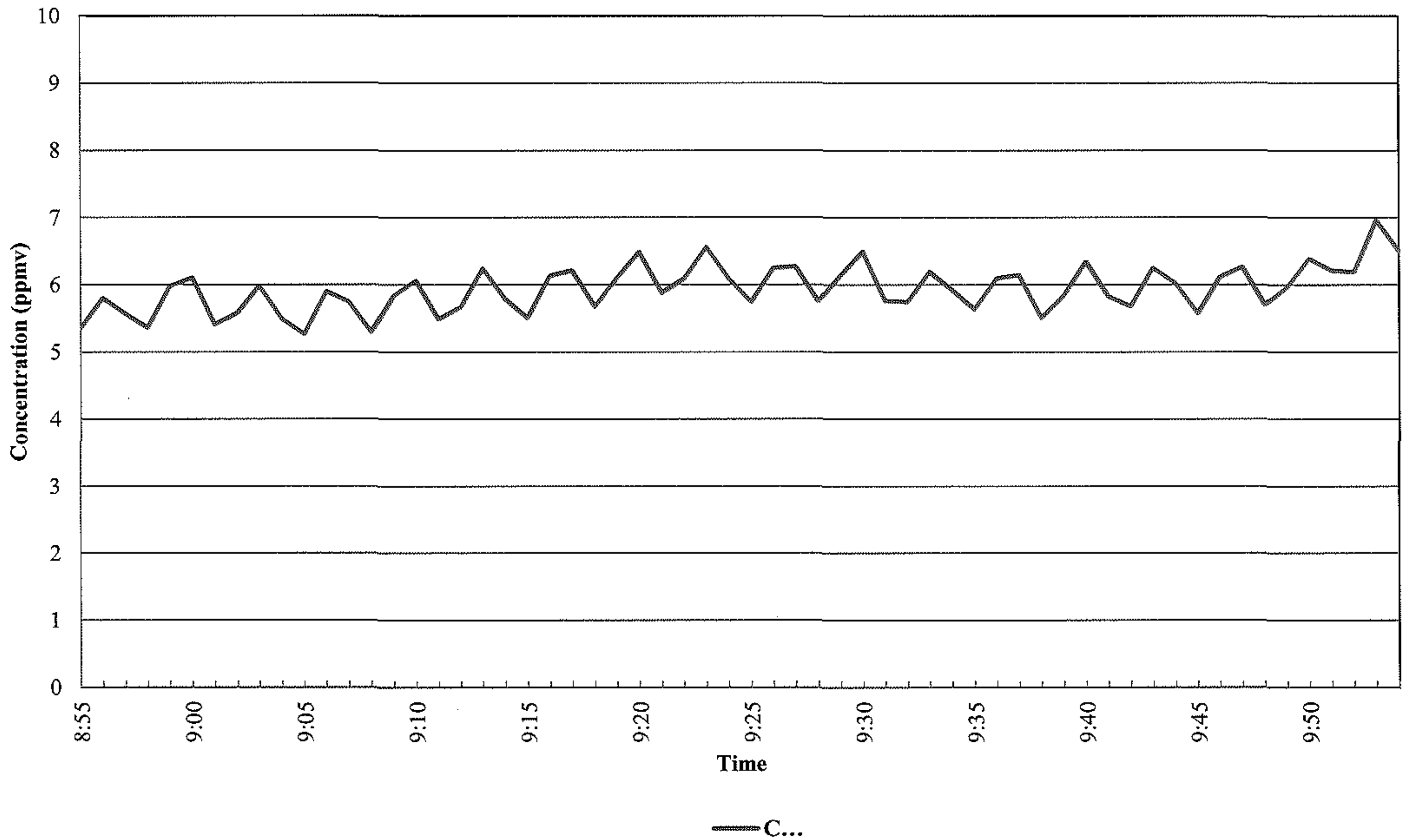
Figure 7
EUCOEN Sampling Ports and Traverse Point Locations

BUREAU VERITAS

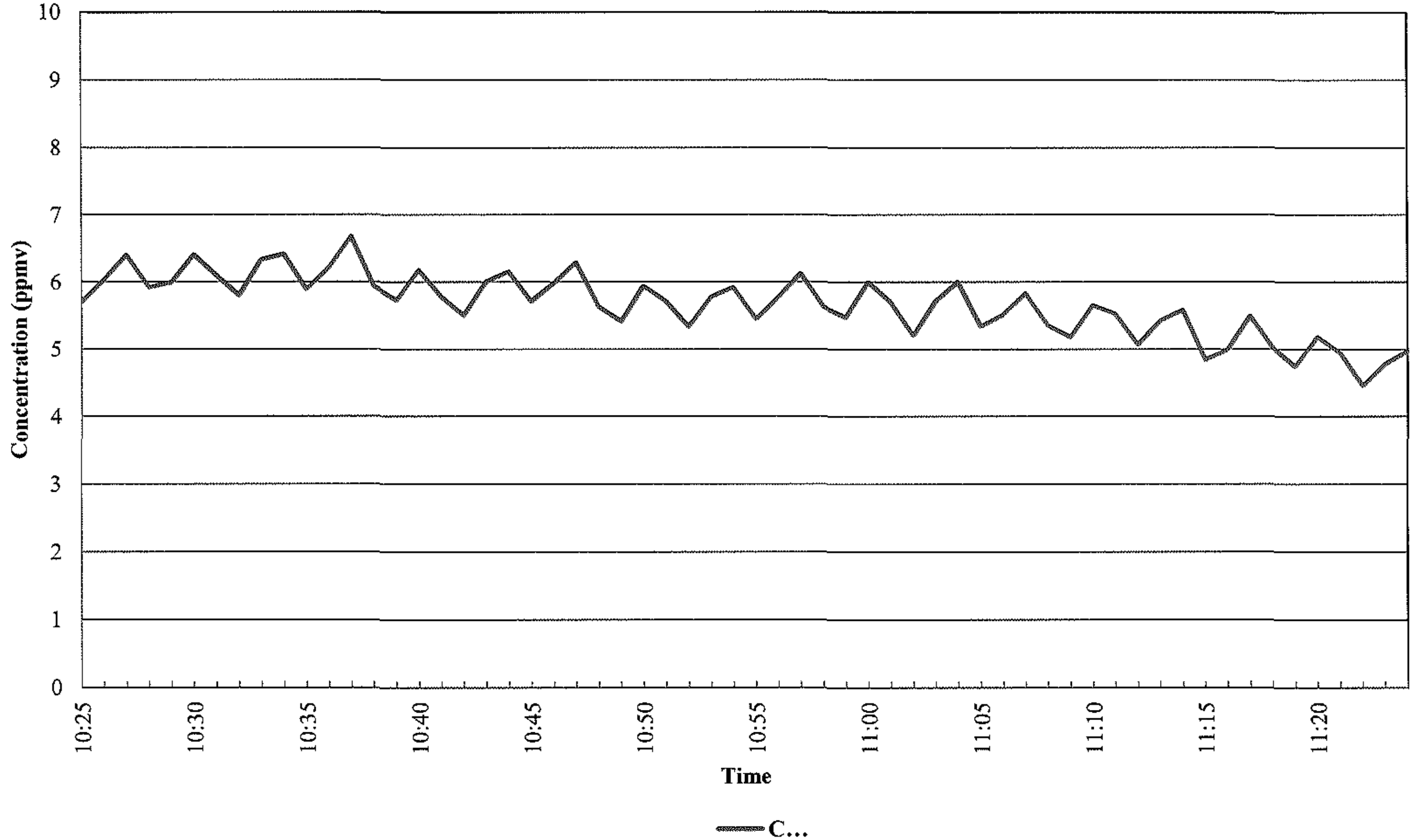
Weyerhaeuser
4111 West Four Mile Road
Grayling, Michigan

Project No. 11016-000215.00 | Last Revision: December 16, 2016

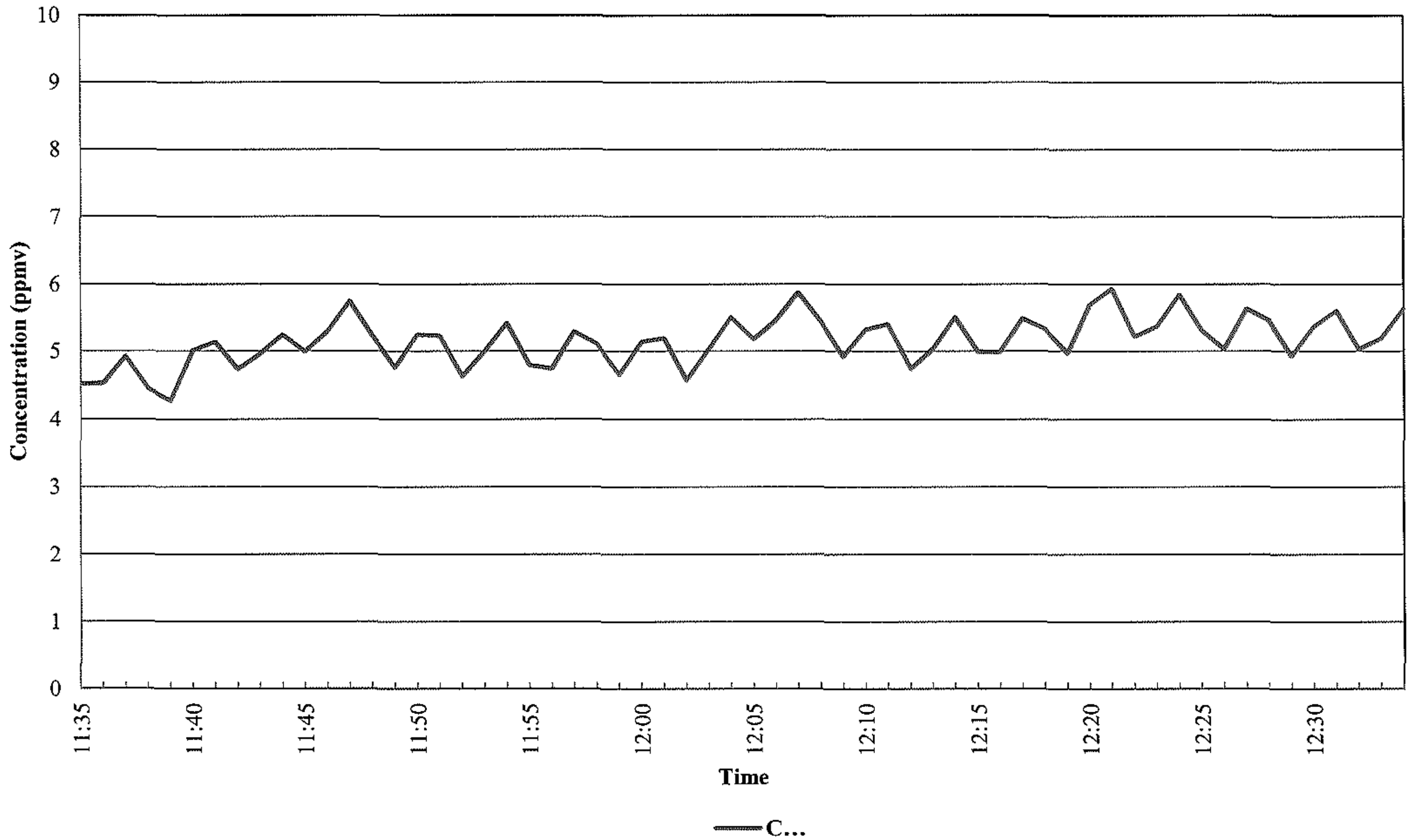
EUPRESSLINE Biofilter CO Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016



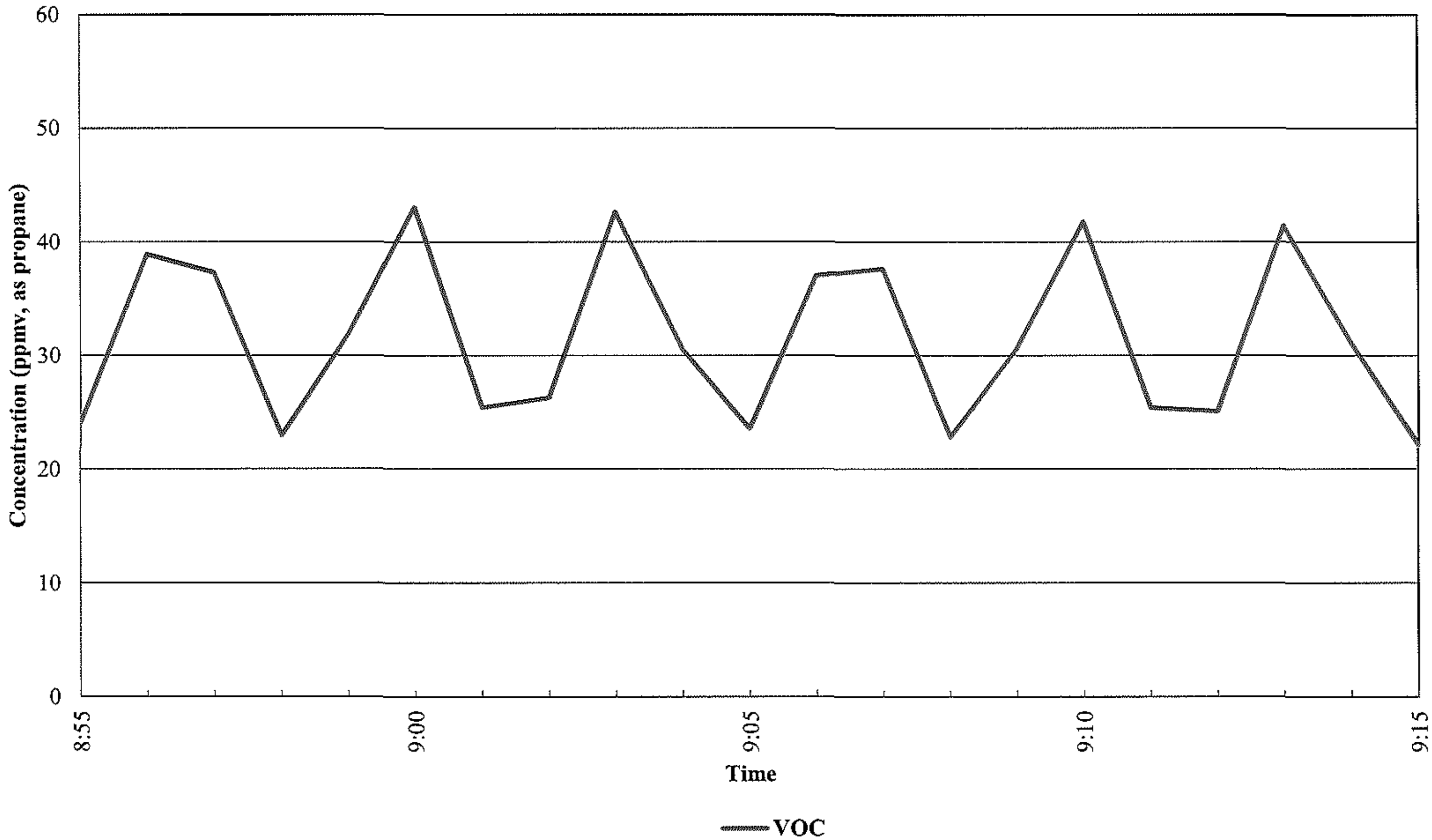
EUPRESSLINE Biofilter CO Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016

