Appendix M
Air Emissions Reports

Appendix M-1
Stantec Consulting Ltd., 2015

Source Emissions Testing 2015 –
CertainTeed Gypsum Wallboard Plant,
McAdam,
New Brunswick

Prepared for:
CertainTeed Gypsum Canada Inc.
57 Quality Way
McAdam, NB E6J 1B1

Prepared by:
Stantec Consulting Ltd.
845 Prospect Street
Fredericton, NB E3B 2T7

Project No. 121811606
December 16, 2015

December 16, 2015

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

December 16, 2015

LIST OF APPENDICES

December 16, 2015

EXECUTIVE SUMMARY

CertainTeed Gypsum Canada Inc. (CertainTeed) retained Stantec Consulting Ltd. (Stantec) conduct source emissions testing on the exhaust stacks at its Wallboard Plant in McAdam, New Brunswick. The objective of the source emissions testing was to quantify the emissions from select stacks, in partial fulfillment of the regulatory requirements set out in the Certificate of Approval to Operate (Approval #I-8150, presented in Appendix A) issued by the New Brunswick Department of Environment and Local Government (NBDELG).

The source emissions testing was conducted over the period of October 20-29, 2015, and was completed under normal operating conditions in order to determine the emission rates and concentrations of specified contaminants outlined in Table I.

Table I Source Emissions Testing Matrix – Gypsum Wallboard Plant, McAdam, NB

Sampling Location	No. of Tests	Sample Type / Pollutant	Sampling Method
Calcine Mill, Rock Dryer, Zone 1 and Zone 2 Dryers (4 sources)	3	Velocity Traverse	EPS 1/RM/8, Method B
	3	Molecular Weight	EPS 1/RM/8, Method C
	3	Moisture Content	EPS 1/RM/8, Method D
	3	Total Suspended Particulate Matter (PM)	EPS 1/RM/8, Method E
	3	Oxygen (O_2)	EPS 1/RM/15
	3	Carbon Dioxide (CO_2)	EPS 1/RM/15
	3	Sulphur Dioxide (SO_2)	EPS 1/RM/15
	3	Nitrogen Oxides (NO_X as NO_2)	EPS 1/RM/15
	3	Carbon Monoxide (CO)	EPS 1/RM/15

No stack specific limits are specified in the Approval to Operate.

December 16, 2015

1.0 INTRODUCTION

1.1 GENERAL SYNOPSIS

CertainTeed Gypsum Canada Inc. (CertainTeed) retained Stantec Consulting Ltd. (Stantec) to conduct source emissions testing on selected exhaust stacks at its Gypsum Wallboard Plant located in McAdam, New Brunswick. The objective of the source emissions testing was to quantify the emission rates and/or concentrations of contaminants being released from the selected sources, in partial compliance with CertainTeed's Certificate of Approval to Operate (No. I-8150) issued by the New Brunswick Department of Environment and Local Government (NBDELG). The source emissions testing was conducted during the period of October 20-29, 2015.

The report is organized into four sections. A brief introduction to the report, including the scope and objectives of the project, is presented in Section 1.0. The source emissions testing methodology is presented in Section 2.0. The results of the source emissions testing program are presented in Section 3.0, and closing remarks are provided in Section 4.0. Supporting information, field sheets, raw data, calculations, and laboratory data are provided in the Appendices.

2.0 STUDY METHODOLOGY

2.1 SCOPE OF WORK AND OVERVIEW OF METHODOLOGY

The source emissions testing requirements are outlined in the Approval to Operate (I-8150), issued to CertainTeed by the New Brunswick Department of Environment and Local Government (NBDELG). The Approval to Operate is provided for reference in Appendix A.

Stantec conducted the source emissions testing campaign at the Gypsum Wallboard Plant from October 20-29, 2015. Source emissions testing was completed under normal operating conditions in order to determine the emission rates and concentrations of specified contaminants, as outlined in Table 2.1.

Table 2.1 Source Emissions Testing Matrix – Gypsum Wallboard Plant, McAdam, NB

Sampling Location	No. of Tests	Sample Type / Pollutant	Sampling Method
Calcine Mill, Rock Dryer, Zone 1 and Zone 2 Dryers (4 sources)	3	Velocity Traverse	EPS 1/RM/8, Method B
	3	Molecular Weight	EPS 1/RM/8, Method C
	3	Moisture Content	EPS 1/RM/8, Method D
	3	Total Suspended Particulate Matter (PM)	EPS 1/RM/8, Method E
	3	Oxygen (O_2)	EPS 1/RM/15
	3	Carbon Dioxide (CO_2)	EPS 1/RM/15
	3	Sulphur Dioxide (SO_2)	EPS 1/RM/15
	3	Nitrogen Oxides (NO_X as NO_2)	EPS 1/RM/15
	3	Carbon Monoxide (CO)	EPS 1/RM/15

All testing was conducted in accordance with the conditions of the Approval to Operate (I-8150), the NB *Air Quality Regulation*, and the applicable source emissions testing methods of Environment Canada and the United States Environmental Protection Agency (US EPA). In accordance with the regulatory requirements for source emissions testing, three replicate tests were conducted for each contaminant from each stack. The specific source emissions testing reference methods used to complete the source emissions testing campaign are presented in Table 2.1.

The testing methodology and specific work-task breakdown is described in the following subsections.

2.2 TASK 1 – INITIAL PREPARATION

Following award of the contract, Stantec made initial preparations to conduct the source testing work, including equipment calibrations and ensuring the preparation of the sampling locations. The Pre-test Plan describing the source emissions testing program was prepared and submitted to Ms. Sheryl Johnstone of the NBDELG via email for approval on September 30, 2015. Approval of the methods outlined in the Pre-test Plan was obtained on October 1, 2015. The Pre-test Plan and approval are provided in Appendix B of this report.

2.3 TASK 2 – ON-SITE SOURCE EMISSIONS TESTING

Stantec conducted source emissions testing while the process was under normal operation and in accordance with the applicable source testing reference methods. Three repetitions of each test method were completed for each contaminant from each stack, in accordance with the regulatory requirements for compliance testing.

Emission concentrations are reported in milligrams per reference cubic meter (mg/Rm^3) and corrected to reference conditions (25°C and 101.3 kPa), as well as the corresponding mass emission rates in kilograms per hour (kg/hr). Stantec completed the testing in accordance with the applicable source emissions testing reference methods, the conditions of the Approval to Operate, and the NBDELG *Guidance Document for Source Emissions Testing*.

A brief description of the source emissions testing reference methods followed for the testing campaign is in the following subsections.

2.3.1 Preliminary Testing

Upon arrival at each sampling location, the source emissions testing equipment was set up and a preliminary survey was conducted to measure the average flue gas velocity, moisture content, and flue gas composition in the stack, in accordance with the Environment Canada Reference Method EPS 1/RM/8 Methods B, C, and D, respectively, entitled *Reference Method for Source Testing: Measurement of Releases of Particulate from Stationary Sources*.

The data from the preliminary survey was used to determine the appropriate nozzle size to conduct isokinetic sampling (where the velocity of the gas entering the nozzle is equal to the gas velocity in the stack) during the particulate matter testing, and in calculations for reporting emission rates and concentrations of the sampled contaminants. Verification for cyclonic or reverse flow was also conducted during the preliminary survey, according to procedures outlined in EPS 1/RM/8. Where applicable, flow verification data from previous testing campaigns was used.

2.3.2 Total Particulate Matter

Particulate matter emissions were measured in accordance with the United States Environmental Protection Agency (US EPA) Method 5, entitled *Determination of Particulate Matter Emissions from Stationary Sources*. The sampling train consists of several different components which include: a heated sampling probe (a nozzle, stainless steel liner, thermocouple, and pitot tube assembly), a heated sample case containing a filter, an ice box containing impinger glassware, and an umbilical cord leading to the pump and control console.

The operation of the Method 5 sampling train can be generally described as follows.

Exhaust gases are drawn through the probe nozzle at or near isokinetic conditions (i.e., where the gas velocity in the nozzle is at the same velocity as the gas in the stack). The gases are then drawn through the inner stainless steel liner of the electrically heated sampling probe to the other components of the sampling train.
A pitot tube assembly is attached to the probe next to the nozzle to measure the exhaust gas velocity in the area of the probe nozzle. Using the differential pressure reading on the control console, the desired nozzle flow rate is determined from the differential pressure across a calibrated orifice.
The exhaust gases are drawn from the probe liner through a pre-weighed glass fiber filter, in the hot side of the sampling unit, and then through pre-weighed impingers in an ice bath to cool the gases and condense the moisture in the gas, before the gas enters the umbilical cord.
The umbilical cord carries the filtered, cooled exhaust gases from the sampling site to the control console. The control console contains a fiber vane vacuum pump, which is used to draw the exhaust gases through the sampling train. A calibrated dry gas meter records the volume of gas sampled.

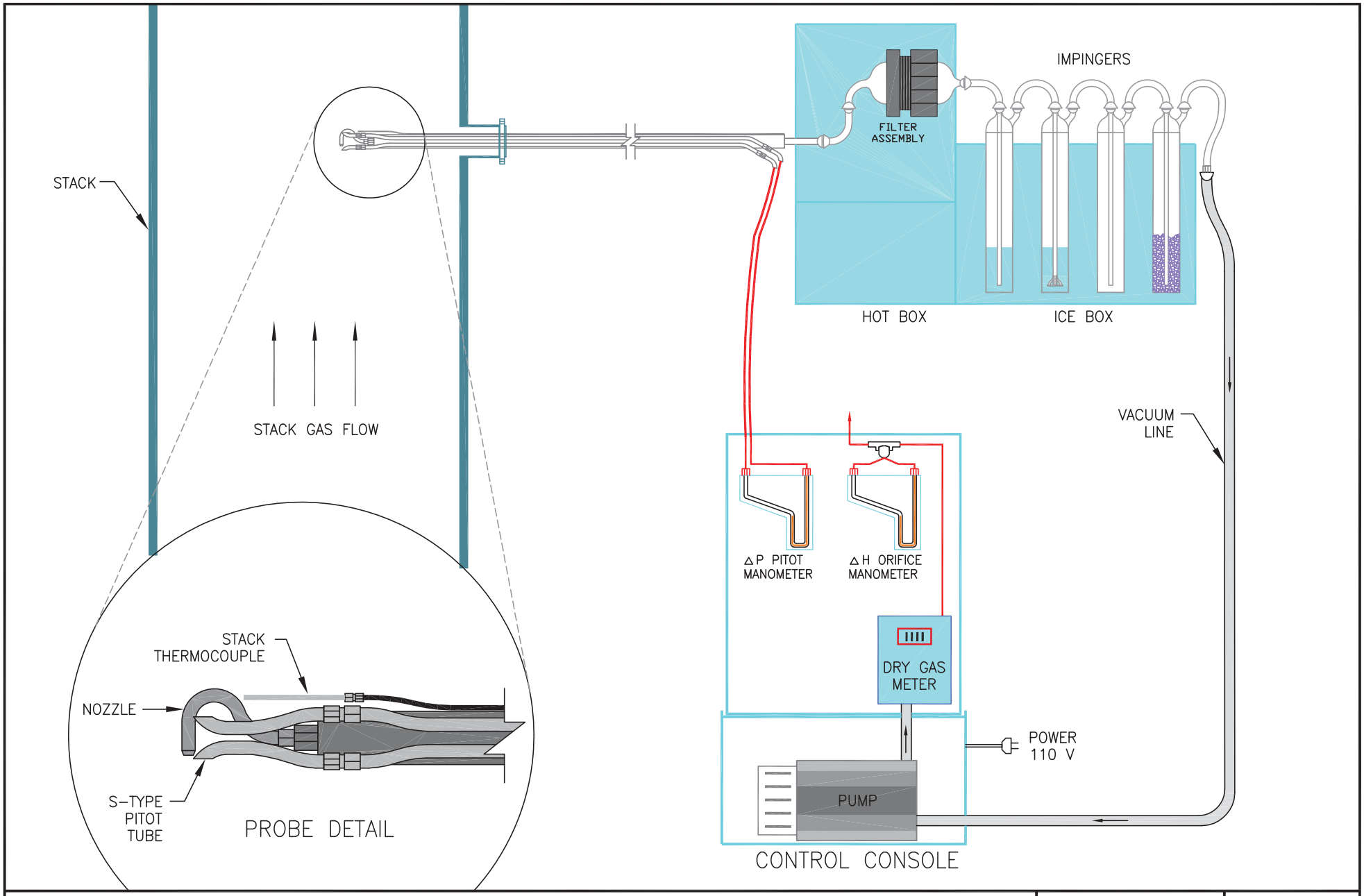
A diagram of the Method 5 particulate matter sampling train is provided in Figure 1.

