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Continuous Emissions Monitoring System Certification Test Report

Verso Corporation
Quinnesec Mill
Package Boiler Outlet Duct, Waste Fuel Boiler Outlet Duct, Recovery Boiler Outlet Duct, and Lime Kiln Stack
Quinnesec, Michigan
RATA Test Date: May 15 through 17, 2018
Seven Day Calibration Test Dates: April 27 through May 16, 2018

Report Submittal Date
June 8, 2018

Project No. M182008

888 Industrial Drive
Elmhurst, Illinois 60126
630-993-2100

1.0 EXECUTIVE SUMMARY

MOSTARDI PLATT conducted a Continuous Emissions Monitoring System (CEMS) certification test program for Verso Corporation at the Quinnesec, Michigan facility. Verso Quinnesec upgraded the facility's existing CEMS gas concentration analyzers which are used to continuously monitor carbon monoxide (CO), oxygen (O2), and nitrogen oxides (NOx) on the Package Boiler, total reduced sulfur (TRS), CO, NOx, O2, and sulfur dioxide (SO2) on the Recovery Boiler, NOx, O2, and SO2 on the Waste Fuel Boiler, and TRS and O2 on the Lime Kiln. The analyzers are used for compliance monitoring associated with the applicable regulatory requirements of 40 CFR 60 Subparts D, Db, and BB, 40 CFR 52.21 (PSD), and the Michigan Air Pollution Control Rules. Analyzers were upgraded to the latest Thermo iQ series instruments. Note that the stack gas flow meters on the Recovery Furnace and Waste Fuel Boiler were not upgraded. The installation of the new analyzers occurred during the weeks of April 14th and April 21st 2018. The facility's regulated emission sources were down for a facility-wide maintenance outage during the CEMS installation. All new analyzers were calibrated and online upon startup of the regulated sources (April 21st to April 28th, 2018). This report summarizes the results of the test program and test methods used.

The test locations, RATA test dates, and test parameters are summarized below.

TEST INFORMATION		
Test Locations	**RATA Test Dates**	**Test Parameters**
Package Boiler Outlet Duct	May 15, 2018	Nitrogen Oxides (NO_x), Carbon Monoxide (CO), and Oxygen (O_2)
Waste Fuel Boiler Outlet Duct	May 17, 2018	NO_x, Sulfur Dioxide (SO_2), Carbon Dioxide (CO_2), O_2, and Volumetric Flow
Recovery Boiler Outlet Duct	May 15-17, 2018	NO_x, SO_2, O_2, CO, Total Reduced Sulfur (TRS), and Volumetric Flow
Lime Kiln Stack	May 15 and 16, 2018	TRS and O_2

The purpose of the test program was to demonstrate the relative accuracy of the parameters listed above and to certify the CEMS. The test results from this test program indicate that each CEMS meets the United States Environmental Protection Agency (USEPA) annual performance specification for relative accuracy and certification as published in 40 Code of Federal Regulations Part 60 (40CFR60). Selected results of the test program are summarized below. A complete summary of emission test results, for each location, follows the narrative portion of this report.

PACKAGE BOILER OUTLET DUCT					
Date	**Parameter**	**Criteria**	**Units**	**Required Performance**	**Actual Performance**
5/3-9/18	NOx	7 Day Calibration Drift	ppm	< 2.5% of the span for 7 days	<1.02%
5/15/18		RATA	lb/mmBtu	<20% of the mean reference method value	0.00%
		RATA	lb/hr	<20% of the mean reference method value	2.65%
5/3-9/18	O2	7 Day Calibration Drift	%	< 0.5% mean difference for 7 days	<0.21% mean difference
5/15/18		RATA	% dry	<20% of the mean reference method value	3.53%
5/3-9/18	CO	7 Day Calibration Drift	ppm	< 5.0% of the span for 6 of 7 days	<3.83%
5/15/18		RATA	lb/mmBtu	<10% of the mean reference method value	0.00%
		RATA	ppmvd	+/-5 ppmvd meand difference plus confidence coefficient	0.00 ppmvd mean difference + cc
		RATA	lb/hr	<10% of the mean reference method value	0.00%

WASTE FUEL BOILER OUTLET DUCT					
Date	**Parameter**	**Criteria**	**Units**	**Acceptance Criteria**	**Actual Performance**
4/27/18 - 5/3/18	NO_x	7 Day Calibration Drift	ppm	< 2.5% of the span for 7 days	<0.61%
5/17/18		RATA	lbs/mmBtu	<20% of the mean reference method value	5.91%
		RATA	ppmvd	<20% of the mean reference method value	4.43%
		RATA	lb/hr	<20% of the mean reference method value	11.15%
5/17/18	CO_2	RATA	% dry	<20% of the mean reference method value	0.58%
4/27/18 - 5/3/18	O_2	7 Day Calibration Drift	%	< 0.5% mean difference for 7 days	<0.35% mean difference
5/17/18		RATA	% dry	<20% of the mean reference method value	4.44%
4/27/18 - 5/3/18	SO_2	7 Day Calibration Drift	ppm	< 2.5% of the span for 7 days	<2.24%
5/17/18		RATA	lb/mmBtu	≤10.0% of Applicable Standard of 1.2 lb/mmBtu	1.08% of Applicable Standard of 1.2 lb/mmBtu
		RATA	lb/hr	≤10.0% of Applicable Standard of 476 lb/hr	0.57% of Applicable Standard of 476 lb/hr
5/17/18	Volumetric Flow	RATA	dscfm	<20% of the mean reference method value	7.92%

RECOVERY BOILER OUTLET DUCT					
Date	**Parameter**	**Criteria**	**Units**	**Acceptance Criteria**	**Actual Performance**
5/1-7/18	NO_x	7 Day Calibration Drift	ppm	< 2.5% of the span for 7 days	<1.52%
5/16/18		RATA	ppmvd @ 8%O_2	<20% of the mean reference method value	2.25%
5/1-7/18	O_2	7 Day Calibration Drift	%	< 0.5% mean difference for 7 days	<0.21% mean difference
5/16/18		RATA	% dry	<20% of the mean reference method value	2.75%
5/9-16/18	SO_2	7 Day Calibration Drift	ppm	< 2.5% of the span for 7 days	<1.45%
5/16/18		RATA	ppmvd @ 8%O_2	<10% of applicable standard of 50 ppmvd@ 8%O_2	0.36% of applicable standard of 50 ppmvd@ 8%O_2
5/1-7/18	CO	7 Day Calibration Drift	ppm	< 5.0% of the span for 6 of 7 days	<2.82%
5/16/18		RATA	ppmvd @ 8%O_2	<10% of the mean reference method value	3.82%
5/1-7/18	TRS	7 Day Calibration Drift	ppm	< 5.0% of the span for 6 of 7 days	<2.57%
5/16 & 17/18		RATA	ppmvd @ 8%O_2	<10% of applicable standard of 5 ppmvd@ 8%O_2	9.08% of applicable standard of 5 ppmvd@ 8%O_2
5/15/18	Volumetric Flow	RATA	dscfm	<20% of the mean reference method value	9.67%

LIME KILN STACK					
Date	**Parameter**	**Criteria**	**Units**	**Acceptance Criteria**	**Actual Performance**
5/9-15/18	TRS	7 Day Calibration Drift	ppm	< 5.0% of the span for 6 of 7 days	<2.33%
5/15 & 16/18		RATA	ppmvd @ 10%O_2	<10% of applicable standard of 10 ppmvd@ 10%O_2	5.74% of applicable standard of 10 ppmvd@ 10%O_2
5/9-15/18	O_2	7 Day Calibration Drift	%	< 0.5% mean difference for 7 days	<0.25% mean difference
5/15 & 16/18		RATA	% dry	<20% of the mean reference method value	7.98%

The gas cylinders used to perform the RATA are summarized below.