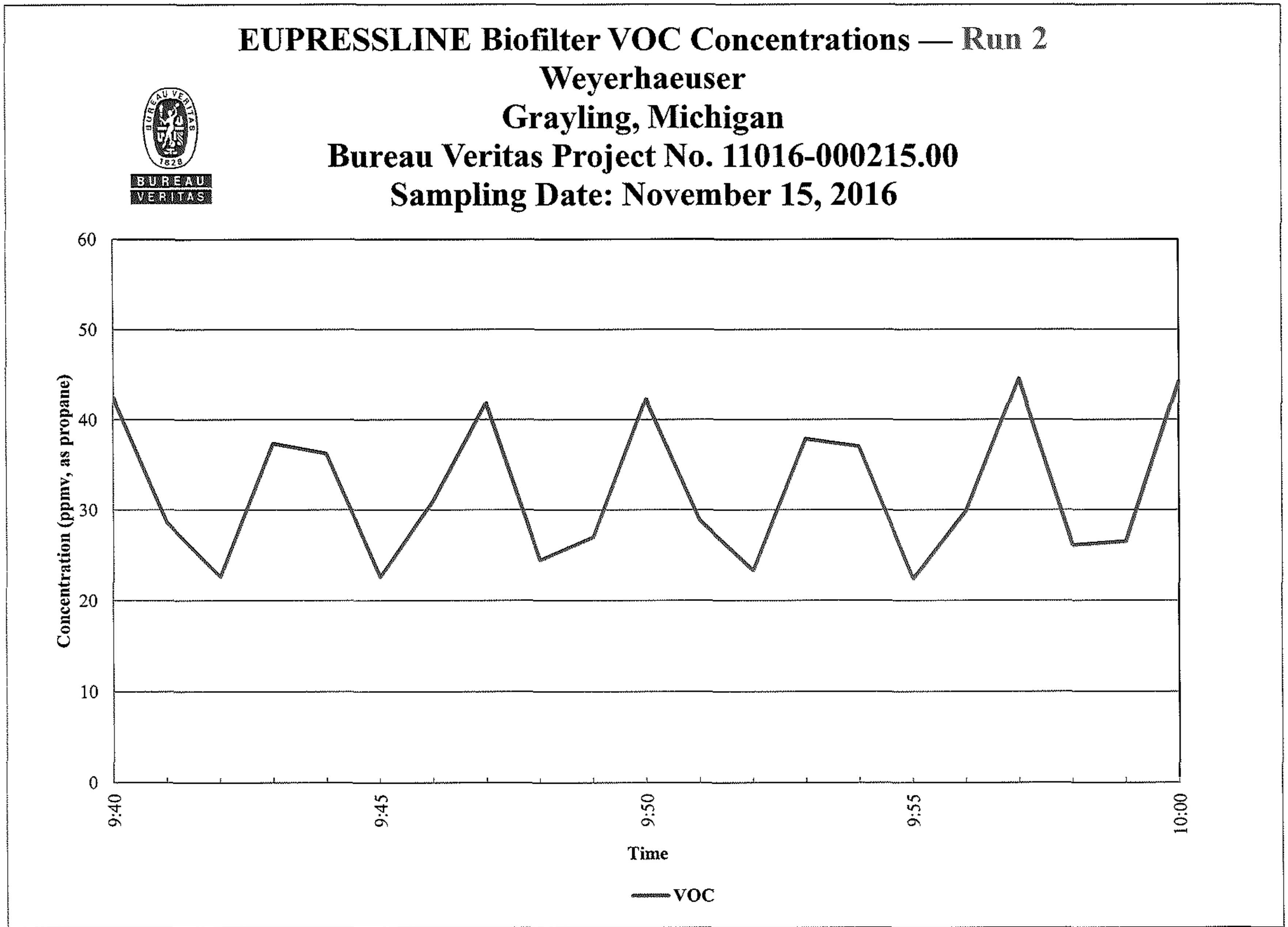


EUPRESSLINE Biofilter CO Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016

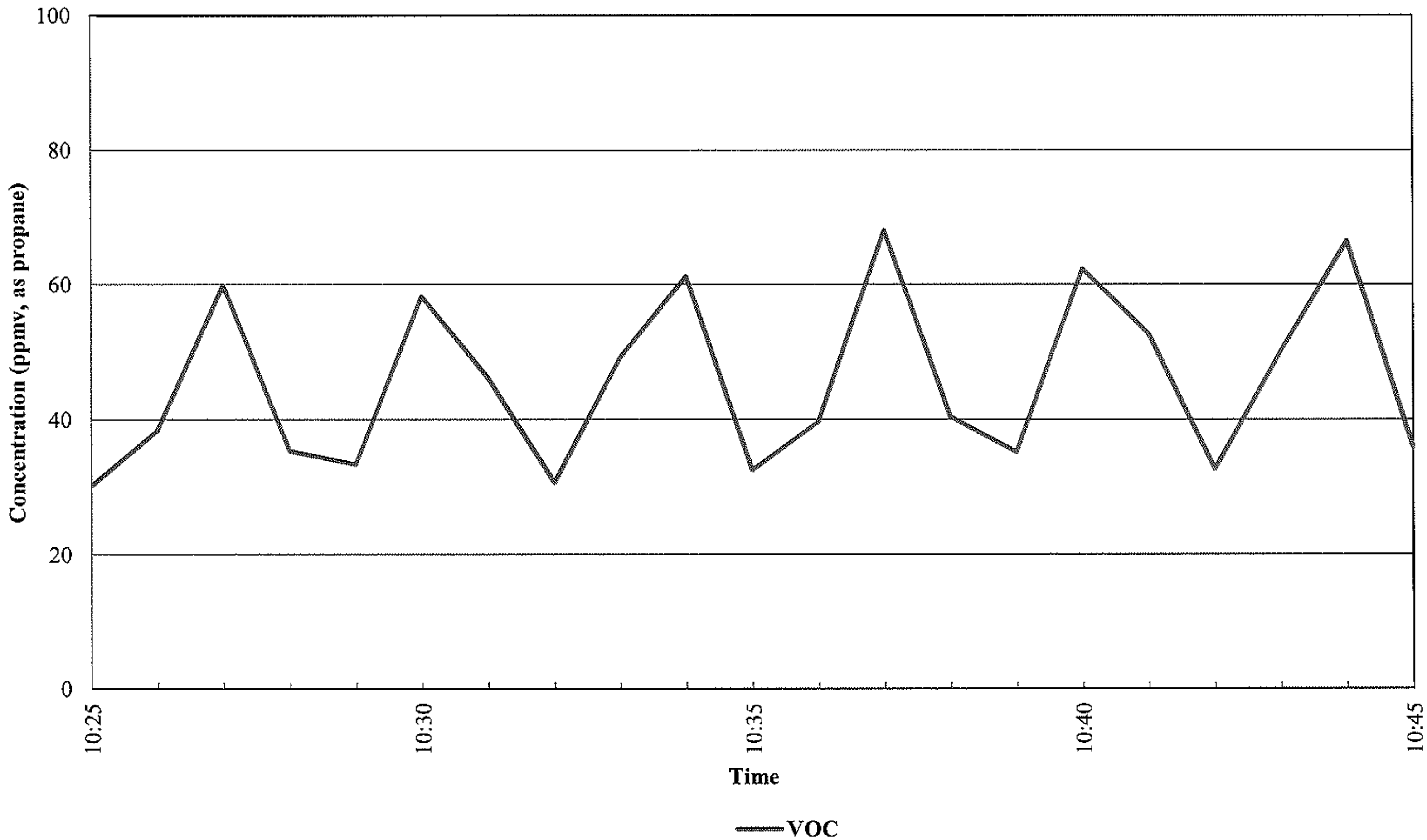


EUPRESSLINE Biofilter VOC Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016

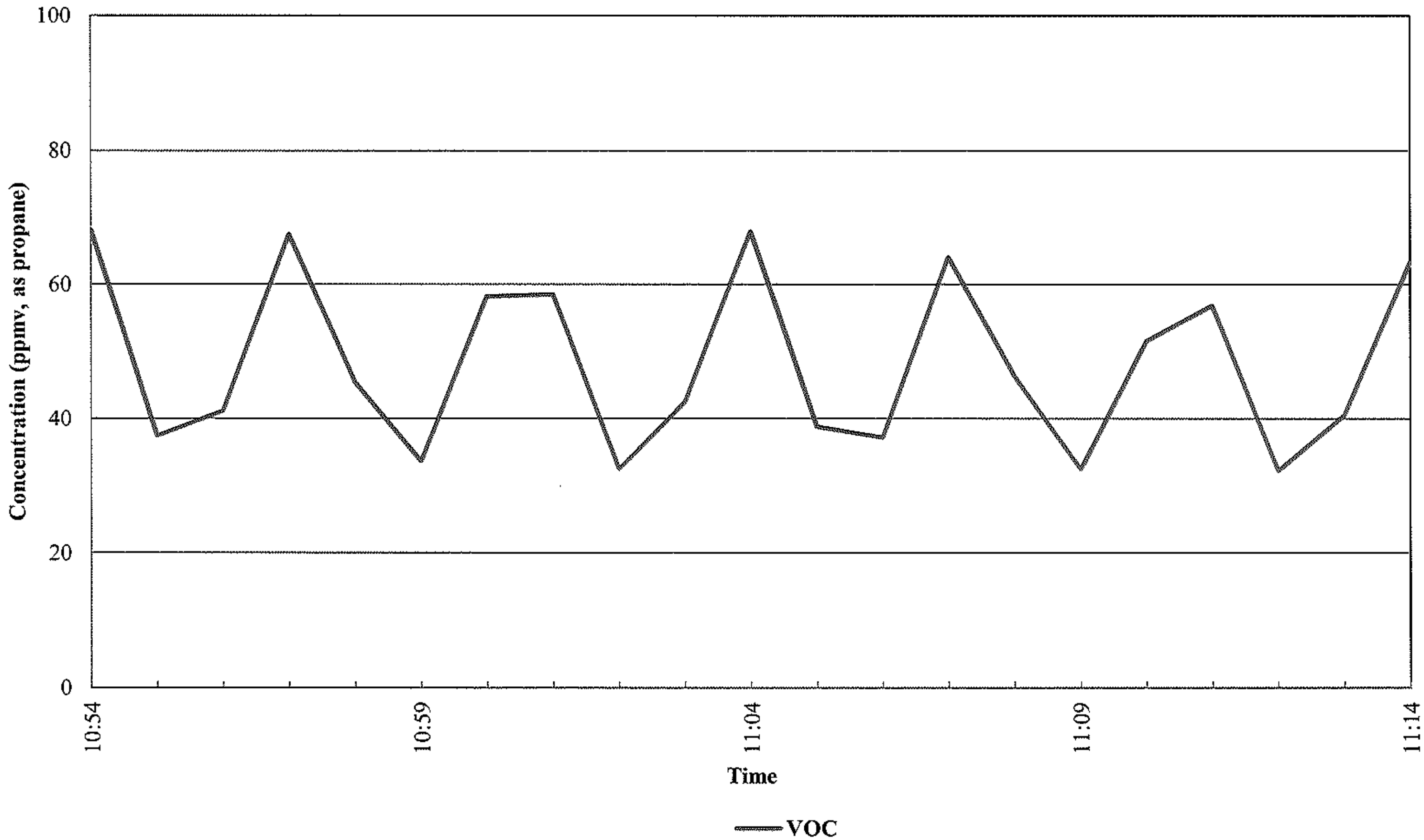


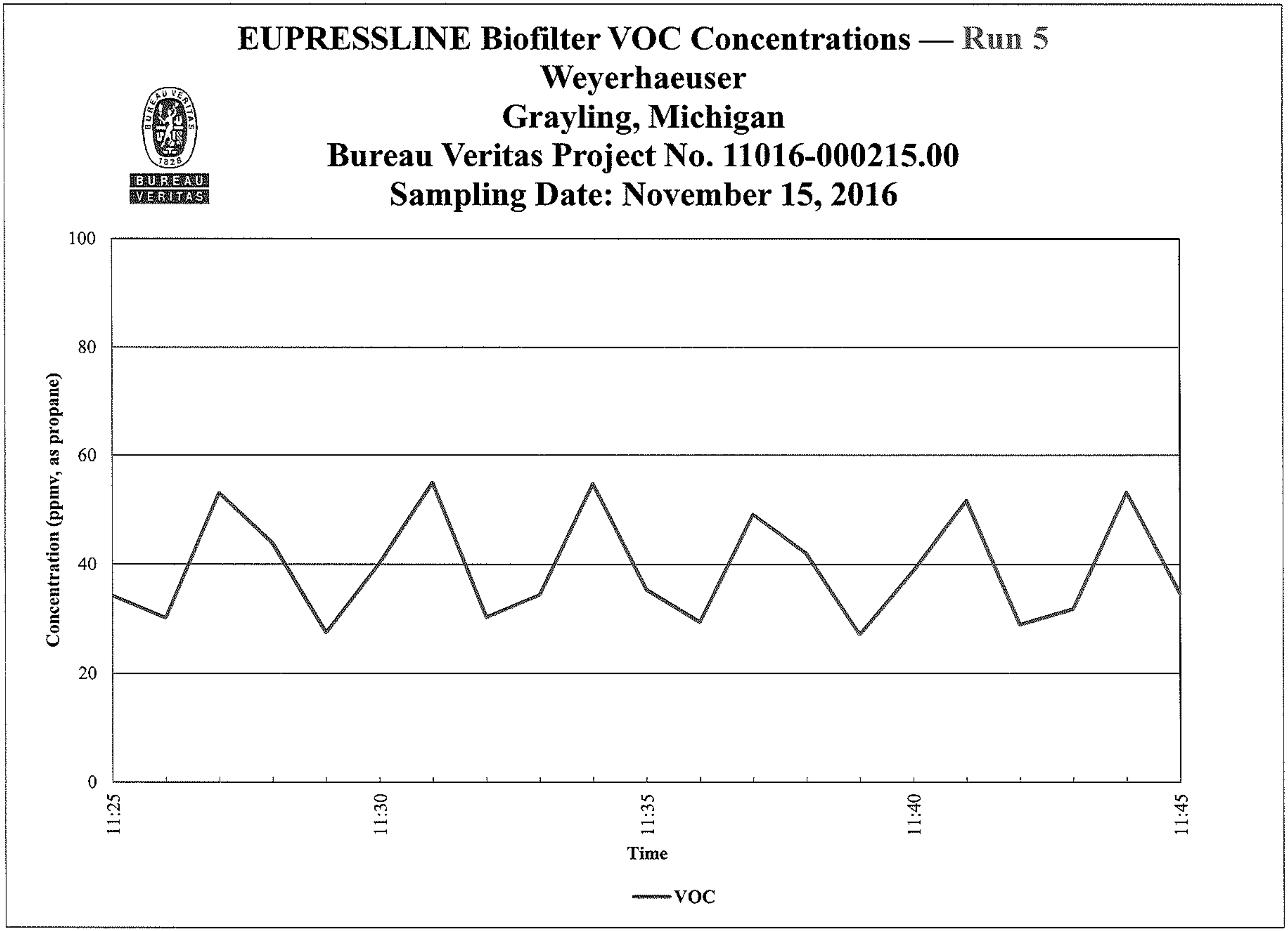

EUPRESSLINE Biofilter VOC Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016
BUREAU VERITAS
1828
Concentration (ppmv, as propane)
0
10
20
30
40
50
60
9:40
9:45
9:50
9:55
10:00
Time
VOC

EUPRESSLINE Biofilter VOC Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016

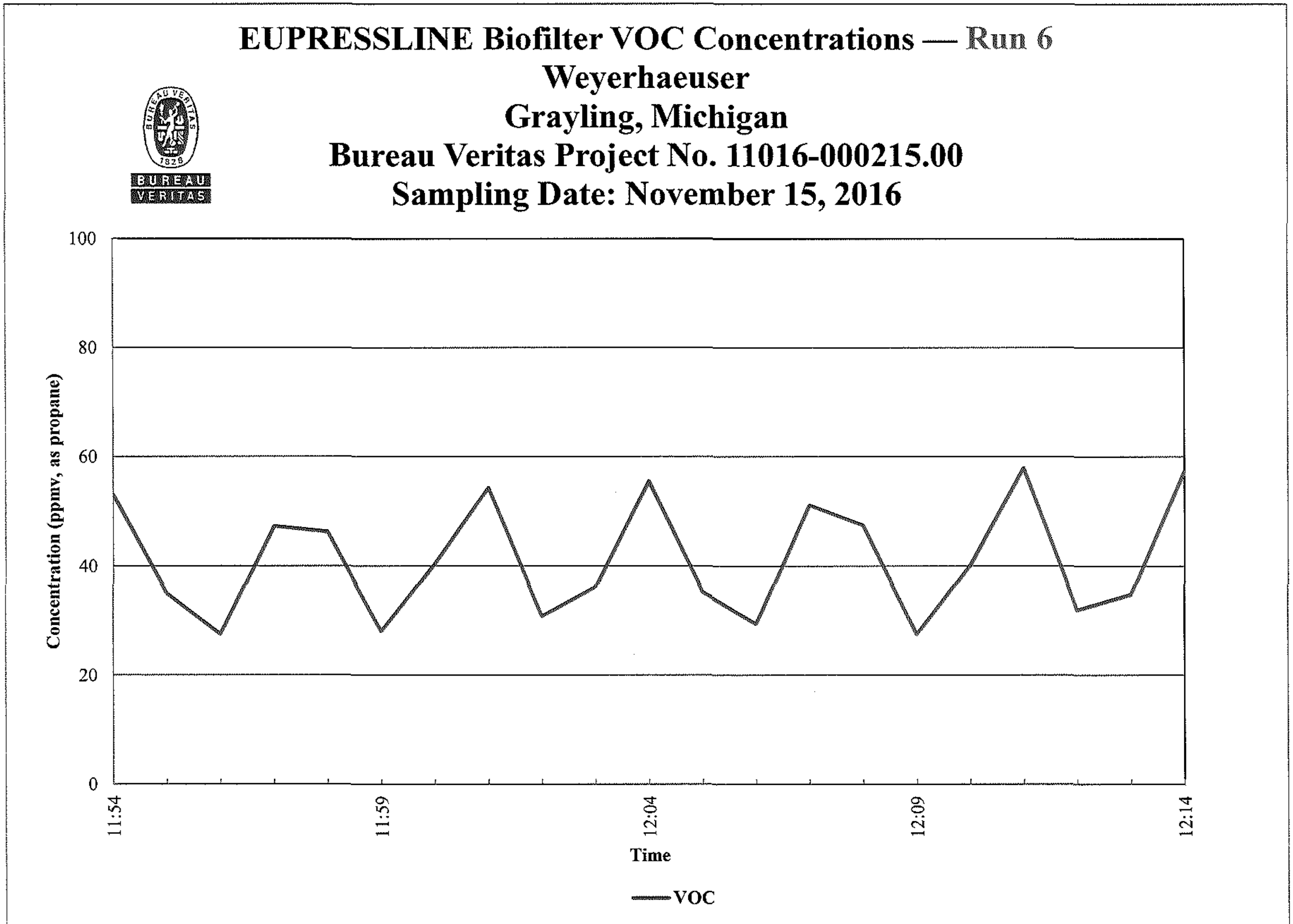


EUPRESSLINE Biofilter VOC Concentrations — Run 4
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016



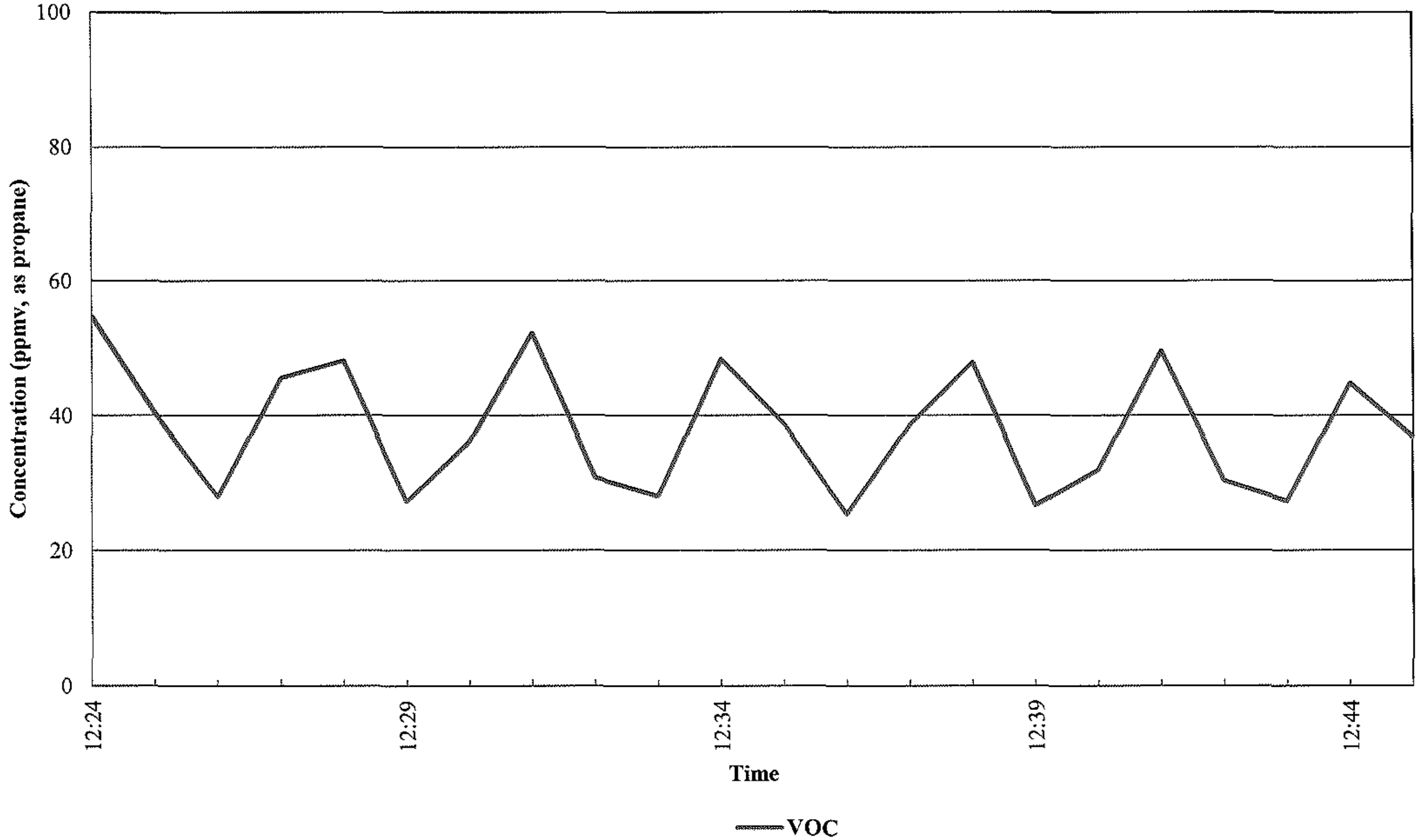


EUPRESSLINE Biofilter VOC Concentrations — Run 5
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016
100
80
60
40
20
0
Concentration (ppmv, as propane)
11:25
11:30
11:35
11:40
11:45
Time
VOC