2.3.3 Combustion Gases

Emissions of combustion gases including oxygen, carbon dioxide, sulphur dioxide, nitrogen oxides and carbon monoxide were determined in accordance with the Environment Canada Reference Method EPS 1/RM/15, entitled *Reference Method for the Monitoring of Gaseous Emissions from Fossil Fuel-fired Boilers*.

The combustion gases were analyzed using a Testo 350 XL Flue Gas Analyzer manufactured by Testo GmbH and Co. This unit is equipped with electrochemical cells that are used to measure the concentrations of oxygen, carbon dioxide, sulphur dioxide, nitrogen oxides, carbon monoxide, and total hydrocarbons, in accordance with EPS 1/RM/15. The system is equipped with a flue gas probe that has an integrated filter trap and condensate trap and a housing unit that contains the pump and the electrochemical cells.

FILE: STANDARD1



Stantec

SOURCE EMISSIONS TESTING
METHOD 5 SAMPLING TRAIN

Scale: N.T.S.

Fig. No.: 1

STUDY METHODOLOGY
December 16, 2015

The calibration data for the gas analyzer is in Appendix C.

2.4 TASK 3 – LABORATORY ANALYSIS OF COLLECTED SAMPLES

Total particulate matter is determined gravimetrically at Stantec's laboratory in Fredericton, New Brunswick. The total reported mass of particulate matter is the sum of the solid portions of the probe rinse and the mass captured on the filter. The mass of particulate collected in the impingers is reported separately and not included in the calculation of exhaust gas particulate matter concentration.

2.5 TASK 4 – DATA ANALYSIS AND EMISSION CALCULATIONS

After the source emissions testing work, and the laboratory analysis were completed, Stantec reviewed and analyzed the data and calculated the concentrations and emission rates for combustion gasses and the contaminants described above. Data and calculations were subjected to quality assurance and quality control protocols as per Stantec's quality management process to confirm their accuracy.

2.6 TASK 5 – REPORTING

Finally, the results of the source emissions testing program described above were summarized and described in this report. Emission concentrations are reported in mg/Rm^3 corrected to reference conditions (25°C and 101.3 kPa), as well as the corresponding mass emission rates in kg/hr.

2.7 QUALITY ASSURANCE AND QUALITY CONTROL

As a company offering a professional source emissions testing service, Stantec's measuring equipment used in the stack testing procedure are calibrated and traceable to applicable international standards of measurement. Calibrations were conducted to address instrument drift and further confirm measurement accuracy was maintained for all tests. Stantec QA/QC checks are summarized below.

Calibrations include, but are not limited to the following:

Pitot tubes: calibrated in a wind tunnel with probe and nozzles attached.
Gas meters: calibrated using a certified critical orifice calibration set.
Thermocouples: calibrated using a potentiometric technique.
Nozzle: four diameter measurements made using a micrometer across the sharpened edges.
Gas Analyzer: : The analyzer was calibrated against reference gas using standard calibration gases meeting the United States Environmental Protection Agency "Protocol 1" method specifications and within the expected range of concentrations from the source.

Appendix C provides the calibration data for equipment.

Quality control checks were performed at several stages during the testing program to confirm the collection of representative samples and the generation of valid results. These checks were performed by test personnel throughout the program under the guidance of the source testing crew chief. The Quality Control (QC) checks included, but are not limited to the following:

- use of standardized checklists to confirm completeness, traceability, and comparability of the process information and samples collected;
- field review of standardized forms by a second person to confirm accuracy and completeness;
- adherence to sample chain-of-custody procedures;
- use of appropriate field blanks (e.g., filter and solution samples);
- testing for cyclonic or reverse flow, as well as stratified flow conditions; and
- leak checks of sample trains.

3.0 RESULTS AND DISCUSSION

A brief description of the stacks tested, and the results of the source emissions testing campaign are provided in the following subsections.

The detailed calculations and source testing raw data are provided in Appendices E and F, respectively. The velocity profiles across the stacks, as shown in Appendix E, were consistent between tests and did not indicate the presence of cyclonic or reverse flow.

3.1 CALCINE MILL

The calcine mill is where dried gypsum from the Rock Dryer is fed for further size reduction, and then calcined into stucco. The mill can be operated on natural gas or No. 2 Fuel oil and is equipped with an exhaust stack that is 0.6 m in diameter. Sampling location details for the Calcine Mill are provided in Appendix D.

The testing was completed while the calcine mill was operating on No. 2 Fuel oil, and the results of the source emissions testing for the Calcine Mill exhaust stack are presented in Table 3.1.

Table 3.1 Source Emissions Testing Results – Calcine Mill, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Test Date	October 22, 2015	October 27, 2015	October 27, 2015	-	-
Test Period	13:20-15:00	10:40-12:35	14:03-15:45	-	-
Test Duration (min)	96	96	96	96	-
Barometric Pressure (kPa)	101.6	103.3	102.9	102.6	-
Stack Gas Static Pressure (kPa)	0.02	0.02	0.02	0.02	-
Volume of Gas Sampled (Rm^3)	3.08	3.07	3.19	3.11	-
Average Isokineticity (%)	95.9	100.6	99.3	98.6	$90 \leq \%I \leq 110$
Total mass of particulate in Impingers (mg)	5.91	5.79	5.81	5.83	-
Total Mass of Particulate Collected (excluding impinger catch) (mg)	10.1	15.9	18.1	14.7	-

Table 3.1 Source Emissions Testing Results – Calcine Mill, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Exhaust Gas Parameter					**CoA Limits**
Stack Gas Temperature (°C)	145	149	152	149	-
Moisture Content of Stack Gases (%)	17.3	21.0	20.3	19.5	-
Stack Gas Velocity (m/s)	19.99	19.74	20.86	20.20	-
Stack Gas Flow Rate (Rm^3/s)	7.77	7.37	7.78	7.64	-
Oxygen - O_2 (%)	17.4	17.5	17.4	17.5	-
Carbon Dioxide - CO_2 (%)	2.45	2.58	2.66	2.56	-
Sulphur Dioxide - SO_2					
SO_2 Measured Concentration (ppm)	3.29	2.71	2.57	2.86	-
Concentration (mg/Rm^3)	8.61	7.11	6.74	7.49	-
Emission Rate (kg/hr)	0.24	0.19	0.19	0.21	-
Nitrogen Oxides – NO_X					
NO_X Measured Concentration (ppm)	86.9	81.4	102.3	90.2	-
Concentration (mg/Rm^3)	163	153	193	170	-
Emission Rate (kg/hr)	4.57	4.07	5.39	4.68	-
Carbon Monoxide – CO					
CO Measured Concentration (ppm)	9.71	8.14	9.29	9.05	-
Concentration (mg/Rm^3)	11.1	9.32	10.6	10.4	-
Emission Rate (kg/hr)	0.31	0.25	0.30	0.29	-
Particulate Matter – PM					
Particulate Concentration (mg/Rm^3)	3.29	5.17	5.68	4.72	-
Particulate Emission Rate (kg/hr)	0.09	0.14	0.16	0.13	-

Legend:

°C	degrees Celsius	kPa	kilopascals
m/s	metres per second	kg/hr	kilograms per hour
ND	not detected		
Rm^3/s	Reference cubic metres per second (25°C and 101.3 kPa)		
mg/Rm^3	milligrams per reference cubic metre (25°C and 101.3 kPa)		
ppm	parts per million		

The measured particulate matter concentration was 4.72 mg/Rm^3. There are no stack specific limits specified in the Approval to Operate for this facility.

3.2 ROCK DRYER

The Rock Dryer is a rotary kiln dryer unit used to evaporate excess free moisture from the rock. The Rock Dryer burns No. 2 Fuel oil and is equipped with an exhaust stack that is 0.9 m in diameter.

Sampling location details for the Rock Dryer stack are provided in Appendix D.

The results of the source emissions testing for the Rock Dryer stack are presented in Table 3.2.

Table 3.2 Source Emissions Testing Results – Rock Dryer, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Test Date	October 20, 2015	October 20, 2015	October 21, 2015	-	-
Test Period	10:30-12:15	12:45-14:45	10:30-12:10	-	-
Test Duration (min)	96	96	96	96	-
Barometric Pressure (kPa)	101.2	100.9	102.3	101.5	-
Stack Gas Static Pressure (kPa)	0.05	0.05	0.05	0.05	-
Volume of Gas Sampled (Rm^3)	1.58	1.41	1.54	1.51	-
Average Isokineticity (%)	101	100	98.5	99.9	$90 \leq \%I \leq 110$
Total mass of particulate in Impingers (mg)	0.11	1.02	1.47	0.87	-
Total Mass of Particulate Collected (excluding impinger catch) (mg)	1.85	ND	1.20	<1.02	-
Exhaust Gas Parameter					**CoA Limits**
Stack Gas Temperature (°C)	61.3	61.7	53.8	58.9	-
Moisture Content of Stack Gases (%)	9.7	10.4	7.4	9.2	-
Stack Gas Velocity (m/s)	12.1	11.1	11.5	11.6	-
Stack Gas Flow Rate (Rm^3/s)	6.42	5.79	6.43	6.21	-
Oxygen - O_2 (%)	19.7	19.6	19.7	19.7	-
Carbon Dioxide - CO_2 (%)	0.68	0.86	0.67	0.74	-

Table 3.2 Source Emissions Testing Results – Rock Dryer, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Sulphur Dioxide - SO_2					
SO_2 Measured Concentration (ppm)	0.71	ND	ND	<0.24	-
Concentration (mg/Rm^3)	1.87	ND	ND	<0.62	-
Emission Rate (kg/hr)	0.04	ND	ND	<0.01	-
Nitrogen Oxides – NO_X					
NO_X Measured Concentration (ppm)	10.0	3.14	7.57	6.90	-
Concentration (mg/Rm^3)	18.8	5.91	14.2	13.0	-
Emission Rate (kg/hr)	0.44	0.12	0.33	0.30	-
Carbon Monoxide – CO					
CO Measured Concentration (ppm)	9.71	13.9	10.3	11.3	-
Concentration (mg/Rm^3)	11.1	15.9	11.8	12.9	-
Emission Rate (kg/hr)	0.26	0.33	0.27	0.29	-
Particulate Matter – PM					
Particulate Concentration (mg/Rm^3)	1.17	ND	0.78	<0.65	-
Particulate Emission Rate (kg/hr)	0.03	ND	0.02	<0.02	-

Legend:

°C	degrees Celsius	kPa	kilopascals
m/s	metres per second	kg/hr	kilograms per hour
ND	not detected		
Rm^3/s	Reference cubic metres per second (25°C and 101.3 kPa)		
mg/Rm^3	milligrams per reference cubic metre (25°C and 101.3 kPa)		
ppm	parts per million		

The measured particulate matter concentration was <0.65 mg/Rm^3. There are no stack specific limits specified in the Approval to Operate for this facility.

3.3 ZONE 1 AND ZONE 2 DRYERS

The Zone 1 and Zone 2 Dryers operate on natural gas or No. 2 Fuel oil and are equipped with exhaust stacks that are 0.9 m in diameter.

Appendix D provides sampling location details and requirements for the Zone 1 and Zone 2 dryer stacks.

The testing was completed while the Zone 1 Dryer was operating on No. 2 Fuel oil, and the results of the source emissions testing for the Zone 1 Dryer stack are presented in Table 3.3.