GAS CYLINDER INFORMATION				
Parameter	**Gas Vendor**	**Cylinder Serial Number**	**Cylinder Value**	**Expiration Date**
NO_x	Airgas	CC212454	0.00 ppm	1/30/2026
NO_x	Airgas	CC357177	125.1 ppm	12/29/2022
NO_x	Airgas	CC497102	236.5 ppm	1/23/2025
SO_2	Airgas	EB0086659	0.00 ppm	11/30/2025
SO_2	Airgas	CC503099	49.82 ppm	9/14/2020
SO_2	Airgas	CC507539	89.68 ppm	1/23/2025
O_2	Airgas	CC212545	0.00%	1/30/2026
O_2	Airgas	EB0086659	10.33%	11/30/2025
O_2	Airgas	CC422218	22.35%	3/30/2023
O_2	Airgas	LL39097	10.06%	9/22/2025
O_2	Airgas	XL001317B	18.90%	2/25/2025
CO_2	Airgas	CC503099	0.00%	9/14/2022
CO_2	Airgas	EB0086659	9.814%	11/30/2025
CO_2	Airgas	CC422218	18.45%	3/30/2023
CO	Airgas	CC357177	0.00 ppm	12/29/2022
CO	Airgas	CC212454	251.7 ppm	1/30/2026
CO	Airgas	CC198642	470.1 ppm	7/16/2023
CO	Airgas	CC3883	967.8 ppm	11/14/2024
H_2S	Airgas	CC482474	29.05 ppm	5/08/2019

The identifications of the individuals associated with the test program are summarized below.

Location	**Address**	**Contact**
Test Facility	Verso Corporation U. S. Highway 2 Quinnesec, Michigan 49876	Ms. Paula LaFleur Environmental Engineer (906) 779-3494 (phone) paula.lafleur@versoco.com
Testing Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Mr. Timothy A. Mei Project Manager (630) 993-2100 (phone) tmei@mp-mail.com

The test crew consisted of Messrs. J. Adams, J. Rogers, M. Platt, and T. Mei of Mostardi Platt.

2.0 TEST METHODOLOGY

Emissions testing was conducted following the methods specified in 40CFR, Part 40 CFR, Part 60, Appendix A. Schematics of the test section diagrams and sampling trains used are included in Appendix A and B, respectively. Copies of example calculation and nomenclature are included in Appendix C. Copies of analyzer print-outs for each test run are included in Appendix D. CEM data and process data as provided by Verso Corporation are included in Appendix E.

The following methodologies were used during the test program:

Method 1 Traverse Point Determination

Test measurement points were selected in accordance with Method 1. The characteristics of the measurement locations are summarized below.

Location	Upstream Distance	Downstream Distance	Test Parameter	Number of Sampling Points
Waste Fuel Boiler Outlet Duct	20 feet	100 feet	Volumetric Flow	18
Recovery Boiler Outlet Duct	20 feet	20 feet		

Method 2 Volumetric Flowrate Determination

Gas velocity was measured following Method 2, for purposes of calculating stack gas volumetric flow rate at the Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. An S-type pitot tube, differential pressure gauge, thermocouple and temperature readout were used to determine gas velocity at each sample point at each test location. Copies of field data sheets are included in Appendix F. All of the equipment used was calibrated in accordance with the specifications of the Method. Calibration data are presented in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 3 Oxygen (O_2)/Carbon Dioxide (CO_2) Determination

Stack gas molecular weight was determined in accordance with USEPA Method 3, 40CFR60, Appendix A, during each volumetric flow rate determination at the Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. A Fyrite analyzer was used to determine stack gas O_2 and CO_2 content and, by difference, nitrogen content. Multiple gas extractions were performed during each test run to ensure a stable reading. Chemicals are changed frequently and inspected for reactivity prior to each use. This testing met the performance specifications as outlined in the Method.

Method 3A Oxygen (O_2)/ Carbon Dioxide (CO_2) Determination

Stack gas O_2 and/or CO_2 concentrations were determined in accordance with USEPA Method 3A. Servomex analyzers were used to determine the O_2 and/or CO_2 concentrations in the manner specified in the Method. Each instrument has a paramagnetic detector and the O_2 operates in the nominal range of 0% to 25% with the specific range determined by the high-level calibration gas and the CO_2 operates in the nominal range of 0 to 20% with the specific range determined by the high-level calibration gas. High-range calibrations were performed using USEPA Protocol gas. Zero nitrogen (a low ppm pollutant in balance nitrogen calibration gases) was introduced during other instrument calibrations to check instrument zero. High- and a mid-range % O_2 and/or CO_2 levels in balance nitrogen were also introduced. Zero and mid-range calibrations were performed

using USEPA Protocol gas after each test run. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method.

Method 4 Moisture Determination

USEPA Method 4, 40CFR60, Appendix A, was utilized to determine water (H_2O) content of the exhaust gas Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. 100 milliliters (ml) of water were added to each of the first two impingers, the third impinger was left empty, and the fourth impinger was charged with approximately 200 grams of silica gel. The impingers were placed in an ice bath to maintain the sampled gas passed through the silica gel impinger outlet below 68°F in order to increase the accuracy of the sampled dry gas volume measurement. The water volumes of the impinger train were measured and the silica gel was weighed before and after each test run to determine the mass of moisture condensed.

Each sample was extracted through a heated stainless-steel probe and filter assembly at a constant sample rate of approximately 0.75 cubic feet per minute, which was maintained throughout the course of the test run. Approximately 21 dry standard cubic feet (dscf) were sampled for, each moisture run. After each run, a leak check of the sampling train was performed at a vacuum greater than the sampling vacuum to determine if any leakage had occurred during sampling. Following the leak check, the impingers were removed from the ice bath, water levels were measured, and the silica gel weight was recorded.

All of the equipment used was calibrated in accordance with the specifications of the Method. Copies of field data sheets are included in Appendix F. Calibration data is presented in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 6C Sulfur Dioxide (SO_2) Determination

Stack gas SO_2 concentrations and emission rates were determined in accordance with USEPA Method 6C, 40CFR60, Appendix A at the Waste Fuel Boiler Outlet Duct and Recovery Boiler Outlet Duct. A Thermo Scientific Model 43C Pulsed Fluorescence Sulfur Dioxide Analyzer was used to determine sulfur dioxide concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 100 ppm with the specific range determined by the high-level span calibration gas of 89.68 ppm.