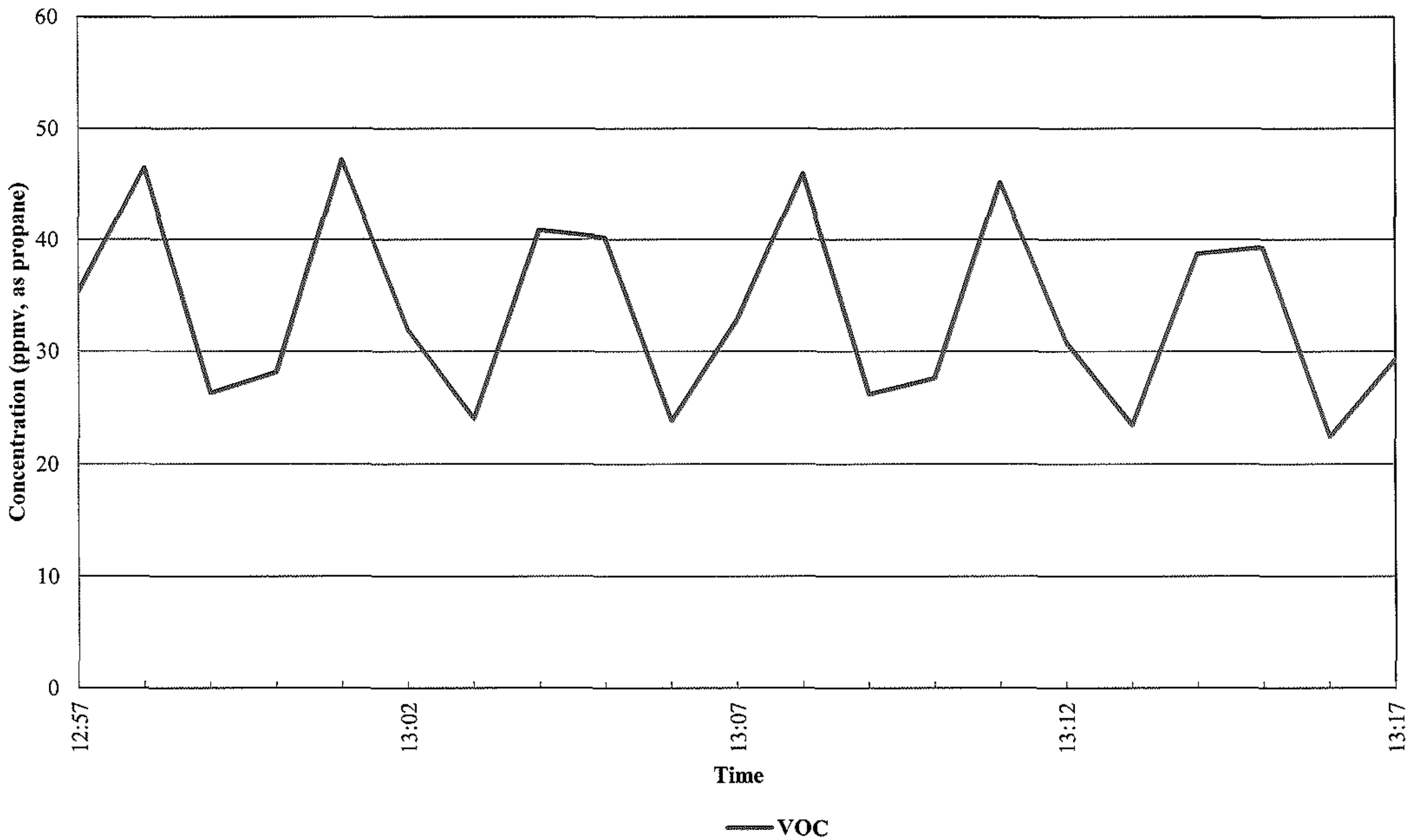


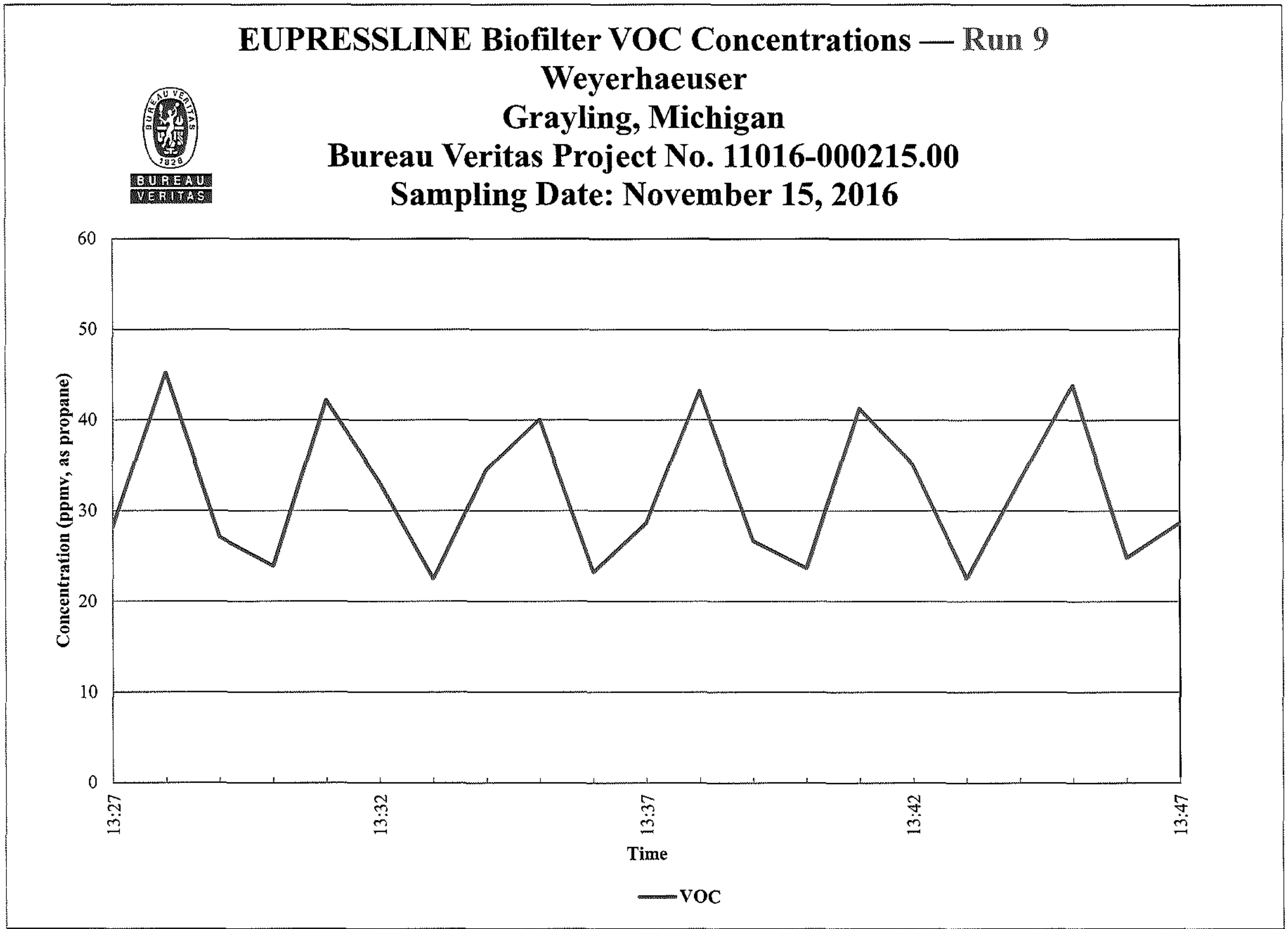
EUPRESSLINE Biofilter VOC Concentrations — Run 6
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016
BUREAU VERITAS
1828
Concentration (ppmv, as propane)
100
80
60
40
20
0
11:54
11:59
12:04
12:09
12:14
Time
VOC

EUPRESSLINE Biofilter VOC Concentrations — Run 7
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016



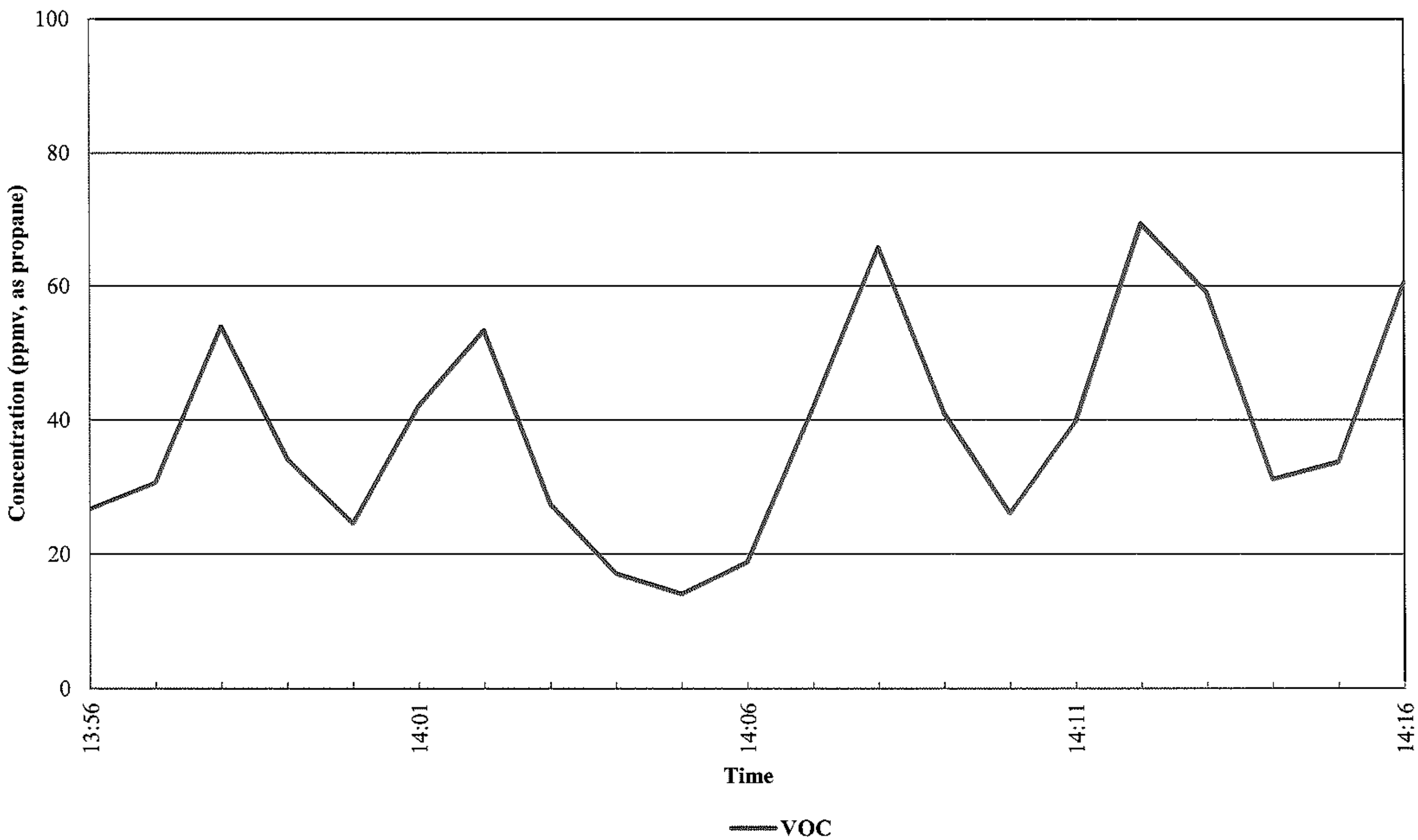
EUPRESSLINE Biofilter VOC Concentrations — Run 8
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016





EUPRESSLINE Biofilter VOC Concentrations — Run 9
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016
BUREAU VERITAS
1828
60
50
40
30
20
10
0
Concentration (ppmv, as propane)
13:27
13:32
13:37
13:42
13:47
Time
VOC

EUPRESSLINE Biofilter VOC Concentrations — Run 10
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 15, 2016



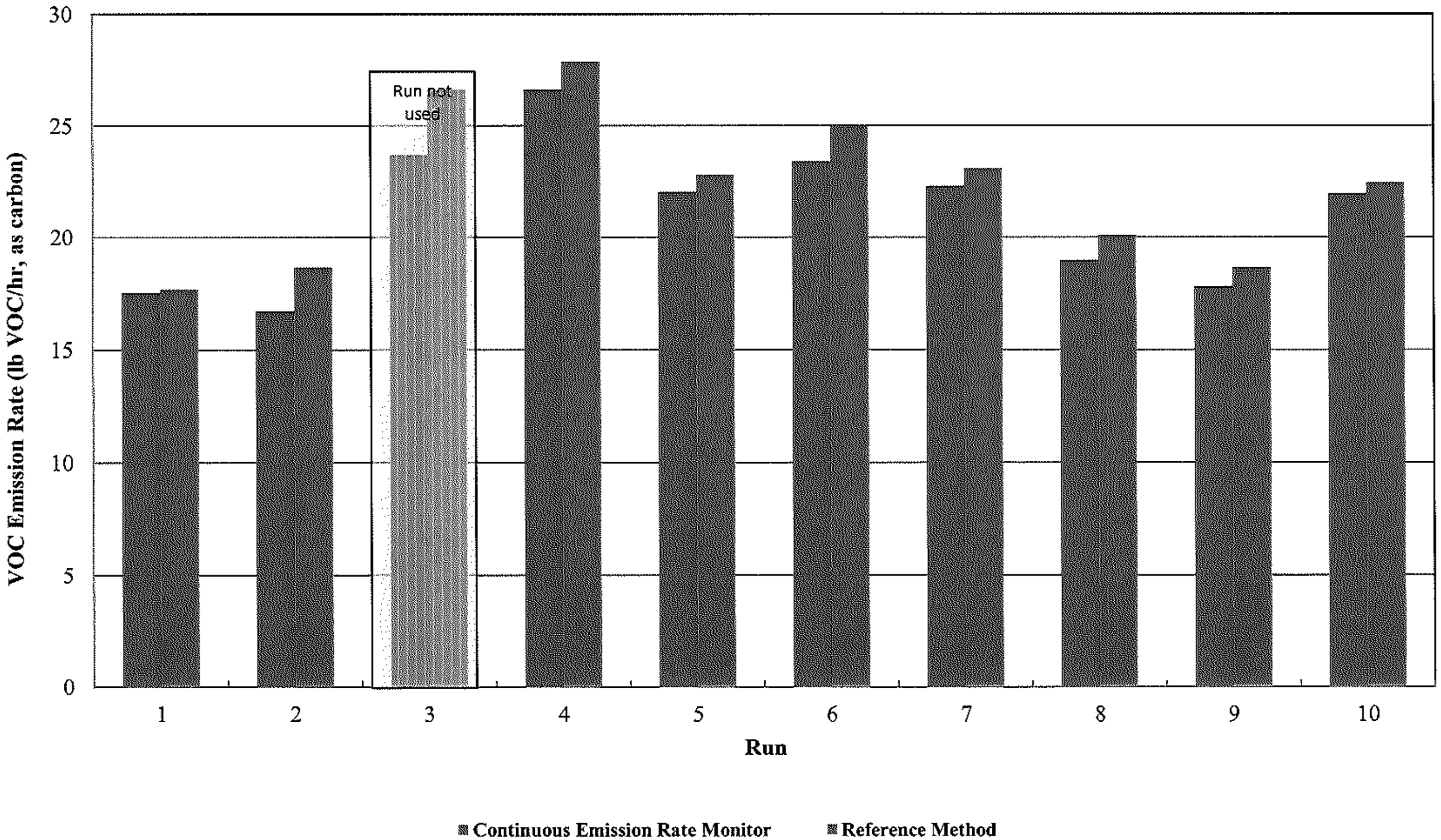
EUPRESSLINE Biofilter VOC RM to CERMS Comparison — lb VOC/hr, as carbon