Table 3.3 Source Emissions Testing Results – Zone 1 Dryer, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Test Date	October 28, 2015	October 29, 2015	October 29, 2015	-	-
Test Period	13:52-15-30	9:55-11:45	13:20-15:00	-	-
Test Duration (min)	96	96	96	96	-
Barometric Pressure (kPa)	101.6	101.5	101.2	101.5	-
Stack Gas Static Pressure (kPa)	0.05	0.05	0.05	0.05	-
Volume of Gas Sampled (Rm^3)	2.00	1.43	1.23	1.55	-
Average Isokineticity (%)	119	104	101	107	90 ≤ %I ≤ 110
Total mass of particulate in Impingers (mg)	44.5	49.6	42.7	45.6	-
Total Mass of Particulate Collected (excluding impinger catch) (mg)	19.7	21.1	12.3	17.7	-
Exhaust Gas Parameter					**CoA Limits**
Stack Gas Temperature (°C)	144	147	143	144	-
Moisture Content of Stack Gases (%)	31.7	40.8	42.0	38.2	-
Stack Gas Velocity (m/s)	12.6	12.1	10.8	11.8	-
Stack Gas Flow Rate (Rm^3/s)	7.23	5.94	5.24	6.14	-
Oxygen - O_2 (%)	14.5	14.7	14.6	14.6	-
Carbon Dioxide - CO_2 (%)	4.81	4.71	4.74	4.76	-
Sulphur Dioxide - SO_2					
SO_2 Measured Concentration (ppm)	ND	ND	ND	ND	-
Concentration (mg/Rm^3)	ND	ND	ND	ND	-
Emission Rate (kg/hr)	ND	ND	ND	ND	-
Nitrogen Oxides – NO_X					
NO_X Measured Concentration (ppm)	140	133	144	139	-
Concentration (mg/Rm^3)	264	250	271	262	-
Emission Rate (kg/hr)	6.86	5.35	5.11	5.77	-
Carbon Monoxide – CO					
CO Measured Concentration (ppm)	14.4	13.9	14.3	14.2	-
Concentration (mg/Rm^3)	16.5	15.9	16.4	16.2	-
Emission Rate (kg/hr)	0.43	0.34	0.31	0.36	-

Table 3.3 Source Emissions Testing Results – Zone 1 Dryer, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Particulate Matter – PM					
Particulate Concentration (mg/Rm^3)	9.85	14.7	10.0	11.5	-
Particulate Emission Rate (kg/hr)	0.26	0.31	0.19	0.25	-

Legend:

°C	degrees Celsius	kPa	kilopascals
m/s	metres per second	kg/hr	kilograms per hour
ND	not detected		
Rm^3/s	Reference cubic metres per second (25°C and 101.3 kPa)		
mg/Rm^3	milligrams per reference cubic metre (25°C and 101.3 kPa)		
ppm	parts per million		

The measured particulate matter concentration was 11.5 mg/Rm^3. There are no stack specific limits specified in the Approval to Operate for this facility. It should be noted that the average isokinetics for test 1 were 119%, which is outside the allowable range (90-110%). This was due to the moisture content being underestimated for the first test, but was corrected for the subsequent testing. Higher isokinetics can potentially result in the measurement being biased low for concentration. However, the three tests are consistent (within 10% of average) therefore the tests are considered representative of the source emissions.

The testing was completed while the Zone 2 Dryer was operating on No. 2 Fuel oil, and the results of the source emissions testing for the Zone 2 Dryer stack are presented in Table 3.4.

Table 3.4 Source Emissions Testing Results – Zone 2 Dryer, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Test Date	October 28, 2015	October 29, 2015	October 29, 2015	-	-
Test Period	14:45-14:30	11:05-12:45	14:15-16:00	-	-
Test Duration (min)	96	96	96	96	-
Barometric Pressure (kPa)	101.6	101.5	101.2	101.5	-
Stack Gas Static Pressure (kPa)	0.05	0.05	0.05	0.05	-
Volume of Gas Sampled (Rm^3)	1.92	1.91	1.88	1.9	-
Average Isokineticity (%)	104	104	98.5	102	90 ≤ %I ≤ 110
Total mass of particulate in Impingers (mg)	72.4	46.9	38.1	52.5	-
Total Mass of Particulate Collected (excluding impinger catch) (mg)	18.7	36.0	17.8	24.2	-

Table 3.4 Source Emissions Testing Results – Zone 2 Dryer, McAdam Gypsum Wallboard Plant

Parameter	Test 1	Test 2	Test 3	Average	Quality Criteria
Exhaust Gas Parameter					**CoA Limits**
Stack Gas Temperature (°C)	116	117	117	117	-
Moisture Content of Stack Gases (%)	39.0	39.3	39.3	39.2	-
Stack Gas Velocity (m/s)	14.4	14.4	15.1	14.6	-
Stack Gas Flow Rate (Rm^3/s)	7.90	7.83	8.16	7.96	-
Oxygen - O_2 (%)	16.8	16.7	16.8	16.8	-
Carbon Dioxide - CO_2 (%)	16.8	16.7	16.8	16.8	-
Sulphur Dioxide - SO_2					
SO_2 Measured Concentration (ppm)	0.71	0.86	0.30	0.62	-
Concentration (mg/Rm^3)	1.87	2.25	0.79	1.63	-
Emission Rate (kg/hr)	0.05	0.06	0.02	0.05	-
Nitrogen Oxides – NO_X					
NO_X Measured Concentration (ppm)	83.1	72.4	78.7	78.1	-
Concentration (mg/Rm^3)	156	136	148	147	-
Emission Rate (kg/hr)	4.45	3.84	4.35	4.22	-
Carbon Monoxide – CO					
CO Measured Concentration (ppm)	11.7	10.3	10.4	10.8	-
Concentration (mg/Rm^3)	13.4	11.8	11.9	12.4	-
Emission Rate (kg/hr)	0.38	0.33	0.35	0.35	-
Particulate Matter – PM					
Particulate Concentration (mg/Rm^3)	9.76	18.9	9.46	12.7	-
Particulate Emission Rate (kg/hr)	0.28	0.53	0.28	0.36	-

Legend:

°C	degrees Celsius	kPa	kilopascals
m/s	metres per second	kg/hr	kilograms per hour
ND	not detected		
Rm^3/s	Reference cubic metres per second (25°C and 101.3 kPa)		
mg/Rm^3	milligrams per reference cubic metre (25°C and 101.3 kPa)		
ppm	parts per million		

The measured particulate matter concentration was 12.7 mg/Rm^3. There are no stack specific limits specified in the Approval to Operate for this facility.

4.0 CLOSING REMARKS

This report has been prepared by Stantec Consulting Ltd. (Stantec) for the sole benefit of CertainTeed Gypsum Canada Inc. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and CertainTeed Gypsum Canada Inc.. This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and used in the preparation of this report were assumed by Stantec to be accurate. Conclusions presented in this report should not be construed as legal advice.

The source testing measurements for each stack were taken over short periods of time and the emissions results are considered representative for the conditions present at the time of testing. The information provided in this report was compiled from such on-site measurements and by applying currently accepted industry standard mitigation and prevention principles. This report represents the best professional judgment of Stantec personnel at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect the any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared by Tristan Blair-Hicks, EIT, and reviewed by Vicki Corning, P.Eng. on behalf of CertainTeed Gypsum Canada Inc. If you have any questions or concerns about this report, please do not hesitate to contact the undersigned.

STANTEC CONSULTING LTD.

Tristan Blair-Hicks, EIT
Air Quality Engineer-in-Training
Environmental Services
(506) 452-7000

Vicki Corning, P.Eng.
Senior Associate
Environmental Services
(506) 452-7000

December 16, 2015

APPENDIX A

Approval to Operate

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

APPROVAL TO OPERATE

I-8150

Pursuant to paragraph 5 (3) (a) of the *Air Quality Regulation - Clean Air Act*, this Approval to Operate is hereby issued to:

CERTAINTEED GYPSUM CANADA, INC.

for the operation of the

McAdam Gypsum Wallboard Plant

Description of Source:	**Gypsum Rock Stockpile, Primary Crusher, Rock Dryer, Calcine Mill, Wallboard Fabrication Line**
Source Classification:	**Air Quality Regulation** **Class 1B**
Parcel Identifier:	**01534668**
Mailing Address:	**57 Quality Way**

McAdam, NB E6J 1B1

Conditions of Approval: **See attached Schedule "A" of this Approval**

Supersedes Approval: **I-6085**

Valid From: **April 01, 2013**

Valid To: **March 31, 2018**

Recommended by: _____

Community Planning & Environmental Protection Division

Issued by: _____ _____

Minister of Environment and Local Government Date

SCHEDULE "A"

A. DESCRIPTION AND LOCATION OF SOURCE

CertainTeed Gypsum Canada, Inc. operates a Gypsum Wallboard Plant that has an annual production capacity of 23 million square metres of Gypsum Wallboard. The plant is located in the Village of McAdam, New Brunswick.

There exists *potential* environmental impacts to the atmospheric environment from: i) upset operating conditions; ii) the release of particulate matter from fuel oil combustion, crushing and drying processes; iii) the release of sulphur dioxide, nitrogen oxides, and carbon monoxide from fuel oil combustion processes; iv) the release of fugitive particulate matter emissions from the on-site stock piles, materials handling, crushing and site access roads; and v) the release of noise from the general operation of the facility.

The operation of the CertainTeed Gypsum Wallboard Plant in the Village of McAdam, County of York, and Province of New Brunswick, and identified by Parcel Identifier (PID) 01534668 is hereby approved subject to the following:

B. DEFINITIONS

1. **"Approval Holder"** means CertainTeed Gypsum Canada, Inc.

2. **"Minister"** means the Minister of the Department of Environment & Local Government and includes any person designated to act on the Minister's behalf.

3. **"Department"** means the New Brunswick Department of Environment & Local Government.

4. **"Director"** means the Director of the Impact Management Branch of the Department of Environment & Local Government and includes any person designated to act on the Director's behalf.

5. **"Inspector"** means an Inspector designated under the *Clean Air Act*, the *Clean Environment Act*, or the *Clean Water Act*.

6. **"environmental emergency"** means a situation where there has been or will be a release, discharge, or deposit of a contaminant or contaminants to the atmosphere, soil, surface water, and/or groundwater environments of such a magnitude or duration that it could cause significant harm to the environment or put the health of the public at risk.

7. **“normal business hours”** means the hours when the Department's offices are open. These include the period between 8:15 a.m. and 4:30 p.m. from Monday to Friday excluding statutory holidays.

8. **"after hours"** means the hours when the Department's offices are closed. These include statutory holidays, weekends, and the hours before 8:15 a.m. and after 4:30 p.m. from Monday to Friday.

9. **"statutory holiday"**, for the purpose of this approval, means the following days: New Year's Day, Good Friday, Easter Monday, Victoria Day, Canada Day, New Brunswick Day, Labour Day, Thanksgiving Day, Remembrance Day, Christmas Day and Boxing Day. If the statutory holiday falls on a Sunday, then the following day shall be considered to be the statutory holiday.

10. **"Facility"** means the property, buildings, equipment, and all contiguous property in the title of the Approval Holder at that location, including but not limited to:

A. GYPSUM STOCKPILE - is the area where the Gypsum Rock, which is the plant feed rock, is stored prior to transportation to the Primary Crusher. In 2012 two tarpaulin fabric covered, steel spanned dome buildings were constructed to improve storage conditions. Each dome building currently has two walls, with the other two open to the environment. The stockpile is considered a potential source of fugitive particulate matter.

B. PRIMARY CRUSHER - is used to crush the feed rock to a reduced size less than 3.8 cm (4.5 in) in diameter. The primary crusher is considered a potential source of fugitive particulate matter.

C. ROCK DRYER - is a rotary kiln dryer unit used to evaporate excess free moisture from the rock. The kiln utilises No. 6 Fuel Oil as the fuel source and is equipped with an exhaust stack that is 0.9 m (3.95 ft) in diameter and 7 m (22.9 ft) above adjacent ground level. The dryer exhaust stack is considered a release point for process gas and a point source of particulate matter (PM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) emissions to the atmospheric environment.

D. CALCINE MILL - is where dried gypsum from the Rock Dryer is fed for further size reduction to 94.2% passing 100-mesh screens, and then calcined to stucco in the Calcine Mill . The mill utilises No. 6 Fuel Oil and is equipped with an exhaust stack that is 0.6 m (1.97 ft) in diameter and 6.5 m (21.3 ft) above adjacent ground level. The mill exhaust stack is considered a release point for process gas and a point source of particulate matter (PM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) emissions to the atmospheric environment.

E. WALLBOARD FABRICATION LINE - is situated after the stucco production in the Calcine Mill. All the dry and liquid ingredients are added, mixed, and placed between sheets of paper; the wallboard is extruded to the desired form and set before it is fed into a drying oven. The drying oven has ten levels and two zones. The initial zone operates at 245 to 288^{o}C (473 to 550^{o}F), while the second zone operates at 191^{o}C (375^{o}F). The initial zone drives off most of the moisture while the second zone permits continued drying. The board emerges from the ovens at about 0.5 % free moisture. The dryer utilises No. 2 Fuel Oil as the fuel source and is equipped with two exhaust stacks, one for each zone, that are 0.9 m (3.95 ft) in diameter and 6.7 m (21.9 ft) above adjacent ground level. The dryer exhaust stacks are considered a release point for process gas and are point sources of particulate matter (PM), sulphur dioxide (SO_2), nitrogen oxides (NO_x), and carbon monoxide (CO) emissions to the atmospheric environment.

F. WASTE WALLBOARD STOCKPILE AREA - is located at the west end of the property and serves as storage for the waste wallboard generated from the operation. The current process allows 35% recycled material. The waste stockpile has decreased in size significantly and future plans include managing the recycle wallboard by the rock shelter. This area is currently considered a potential source of fugitive particulate matter.