The Model 43C High Level is based on the principle that SO_2 molecules absorb ultraviolet (UV) light and become excited at one wavelength, then decay to a lower energy state emitting UV light at a different wavelength. Specifically,

$$SO_2 + h\nu_1 \rightarrow SO_2^* \rightarrow SO_2 + h\nu_2$$

The sample is drawn into the Model 43C High Level through the sample bulkhead. The sample passes a pressure sensor then flows through a capillary and a flow sensor. The sample then flows into the fluorescence chamber, where pulsating UV light excites the SO_2 molecules. The condensing lens focuses the pulsating UV light into the mirror assembly. The mirror assembly contains four selective mirrors that reflect only the wavelengths which excite SO_2 molecules. As the excited SO_2 molecules decay to lower energy states they emit UV light that is proportional to the SO_2 concentration. The bandpass filter allows only the wavelengths emitted by the excited SO_2 molecules to reach the photomultiplier tube (PMT). The PMT detects the UV light emission from the decaying SO_2 molecules. The photodetector, located at the back of the fluorescence chamber, continuously monitors the pulsating UV light source and is connected to a circuit that compensates for fluctuations in the UV light.

The sample then flows to the pump and is exhausted out the exhaust bulkhead of the analyzer. The Model 43C High Level outputs the SO_2 concentration to the front panel display and the analog outputs.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix F. Copies of the gas cylinder certifications are found in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 7E Nitrogen Oxide (NO_x) Determination

Stack gas NO_x concentrations and emission rates were determined in accordance with USEPA Method 7E, 40CFR60, Appendix A, at the Package Boiler Outlet Duct, Waste Fuel Boiler Outlet Duct, and Recovery Boiler Outlet Duct. A Thermo Scientific Model 42i Chemiluminescence Nitrogen Oxides Analyzer was used to determine nitrogen oxides concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 500 ppm with the specific range determined by the high-level span calibration gas of 236.5 ppm.

The Model 42i operates on the principle that nitric oxide (NO) and ozone (O_3) react to produce a characteristic luminescence with an intensity linearly proportional to the NO concentration. Infrared light emission results when electronically excited NO_2 molecules decay to lower energy states. Specifically,

$$NO+O_3 \rightarrow NO_2+O_2+h\upsilon$$

Nitrogen dioxide (NO_2) must first be transformed into NO before it can be measured using the chemiluminescent reaction. NO_2 is converted to NO by a stainless steel NO_2-to-NO converter heated to about 634 °C. The flue gas sample is drawn into the Model 42*i* through the sample bulkhead. The sample flows through a capillary, and then to the mode solenoid valve. The solenoid valve routes the sample either straight to the reaction chamber (NO mode) or through the NO_2-to-NO converter and then to the reaction chamber (NO_x mode). A flow sensor prior to the reaction chamber measures the sample flow. Dry air enters the Model 42*i* through the dry air bulkhead, passes through a flow switch, and then through a silent discharge ozonator. The ozonator generates the ozone needed for the chemiluminescent reaction. At the reaction chamber, the ozone reacts with the NO in the sample to produce excited NO_2 molecules. A photomultiplier tube (PMT) housed in a thermoelectric cooler detects the luminescence generated during this reaction. From the reaction chamber, the exhaust travels through the ozone (O_3) converter to the pump, and is released through the vent.

The NO and NO_x concentrations calculated in the NO and NO_x modes are stored in memory. The difference between the concentrations is used to calculate the NO_2 concentration. The Model 42i outputs NO, NO_2, and NO_x concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or ethernet connection.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using certified

calibration gases introduced at the probe, before and after each test run. This testing met the performance specifications as outlined in the Method.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix G. Copies of the gas cylinder certifications are found in Appendix H. The NO_2 to NO converter tests can be found in Appendix I. This testing met the performance specifications as outlined in the Method.

Method 10 Carbon Monoxide (CO) Determination

Stack gas CO concentrations and emission rates were determined in accordance with USEPA Method 10, 40CFR60, Appendix A at the Package Boiler Outlet Duct and Recovery Boiler Outlet Duct. A Fischer Scientific Model 48C Gas Filter Correlation Carbon Monoxide was used to determine carbon monoxide concentrations, in the manner specified in the Method. The instrument operated in the nominal range of 0 ppm to 500 ppm or 1,000 ppm with the specific range determined by the high-level span calibration gas of 470.1 ppm and 967.8 ppm.

The Model 48C High Level is based on the principle that CO absorbs infrared radiation at a wavelength of 4.6 microns. Because infrared absorption is a nonlinear measurement technique, it is necessary for the instrument electronics to transform the basic analyzer signal into a linear output. The Model 48C High Level uses an exact calibration curve to accurately linearize the instrument output over any range up to a concentration of 20,000 ppm. The sample is drawn into the analyzer through the sample bulkhead. The sample flows through the optical bench. Radiation from an infrared source is chopped and then passed through a gas filter alternating between CO and N2. The radiation then passes through a narrow bandpass interference filter and enters the optical bench where absorption by the sample gas occurs. The infrared radiation then exits the optical bench and falls on an infrared detector. The CO gas filter acts to produce a reference beam which cannot be further attenuated by CO in the sample cell. The N_2 side of the filter wheel is transparent to the infrared radiation and therefore produces a measure beam which can be absorbed by CO in the cell. The chopped detector signal is modulated by the alternation between the two gas filters with an amplitude related to the concentration of CO in the sample cell. Other gases do not cause modulation of the detector signal since they absorb the reference and measure beams equally. Thus the GFC system responds specifically to CO. The Model 48C High Level outputs the CO concentration to the front panel display and the analog outputs.

Stack gas was delivered to the analyzer via a Teflon® sampling line, heated to a minimum temperature of 250°F. Excess moisture in the stack gas was removed using a refrigerated condenser. The entire system was calibrated in accordance with the Method, using certified calibration gases introduced at the probe, before and after each test run.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in Appendix G. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method.

Method 16A Total Reduced Sulfur (TRS) Determination

Integrated gas samples were extracted from the Lime Kiln and Recovery Boiler Outlet Duct gas streams in accordance with Method 16A (impinger technique), 40CFR60, for the determination of total reduced sulfur (TRS) emissions from stationary sources. This method selectively removed sulfur dioxide (SO_2) by bubbling the gas sample through a citrate buffer solution, then thermally oxidizing TRS compounds present to SO_2. The SO_2 was then collected in hydrogen peroxide as sulfate and analyzed by the Method 6 barium-thorin titration procedure, 40CFR60.

Interferences caused by particulate matter entering the sampling train were eliminated by the use of a heated filter medium placed at the end of the heated Teflon®-lined (or glass-lined) probe.

Sampling included three 1-hour tests followed by one 30-minute system validation to be completed as one test run. A description of the test train utilized is appended. Sampling train preparation was in accordance with Method 16A, 40CFR60, and included the following:

1. All probes, filter holders, and sampling lines were cleaned prior to each test.

2. The SO_2 scrubber was charged with 100 mls of citrate buffer solution into each of the first two impingers prior to each test. Citrate buffer solution was prepared by dissolving 300 g of potassium citrate (or 284 g of sodium citrate) and 41 g of anhydrous citric acid in one liter of water. The pH of the solution was then adjusted to between 5.4 and 5.6 with potassium citrate or citric acid, as required.

3. The probe and heated filter media were maintained at approximately 250°F to prevent moisture condensation.

4. The thermal oxidation furnace was maintained at 800°C±100°C during the test time.

5. The SO_2 portion of the train was prepared and analyzed in accordance with the methods described for sulfur dioxide testing listed previously.