Weyerhaeuser

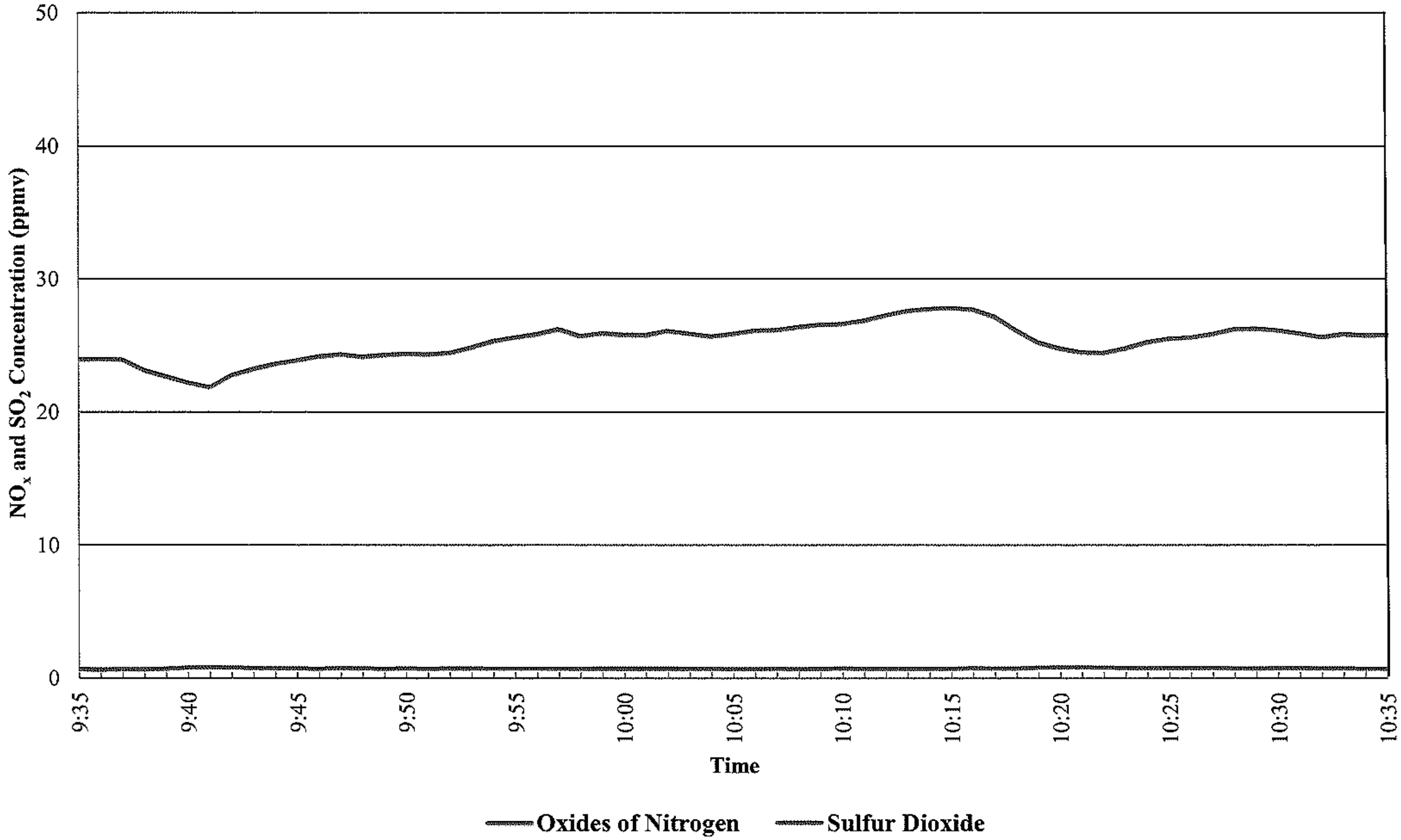
Grayling, Michigan

Project No. 11016-000215.00

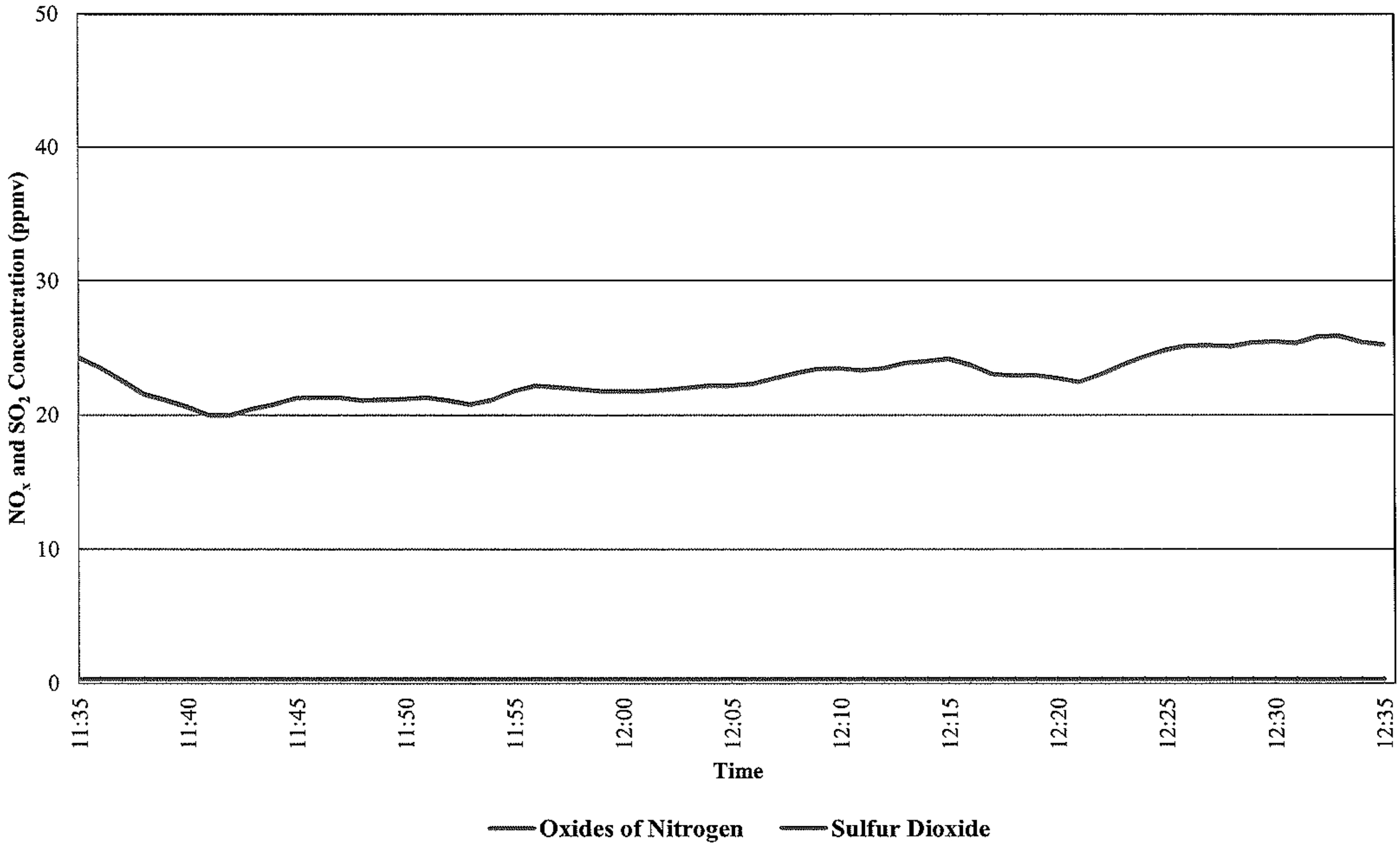
Sampling Date: November 15, 2016



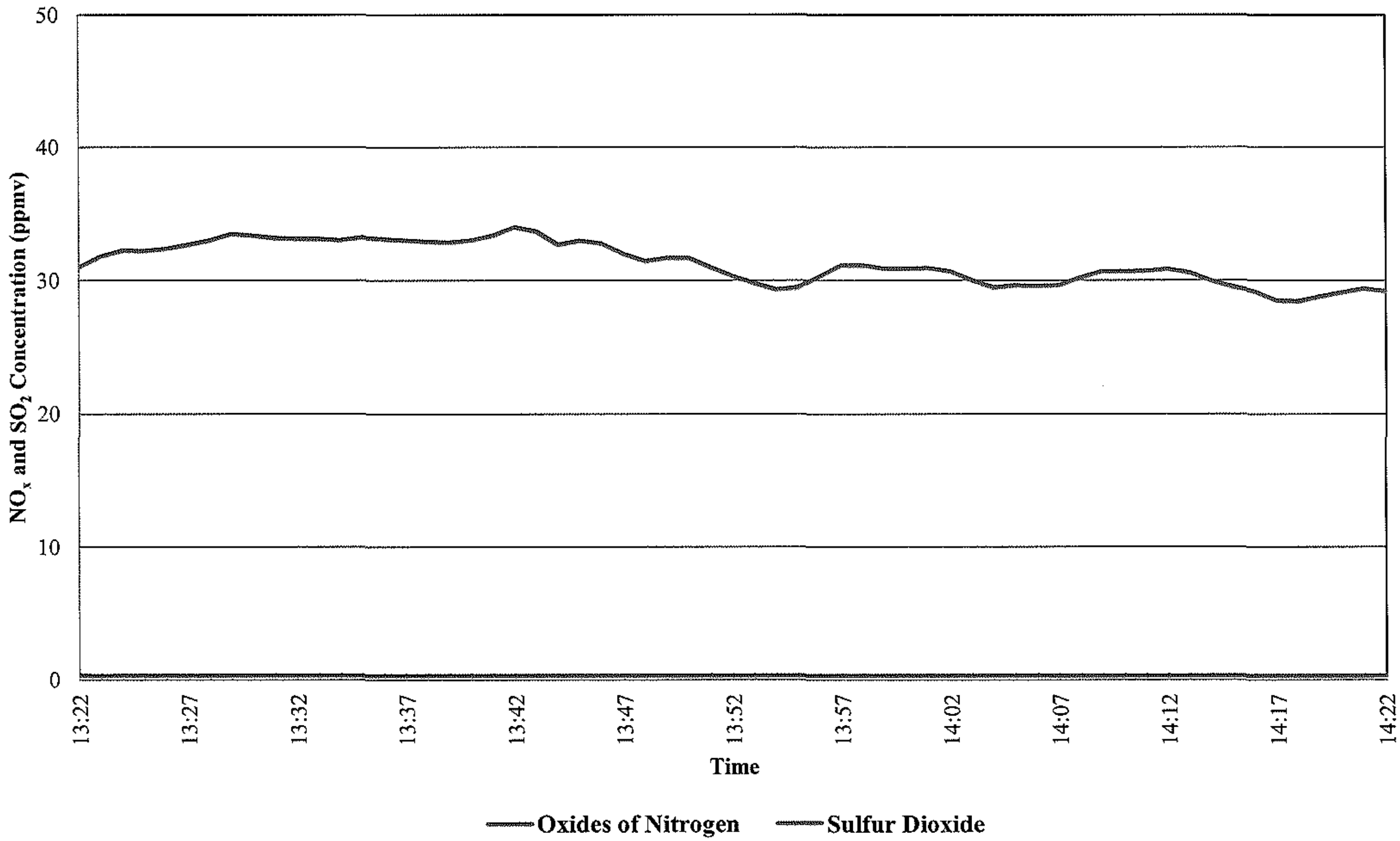
FGDRYERS RTO Outlet NO_x and SO_2 Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016

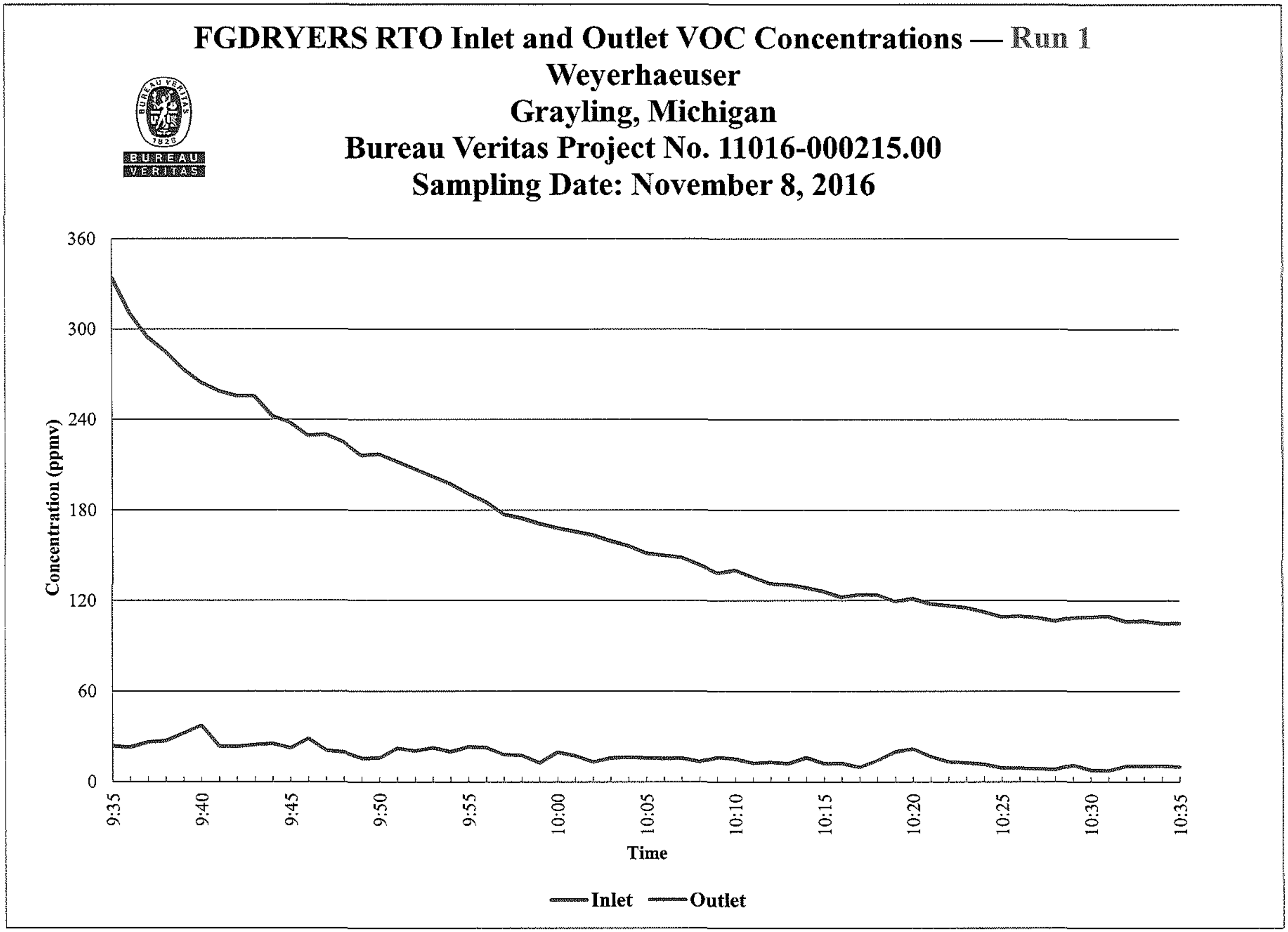


FGDRYERS RTO Outlet NO_x and SO_2 Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016

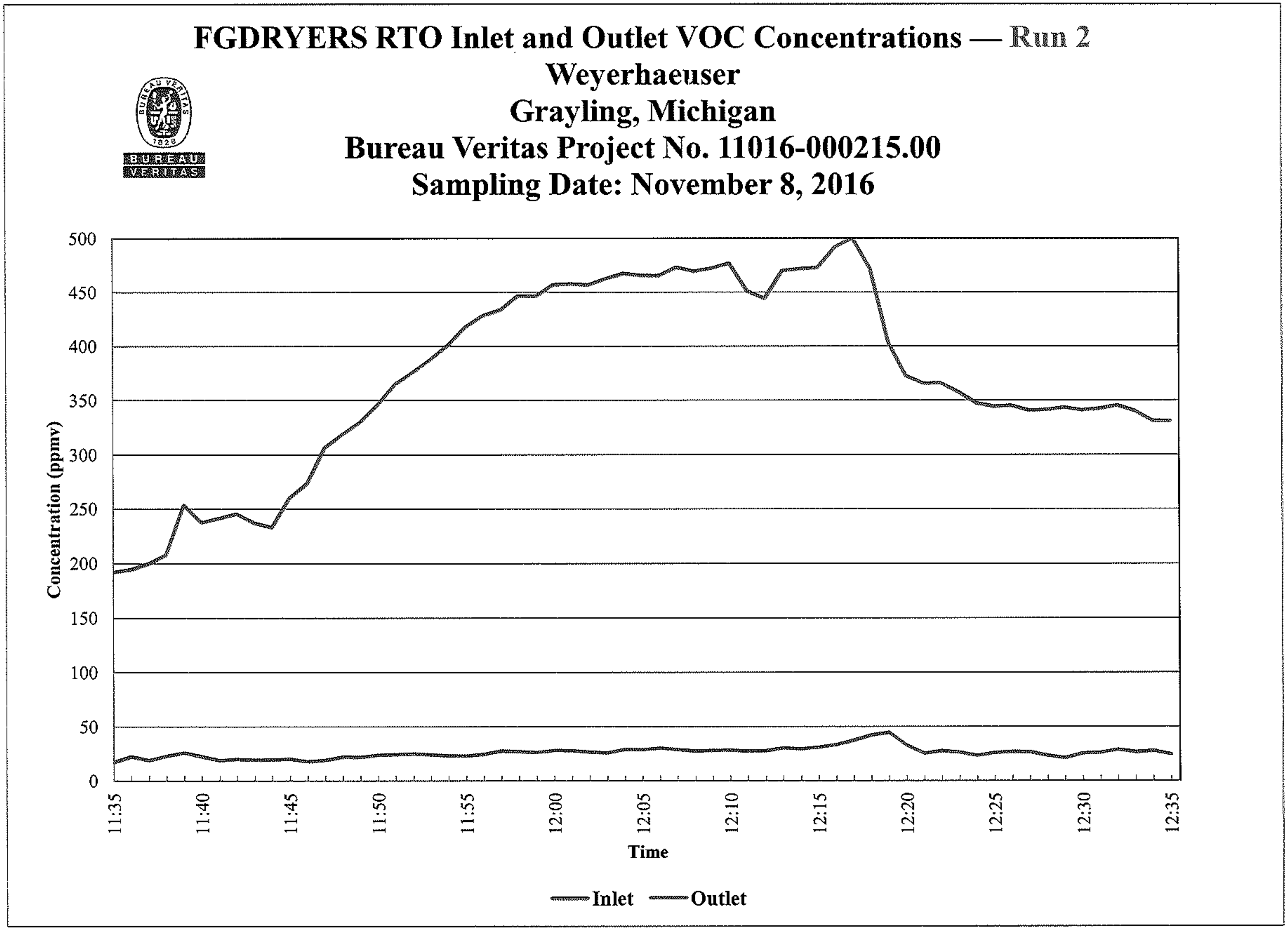


FGDRYERS RTO Outlet NO_x and SO_2 Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016



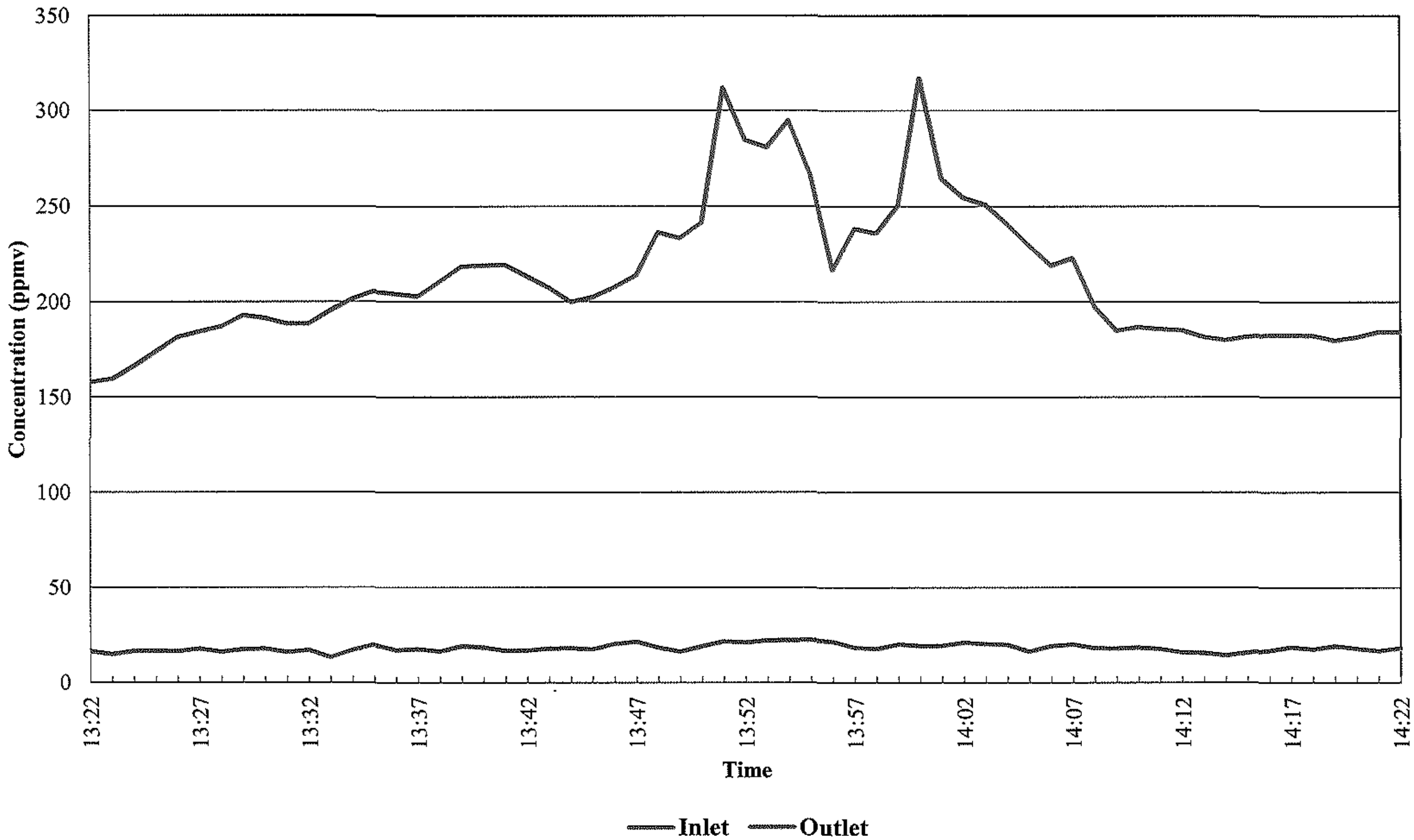


FGDRYERS RTO Inlet and Outlet VOC Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016
BUREAU VERITAS
1828
360
300
240
180
120
60
0
Concentration (ppmv)
9:35
9:40
9:45
9:50
9:55
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
Time
Inlet
Outlet