C. EMERGENCY REPORTING

11. Initial Notification

Immediately following the discovery of an environmental emergency a designate representing the Approval Holder shall notify the Department in the following manner:

During normal business hours, telephone the Department's Fredericton Regional Office **until personal contact is made** (i.e. no voice mail messages will be accepted) and provide as much information that is known about the environmental emergency. The telephone number for the Fredericton Regional Office is provided below:

Fredericton Regional Office (506) 444-5149

After hours, telephone the Canadian Coast Guard **until personal contact is made** and provide as much information that is known about the environmental emergency. The telephone number for the **Canadian Coast Guard** is **1-800-565-1633.**

12. Follow-Up

Within 24-hours of the time of initial notification, a faxed copy of a **Preliminary Emergency Report** shall be filed by a designate representing the Approval Holder to the Department's Fredericton Regional Office and to the Department's Central Office using the fax numbers provided below. The Preliminary Emergency Report shall clearly communicate as much information that is available at the time about the environmental emergency.

Within five (5) days of the time of initial notification, a faxed copy of a **Detailed Emergency Report** shall be filed by a designate representing the Approval Holder to the Department's Fredericton Regional Office and to the Department's Central Office using the fax numbers provided below:

Fredericton Regional Office (fax): (506) 453-2893

Central Office (fax): (506) 457-7805

The **Detailed Emergency Report** shall include, as minimum, the following:

i) a description of the problem that occurred;

ii) a description of the impact that occurred;

iii) a description of what was done to minimize the impact; and

iv) a description of what was done to prevent recurrence of the problem.

D. TERMS AND CONDITIONS

GENERAL CONDITIONS

13. The Approval Holder shall operate the Facility in compliance with the *Air Quality Regulation 97-133* filed under the *Clean Air Act* of the Province of New Brunswick. Violation of any term and condition herein stated constitutes a violation of the *Clean Air Act.*

14. This Facility has been classified as a **Class 1B** source, pursuant to the *Air Quality Regulation 97-133* filed under the *Clean Air Act*. The Approval Holder shall pay the appropriate annual fee within 30 days of receiving an invoice.

15. The terms and conditions of this Approval are severable. If any term or condition of this Approval is held invalid, is revoked or is modified, the remainder of the Approval shall not be affected.

16. **Prior to June 30, 2017**, The Approval Holder shall make application in writing on a form provided by the Minister for a renewal of this Approval.

17. The Approval Holder shall notify the Minister in writing of any plans to modify the operation of the Facility that would result in a significant change in the characteristics or increased rate of discharge or concentration of any pollutants to the environment **at least two hundred and seventy (270) days prior** to the modification.

18. In the event of facility closure, the Approval Holder shall notify the Minister in writing **at least two hundred and seventy (270) days prior** to the anticipated closure date.

19. If, in the opinion of the Minister, the environmental impact of the work described in this Approval is unacceptable, the Minister reserves the right to cancel this Approval and issue a new Approval with terms and conditions as deemed necessary.

20. The issuance of this Approval does not relieve the Approval Holder from compliance with other by-laws, federal or provincial acts or regulations, or any guidelines issued pursuant to regulations.

21. The Approval Holder shall ensure that a copy of this Approval to Operate is posted in a prominent location in the main office or working area of the Facility.

FUGITIVE PARTICULATE MATTER CONTROL

22. The Approval Holder shall ensure that fugitive particulate matter emissions being emitted from the Facility do not cause adverse impacts to any off-site receptor. In the event fugitive particulate matter emission impacts are suspected by the Department to be adversely impacting any off-site receptor, the Approval Holder will be required to develop, submit, and implement a Fugitive Particulate Matter Prevention and Control Plan in accordance with a timetable established by the Department. The plan shall be submitted in writing to the Department for review and approval prior to implementation.

NOISE CONTROL

23. The Approval Holder shall ensure that noise being emitted from the Facility does not adversely impact any off-site receptors. In the event noise impacts are suspected by the Department to adversely impact the environment, the Approval Holder will be required to develop, submit, and implement a Noise Prevention and Control Plan in accordance with a timetable established by the Department. The plan shall be submitted in writing to the Department for review and approval prior to implementation.

EMISSION LIMITS

24. The Approval Holder shall ensure that the total combined release of Sulphur Dioxide (SO_2) from all sources at the Facility does not exceed 200 tonnes per calendar year.

25. The Approval Holder shall ensure that the total combined release of Particulate Matter (PM) from all sources at the Facility does not exceed 200 tonnes per calendar year.

TESTING AND MONITORING

26. The Approval Holder shall conduct performance tests on emissions or ambient air quality at such times and in such manner as the Minister may specify in writing.

27. **Prior to December 01, 2015**, the Approval Holder shall conduct source testing to determine the concentration in milligrams per cubic metre (mg/m^3) and the emission rate in kilograms per hour (kg/hr) of Sulphur Dioxide (SO_2), Carbon Monoxide (CO), Nitrogen Oxides (NO_x), and Particulate Matter (PM) being released from the exhaust stacks of the Rock Dryer, Calcine Mill, and the two Dryer Ovens representing normal operating conditions.

28. The Approval Holder shall ensure that source testing is carried out in accordance with Section 18 of the New Brunswick *Air Quality Regulation 97-133*, and with the requirements embodied in the Department's *Code of Practice for Source Testing* or latest revision, as well as using normal accepted practice as published by the Canadian Environmental Protection Service (EPS) or the United States Environmental Protection Agency (US EPA). A detailed description of the methods to be used shall be submitted to the Director for review at least four (4) weeks prior to commencement of source testing.

REPORTING

29. In the event of a small spill or leak of liquid materials, the Approval Holder shall act first to contain, and then to clean up the spilled or leaked material and mitigate any resulting impacts as soon as the spill or leak is detected. If the spill or leak results in an "environmental emergency" as defined in this Approval, the Approval Holder shall report the event in accordance with the Emergency Reporting section of this Approval. If the spill or leak is not an "environmental emergency", the Approval Holder shall follow the approved Accidental Spill Procedure for recording and reporting a small spill.

30. In the event the Approval Holder violates any Term and Condition of this Approval, the *Air Quality Regulation* or the *Water Quality Regulation*, the Approval Holder is to immediately report this violation by facsimile to the Department's applicable Regional Office and the Central Office in Fredericton at **(506) 457-7805.** In the event the violation may cause the health or safety of the general public to be at risk and/or significant harm to the environment could or has resulted, the Approval Holder shall follow the Emergency Reporting procedures contained in this Approval.

31. In the event the Approval Holder receives a complaint from the public regarding unfavourable environmental impacts associated with the Facility, the Approval Holder is to report this complaint by facsimile to the Department's applicable Regional Office within one business day of receiving the complaint.

32. **By January 31 of each year**, the Approval Holder shall submit to the Department an **Annual Environmental Report** which includes as a minimum the following:

a) the annual amount and type of fuel oil used at the Facility in litres for the previous year;

b) the sulphur content of the fuels used in a);

c) a calculation of the total sulphur dioxide being emitted from the Facility in tonnes per year, based on the fuel consumption and sulphur content provided in a) and b);

d) a summary of any reportable upset conditions and/or spills that occurred during the previous year.

33. **Prior to February 10, 2016**, the Approval Holder shall submit a report pertaining on source testing activities in accordance with Condition 27. Reporting shall be in accordance with the Department's *Code of Practice for Source Testing,* or latest revision.

Prepared by: _____

Sheryl Johnstone, P.Eng.

Industrial Approvals Engineer, Industrial Processes

APPENDIX B

PTP and Approval Email

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

Stantec Consulting Ltd.
845 Prospect Street, Fredericton NB E3B 2T7

File No.: 121811606
September 30, 2015

Attention: Ms. Sheryl Johnstone, P.Eng.
New Brunswick Department of the Environment & Local Government
PO Box 6000, 20 McGloin Street, Marysville Place
Fredericton, NB E3B 5H1

RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC. MCADAM GYPSUM WALLBOARD PLANT MCADAM, NB (COA NO. I-8150)

Dear Ms. Johnstone:

Please accept this Pre-Test Plan submitted on behalf of CertainTeed Gypsum Canada Inc. for the source testing of emissions from the exhaust stacks of their gypsum wallboard plant located in McAdam, New Brunswick.

INTRODUCTION

Stantec Limited has been retained by CertainTeed Gypsum Canada Inc. (CertainTeed) to conduct source emissions testing at the exhaust stacks of its gypsum wallboard plant in McAdam, New Brunswick, as required under the Certificate of Approval to Operate (# I-8150) issued to CertainTeed by the New Brunswick Department of the Environment and Local Government (NBDELG) under the *Air Quality Regulation*. The source emissions testing campaign will be performed according to conditions stipulated in the Certificate of Approval to Operate, Part III of the *Air Quality Regulation 97-133* and the NBDELG *Guidance Document for Source Testing*.

The testing will be performed to determine the concentrations and emissions rates of the following parameters from the calcine mill stack, the rock mill stack, and the Zone 1 and Zone 2 dryer stacks:

- particulate matter (PM);
- carbon monoxide (CO);
- nitrogen oxides (NO_x);
- sulphur dioxide (SO_2);
- oxygen (O_2); and
- carbon dioxide (CO_2).

TEST PROGRAM ORGANIZATION

The source emissions testing program will be performed for:

Company Name:	CertainTeed Gypsum Canada Inc.
Company Address:	57 Quality Way, McAdam, NB, E6J 1B1
Plant Location:	McAdam, NB
Contact Name:	Ms. Agata Sulkiewicz
Position:	Quality and Environmental Manager
Telephone Number:	(506) 784-1224
Fax Number:	(506) 784-3204

**RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC.
MCADAM GYPSUM WALLBOARD PLANT, MCADAM, NB (COA NO. I-8150)**

The source emissions testing program will be performed by:

Sampling Company:	Stantec Consulting Ltd.
Project Co-ordinator:	Tristan Blair-Hicks, EIT.
Telephone No.:	(506) 457-3217
Fax No.:	(506) 452-0112
Email:	tblairhicks@stantec.com
Sampling Team:	See "qualifications of source testing team"

Source Description

The source emissions testing will be conducted on the exhaust stacks of the calcine mill, the rock dryer, and the Zone 1 and Zone 2 Dryers. The following is a brief description of the plant and the sources.

- **Gypsum Plant:** The facility is a gypsum wallboard plant with a production capacity of 23 million square metres of gypsum wallboard. The plant transforms gypsum rock to wallboard in a process of grinding and drying the rock, calcination, extruding and forming into boards and then drying.

- **Calcine Mill Stack:** The calcine mill burner burns natural gas or No. 2 fuel oil and hot combustion gases from the process are exhausted through a circular, vertical stack that measured 0.9 metres in diameter and is equipped with 2 sample ports.

- **Rock Dryer Stack:** The rock dryer burns No. 2 Fuel oil and hot combustion gases from the process are exhausted through a circular, vertical stack that measures 0.9 metres in diameter and is equipped with 2 sample ports.

- **Zone 1 and Zone 2 Dryer Stacks:** The Zone 1 and Zone 2 dryers burn natural gas or No. 2 fuel oil and hot combustion gases from the process are exhausted through circular, vertical stacks that measure 1.22 metres in diameter and are equipped with 2 sample ports.

Source Emissions Testing Program

Source emissions testing will be completed for CertainTeed to determine the concentrations and emission rates of particulate matter and combustion gases from the exhaust stack of the calcine mill stack, the rock mill stack, and the Zone 1 and Zone 2 dryer stacks. Emissions testing will be conducted while the facility is operated under normal conditions.

A brief description of each of the source emissions testing reference methods is provided below. Three (3) tests will be conducted for each contaminant in accordance with the applicable source emissions testing reference methods, Part III of the New Brunswick *Air Quality Regulation* 97-133 under the *Clean Air Act,* and the NBDELG *Guidance Document for Source Testing*.

**RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC.
MCADAM GYPSUM WALLBOARD PLANT, MCADAM, NB (COA NO. I-8150)**

Table 1 Source Emissions Testing Matrix – Certainteed Gypsum

Source	Contaminant	No. of Tests	Sampling Protocol
Calcine mill stack, rock mill stack, zone 1 and zone 2 dryer stacks (4 Sources)	Velocity Traverse/Flowrate	3	EPS 1/RM/8, Method B
	Molecular Weight	3	EPS 1/RM/8, Method C
	Moisture Content	3	EPS 1/RM/8, Method D
	Total Particulate Matter (PM)	3	EPS 1/RM/8, Methods B to E
	Oxygen (O_2)	3	EPS 1/RM/15
	Carbon Dioxide (CO_2)	3	EPS 1/RM/15
	Sulphur Dioxide (SO_2)	3	EPS 1/RM/15
	Nitrogen Oxides (NO_x)	3	EPS 1/RM/15
	Carbon Monoxide (CO)	3	EPS 1/RM/15

Preliminary Survey and Sample Location Details

Upon arrival at the stack sampling location, Stantec will set up the source testing equipment and conduct a preliminary survey to measure the average velocity, moisture content, and flue gas composition in the stack. The data from this survey will be used to determine the appropriate nozzle size to conduct isokinetic sampling (where the velocity of the gas entering the nozzle is equal to the gas velocity in the stack) for particulate matter during the testing.