The validations involved sampling a known concentration of hydrogen sulfide (H_2S) and comparing the analyzed concentration with the known concentration. The H_2S recovery gas was mixed with combustion gas in a dilution system. The flowrates were adjusted to generate an H_2S concentration in the range of the stack gas. The samples were collected and analyzed in the same manner as a normal stack test. The sample was collected through the end of the probe to ensure extraction of a representative sample. System validations were performed following each set of three 1-hour tests.

A list of calibration gases used and the results of all calibration and other required quality assurance checks can be found in Appendix F. Copies of calibration gas certifications can be found in Appendix G.

3.0 TEST RESULT SUMMARIES

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008
Fuel Type: Natural Gas

Location: Package Boiler Outlet Duct
Date: 5/15/18
Test Method: 7E, 3A
Fuel Factor: 8710

O2 based NOx lb/mmBtu RATA

CEM Monitor Information

NO_x Monitor/Model:	Thermo 42iQ	**NO_x Serial # :**	1180090011
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180390002

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/MMBtu	CEM NO_x lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	05/15/18	08:55	09:15	0.05	0.05	0.00	0.000
1	2	05/15/18	09:33	09:53	0.05	0.05	0.00	0.000
1	3	05/15/18	10:11	10:31	0.05	0.05	0.00	0.000
1	4	05/15/18	10:53	11:13	0.05	0.05	0.00	0.000
1	5	05/15/18	11:33	11:53	0.05	0.05	0.00	0.000
1	6	05/15/18	12:17	12:37	0.05	0.05	0.00	0.000
1	7	05/15/18	12:59	13:19	0.05	0.05	0.00	0.000
1	8	05/15/18	13:50	14:10	0.05	0.05	0.00	0.000
1	9	05/15/18	14:33	14:53	0.05	0.05	0.00	0.000
1	10	05/15/18	15:15	15:35	0.05	0.05	0.00	0.000

n	9	
t(0.975)	2.306	
Mean Reference Method Value	0.050	RM avg
Mean CEM Value	0.050	CEM avg
Sum of Differences	0.000	di
Mean Difference	0.000	d
Sum of Differences Squared	0.000	di^2
Standard Deviation	0.000	sd
Confidence Coefficient 2.5% Error (1-tail)	0.000	cc
Relative Accuracy	0.00	RA

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Package Boiler Outlet Duct
Date: 5/15/18
Test Method: 7E, 2

NO_x lb/hr RATA

CEM Monitor Information

NO_x Monitor/Model:			Thermo 42iQ		NO_x Serial # :		1180090011	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/hr	CEM NO_x lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/15/18	08:55	09:15	7.3	7.3	0.0	0.00
1	2	05/15/18	09:33	09:53	7.5	7.4	0.1	0.01
0	3	05/15/18	10:11	10:31	7.5	7.3	0.2	0.04
1	4	05/15/18	10:53	11:13	7.5	7.3	0.2	0.04
1	5	05/15/18	11:33	11:53	7.6	7.4	0.2	0.04
1	6	05/15/18	12:17	12:37	7.6	7.5	0.1	0.01
1	7	05/15/18	12:59	13:19	7.7	7.5	0.2	0.04
1	8	05/15/18	13:50	14:10	7.7	7.5	0.2	0.04
1	9	05/15/18	14:33	14:53	7.6	7.4	0.2	0.04
1	10	05/15/18	15:15	15:35	7.6	7.5	0.1	0.01

n	9	
t(0.975)	2.306	
Mean Reference Method Value	7.567	RM avg
Mean CEM Value	7.422	CEM avg
Sum of Differences	1.300	di
Mean Difference	0.144	d
Sum of Differences Squared	0.230	di^2
Standard Deviation	0.073	sd
Confidence Coefficient 2.5% Error (1-tail)	0.056	cc
Relative Accuracy	2.65	RA

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Package Boiler Outlet Duct
Date: 5/15/18
Test Method: 3A

O_2 % (dry) RATA

CEM Monitor Information

O_2 Monitor/Model:			Thermo CTL902C		O_2 Serial # :		1180390002	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/15/18	08:55	09:15	6.8	7.0	-0.2	0.04
1	2	05/15/18	09:33	09:53	6.6	6.8	-0.2	0.04
1	3	05/15/18	10:11	10:31	6.1	6.3	-0.2	0.04
1	4	05/15/18	10:53	11:13	5.8	6.0	-0.2	0.04
1	5	05/15/18	11:33	11:53	6.0	6.1	-0.1	0.01
1	6	05/15/18	12:17	12:37	5.9	6.1	-0.2	0.04
1	7	05/15/18	12:59	13:19	5.8	6.0	-0.2	0.04
1	8	05/15/18	13:50	14:10	5.4	5.6	-0.2	0.04
0	9	05/15/18	14:33	14:53	5.2	5.4	-0.2	0.04
1	10	05/15/18	15:15	15:35	5.5	5.6	-0.1	0.01

n	9	
t(0.975)	2.306	
Mean Reference Method Value	5.989	RM avg
Mean CEM Value	6.167	CEM avg
Sum of Differences	-1.600	di
Mean Difference	-0.178	d
Sum of Differences Squared	0.300	di^2
Standard Deviation	0.044	sd
Confidence Coefficient 2.5% Error (1-tail)	0.034	cc
Relative Accuracy	3.53	RA

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Package Boiler Outlet Duct
Date: 5/15/18
Test Method: 10

CO ppmvd RATA

CEM Monitor Information

CO Monitor/Model:			Thermo 48iQ		CO Serial # :		1170680006	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	05/15/18	08:55	09:15	0.0	0.0	0.0	0.00
1	2	05/15/18	09:33	09:53	0.0	0.0	0.0	0.00
1	3	05/15/18	10:11	10:31	0.0	0.0	0.0	0.00
1	4	05/15/18	10:53	11:13	0.0	0.0	0.0	0.00
1	5	05/15/18	11:33	11:53	0.0	0.0	0.0	0.00
1	6	05/15/18	12:17	12:37	0.0	0.0	0.0	0.00
1	7	05/15/18	12:59	13:19	0.0	0.0	0.0	0.00
1	8	05/15/18	13:50	14:10	0.0	0.0	0.0	0.00
1	9	05/15/18	14:33	14:53	0.0	0.0	0.0	0.00
1	10	05/15/18	15:15	15:35	0.0	0.0	0.0	0.00

n	9	
t(0.975)	2.306	
Mean Reference Method Value	0.000	RM avg
Mean CEM Value	0.000	CEM avg
Sum of Differences	0.000	di
Mean Difference	0.000	d
Sum of Differences Squared	0.000	di^2
Standard Deviation	0.000	sd
Confidence Coefficient 2.5% Error (1-tail)	0.000	cc
Relative Accuracy - APS	0.00	ppm + cc difference[A]

[A] Relative accuracy based upon alternate performance standard of +/- 5 ppm CO plus the confidence coefficient.