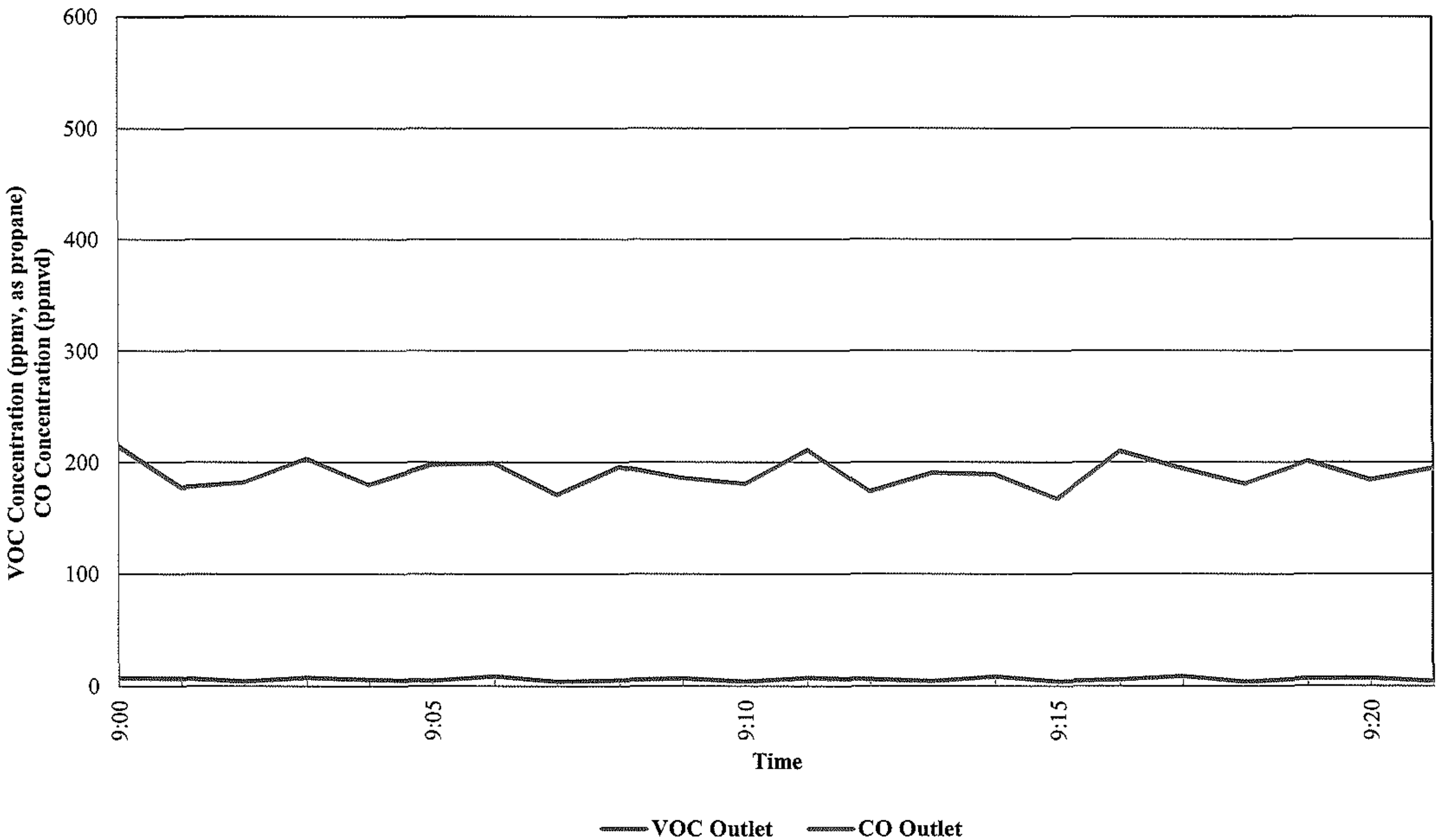


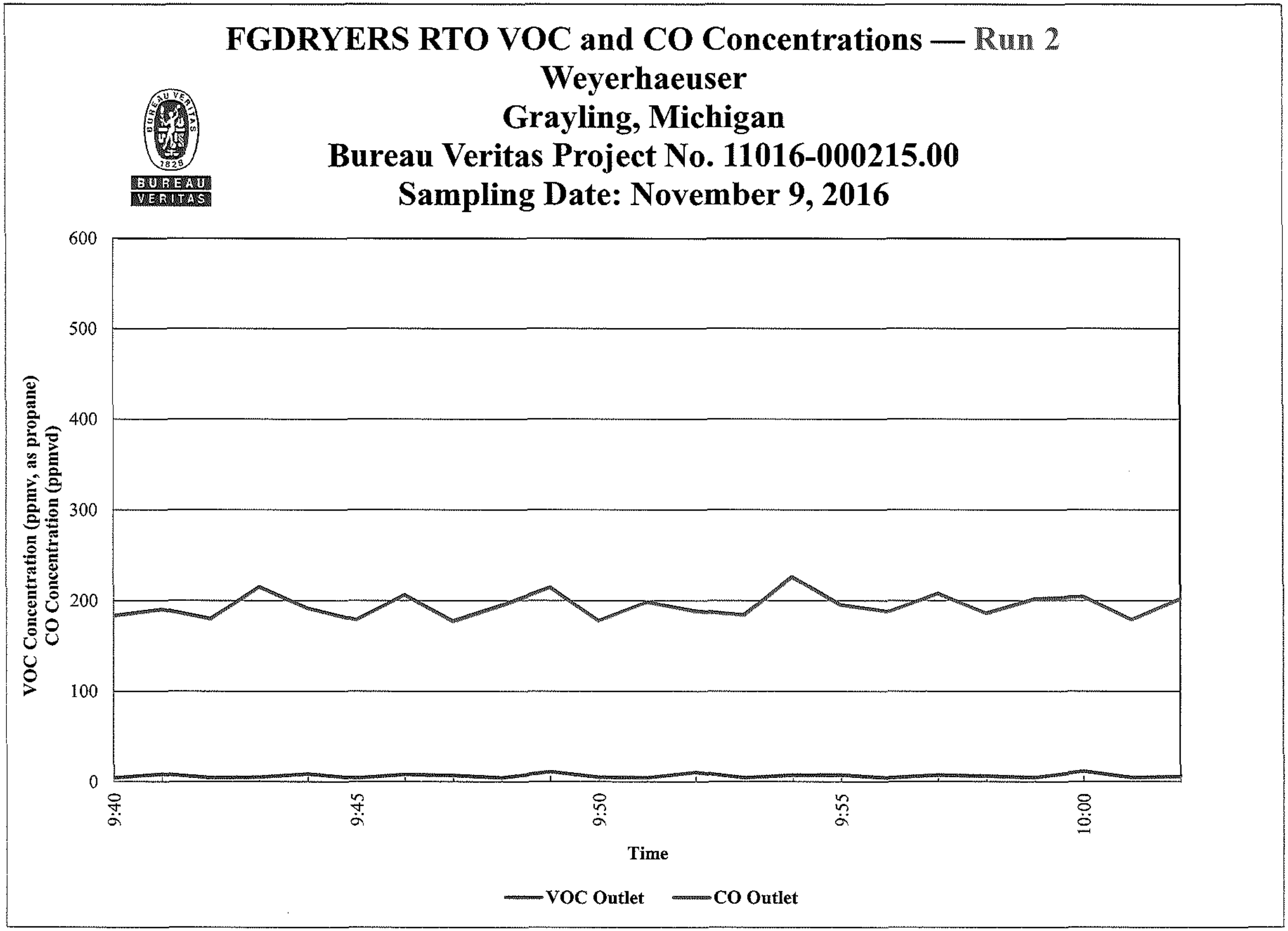
FGDRYERS RTO Inlet and Outlet VOC Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016
BUREAU VERITAS
1828
Concentration (ppmv)
500
450
400
350
300
250
200
150
100
50
0
11:35
11:40
11:45
11:50
11:55
12:00
12:05
12:10
12:15
12:20
12:25
12:30
12:35
Time
Inlet
Outlet

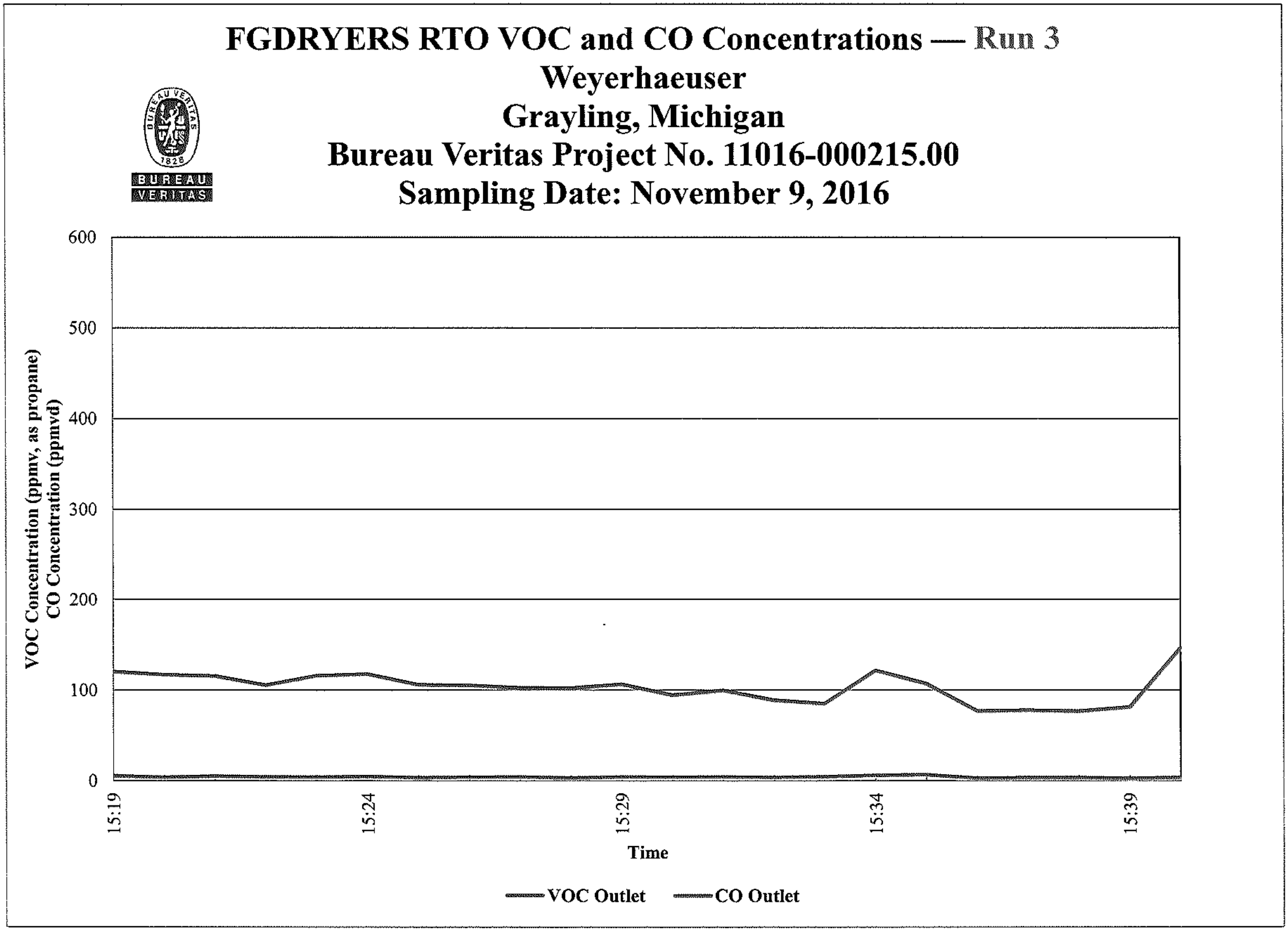
FGDRYERS RTO Inlet and Outlet VOC Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 8, 2016



FGDRYERS RTO VOC and CO Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016

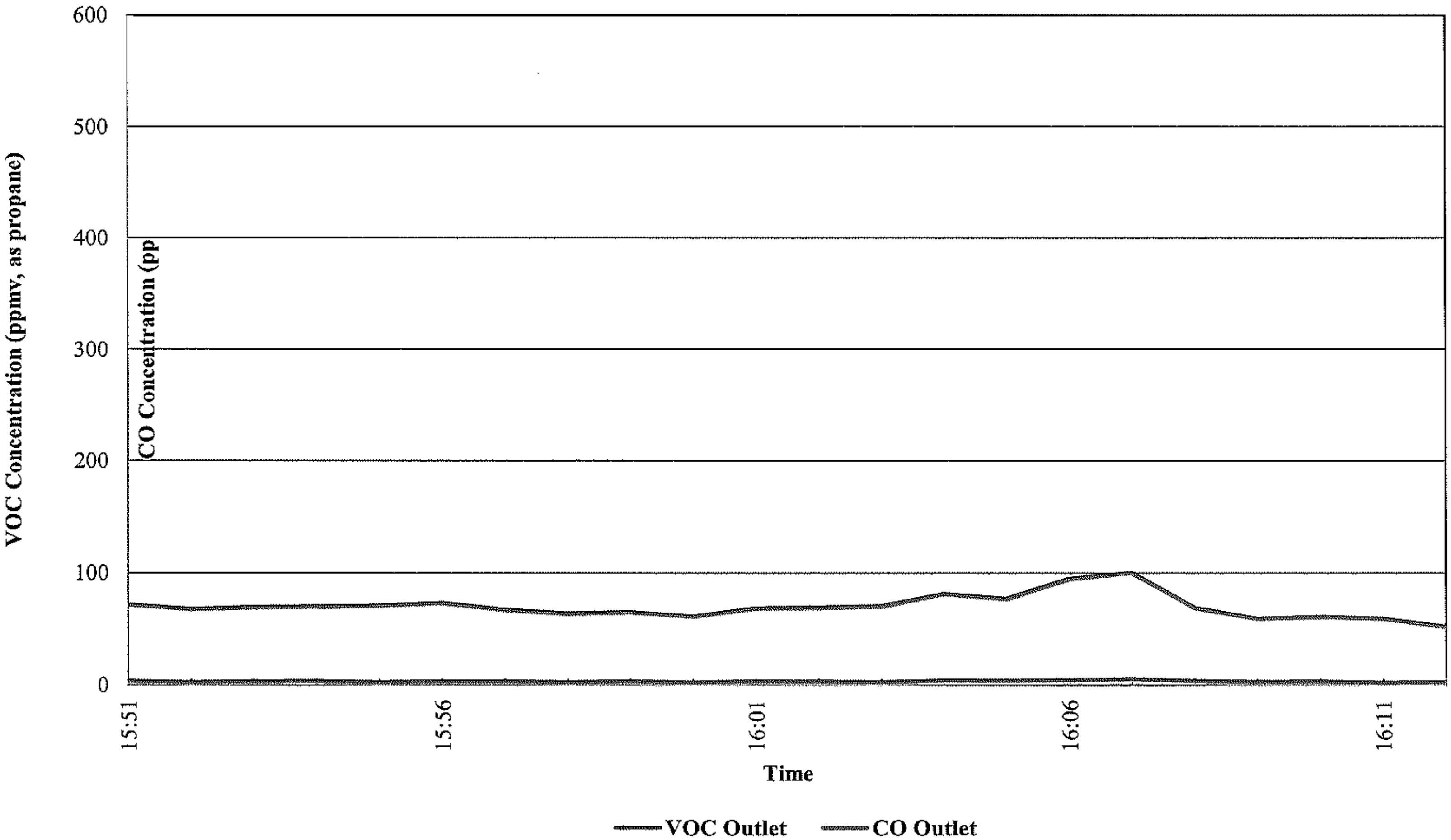



FGDRYERS RTO VOC and CO Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016
VOC Concentration (ppmv, as propane)
CO Concentration (ppmvd)
600
500
400
300
200
100
0
9:40
9:45
9:50
9:55
10:00
Time
VOC Outlet
CO Outlet

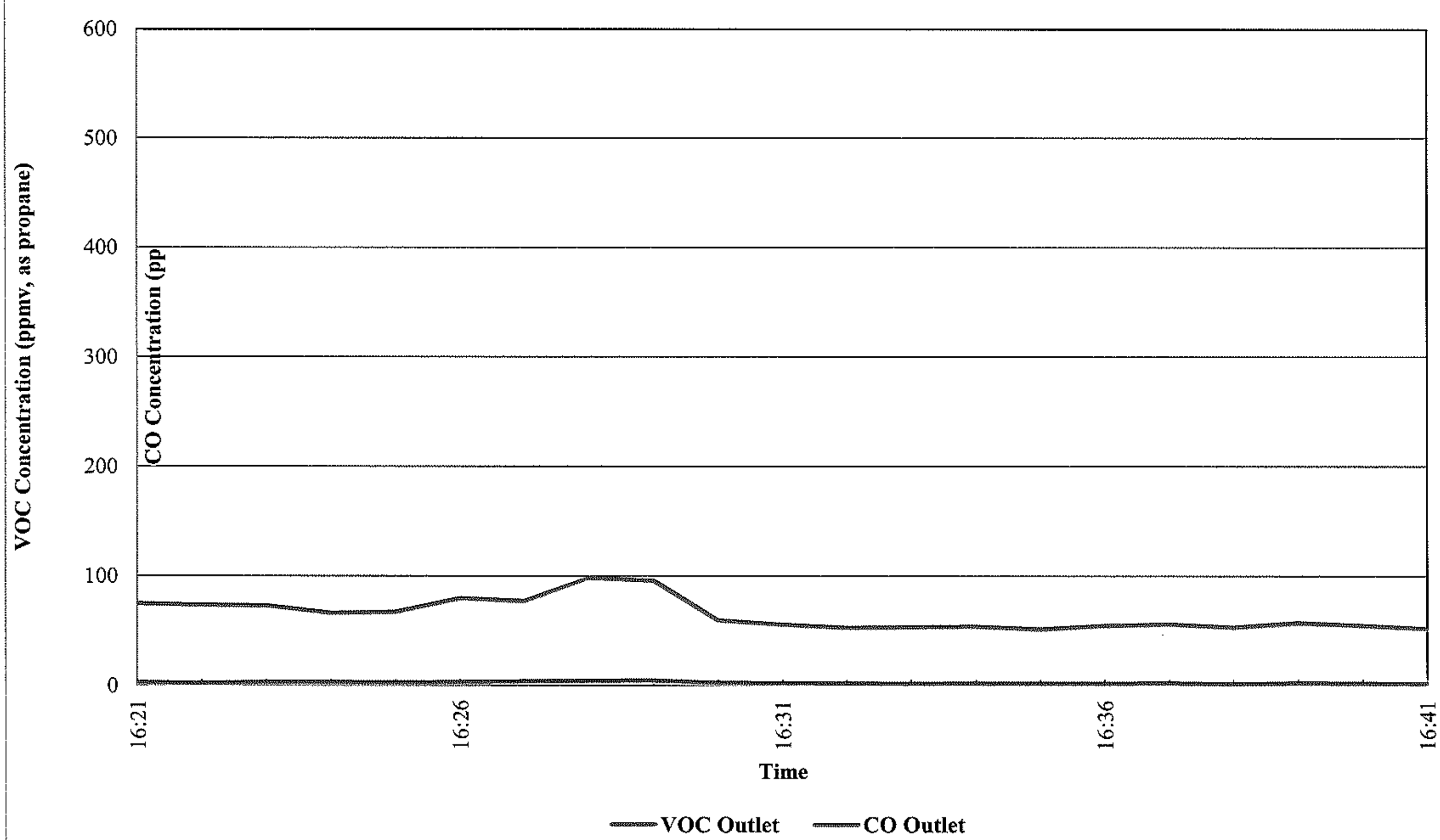


FGDRYERS RTO VOC and CO Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016
BUREAU VERITAS
1828
600
500
400
300
200
100
0
VOC Concentration (ppmv, as propane)
CO Concentration (ppmvd)
15:19
15:24
15:29
15:34
15:39
Time
VOC Outlet
CO Outlet