Verification for cyclonic or reverse flow will also be conducted during the preliminary survey, according to procedures outlined in the Environment Canada reference method EPS 1/RM/8. In the event that cyclonic, reverse flow, or the fluctuations in the velocity pressure at any traverse point exceed 20% of the average pressure for that point, the NBDELG will be consulted on whether deviations from the standard methods are warranted to complete the testing campaign. If reverse flow conditions are present as determined during the preliminary survey, Stantec proposes that sampling be conducted only at points having positive flow conditions, with sampling time per point adjusted accordingly.

The number and location of sample points along each traverse will be determined according to EPS 1/RM/8, Method A, using the exhaust stack dimensions. The sample location details are summarized in Table 2. These sampling locations will be confirmed upon arrival at the site, and included in the final report.

Table 2 Sample Location Details - Certainteed Gypsum

Parameter	Calcine Mill	Rock Mill	Zone 1 Dryer	Zone 2 Dryer
Stack Height - Above Grade (m)	21	21	6.7	6.7
Stack/Duct Description	circular, vertical	circular, vertical	circular, vertical	circular, vertical
Diameter (m)	0.9	0.9	1.22	1.22
Number of Ports	2	2	2	2
Sample Port Configuration	2 @ 90°	2 @ 90°	2 @ 90°	2 @ 90°
Sample Port Diameters (m)	0.1	0.1	0.1	0.1

**RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC.
MCADAM GYPSUM WALLBOARD PLANT, MCADAM, NB (COA NO. I-8150)**

Table 2 Sample Location Details - Certainteed Gypsum

Parameter	Calcine Mill	Rock Mill	Zone 1 Dryer	Zone 2 Dryer
Location Upstream from any Disturbance, Dimension A from Figure 2 (Number of Stack Diameters)	<2	<2	<2	<2
Location Downstream from any Disturbance, Dimension B from Figure 2 (Number of Stack Diameters)	<8	<8	<8	<8
Ideal or Non Ideal[1]	non-ideal[1]	non-ideal[1]	non-ideal[1]	non-ideal[1]
Total Number of Sample Points	24	24	24	24
Number of Sample Points per Traverse for PM	12	12	12	12
Sample Time per Point for PM (min)	4	4	4	4
Total Sample Time per Test for PM (min)	96 min	96 min	96 min	96 min
Total Sample Time for Combustion Gases	30 min	30 min	30 min	30 min

Notes:
[1] The exhaust gas flow characteristics at the sampling location are referred to as being "Ideal" if the sample ports are located in a straight section of stack at least 8 stack diameters downstream and two stack diameters upstream of any flow disturbance.

Source Emissions Testing

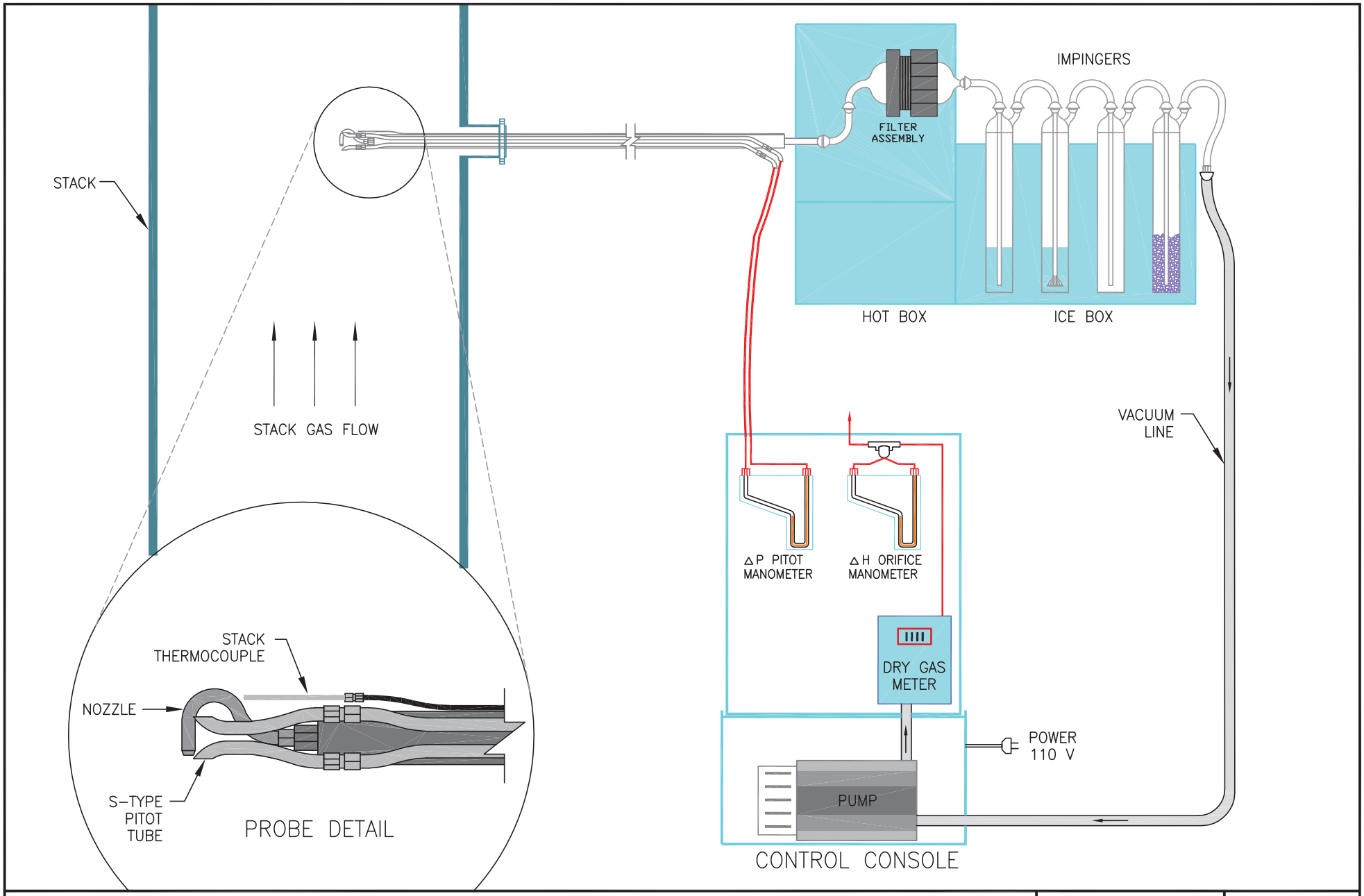
Source emissions testing on the plant exhaust stack will be conducted with the plant operating at a consistent load in accordance with the source testing reference method EPS 1/RM/8 for particulate matter. Combustion gas emissions will be measured in accordance with the Environment Canada reference method EPS 1/RM/15. Three repetitions of each test method will be completed for each of the sources to be tested, in accordance with the regulatory requirements for compliance source emissions testing.

Particulate Matter Testing

The source emissions testing for total suspended particulate matter will be conducted in accordance with the Environment Canada reference method EPS 1/RM/8, entitled "Measurement of Releases of Particulate from Stationary Sources".

The particulate sampling train, used specifically for isokinetic sampling, is described in detail in EPS 1/RM/8, and is generally referred to as the "Method 5" sampling train for particulate matter (after the US EPA protocol). The sampling train has several different components which include: a heated sampling probe (a nozzle, stainless steel liner, thermocouple, and pitot tube assembly), a heated sample case containing a filter, an ice box containing impinger glassware, and an umbilical cord leading to the pump, and control console. The operation and accuracy of the dry gas meter will be checked before and after the testing is completed. A schematic of the sampling system is shown Figure 1. Figure 2 shows the sampling point locations for isokinetic sampling.

FILE: STANDARD1



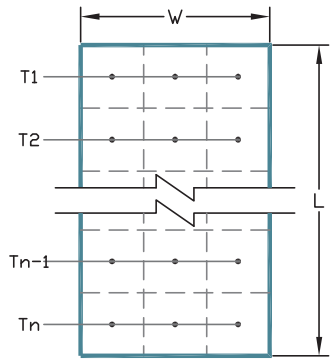
Stantec

SOURCE EMISSIONS TESTING
METHOD 5 SAMPLING TRAIN

Scale: N.T.S.

Fig. No.: 1

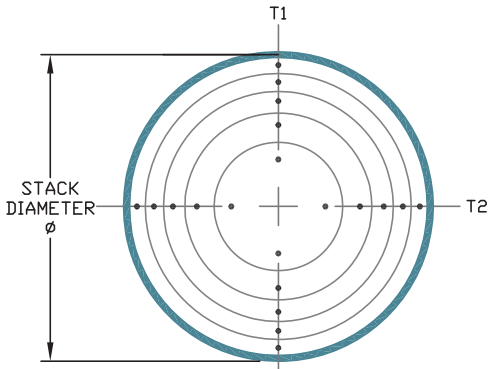
FILE: STANDARD2c



EQUIVALENT DIAMETER = $\frac{2LW}{(L+W)}$

TYPICAL RECTANGULAR STACK SECTION
TRAVERSE POINT LOCATIONS

Tn = n TRAVERSES AS DETERMINED BY EPS 1/RM/8 METHOD A

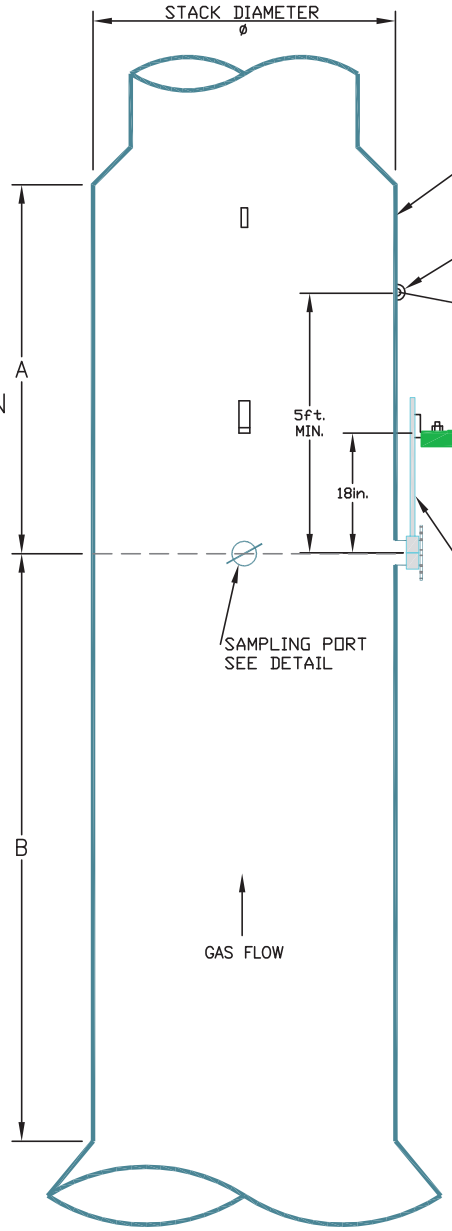


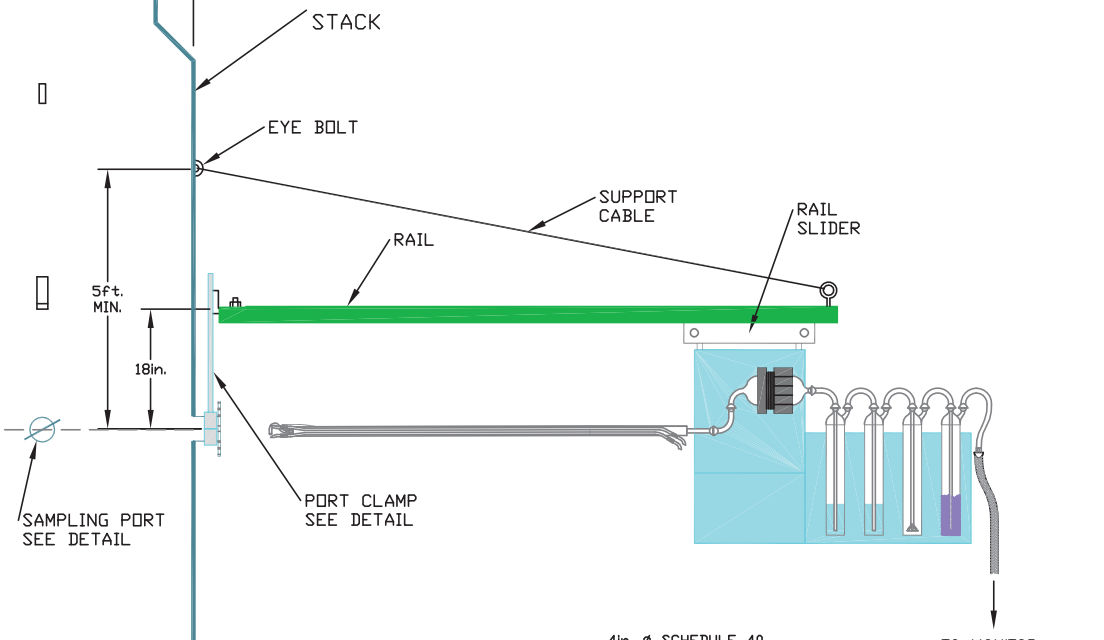
TYPICAL CIRCULAR STACK SECTION
TRAVERSE POINT LOCATIONS