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008
Fuel Type: Natural Gas

Location: Package Boiler Outlet Duct
Date: 5/15/18
Test Method: 10, 3A
Fuel Factor: 8710

Applicable Standard: 0.12

O2 based CO lb/mmBtu RATA

CEM Monitor Information

CO Monitor/Model:	Thermo 48iQ	**CO Serial # :**	1170680006
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180390002

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO lb/MMBtu	CEM CO lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	05/15/18	08:55	09:15	0.00	0.00	0.00	0.000
1	2	05/15/18	09:33	09:53	0.00	0.00	0.00	0.000
1	3	05/15/18	10:11	10:31	0.00	0.00	0.00	0.000
1	4	05/15/18	10:53	11:13	0.00	0.00	0.00	0.000
1	5	05/15/18	11:33	11:53	0.00	0.00	0.00	0.000
1	6	05/15/18	12:17	12:37	0.00	0.00	0.00	0.000
1	7	05/15/18	12:59	13:19	0.00	0.00	0.00	0.000
1	8	05/15/18	13:50	14:10	0.00	0.00	0.00	0.000
1	9	05/15/18	14:33	14:53	0.00	0.00	0.00	0.000
1	10	05/15/18	15:15	15:35	0.00	0.00	0.00	0.000

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**0.000**	**RM avg**
Mean CEM Value	**0.000**	**CEM avg**
Sum of Differences	**0.000**	**di**
Mean Difference	**0.000**	**d**
Sum of Differences Squared	**0.000**	**di^2**
Standard Deviation	**0.000**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.000**	**cc**
Relative Accuracy	**0.00**	**RA**

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Package Boiler Outlet Duct
Date: 5/15/18
Test Method: 10, 2

Applicable Standard: 25.5

CO lb/hr RATA

CEM Monitor Information

CO Monitor/Model:	Thermo 48iQ	CO Serial # :	1170680006

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO lb/hr	CEM CO lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	05/15/18	08:55	09:15	0.0	0.0	0.0	0.00
1	2	05/15/18	09:33	09:53	0.0	0.0	0.0	0.00
1	3	05/15/18	10:11	10:31	0.0	0.0	0.0	0.00
1	4	05/15/18	10:53	11:13	0.0	0.0	0.0	0.00
1	5	05/15/18	11:33	11:53	0.0	0.0	0.0	0.00
1	6	05/15/18	12:17	12:37	0.0	0.0	0.0	0.00
1	7	05/15/18	12:59	13:19	0.0	0.0	0.0	0.00
1	8	05/15/18	13:50	14:10	0.0	0.0	0.0	0.00
1	9	05/15/18	14:33	14:53	0.0	0.0	0.0	0.00
1	10	05/15/18	15:15	15:35	0.0	0.0	0.0	0.00

n	9	
t(0.975)	2.306	
Mean Reference Method Value	0.000	RM avg
Mean CEM Value	0.000	CEM avg
Sum of Differences	0.000	di
Mean Difference	0.000	d
Sum of Differences Squared	0.000	di^2
Standard Deviation	0.000	sd
Confidence Coefficient 2.5% Error (1-tail)	0.000	cc
Relative Accuracy	0.00	RA

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008
Fuel Type: Other

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 7E, 3A
Fuel Factor: 9583

Applicable Standard: 0.7

O2 based NOx lb/mmBtu RATA

CEM Monitor Information

NO_x Monitor/Model:	Thermo 42iQ	**NO_x Serial # :**	1180030057
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180530001

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/MMBtu	CEM NO_x lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/17/18	08:08	08:28	0.27	0.25	0.02	0.000
1	2	05/17/18	08:53	09:13	0.28	0.27	0.01	0.000
1	3	05/17/18	09:38	09:58	0.26	0.25	0.01	0.000
0	4	05/17/18	11:50	12:10	0.26	0.24	0.02	0.000
1	5	05/17/18	12:27	12:47	0.22	0.22	0.00	0.000
1	6	05/17/18	13:05	13:25	0.22	0.22	0.00	0.000
1	7	05/17/18	13:44	14:04	0.23	0.23	0.00	0.000
1	8	05/17/18	14:31	14:51	0.27	0.25	0.02	0.000
1	9	05/17/18	15:10	15:30	0.26	0.25	0.01	0.000
1	10	05/17/18	15:54	16:14	0.26	0.25	0.01	0.000

n	9	
t(0.975)	2.306	
Mean Reference Method Value	0.252	RM avg
Mean CEM Value	0.243	CEM avg
Sum of Differences	0.080	di
Mean Difference	0.009	d
Sum of Differences Squared	0.001	di^2
Standard Deviation	0.008	sd
Confidence Coefficient 2.5% Error (1-tail)	0.006	cc
Relative Accuracy	5.91	RA

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 7E

NO_x ppmvd RATA

CEM Monitor Information

NO_x Monitor/Model:	Thermo 42iQ	NO_x Serial # :	1180030057

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x ppmvd	CEM NO_x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	05/17/18	08:08	08:28	166.7	157.9	8.8	77.4
1	2	05/17/18	08:53	09:13	170.9	165.4	5.5	30.3
1	3	05/17/18	09:38	09:58	160.4	153.0	7.4	54.8
1	4	05/17/18	11:50	12:10	151.6	144.6	7.0	49.0
1	5	05/17/18	12:27	12:47	143.8	138.2	5.6	31.4
1	6	05/17/18	13:05	13:25	148.0	143.1	4.9	24.0
1	7	05/17/18	13:44	14:04	149.3	144.9	4.4	19.4
1	8	05/17/18	14:31	14:51	160.7	156.4	4.3	18.5
1	9	05/17/18	15:10	15:30	160.4	152.8	7.6	57.8
1	10	05/17/18	15:54	16:14	159.1	152.4	6.7	44.9

n	9	
t(0.975)	2.306	
Mean Reference Method Value	156.022	RM avg
Mean CEM Value	150.089	CEM avg
Sum of Differences	53.400	di
Mean Difference	5.933	d
Sum of Differences Squared	329.880	di^2
Standard Deviation	1.277	sd
Confidence Coefficient 2.5% Error (1-tail)	0.981	cc
Relative Accuracy	4.43	RA

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 7E, 2

Applicable Standard: 436

NO_x lb/hr RATA

CEM Monitor Information

NO_x Monitor/Model:		Thermo 42iQ			**NO_x Serial # :**		1180030057	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM NO_x lb/hr**	**CEM NO_x lb/hr**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/17/18	08:08	08:28	142.6	134.7	7.9	62.41
1	2	05/17/18	08:53	09:13	153.0	143.0	10.0	100.00
1	3	05/17/18	09:38	09:58	143.9	135.3	8.6	73.96
0	4	05/17/18	11:50	12:10	140.9	121.6	19.3	372.49
1	5	05/17/18	12:27	12:47	124.3	115.8	8.5	72.25
1	6	05/17/18	13:05	13:25	133.9	122.7	11.2	125.44
1	7	05/17/18	13:44	14:04	131.7	120.4	11.3	127.69
1	8	05/17/18	14:31	14:51	151.4	134.8	16.6	275.56
1	9	05/17/18	15:10	15:30	138.6	120.7	17.9	320.41
1	10	05/17/18	15:54	16:14	140.4	121.6	18.8	353.44

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**139.978**	**RM avg**
Mean CEM Value	**127.667**	**CEM avg**
Sum of Differences	**110.800**	**di**
Mean Difference	**12.311**	**d**
Sum of Differences Squared	**1511.160**	**di^2**
Standard Deviation	**4.288**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**3.296**	**cc**
Relative Accuracy	**11.15**	**RA**