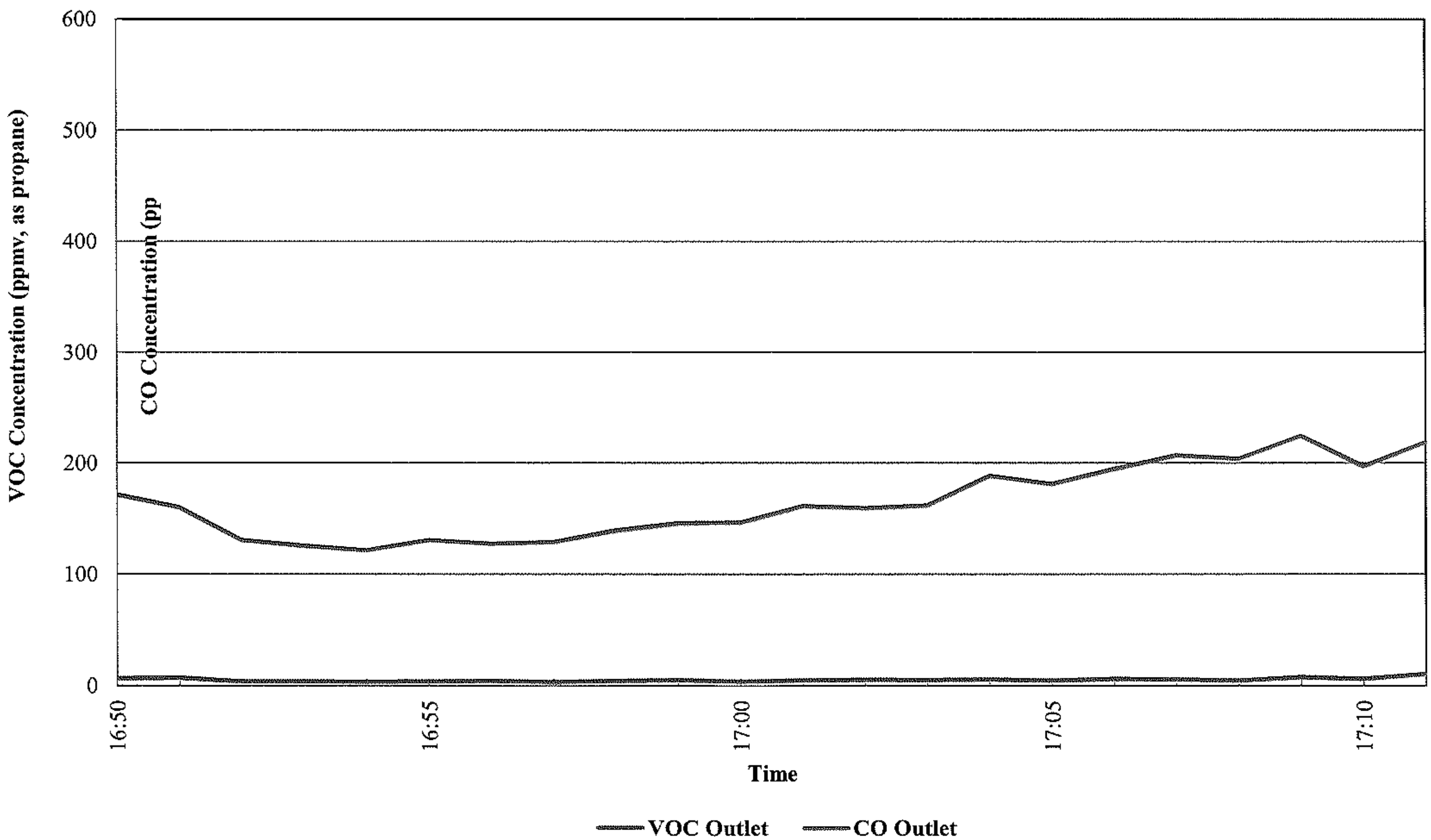
FGDRYERS RTO VOC and CO Concentrations — Run 4
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016



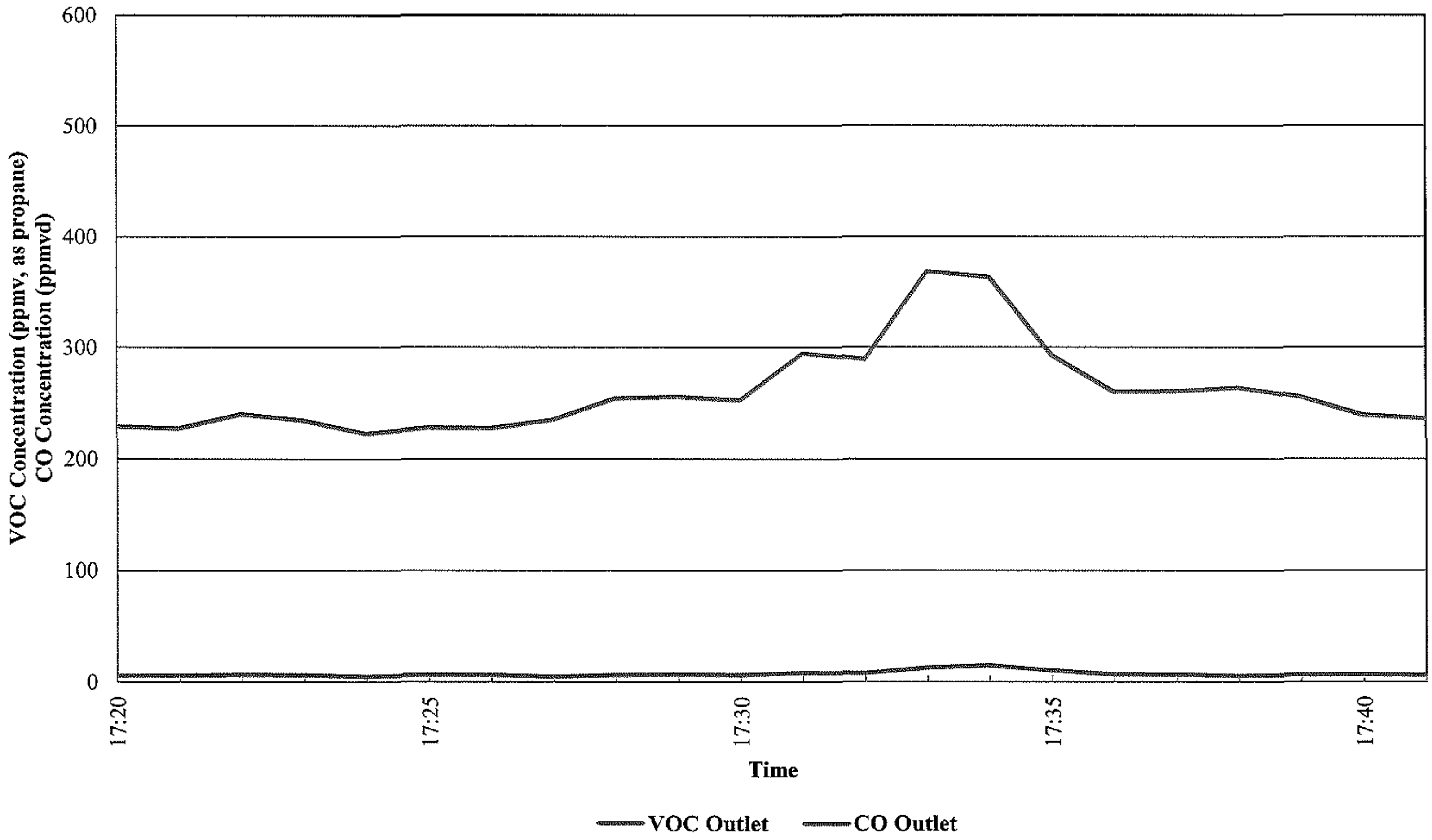
FGDRYERS RTO VOC and CO Concentrations — Run 5
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016

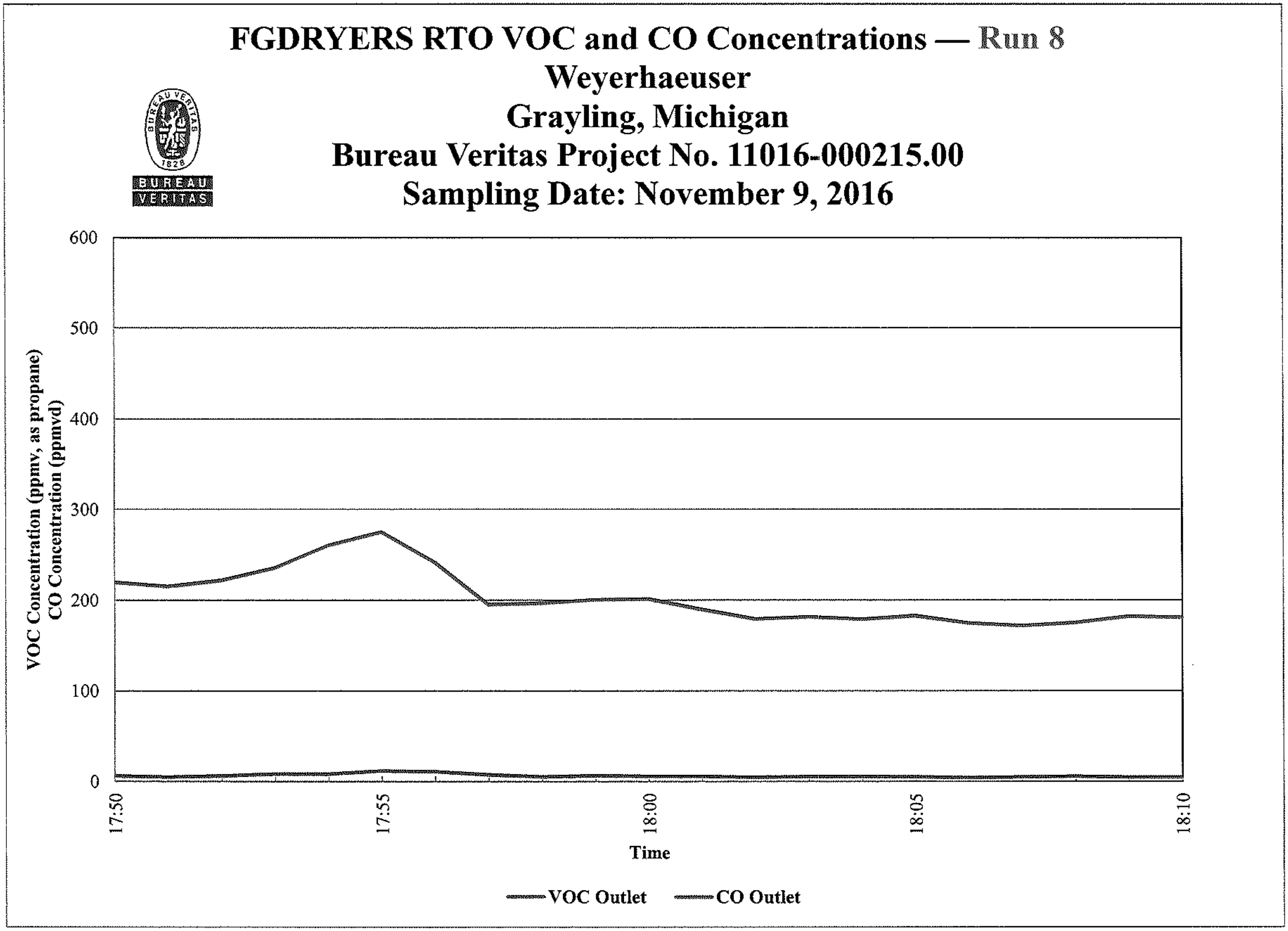


FGDRYERS RTO VOC and CO Concentrations — Run 6
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016

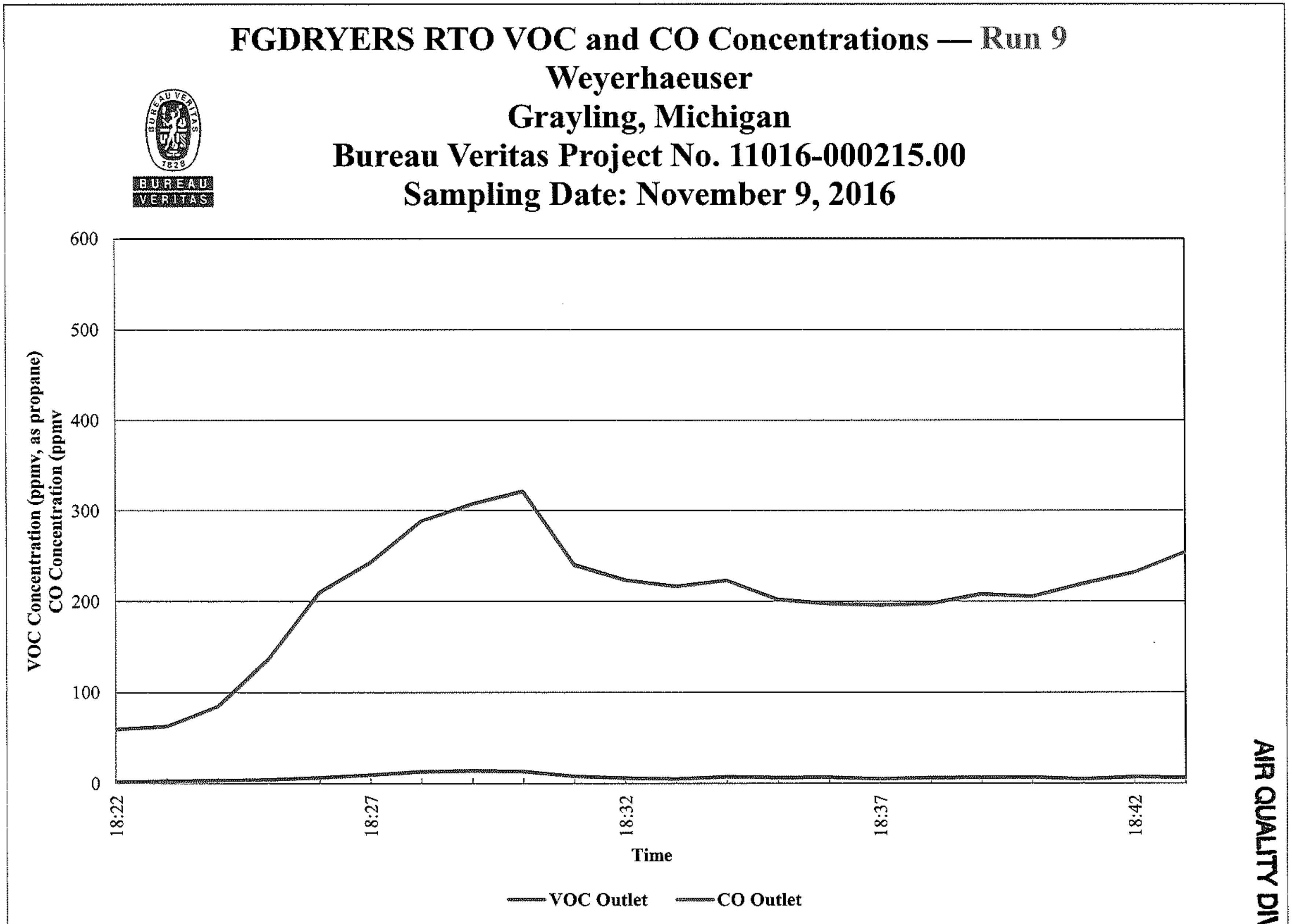


FGDRYERS RTO VOC and CO Concentrations — Run 7
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016



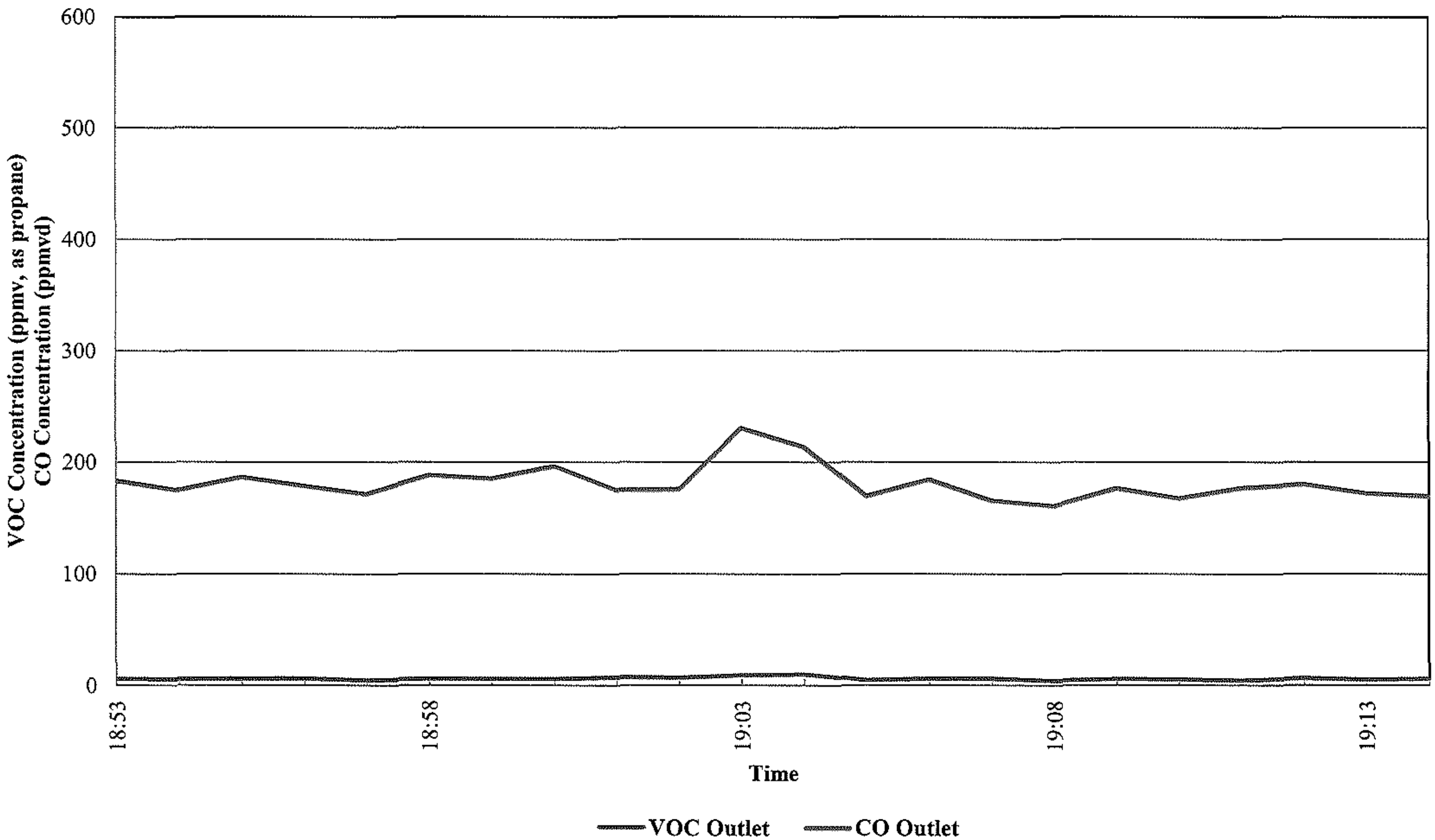


FGDRYERS RTO VOC and CO Concentrations — Run 8
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016
BUREAU VERITAS
1828
600
500
400
300
200
100
0
VOC Concentration (ppmv, as propane)
CO Concentration (ppmvd)
17:50
17:55
18:00
18:05
18:10
Time
VOC Outlet
CO Outlet