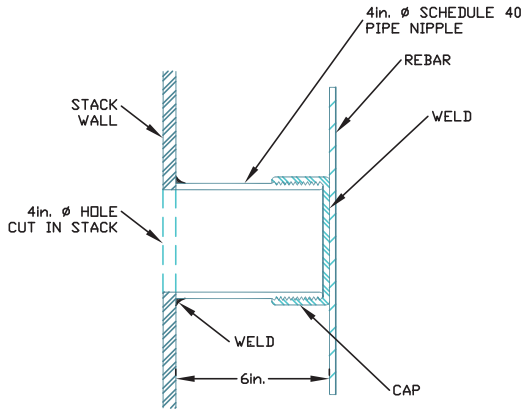
T1 – TRAVERSE 1
T2 – TRAVERSE 2

DISTANCE TO NEAREST FLOW DISTURBANCE

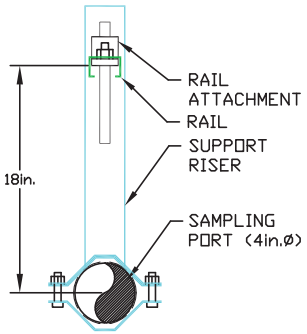
A – DOWNSTREAM (IDEAL ≥ 2ø)
B – UPSTREAM (IDEAL ≥ 8ø)







SAMPLING PORT DETAIL



PORT CLAMP DETAIL

Stantec

SOURCE EMISSIONS TESTING
SAMPLE LOCATION DETAIL

Scale: N.T.S.

Fig. No.: 2

**RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC.
MCADAM GYPSUM WALLBOARD PLANT, MCADAM, NB (COA NO. I-8150)**

Theoretically, particulate matter greater than 0.3 µm in diameter will be captured in the front half of the sampling train and on the filter. Any particulate matter or vapour mist less than 0.3 µm in diameter will pass through the filter and be deposited in the impingers (i.e., the back half of the train). The amount of material caught in the impingers will be determined gravimetrically and reported separately from the calculated total particulate matter emissions. All particulate matter samples will be recovered and analyzed at our laboratory in Fredericton, New Brunswick.

Three replicate tests will be conducted for each source for particulate matter, in accordance with the requirements of the *Air Quality Regulation*.

Combustion Gases (oxygen, carbon dioxide, sulphur dioxide, nitrogen oxides, and carbon monoxide)

The combustion gases will be sampled according to the Environment Canada reference method EPS 1/RM/15, entitled "Reference Method for the Monitoring of Gaseous Emissions from Fossil Fuel-fired Boilers". In this method, samples of flue gas are drawn through a probe, non-isokinetically, from a single point near the centre of the stack. A Testo 350 XL Flue Gas Analyzer, manufactured by Testo GmbH and Co., will be used to conduct the sampling. The Testo 350 XL Flue Gas Analyzer is manufactured and calibrated to ensure high accuracy. Calibration data will be included with the final report.

REPORTING

Actual emissions will be reported in mg/m^3 and kg/hr at reference conditions of 25 °C and 101.3 kPa. The concentrations will be corrected to appropriate conditions for comparison with the limits documented in the Approval to Operate No. I-8150.

Results of the source emissions testing will be documented in the final report for submission to NBDELG for review and approval.

QUALITY ASSURANCE AND QUALITY CONTROL

Throughout the stack testing program, quality assurance and quality control procedures will be applied to ensure the collection of reliable, representative, and reproducible emissions data. All equipment will be calibrated according to the protocols and schedule as prescribed by the New Brunswick Department of Environment (NBDELG), Environment Canada, and the US EPA. These calibrations include, but are not limited to the following:

- **Pitots:** calibrated in a wind tunnel with probe and nozzles attached.
- **Gas Meters:** calibrated using a standard set of critical orifices.
- **Thermocouples:** calibrated using a potentiometric technique.
- **Nozzle:** four diameter measurements made using a micrometer across sharpened edges.
- **Gas Analyzers:** The analyzers are calibrated using standard calibration gases meeting the USEPA "Protocol 1" method specifications.

Calibration data for all equipment will be provided in the final report.

Quality control checks will be performed at several stages during the testing program to ensure the collection of representative samples and the generation of valid results. These checks are performed

**RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC.
MCADAM GYPSUM WALLBOARD PLANT, MCADAM, NB (COA NO. I-8150)**

by test personnel throughout the program under the guidance of the source testing crew chief. The Quality Control (QC) checks include, but are not limited to the following:

- use of standardized checklists and field notebooks to confirm completeness, traceability, and comparability of the process information and samples collected;
- field checking of standardized forms by a second person to confirm accuracy and completeness;
- adherence to sample chain-of-custody procedures;
- use of appropriate field blanks (e.g., filter and solution samples); and
- leak checks of sample trains.

QUALIFICATIONS OF SOURCE TESTING TEAM

The successful completion of the project requires the skills of competent and experienced professionals who have a strong commitment to finish the project quickly and efficiently. The source testing team we have assembled to meet the challenges of this assignment consists of highly trained professionals who bring a broad range of expertise and experience to the project. The following paragraphs provide brief descriptions of the qualifications of the source emissions testing team.

Project Management

Mr. Tristan Blair-Hicks, EIT, has a degree in mechanical engineering and joined the Stantec air quality team in the summer of 2011. He has led a number of emissions testing campaigns including for particulate matter, particle size distribution, volatile organics and combustion gases. Tristan has experience testing boilers, asphalt plants and refinery process units. Tristan will coordinate the project, and will also aid in conducting on-site testing work, data analysis and reporting, as required.

Senior Review

Ms. Vicki Corning, P.Eng., will be the quality reviewer for the emissions testing campaign. Ms. Corning has a degree in chemical engineering and 10 years of technical and management expertise in many environmental services including: source emissions testing (particulate matter, gases, volatile organic compounds, chlorine compounds, reduced sulphur compounds, metals, dioxins and furans, relative accuracy test audits) regulatory activities (environmental impact assessments, responses to technical review committees, environmental protection plans, environmental monitoring plans, Alberta Greenhouse Gas Baseline and Compliance Application Verifications, Alberta NO_X and SO_2 Credit Application Verifications); ambient air quality monitoring; emissions inventories; pollutant dispersion modelling (AERMOD, ISC); ambient sound quality assessments; noise attenuation modelling; landfill gas testing and utilization; and National Pollutant Reporting Inventory preparation. Ms. Corning has experience in public and stakeholder relations, having participated in several open houses as an air and sound quality specialist on projects undergoing environmental assessment.

Ms. Corning has worked with clients in a variety of different industries in Canada and the US including: gas processing plants, oil refineries, pipeline operations, electrical generating stations (coal, gas, co-generation), manufacturing plants, construction projects, and pulp mills.

**RE: PRE-TEST PLAN FOR CERTAINTEED GYPSUM CANADA INC.
MCADAM GYPSUM WALLBOARD PLANT, MCADAM, NB (COA NO. I-8150)**

Source Testing Team

Mr. Nick MacDonald, P.Tech. - graduated from NBCC Moncton, since graduation Mr. MacDonald has worked in environmental engineering, specializing in source emissions testing since 2007. Mr. MacDonald has been involved with over 100 source testing projects including testing for total particulate matter, combustion gases (including RATAs), metals, PAHs, dioxins and furans and particle size distribution (PM_{10}, $PM_{2.5}$). Mr. MacDonald is Stantec's field team leader and is responsible for maintenance and calibration of the Stantec source testing equipment. He will act as the source testing crew chief onsite.

Mr. Josh Babin, P.Tech. - graduated from NBCC Moncton in 2013 in Civil Engineering Technology: Building System Services. He joined Stantec's engineering department in Fredericton after graduation and supported design & drafting for various industrial clients from the Forestry/Pulp & Paper, Food & Beverage, and Power Generation sectors. He is a recent addition to the emissions testing team, bringing with him his experience with mechanical systems design and drafting. He has assisted on several testing campaigns under the guidance of our experienced technicians and engineers, for a variety of compounds including those covered by this pre-test plan. Josh would assist in completion of the onsite testing, data entry, and reporting.

Other Stantec staff may be used to support the team in completion of the work as required.

SCHEDULE

Testing is tentatively scheduled to be conducted the weeks of October 19 and October 26, to be confirmed based on plant operation and weather permitting. It is anticipated that the on-site source emissions testing will require two weeks on-site for a two person team.

CLOSURE

Stantec would appreciate your timely review and written approval of the Pre-Test Plan at your convenience. If you have any questions, please do not hesitate to contact me directly.

Sincerely,

STANTEC CONSULTING LTD.

Tristan Blair-Hicks, EIT
Project Manager
Tel: (506) 452-7000
Fax: (506) 452-0112
Tristan.Blair-Hicks@Stantec.com

Vicki Corning, P.Eng.
Technical Quality Reviewer
Tel: (506) 452-7000
Fax: (506) 452-0112
Vicki.Corning@Stantec.com

cc' Agata Sulkiewicz, CertainTeed Gypsum Canada Inc.

Blair-Hicks, Tristan

From: Johnstone, Sheryl (ELG/EGL) <Sheryl.Johnstone@gnb.ca>
Sent: Thursday, October 01, 2015 2:58 PM
To: Blair-Hicks, Tristan
Cc: Corning, Vicki
Subject: RE: Pre-test plan for source testing at Certainteed Gypsum in MacAdam, NB

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Blue Category

Tristan,

The pre-test plan is approved, thanks.

Sheryl Johnstone, P.Eng
Industrial Approvals Engineer
Impact Management
Department of Environment & Local Government

Tel (506) 453-3824
Fax (506) 457-7805
sheryl.johnstone@gnb.ca

From: Blair-Hicks, Tristan [mailto:Tristan.Blair-Hicks@stantec.com]
Sent: Wednesday, September 30, 2015 4:55 PM
To: Johnstone, Sheryl (ELG/EGL)
Cc: Corning, Vicki
Subject: Pre-test plan for source testing at Certainteed Gypsum in MacAdam, NB

Hi Sheryl,
Here is the pre-test plan for the gypsum plant run by Certainteed located in MacAdam, NB and operated under the CoA No. I-8150. The testing is scheduled for the weeks of October 19 and October 26. I apologize for the delay in submitted the pre-test plan, I hope this will not be an issue as it states in their approval that it needs to be submitted 4 weeks in advance. Please feel free to contact me if you have any questions.