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 3A

CO_2 % (dry) RATA

CEM Monitor Information

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (dry)	CEM CO_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/17/18	08:08	08:28	14.4	14.5	-0.1	0.01
1	2	05/17/18	08:53	09:13	13.8	13.9	-0.1	0.01
1	3	05/17/18	09:38	09:58	14.2	14.1	0.1	0.01
1	4	05/17/18	11:50	12:10	13.6	13.6	0.0	0.00
1	5	05/17/18	12:27	12:47	14.3	14.4	-0.1	0.01
1	6	05/17/18	13:05	13:25	14.9	15.0	-0.1	0.01
0	7	05/17/18	13:44	14:04	14.4	14.7	-0.3	0.09
1	8	05/17/18	14:31	14:51	14.3	14.3	0.0	0.00
1	9	05/17/18	15:10	15:30	14.4	14.3	0.1	0.01
1	10	05/17/18	15:54	16:14	14.1	14.0	0.1	0.01

n	9	
t(0.975)	2.306	
Mean Reference Method Value	14.222	RM avg
Mean CEM Value	14.233	CEM avg
Sum of Differences	-0.100	di
Mean Difference	-0.011	d
Sum of Differences Squared	0.070	di^2
Standard Deviation	0.093	sd
Confidence Coefficient 2.5% Error (1-tail)	0.071	cc
Relative Accuracy	0.58	RA

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 3A

O_2 % (dry) RATA

CEM Monitor Information

O_2 Monitor/Model:			Thermo CTL902C		**O_2 Serial # :**		1180530001	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM O_2 % (dry)**	**CEM O_2 % (dry)**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/17/18	08:08	08:28	5.9	5.7	0.2	0.04
1	2	05/17/18	08:53	09:13	6.5	6.4	0.1	0.01
1	3	05/17/18	09:38	09:58	6.1	6.1	0.0	0.00
1	4	05/17/18	11:50	12:10	6.7	6.7	0.0	0.00
0	5	05/17/18	12:27	12:47	5.2	5.9	-0.7	0.49
1	6	05/17/18	13:05	13:25	4.6	5.2	-0.6	0.36
1	7	05/17/18	13:44	14:04	5.1	5.5	-0.4	0.16
1	8	05/17/18	14:31	14:51	6.4	6.0	0.4	0.16
1	9	05/17/18	15:10	15:30	6.0	6.0	0.0	0.00
1	10	05/17/18	15:54	16:14	6.2	6.2	0.0	0.00

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**5.944**	**RM avg**
Mean CEM Value	**5.978**	**CEM avg**
Sum of Differences	**-0.300**	**di**
Mean Difference	**-0.033**	**d**
Sum of Differences Squared	**0.730**	**di^2**
Standard Deviation	**0.300**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.231**	**cc**
Relative Accuracy	**4.44**	**RA**

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008
Fuel Type: Other

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 6C, 3A
Fuel Factor: 9583

Applicable Standard: 1.2

O2 based SO2 lb/mmBtu RATA

CEM Monitor Information

SO_2 Monitor/Model:	Thermo 43iQ	**SO_2 Serial # :**	1180090017
O2 Monitor/Model:	Thermo CTL902C	**O2 Serial # :**	1180530001

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO_2 lb/MMBtu	CEM SO_2 lb/MMBtu	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/17/18	08:08	08:28	0.00	0.00	0.00	0.000
1	2	05/17/18	08:53	09:13	0.01	0.00	0.01	0.000
1	3	05/17/18	09:38	09:58	0.01	0.00	0.01	0.000
1	4	05/17/18	11:50	12:10	0.01	0.00	0.01	0.000
1	5	05/17/18	12:27	12:47	0.01	0.00	0.01	0.000
1	6	05/17/18	13:05	13:25	0.00	0.00	0.00	0.000
1	7	05/17/18	13:44	14:04	0.00	0.00	0.00	0.000
1	8	05/17/18	14:31	14:51	0.02	0.00	0.02	0.000
0	9	05/17/18	15:10	15:30	0.02	0.00	0.02	0.000
1	10	05/17/18	15:54	16:14	0.01	0.00	0.01	0.000

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**0.008**	**RM avg**
Mean CEM Value	**0.000**	**CEM avg**
Sum of Differences	**0.070**	**di**
Mean Difference	**0.008**	**d**
Sum of Differences Squared	**0.001**	**di^2**
Standard Deviation	**0.007**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.005**	**cc**
Relative Accuracy - APS	**1.08**	**RA[A]**

[A] Relative accuracy based upon +/- 10% of applicable standard of 1.2 lb/MMBtu

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Waste Fuel Boiler Outlet Duct
Date: 5/17/18
Test Method: 6C, 2

Applicable Standard: 476

SO2 lb/hr RATA

CEM Monitor Information

SO_2 Monitor/Model:		Thermo 43iQ			SO_2 Serial # :		1180090017	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO_2 lb/hr	CEM SO_2 lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/17/18	08:08	08:28	1.9	8.3	-6.4	40.96
1	2	05/17/18	08:53	09:13	2.9	3.3	-0.4	0.16
1	3	05/17/18	09:38	09:58	3.9	4.3	-0.4	0.16
1	4	05/17/18	11:50	12:10	5.3	2.4	2.9	8.41
1	5	05/17/18	12:27	12:47	7.3	6.3	1.0	1.00
1	6	05/17/18	13:05	13:25	2.3	0.2	2.1	4.41
1	7	05/17/18	13:44	14:04	1.5	0.1	1.4	1.96
1	8	05/17/18	14:31	14:51	10.3	7.4	2.9	8.41
0	9	05/17/18	15:10	15:30	9.2	5.3	3.9	15.21
1	10	05/17/18	15:54	16:14	5.6	4.0	1.6	2.56

n	9	
t(0.975)	2.306	
Mean Reference Method Value	4.556	RM avg
Mean CEM Value	4.033	CEM avg
Sum of Differences	4.700	di
Mean Difference	0.522	d
Sum of Differences Squared	68.030	di^2
Standard Deviation	2.863	sd
Confidence Coefficient 2.5% Error (1-tail)	2.201	cc
Relative Accuracy - APS	0.57	RA[A]

[A] Relative accuracy based upon +/- 10% of applicable standard of 476 lb/hr

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Test Location: Waste Fuel Boiler Outlet Duct
Test Date: 5/17/2018
Test Method: 2

CEM Monitor Information

Volumetric Flow RATA - Normal Load

Flow Monitor/Model:	Deterich	Flow Serial # :	22-F-C-179, 27487.02.1

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	Reference Method Flow DSCFM	CEM Flow DSCFM	(RM-CEM) Difference (di)	(RM-CEM) Difference ^{2} (di^2)
1	1	05/17/18	08:08	08:18	119,400	121,000	-1,600	2,560,000
1	2	05/17/18	08:58	09:07	125,000	121,600	3,400	11,560,000
1	3	05/17/18	09:38	09:47	125,200	123,600	1,600	2,560,000
1	4	05/17/18	11:50	12:02	129,700	118,700	11,000	121,000,000
1	5	05/17/18	12:27	12:37	120,700	114,500	6,200	38,440,000
1	6	05/17/18	13:05	13:14	126,300	117,700	8,600	73,960,000
1	7	05/17/18	13:44	13:57	123,100	116,800	6,300	39,690,000
1	8	05/17/18	14:31	14:42	131,500	119,600	11,900	141,610,000
1	9	05/17/18	15:10	15:20	120,600	110,600	10,000	100,000,000
0	10	05/17/18	15:54	16:04	123,200	111,000	12,200	148,840,000

n	9	
t(0.025)	2.306	
Mean Reference Method Value	124611.111	RM avg
Mean CEM Value	118233.333	CEM avg
Sum of Differences	57400.000	di
Mean Difference	6377.778	d
Sum of Differences Squared	531380000.000	di^2
Standard Deviation	4545.541	sd
Confidence Coefficient 2.5% Error (1-tail)	3494.006	cc
Relative Accuracy	7.92	RA