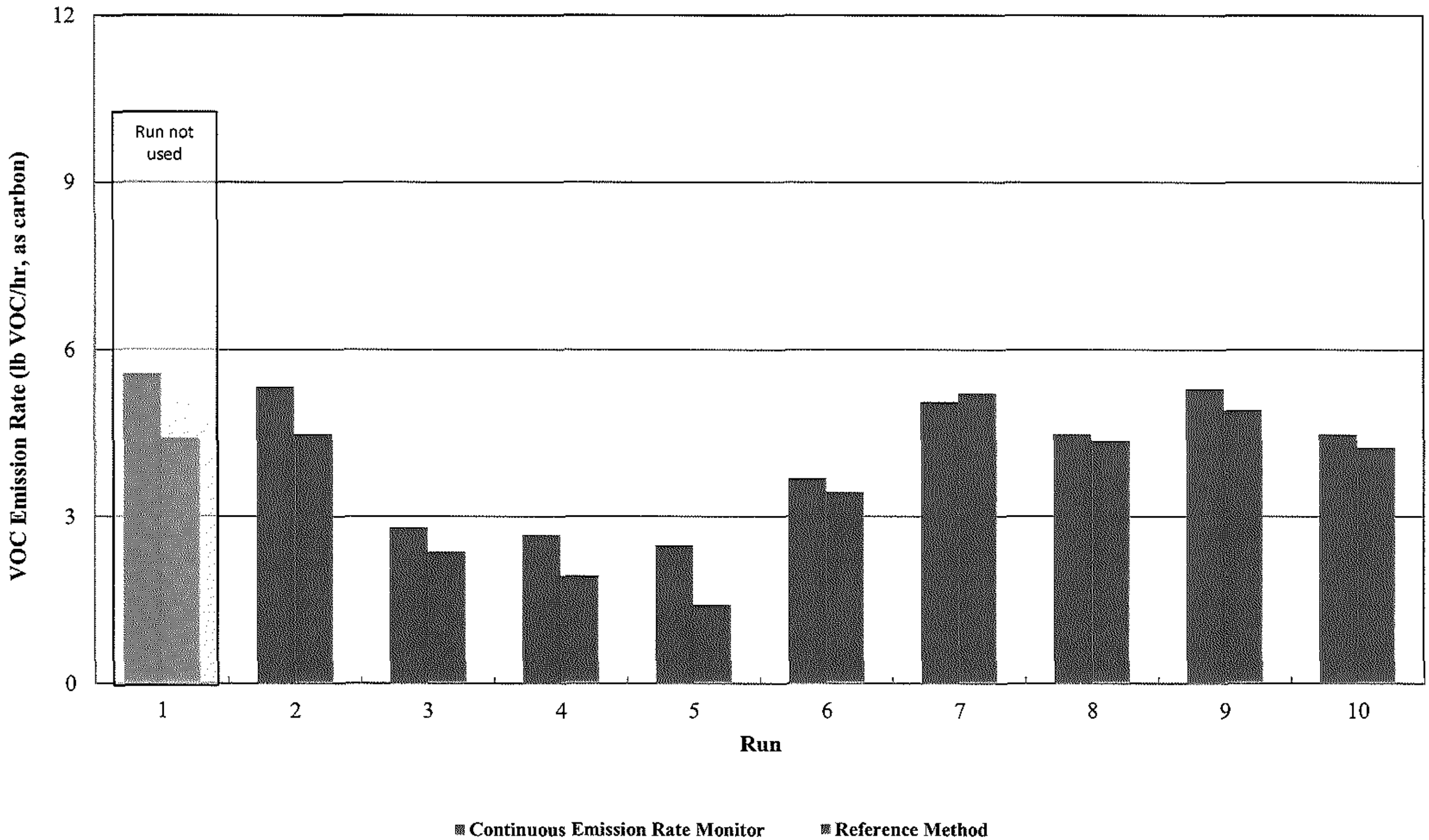


FGDRYERS RTO VOC and CO Concentrations — Run 9
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016
BUREAU VERITAS
VOC Concentration (ppmv, as propane)
CO Concentration (ppmv
600
500
400
300
200
100
0
18:22
18:27
18:32
18:37
18:42
Time
VOC Outlet
CO Outlet

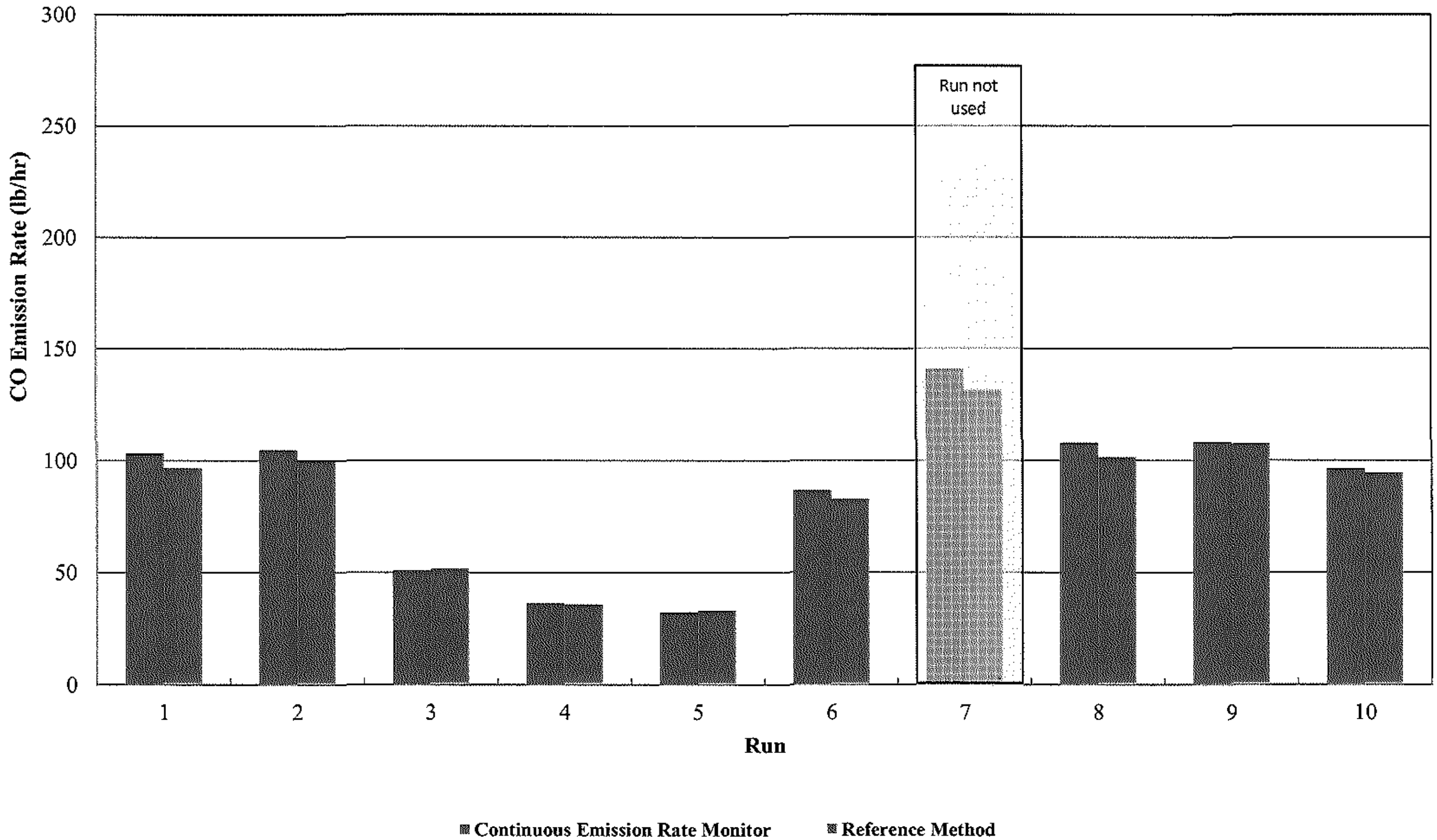
FGDRYERS RTO VOC and CO Concentrations — Run 10
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 9, 2016



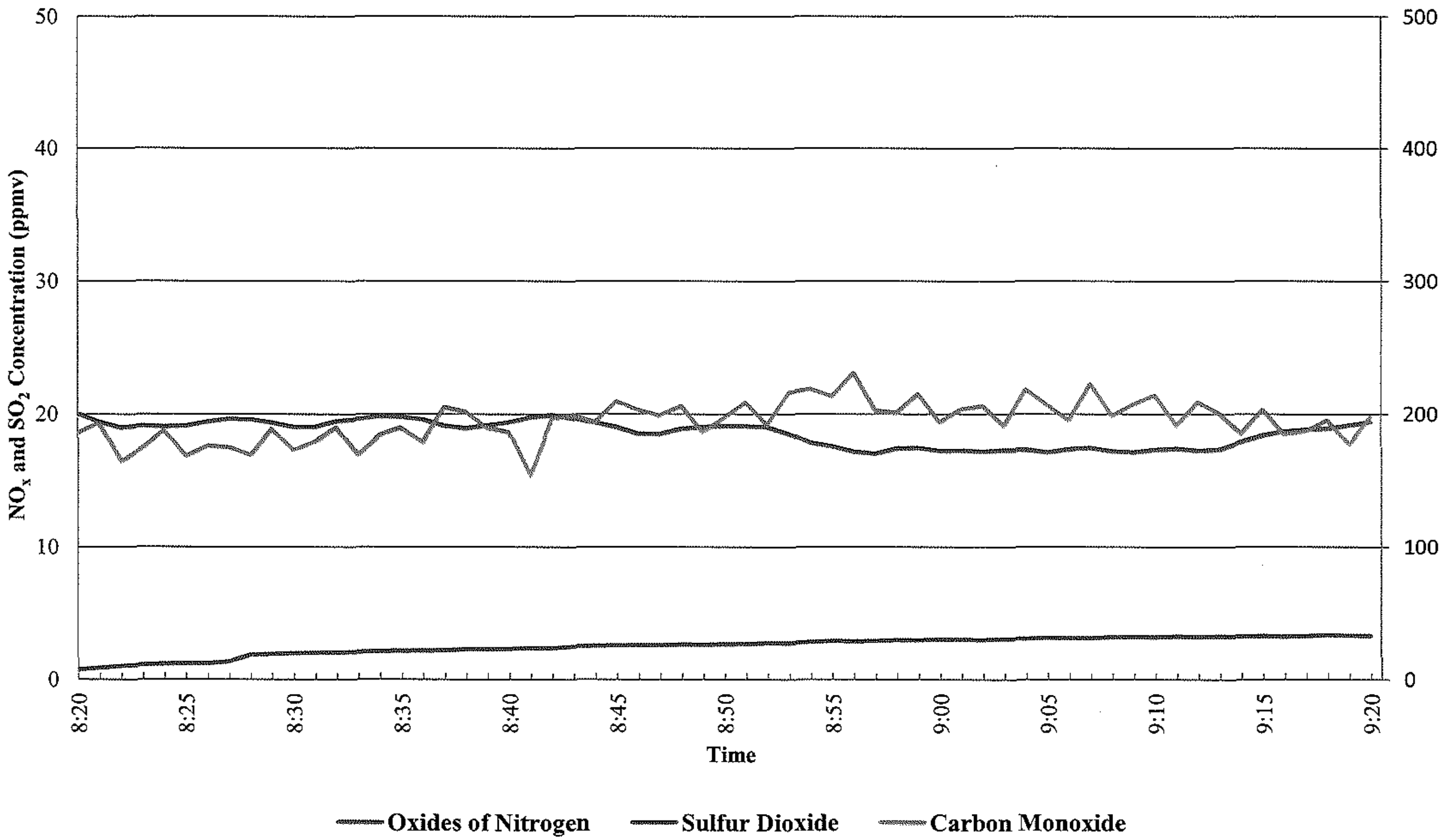
FGDRYERS RTO VOC RM to CERMS Comparison — lb VOC/hr, as carbon
Weyerhaeuser
Grayling, Michigan
Project No. 11016-000215.00
Sampling Date: November 9, 2016

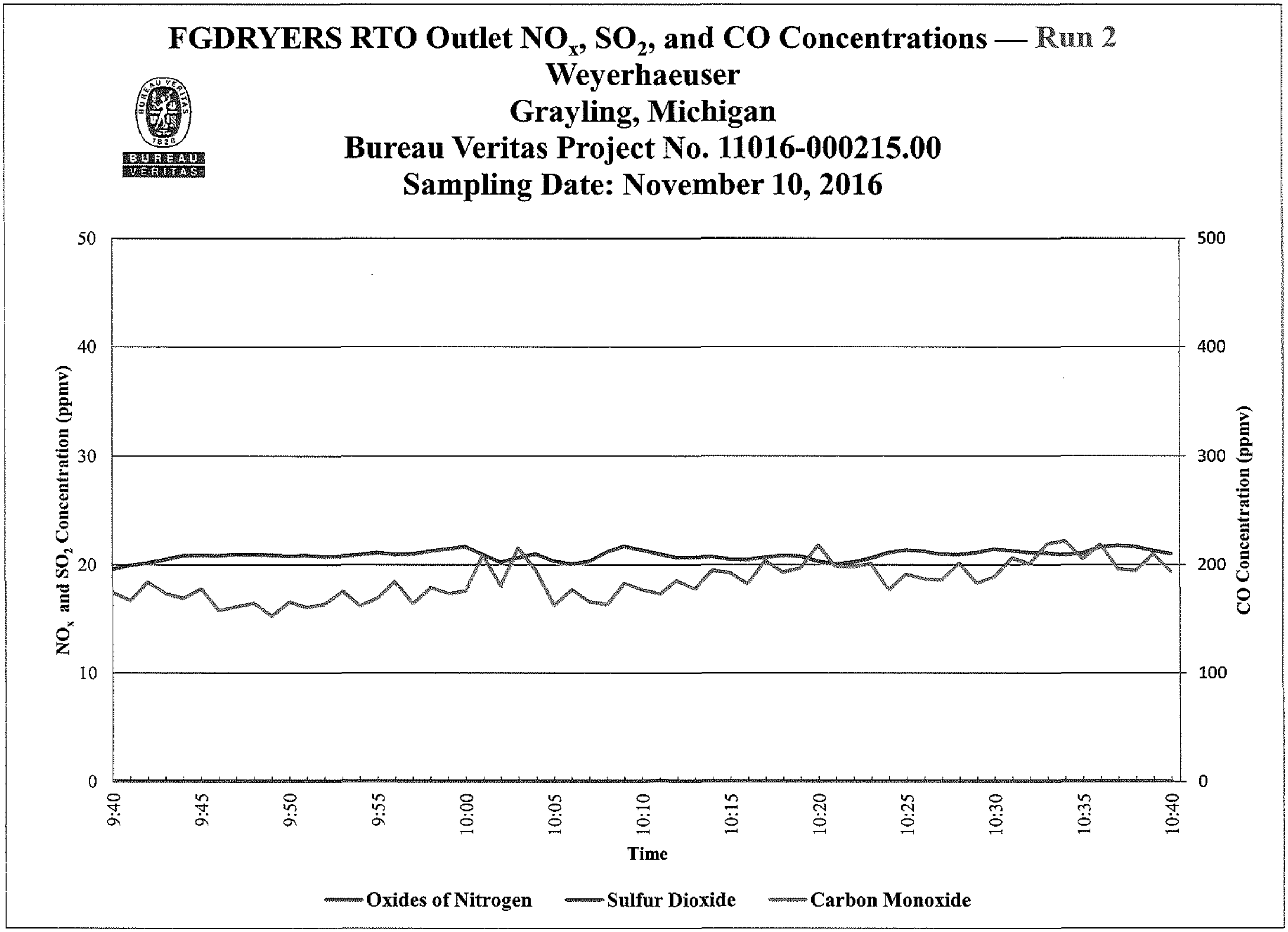


FGDRYERS RTO CO RM to CERMS Comparison — lb/hr
Weyerhaeuser
Grayling, Michigan
Project No. 11016-000215.00
Sampling Date: November 9, 2016



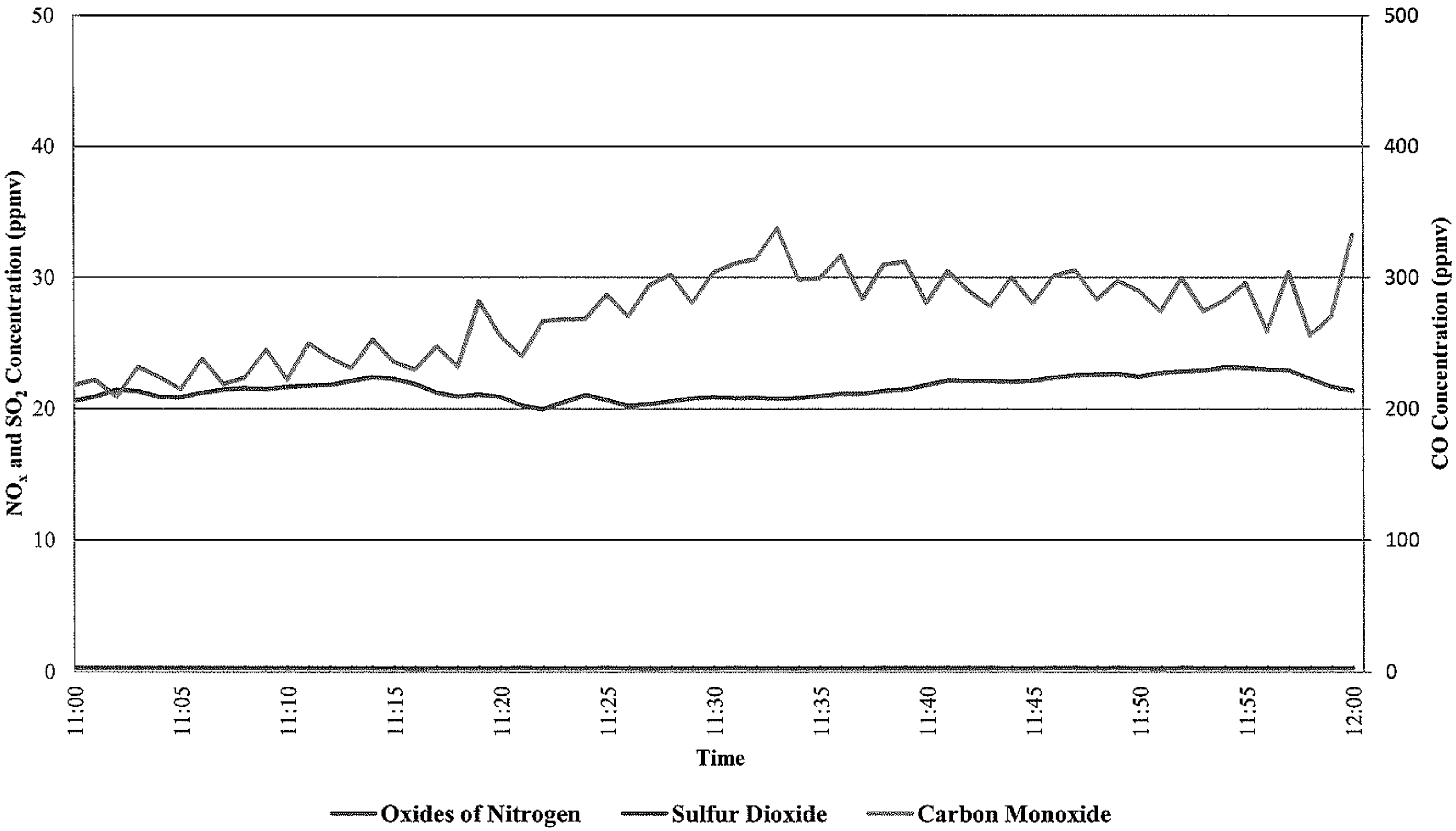
FGDRYERS RTO Outlet NO_x, SO_2, and CO Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 10, 2016