Tristan Blair-Hicks
Air Quality Engineer In Training
Stantec
845 Prospect Street Fredericton NB E3B 2T7
Phone: (506) 452-7000
Cell: (506) 461-6586
Fax: (506) 452-0112
Tristan.Blair-Hicks@stantec.com

December 16, 2015

APPENDIX C

Calibration Data

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

VALLEY ENVIRONMENTAL CALIBRATION SERVICES

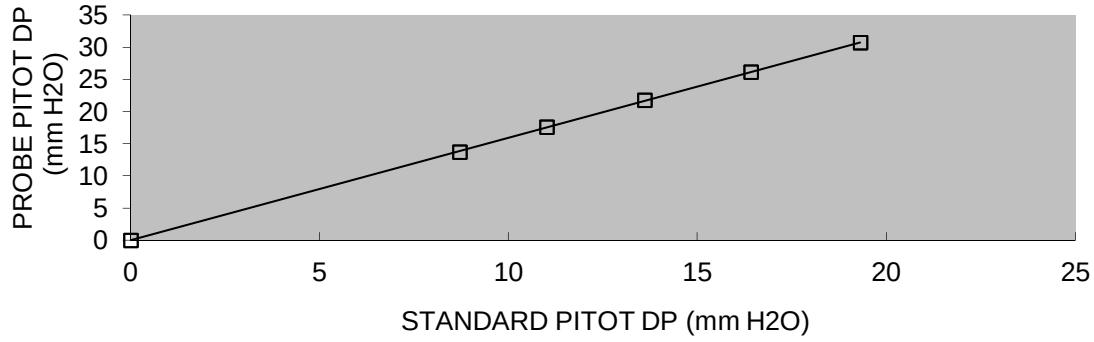
PITOT TUBE CALIBRATION REPORT

CLIENT - **Stantec**
PROBE ID - **3FT M5**
NOZZLE - **#8- 0.250"**
DATE - **Februaury 24, 2015**

FAN SPEED m/s	STANDARD PITOT (mm H2O)	PROBE PITOT (mm H2O)
0.00	0.00	0.00
12.1	8.70	13.80
13.7	11.00	17.70
15.2	13.60	21.80
16.7	16.40	26.20
18.1	19.30	30.80

PITOT FACTOR Cp = **0.791**

PITOT - 3FT M5 NOZZLE - #8- 0.250"
Februaury 24, 2015



Technician: T. Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES
160 Pony Drive #1
Newmarket, Ontario L3Y 7B6
PH: (905) 830 0136
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot Cp	0.999
Static	-0.25
Barometric	28.7
Temperature	65
Abs Static	28.68

VALLEY ENVIRONMENTAL CALIBRATION SERVICES

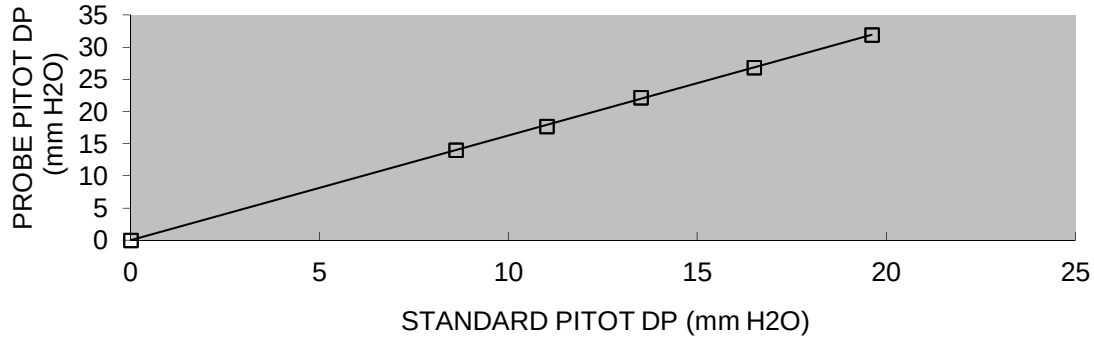
PITOT TUBE CALIBRATION REPORT

CLIENT - **Stantec**
PROBE ID - **3FT M5**
NOZZLE - **#10- 0.3125"**
DATE - **Februaury 24, 2015**

FAN SPEED m/s	STANDARD PITOT (mm H2O)	PROBE PITOT (mm H2O)
0.00	0.00	0.00
12.1	8.60	14.10
13.7	11.00	17.80
15.1	13.50	22.20
16.7	16.50	26.90
18.2	19.60	32.00

PITOT FACTOR Cp = **0.783**

PITOT - **3FT M5** **NOZZLE -** **#10- 0.3125"**
Februaury 24, 2015



Technician: T. Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES
160 Pony Drive #1
Newmarket, Ontario L3Y 7B6
PH: (905) 830 0136
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot Cp	0.999
Static	-0.25
Barometric	28.7
Temperature	65
Abs Static	28.68

VALLEY ENVIRONMENTAL CALIBRATION SERVICES

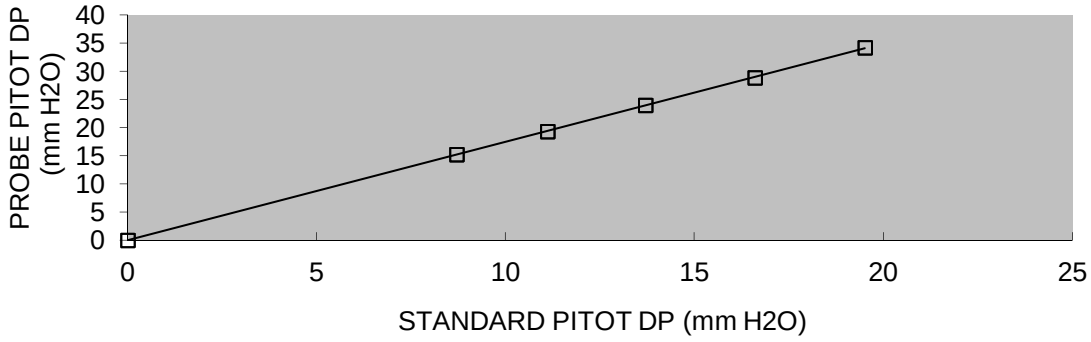
PITOT TUBE CALIBRATION REPORT

CLIENT - **Stantec**
PROBE ID - **4FT M5**
NOZZLE - **#10- 0.3125"**
DATE - **February 23, 2015**

FAN SPEED m/s	STANDARD PITOT (mm H2O)	PROBE PITOT (mm H2O)
0.00	0.00	0.00
12.1	8.70	15.30
13.6	11.10	19.40
15.1	13.70	24.00
16.6	16.60	28.90
18.0	19.50	34.30

PITOT FACTOR Cp = **0.756**

PITOT - 4FT M5 NOZZLE - #10- 0.3125"
February 23, 2015



Technician: T. Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES
160 Pony Drive #1
Newmarket, Ontario L3Y 7B6
PH: (905) 830 0136
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot Cp	0.999
Static	-0.25
Barometric	29.15
Temperature	65
Abs Static	29.13

VALLEY ENVIRONMENTAL CALIBRATION SERVICES

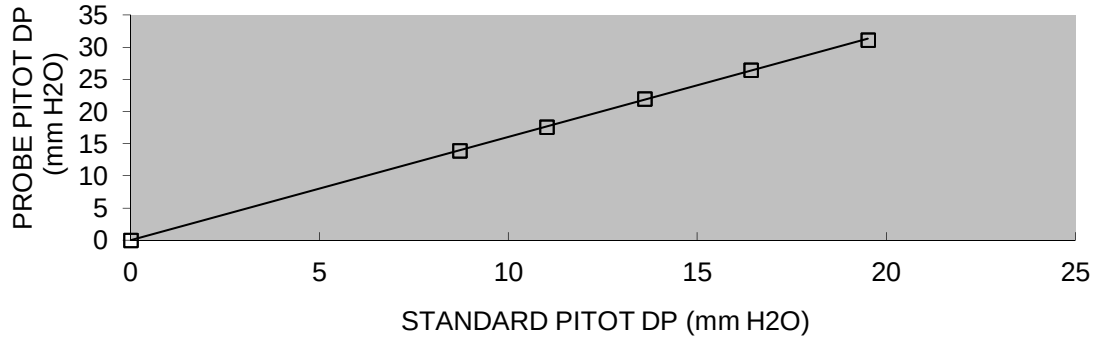
PITOT TUBE CALIBRATION REPORT

CLIENT - **Stantec**
PROBE ID - **6FT M5**
NOZZLE - **#10- 0.3125"**
DATE - **February 25, 2015**

FAN SPEED m/s	STANDARD PITOT (mm H2O)	PROBE PITOT (mm H2O)
0.00	0.00	0.00
12.1	8.70	14.00
13.7	11.00	17.70
15.2	13.60	22.00
16.7	16.40	26.50
18.2	19.50	31.20

PITOT FACTOR Cp = **0.788**

PITOT - 6FT M5 NOZZLE - #10- 0.3125"
February 25, 2015



Technician: T. Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES
160 Pony Drive #1
Newmarket, Ontario L3Y 7B6
PH: (905) 830 0136
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot Cp	0.999
Static	-0.25
Barometric	28.7
Temperature	65
Abs Static	28.68

Pre-Test Dry Gas Meter - Control Unit Calibration

Date : 10/20/2015
Barometric Pressure, Pb : 30
Model Number : 1848
Calibrated By : TBH
Job #: 121899000

Orifice Manometer Setting, deltaH (in. H2O)				Dry Gas Meter Volume, Vm (cu.ft)			Temperatures (F)				Time, theta (min)
								Dry Gas Meter			
						Total			Outlet, to	Average, tm	
0.8						5.552			71	71	10
1.2						5.432			70	70	8
2.0						5.872			70	71	7

Calculations

Orifice Manometer Setting, deltaH (in. H2O)	Dry Gas Correction Factor, gamma (Tolerance = 0.95 - 1.05, +/-1.5% of avg)	Orifice Pressure Differential (delta H@) yielding 0.75 cfm of air at 68F and 29.92 in.Hg as in. H2O (Tolerance = +/- 0.15 in.)	Orifice Coefficient Ko
0.8	0.976	1.516	0.779
1.2	0.971	1.553	0.773
2.0	0.973	1.687	0.740
Average	**0.974**	**1.585**	**0.764**

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

DATE: 10/10/2015 | METER SERIAL #: 14108776 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.97, FINAL 29.91, AVG (P_{bar}) 29.94

METER PART #: 1848 | CRITICAL ORIFICE SET SERIAL #: 1463s

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
15	1	0.4164	18	19.64	25.28	5.640	70	71	70	72	71	71	10.00	0.79	5.6238	5.4169	0.963		1.51
	2	0.4164	18	25.28	30.79	5.505	72	70	70	71	71	70.5	10.00	0.79	5.4944	5.4067	0.984		1.52
	3	0.4164	18	30.79	36.30	5.510	73	70	70	71	70	70.25	10.00	0.79	5.5020	5.4016	0.982		1.52
																AVG =	0.976	0.28	
18	1	0.5085	18	56.76	62.21	5.450	74	70	71	70	70	70.25	8.00	1.20	5.4475	5.2722	0.968		1.55
	2	0.5085	18	62.21	67.65	5.440	73	71	71	70	70	70.5	8.00	1.20	5.4350	5.2771	0.971		1.55
	3	0.5085	18	67.65	73.06	5.405	75	71	71	70	70	70.5	8.00	1.20	5.40	5.2672	0.975		1.56
																AVG =	0.971	-0.23	
23	1	0.6307	16.5	73.06	78.91	5.855	75	71	71	70	70	70.5	7.00	2.00	5.8610	5.7164	0.975		1.69
	2	0.6307	16.5	78.91	84.81	5.90	75	71	71	70	70	70.5	7.00	2.00	5.9061	5.7164	0.968		1.69
	3	0.6307	16.5	87.11	92.97	5.860	73	71	71	70	70	70.5	7.00	2.00	5.8660	5.7271	0.976		1.68
																AVG =	0.973	-0.05	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.974

AVERAGE $\Delta H_@$ = 1.59

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$\Delta H_@ = \left(\frac{0.75\,\theta}{V_{cr(std)}}\right)^2 \Delta H \left(\frac{V_{m(std)}}{V_m}\right)$$

Pre-Test Dry Gas Meter - Control Unit Calibration

Date : 6/29/2015
Barometric Pressure, Pb : 29.7
Model Number : 1646
Calibrated By : JJB
Job #:

Orifice Manometer Setting, deltaH (in. H2O)				Dry Gas Meter Volume, Vm (cu.ft)			Temperatures (F)				Time, theta (min)
								Dry Gas Meter			
						Total			Outlet, to	Average, tm	
0.9						5.430			64	65	10
1.5						5.353			66	66	8
2.3						5.803			67	67	7

Calculations

Orifice Manometer Setting, deltaH (in. H2O)	Dry Gas Correction Factor, gamma (Tolerance = 0.95 - 1.05, +/-1.5% of avg)	Orifice Pressure Differential (delta H@) yielding 0.75 cfm of air at 68F and 29.92 in.Hg as in. H2O (Tolerance = +/- 0.15 in.)	Orifice Coefficient Ko
0.9	1.039	1.590	0.758
1.5	1.030	1.776	0.723
2.3	1.032	1.770	0.723
Average	**1.033**	**1.712**	**0.734**

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the **GREEN** cells, YELLOW cells are calculated.