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Recovery Boiler Outlet Duct
Date: 5/16/18
Test Method: 7E, 3A

Applicable Standard: 120

NOx ppmvd @ 8% O2 RATA

CEM Monitor Information

NO_x Monitor/Model:			Thermo 42iQ			**NO_x Serial # :**	1180090013	
O_2 Monitor/Model:			Thermo CTL902C			**O_2 Serial # :**	1180240002	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM NOx ppmvd @ 8 %O2**	**CEM NOx ppmvd @ 8 %O2**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/16/18	7:55	8:15	100.8	99.3	1.5	2.25
1	2	05/16/18	8:45	9:05	104.4	103.0	1.4	1.96
1	3	05/16/18	9:30	9:50	106.0	103.5	2.5	6.25
1	4	05/16/18	10:25	10:45	109.5	107.4	2.1	4.41
1	5	05/16/18	11:15	11:35	117.3	115.0	2.3	5.29
1	6	05/16/18	12:40	13:00	106.2	104.9	1.3	1.69
1	7	05/16/18	13:27	13:47	106.5	103.8	2.7	7.29
1	8	05/16/18	14:12	14:32	107.9	105.7	2.2	4.84
0	9	05/16/18	14:57	15:17	101.8	99.1	2.7	7.29
1	10	05/16/18	15:41	16:01	103.0	100.8	2.2	4.84
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**106.844**		**RM avg**	
				Mean CEM Value	**104.822**		**CEM avg**	
				Sum of Differences	**18.200**		**di**	
				Mean Difference	**2.022**		**d**	
				Sum of Differences Squared	**38.820**		**di^2**	
				Standard Deviation	**0.502**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.386**		**cc**	
				Relative Accuracy	**2.25**		**RA**	

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Recovery Boiler Outlet Duct
Date: 5/16/18
Test Method: 3A

O_2 % (dry) RATA

CEM Monitor Information

O_2 Monitor/Model:	Thermo CTL902C	O_2 Serial # :	1180240002

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/16/18	7:55	8:15	4.3	4.3	0.0	0.00
1	2	05/16/18	8:45	9:05	4.5	4.7	-0.2	0.04
1	3	05/16/18	9:30	9:50	5.1	5.1	0.0	0.00
1	4	05/16/18	10:25	10:45	5.0	5.0	0.0	0.00
1	5	05/16/18	11:15	11:35	5.7	5.8	-0.1	0.01
0	6	05/16/18	12:40	13:00	4.3	4.5	-0.2	0.04
1	7	05/16/18	13:27	13:47	4.3	4.4	-0.1	0.01
1	8	05/16/18	14:12	14:32	4.5	4.6	-0.1	0.01
1	9	05/16/18	14:57	15:17	4.4	4.5	-0.1	0.01
1	10	05/16/18	15:41	16:01	4.4	4.5	-0.1	0.01

n	9	
t(0.975)	2.306	
Mean Reference Method Value	4.689	RM avg
Mean CEM Value	4.767	CEM avg
Sum of Differences	-0.700	di
Mean Difference	-0.078	d
Sum of Differences Squared	0.090	di^2
Standard Deviation	0.067	sd
Confidence Coefficient 2.5% Error (1-tail)	0.051	cc
Relative Accuracy	2.75	RA

Client: Verso Paper | **Location:** Recovery Boiler Outlet Duct
Facility: Quinnesec Mill | **Date:** 5/16/18
Project #: M182008 | **Test Method:** 6C, 3A
Applicable Standard: 50

SO2 ppmvd @ 8% O2 RATA

CEM Monitor Information

SO_2 Monitor/Model:	Thermo 43iQ	SO_2 Serial # :	1180090009
O_2 Monitor/Model:	Thermo CTL902C	O_2 Serial # :	1180240002

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO2 ppmvd @ 8 %O2	CEM SO2 ppmvd @ 8 %O2	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/16/18	7:55	8:15	0.5	0.5	0.0	0.00
1	2	05/16/18	8:45	9:05	0.7	0.4	0.3	0.09
0	3	05/16/18	9:30	9:50	0.8	0.4	0.4	0.16
1	4	05/16/18	10:25	10:45	0.5	0.4	0.1	0.01
1	5	05/16/18	11:15	11:35	0.3	0.4	-0.1	0.01
1	6	05/16/18	12:40	13:00	0.4	0.4	0.0	0.00
1	7	05/16/18	13:27	13:47	0.5	0.4	0.1	0.01
1	8	05/16/18	14:12	14:32	0.6	0.4	0.2	0.04
1	9	05/16/18	14:57	15:17	0.5	0.4	0.1	0.01
1	10	05/16/18	15:41	16:01	0.5	0.4	0.1	0.01

n	9	
t(0.975)	2.306	
Mean Reference Method Value	0.500	RM avg
Mean CEM Value	0.411	CEM avg
Sum of Differences	0.800	di
Mean Difference	0.089	d
Sum of Differences Squared	0.180	di^2
Standard Deviation	0.117	sd
Confidence Coefficient 2.5% Error (1-tail)	0.090	cc
Relative Accuracy - APS	0.36	RA^A

[A] Relative accuracy based upon +/- 10% of applicable standard 0f 50 ppmvd @ 8% O_2

Client: Verso Paper
Facility: Quinnesec Mill
Project #: M182008

Location: Recovery Boiler Outlet Duct
Date: 5/16/18
Test Method: 10, 3A

Applicable Standard: 500

CO ppmvd @ 8% O2 RATA

CEM Monitor Information

CO Monitor/Model:	Thermo 48iQ	**CO Serial # :**	1170680002
O_2 Monitor/Model:	Thermo CTL902C	**O_2 Serial # :**	1180240002

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO ppmvd @ 8 %O2	CEM CO ppmvd @ 8 %O2	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/16/18	7:55	8:15	244.1	235.4	8.7	75.69
1	2	05/16/18	8:45	9:05	154.6	148.3	6.3	39.69
1	3	05/16/18	9:30	9:50	506.1	528.1	-22.0	484.00
1	4	05/16/18	10:25	10:45	357.2	363.0	-5.8	33.64
1	5	05/16/18	11:15	11:35	258.3	257.4	0.9	0.81
1	6	05/16/18	12:40	13:00	108.8	103.5	5.3	28.09
1	7	05/16/18	13:27	13:47	86.5	87.2	-0.7	0.49
1	8	05/16/18	14:12	14:32	56.2	57.1	-0.9	0.81
0	9	05/16/18	14:57	15:17	238.0	214.9	23.1	533.61
1	10	05/16/18	15:41	16:01	185.1	172.3	12.8	163.84