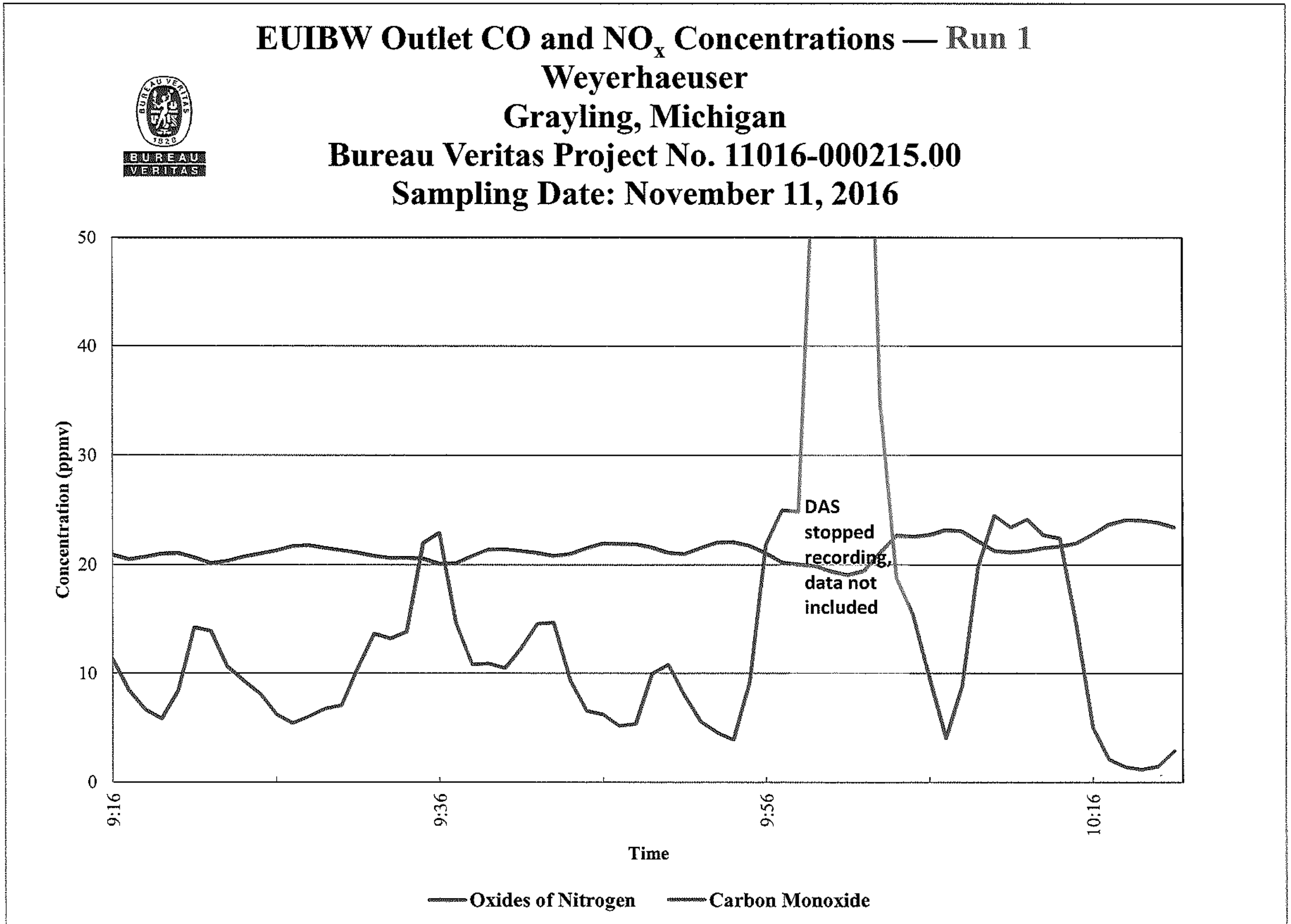




FGDRYERS RTO Outlet NOx, SO2, and CO Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 10, 2016
BUREAU VERITAS
1828
NOx and SO2 Concentration (ppmv)
CO Concentration (ppmv)
0
10
20
30
40
50
100
200
300
400
500
9:40
9:45
9:50
9:55
10:00
10:05
10:10
10:15
10:20
10:25
10:30
10:35
10:40
Time
Oxides of Nitrogen
Sulfur Dioxide
Carbon Monoxide

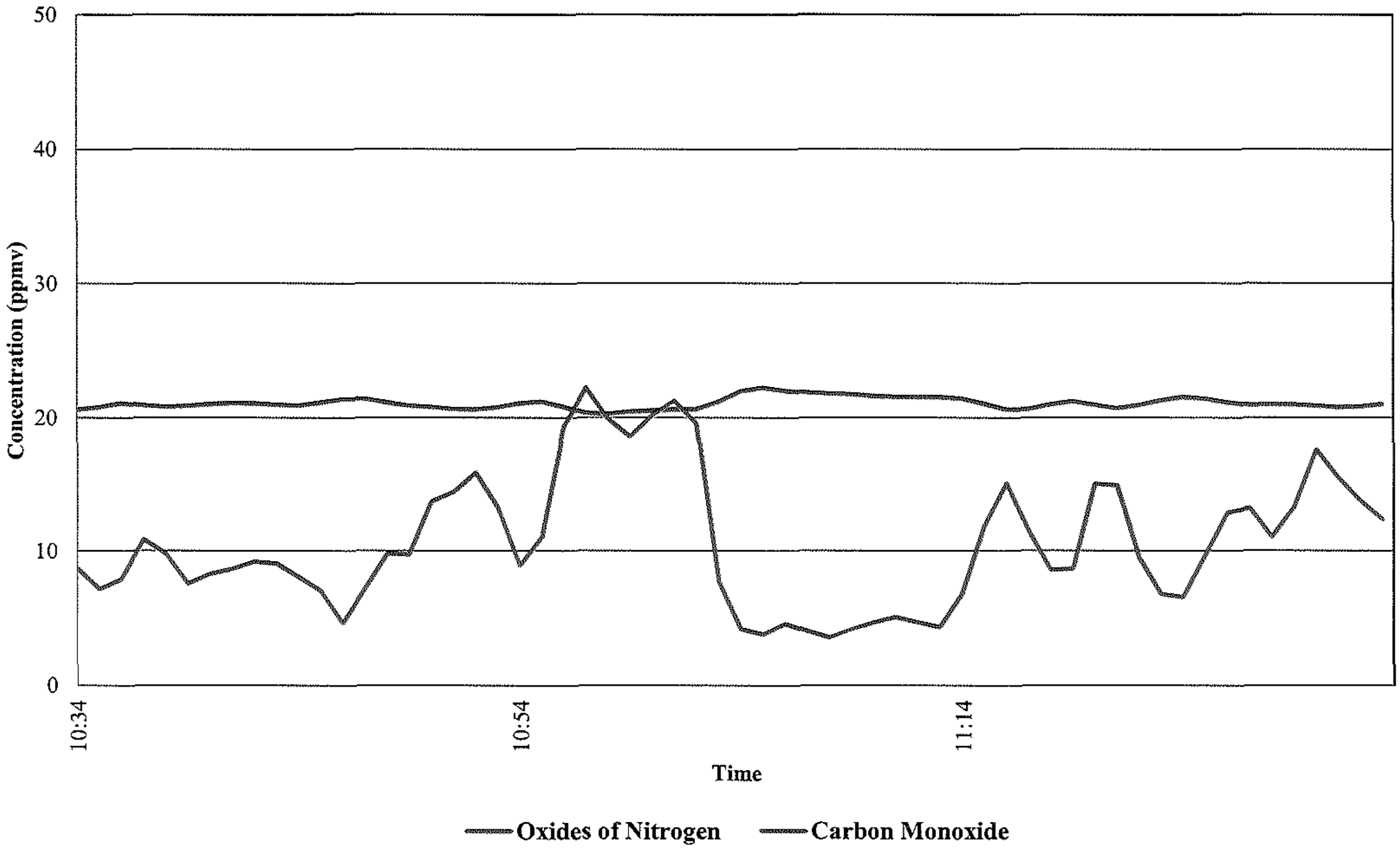
FGDRYERS RTO Outlet NO_x, SO_2, and CO Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 10, 2016



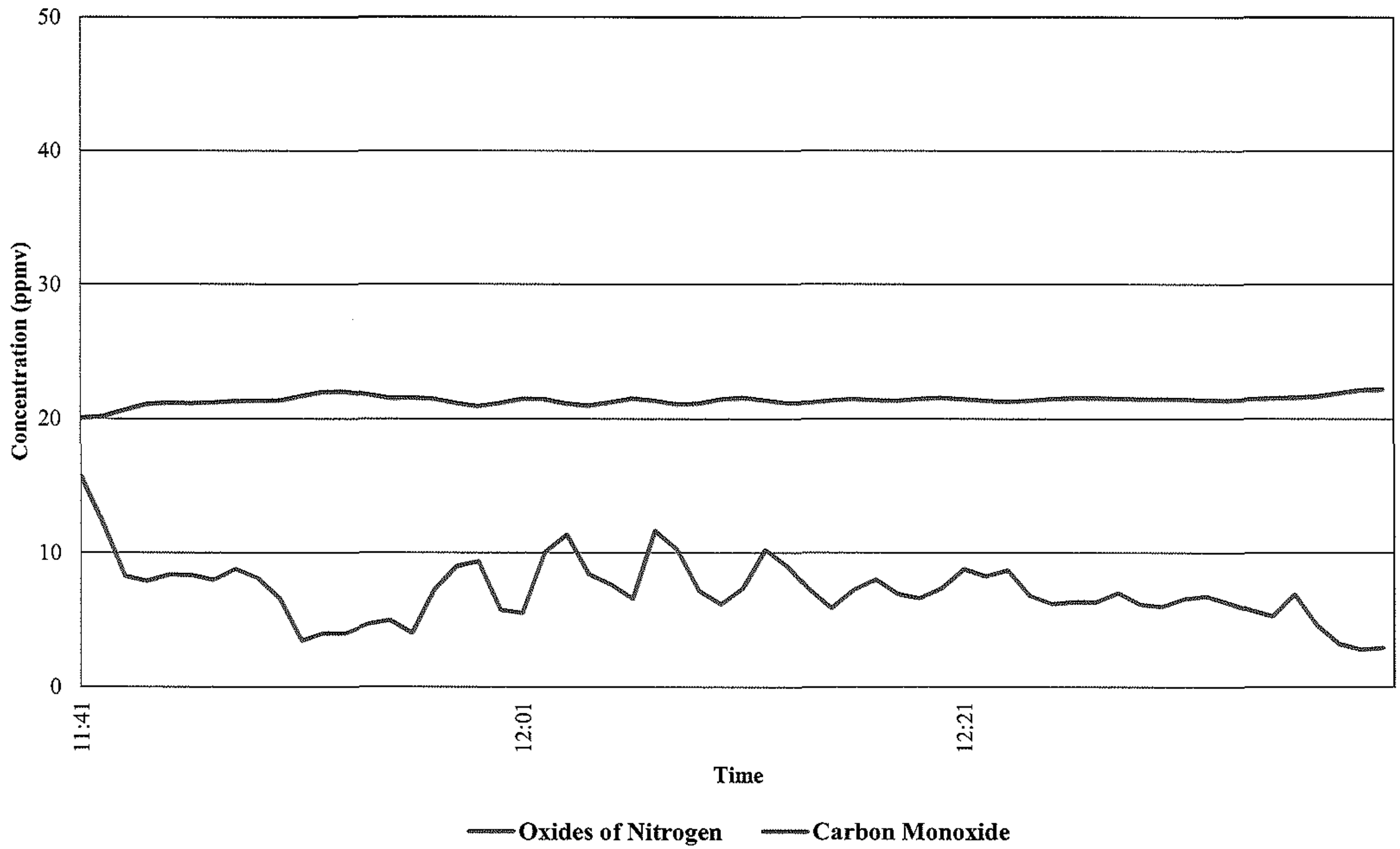


EUIBW Outlet CO and NOx Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 11, 2016
BUREAU VERITAS
1828
Concentration (ppmv)
50
40
30
20
10
0
9:16
9:36
9:56
10:16
Time
DAS stopped recording, data not included
Oxides of Nitrogen
Carbon Monoxide

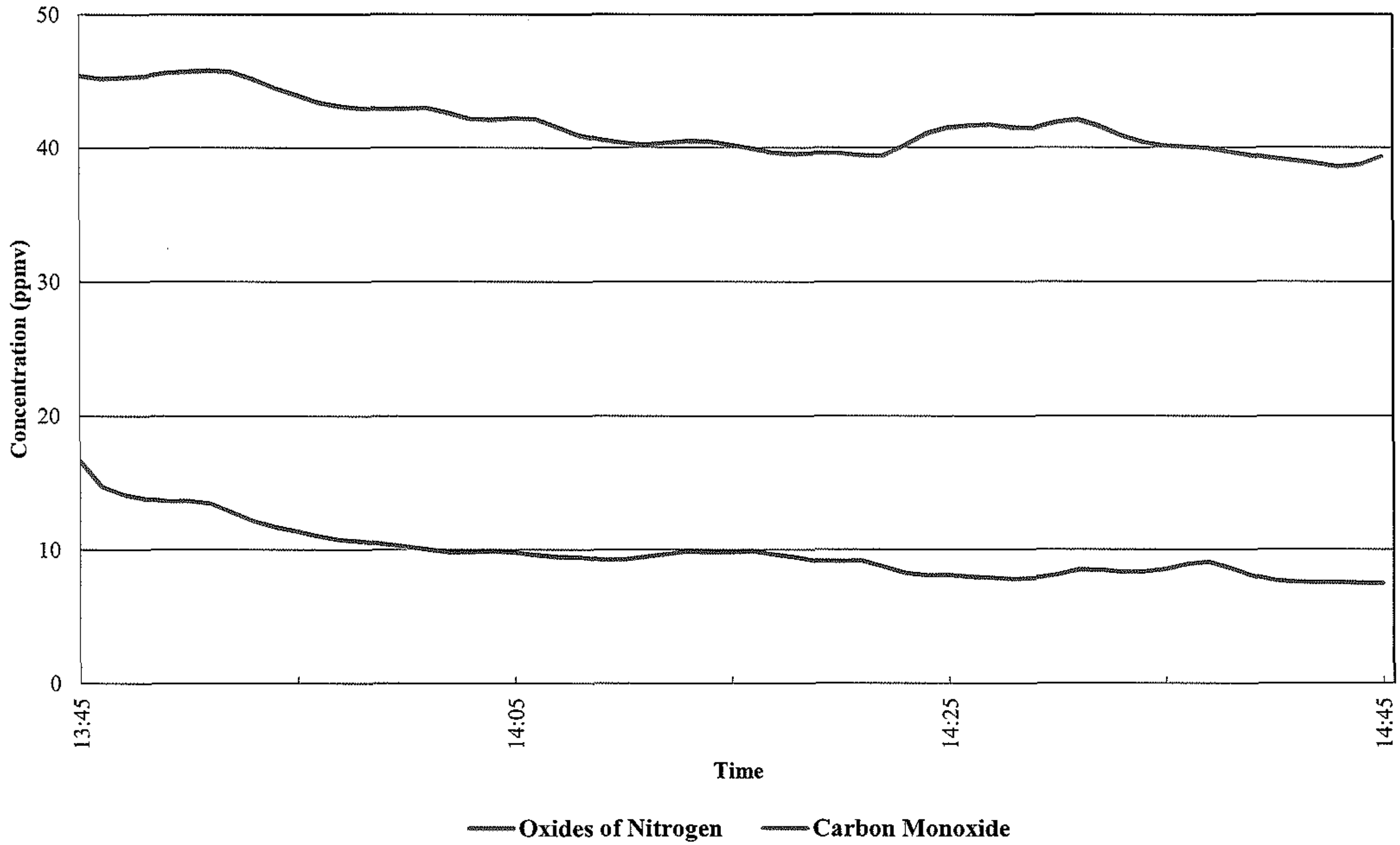
EUIBW Outlet CO and NO_x Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 11, 2016



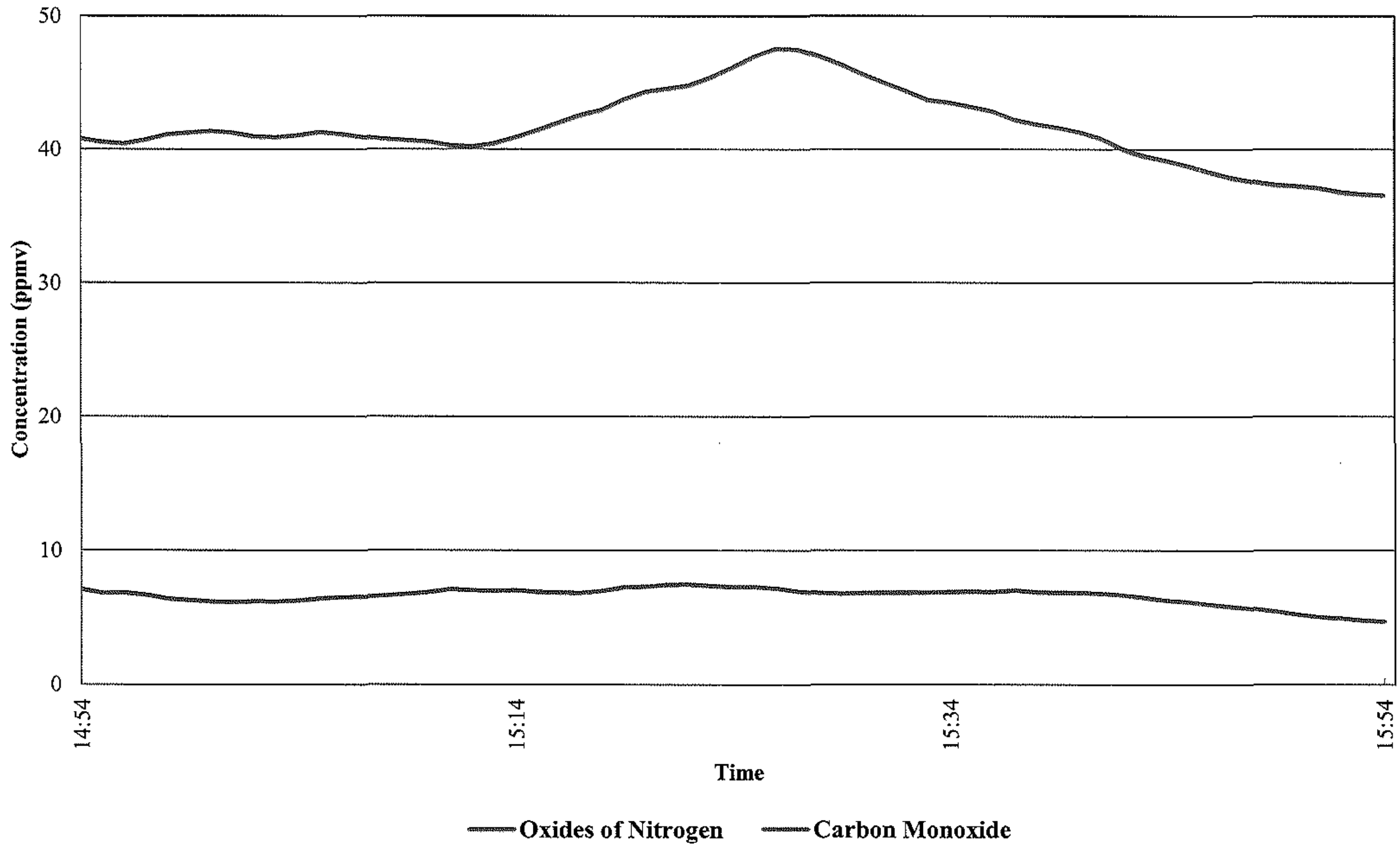
EUIBW Outlet CO and NO_x Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 11, 2016



EUCOEN Outlet CO and NO_x Concentrations — Run 1
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 11, 2016



EUCOEN Outlet CO and NO_x Concentrations — Run 2
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 11, 2016



EUCOEN Outlet CO and NO_x Concentrations — Run 3
Weyerhaeuser
Grayling, Michigan
Bureau Veritas Project No. 11016-000215.00
Sampling Date: November 11, 2016