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**217.433**	**RM avg**
Mean CEM Value	**216.922**	**CEM avg**
Sum of Differences	**4.600**	**di**
Mean Difference	**0.511**	**d**
Sum of Differences Squared	**827.060**	**di^2**
Standard Deviation	**10.153**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**7.804**	**cc**
Relative Accuracy	**3.82**	**RA**

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Recovery Boiler Outlet Duct
Date: 5/16/18-5/17/18
Test Method: 16A, 3A

Applicable Standard: 5

TRS as SO_2 ppmvd @ 8% O_2 RATA

TRS Monitor Model:		Thermo 43iQ			TRS Monitor Serial # :		1180090010	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM TRS as SO_2 ppmvd @ 8% O_2	CEM TRS as SO_2 ppmvd @ 8% O_3	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/16/18	13:40	14:40	1.0	1.5	-0.5	0.25
1	2	05/16/18	14:50	15:50	1.0	1.5	-0.5	0.25
1	3	05/16/18	16:00	17:00	1.2	1.6	-0.4	0.16
1	4	05/17/18	07:30	08:30	1.2	1.4	-0.2	0.04
1	5	05/17/18	08:40	09:40	1.4	1.3	0.1	0.01
1	6	05/17/18	09:50	10:50	1.4	1.4	0.0	0.00
1	7	05/17/18	11:40	12:40	1.0	1.3	-0.3	0.09
1	8	05/17/18	12:50	13:50	1.0	1.4	-0.4	0.16
1	9	05/17/18	14:00	15:00	1.0	1.4	-0.4	0.16
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**1.133**		**RM avg**	
				Mean CEM Value	**1.422**		**CEM avg**	
				Sum of Differences	**-2.600**		**di**	
				Mean Difference	**-0.289**		**d**	
				Sum of Differences Squared	**1.120**		**di^2**	
				Standard Deviation	**0.215**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.165**		**cc**	
				Relative Accuracy - APS	**9.08**		**RA[A]**	

[A] Relative accuracy based upon alternate standard of 5 ppmvd @ 8 % O2

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Test Location: Recovery Boiler Outlet Duct
Test Date: 5/15/2018
Test Method: 2

CEM Monitor Information

Volumetric Flow RATA - Normal Load

Flow Monitor/Model: OSI-OFS 2000 **Flow Serial # :** 0404127

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	Reference Method Flow DSCFM	CEM Flow DSCFM	(RM-CEM) Difference (di)	(RM-CEM) Difference ^{2} (di^2)
1	1	05/15/18	11:26	11:40	200,643	199,003	1,640	2,689,600
1	2	05/15/18	11:55	12:06	202,827	181,923	20,904	436,977,216
1	3	05/15/18	12:33	12:41	203,367	190,958	12,409	153,975,836
1	4	05/15/18	12:46	12:57	203,675	194,147	9,528	90,784,690
0	5	05/15/18	13:21	13:30	201,057	178,203	22,854	522,287,033
1	6	05/15/18	13:31	13:45	200,585	179,749	20,836	434,143,063
1	7	05/15/18	13:54	14:02	200,042	189,614	10,428	108,751,527
1	8	05/15/18	15:10	15:18	201,605	185,802	15,803	249,734,809
1	9	05/15/18	15:23	15:31	200,526	180,727	19,799	391,984,562
1	10	05/15/18	15:37	15:45	199,724	180,883	18,842	355,002,122

n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**201443.778**	**RM avg**
Mean CEM Value	**186978.400**	**CEM avg**
Sum of Differences	**130188.400**	**di**
Mean Difference	**14465.378**	**d**
Sum of Differences Squared	**2224043424.280**	**di^2**
Standard Deviation	**6527.050**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**5017.126**	**cc**
Relative Accuracy	**9.67**	**RA**

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Lime Kiln Stack
Date: 5/15/18 & 5/16/18
Test Method: 16A, 3A

Applicable Standard: 10

TRS as SO_2 ppmvd @ % O_2 RATA

TRS Monitor Model:		Thermo 43iQ			TRS Monitor Serial # :		1180090014	
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM TRS as SO_2 ppmvd @ 10% O_2	CEM TRS as SO_2 ppmvd @ 10% O_3	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	05/15/18	10:40	11:40	3.0	3.3	-0.3	0.09
1	2	05/15/18	11:52	12:52	2.4	2.2	0.2	0.04
1	3	05/15/18	13:05	14:05	2.8	3.1	-0.3	0.09
1	4	05/15/18	15:05	16:05	2.6	3.0	-0.4	0.16
1	5	05/15/18	16:15	17:15	2.9	3.3	-0.4	0.16
1	6	05/15/18	17:25	18:25	3.5	3.8	-0.3	0.09
1	7	05/16/18	07:25	08:25	0.9	1.7	-0.8	0.64
1	8	05/16/18	08:35	09:35	0.9	1.5	-0.6	0.36
1	9	05/16/18	09:45	10:45	0.9	1.3	-0.4	0.16
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**2.211**		**RM avg**	
				Mean CEM Value	**2.578**		**CEM avg**	
				Sum of Differences	**-3.300**		**di**	
				Mean Difference	**-0.367**		**d**	
				Sum of Differences Squared	**1.790**		**di^2**	
				Standard Deviation	**0.269**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.207**		**cc**	
				Relative Accuracy - APS	**5.74**		**RA[A]**	

[A] Relative accuracy based upon alternate standard of 10 ppmvd @ 10 % O2

Client: Verso Corporation
Facility: Quinnesec Mill
Project #: M182008

Location: Lime Kiln Stack
Date: 5/15/18 and 5/16/18
Test Method: 3A

O_2 % (dry) RATA

CEM Monitor Information

O_2 Monitor/Model:			Thermo CTL902C		**O_2 Serial # :**		1180570001	
1=accept 0=reject	**Test Run**	**Test Date**	**Start Time**	**End Time**	**RM O_2 % (dry)**	**CEM O_2 % (dry)**	**(RM-CEM) Difference (di)**	**(RM-CEM) Difference^2 (di^2)**
1	1	05/15/18	10:40	11:40	2.90	3.04	-0.14	0.020
1	2	05/15/18	11:52	12:52	3.00	3.13	-0.13	0.017
1	3	05/15/18	13:05	14:05	2.61	2.72	-0.11	0.012
1	4	05/15/18	15:05	16:05	2.52	2.70	-0.18	0.032
1	5	05/15/18	16:15	17:15	2.45	2.63	-0.18	0.032
1	6	05/15/18	17:25	18:25	2.48	2.66	-0.18	0.032
1	7	05/16/18	07:25	08:25	2.77	3.02	-0.25	0.063
1	8	05/16/18	08:35	09:35	2.71	2.94	-0.23	0.053
1	9	05/16/18	09:45	10:45	2.76	2.97	-0.21	0.044
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**2.689**		**RM avg**	
				Mean CEM Value	**2.868**		**CEM avg**	
				Sum of Differences	**-1.610**		**di**	
				Mean Difference	**-0.179**		**d**	
				Sum of Differences Squared	**0.305**		**di^2**	
				Standard Deviation	**0.046**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.036**		**cc**	
				Relative Accuracy	**7.98**		**RA**	