DATE:	6/29/2015	METER SERIAL #:	17485069	BAROMETRIC PRESSURE (in Hg):	INITIAL 29.7	FINAL 29.7	AVG (P_{bar}) 29.7
METER PART #:	1646	CRITICAL ORIFICE SET SERIAL #:	1463s				

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
15	1	0.4164	18	983.61	989.03	5.420	20.2	63	66	63	64	64	10.00	0.90	5.4343	5.6454	1.039		1.59
	2	0.4164	18	989.03	994.47	5.440	20.4	66	66	64	65	65.25	10.00	0.90	5.4414	5.6442	1.037		1.59
	3	0.4164	18	994.47	999.90	5.430	20.5	66	66	65	65	65.5	10.00	0.90	5.4288	5.6437	1.040		1.59
																AVG =	1.039	0.51	
18	1	0.5085	17	999.90	1,005.25	5.350	20.5	66	67	65	65	65.75	8.00	1.50	5.3542	5.5135	1.030		1.78
	2	0.5085	17	1,005.25	1,010.61	5.360	20.5	67	67	65	66	66.25	8.00	1.50	5.3591	5.5135	1.029		1.78
	3	0.5085	17	1,010.61	1,015.96	5.350	20.5	67	67	66	66	66.5	8.00	1.50	5.3466	5.5135	1.031		1.78
																AVG =	1.030	-0.33	
23	1	0.6307	16	1,015.96	1,021.77	5.810	20.5	67	68	66	67	67	7.00	2.30	5.8122	5.9837	1.030		1.77
	2	0.6307	16	1,021.77	1,027.56	5.790	20.5	68	69	67	66	67.5	7.00	2.30	5.7867	5.9837	1.034		1.77
	3	0.6307	16	1,027.56	1,033.37	5.810	20.5	69	69	66	67	67.75	7.00	2.30	5.8040	5.9837	1.031		1.77
																AVG =	1.032	-0.18	

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.033

AVERAGE $\Delta H_@$ = 1.71

(1) $$Vm_{(std)} = K_1 * Vm * \frac{Pbar + (\Delta H / 13.6)}{Tm}$$

= Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' * \frac{Pbar * \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$\Delta H_@ = \left(\frac{0.75\,\theta}{V_{cr(std)}}\right)^2 \Delta H \left(\frac{V_{m(std)}}{V_m}\right)$$

Probe Stack Thermocouple Calibration

Calibration Date: 19-Mar-15

Calibrated By: NGM, JJB

Reference ID Fisher Scientific catalog #150414E

Ice Bath

Thermocouple #	Reference Temp (F)	Observed Temp (F)	Percent Difference (Absolute Temp)
#1 -2' probe	32	32.3	-0.06%
#1 -3' probe	32	32.1	-0.02%
#1 -4' probe	32	33.7	-0.34%
#1 -5' probe	32	33.1	-0.22%
#1 - 6' probe	32	32.5	-0.10%
#1 - 8'-1 probe	32	32.7	-0.14%
#1 -8'-2 probe	32	32.6	-0.12%
#1 -10'-1 probe	32	33	-0.20%
#1 -10'-2 probe	32	33	-0.20%
#6 -1848	32		
#7 -1848	32		
#6 -1646	32		
#7 -1646	32		

Boiling Water

Thermocouple #	Reference Temp (F)	Observed Temp (F)	Percent Difference (Absolute Temp)
#1 -2' probe	202	206.7	-0.70%
#1 -3' probe	201	208.7	-1.15%
#1 -4' probe	203	201.6	0.21%
#1 -5' probe	203	206.3	-0.50%
#1 - 6' probe	202	203.3	-0.20%
#1 - 8'-1 probe	203	204.5	-0.23%
#1 -8'-2 probe	202	202.3	-0.05%
#1 -10'-1 probe	200	212.1	-1.80%
#1 -10'-2 probe	202	210.3	-1.24%
#6 -1848	202		
#7 -1848	203		
#6 -1646	203		
#7 -1646	201		

Error should be < 1.5%

CAL-CHEK CANADA

250 GOVERNOR'S ROAD - DUNDAS, ONTARIO L9H 3K3
TELEPHONE: (905) 628-4636 FAX: (905) 627-5903
email calchek@cogeco.ca

Scale / Balance Certification

Date: February 9, 2015

Certificate Number: S150165

Customer: Stantec Consulting Ltd.
845 Prospect Street
Fredericton, New Brunswick E3B 2T7

Room Temperature: 20.1°C

Calibration Location: 10 Timothy Road North Kingsclear Lab

Scale / Balance Manufacturer: Radwag

Resolution: 0.0001g

Model Number: XA220-2X

Serial Number: 336271

Capacity: 220 g

Capacity Calibrated To: 220 g

ACTUAL WEIGHT APPLIED GRAMS	SCALE READINGS AS FOUND	ERROR AS FOUND	ACTUAL WEIGHT APPLIED GRAMS	SCALE READINGS AS LEFT	ERROR AS LEFT
0.0020	0.0020	0.0000	**0.0020**	0.0020	0.0000
0.0050	0.0050	0.0000	**0.0050**	0.0050	0.0000
0.0100	0.0100	0.0000	**0.0100**	0.0100	0.0000
0.0500	0.0500	0.0000	**0.0500**	0.0500	0.0000
0.1000	0.1000	0.0000	**0.1000**	0.1000	0.0000
0.5000	0.5001	-0.0001	**0.5000**	0.5000	0.0000
1.0000	0.9998	0.0002	**1.0000**	0.9999	0.0001
5.0000	4.9999	0.0001	**5.0000**	4.9990	0.0010
10.0000	10.0001	-0.0001	**10.0000**	10.0000	0.0000
20.0000	20.0016	-0.0016	**20.0000**	20.0009	-0.0009
50.0000	50.0030	-0.0030	**50.0000**	50.0020	-0.0020
100.0000	99.9982	0.0018	**100.0000**	99.9992	0.0008
200.0000	200.0134	-0.0134	**200.0000**	200.0027	-0.0027
220.0000	220.0170	-0.0170	**220.0000**	220.0110	-0.0110

The above mentioned Scale / Balance has been checked for accuracy using the following N.I.S.T. calibrated dead weights as per the CSA method.

STANDARD	CAL DATE	NIST LAB #
22XE	03/10/13	681/280058-10

Obtained results are within the manufacturer's stated accuracy and/or are within +/-0.01% or 1 division whichever is greater at any point of the calibrated range.

Pass/Fail statements are based on data from measurements made, procedures utilized, professional experience and the uncertainty associated with this calibration. It is the responsibility of the user of this equipment to determine if the results identified meet specific requirements for its intended application.

Calibration Technician: Dave Newitt

Authorized Signatory: Roni Newitt

Suggested Calibration Due Date: February 2016

Due dates appearing on the certificate of calibration and label are determined by client for administrative purposes and do not imply continued conformance to specifications.

All calibrations performed at customer location unless otherwise noted.

Stantec Consulting Ltd.

Steel Nozzle Calibration Data Sheet

NozzleID	Nozzle Diameter (inches)					
Set - 1	<1>	<2>	<3>	<4>	Hi-Lo	**Avg.**
1-4	0.125	0.124	0.125	0.125	0.001	**0.125**
1-6	0.175	0.173	0.165	0.175	0.010	**0.172**
1-8	0.236	0.232	0.234	0.232	0.004	**0.234**
1-10	0.307	0.305	0.308	0.305	0.003	**0.306**
1-12	0.367	0.372	0.367	0.371	0.005	**0.369**
1-14	0.434	0.434	0.433	0.434	0.001	**0.434**
1-16	0.500	0.497	0.503	0.501	0.006	**0.500**

QA/QC Check

	Each Diameter Measured To Within = 0.001 Inches
	High - Low </= 0.004

Prepared By: JJB		Date: Feb 05, 2015

Stantec Consulting Ltd.

Steel Nozzle Calibration Data Sheet

NozzleID	Nozzle Diameter (inches)					
Set - 2	<1>	<2>	<3>	<4>	Hi-Lo	**Avg.**
2-4	0.124	0.126	0.125	0.127		**0.126**
2-6	0.177	0.174	0.176	0.173		**0.175**
2-8	0.245	0.249	0.231	0.244		**0.242**
2-10	0.306	0.306	0.304	0.302		**0.305**
2-12	0.359	0.363	0.365	0.361		**0.362**
2-14	0.432	0.430	0.432	0.433		**0.432**
2-16	0.493	0.500	0.497	0.492		**0.496**

QA/QC Check

	Each Diameter Measured To Within = 0.001 Inches
	High - Low </= 0.004

Prepared By: JB		Date: Feb 05, 2015

QRM ELECTRONICS

QRM Electronics Inc. calibration laboratory certifies that the described instrument has been presented for inspection and the tests as shown indicate that the work performed has been completed and that the standard used in obtaining data are calibrated regularly traceable to the **National Institute of Standards and Technology**

Date:	6/24/2015	Customer:	STANTEC
Control Number:	8309	Address:	845 PROSPECT ST. FREDERICTON, NEW BRUNSWICK E3B 2T7
Description:	350M/XL		
Serial Number:	00968835/404 – 00959384/404		

SUGGESTED RECALIBRATION DATE: 6/24/2016

Parameter: Combustion **Accuracy Statement: +/- 20 ppm or 5% of m.v.**

STANDARD	AS RECEIVED				AFTER CALIBRATION			
	PPM	°F	PASS/FAIL	NOTE	PPM	°F	PASS/FAIL	NOTE
O2 3.06 %	3.00 %	76.2	PASS		3.05 %	76.2	PASS	SR
CO 497 PPM	482 PPM	76.2	PASS		496 PPM	76.2	PASS	
NO 824 PPM	795 PPM	76.2	PASS		832 PPM	76.2	PASS	
NO2 96 PPM	94.1 PPM	76.2	PASS		97.0 PPM	76.2	PASS	
SO2 994.7 PPM	985 PPM	76.2	PASS		995 PPM	76.2	PASS	
HC 4980 PPM	4160 PPM	76.2	PASS		4990 PPM	76.2	PASS	

***NOTE: SR** = Sensor Replaced, **RNS** = Response Not Stable

Test Equipment
Transfer standards from:

Cylinder #	Gas	Concentration	Certification Date	Expiration Date
RA56616	CO / O2	996.9 PPM / 3.10 %	03/27/2014	03/27/2017
XF000167B	SO2	994.7 PPM	03/31/2014	03/31/2016
SV14124	NO2	96 PPM	04/09/2014	04/09/2016
SX34840	NO / CO2	824 PPM / 17 %	05/01/2014	05/01/2017
S970111A	CO / H2	497 PPM / 296 PPM	06/10/2014	06/10/2017
CC107025	NO	81.3 PPM	03/06/2015	03/06/2017
SX21602	CO / O2	99.2 PPM / 3.06 %	03/11/2015	03/11/2018

Calibrated at:
QRM Electronics Inc.
250 West Beaver Creek Rd.
Unit 15, Richmond Hill, ON
L4B 1C7

Phone: (905) 771 5009
Fax : (905) 771 6041

KYLE ANDERSON
Calibrated By

Authorized Signature

December 16, 2015

APPENDIX D

Sampling Locations

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

December 16, 2015

Sample Location Details - CertainTeed Gypsum

Parameter	Calcine Mill	Rock Mill	Zone 1 Dryer	Zone 2 Dryer
Stack Height - Above Grade (m)	21	21	6.7	6.7
Stack/Duct Description	circular, vertical	circular, vertical	circular, vertical	circular, vertical
Diameter (m)	0.9	0.9	1.22	1.22
Number of Ports	2	2	2	2
Sample Port Configuration	2 @ 90°	2 @ 90°	2 @ 90°	2 @ 90°
Sample Port Diameters (m)	0.1	0.1	0.1	0.1
Location Upstream from any Disturbance (Number of Stack Diameters)	<2	<2	<2	<2
Location Downstream from any Disturbance, (Number of Stack Diameters)	<8	<8	<8	<8
Ideal or Non Ideal[1]	non-ideal[1]	non-ideal[1]	non-ideal[1]	non-ideal[1]
Total Number of Sample Points	24	24	24	24
Number of Sample Points per Traverse for PM	12	12	12	12
Sample Time per Point for PM (min)	4	4	4	4
Total Sample Time per Test for PM (min)	96 min	96 min	96 min	96 min
Total Sample Time for Combustion Gases	30 min	30 min	30 min	30 min

Notes:

[1] The exhaust gas flow characteristics at the sampling location are referred to as being "Ideal" if the sample ports are located in a straight section of stack at least 8 stack diameters downstream and two stack diameters upstream of any flow disturbance.

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

December 16, 2015

APPENDIX E

Calculated Data – Sample Calculations and Velocity Profiles

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

MOISTURE FIELD DATA SHEET

0922-04

Project No.: 121811606
Client: CertainTeed
Plant: Rock Dryer
Location: McAdam, NB
Test: PM-1
Date: Oct 20, 2015
Analyst: JJB/NGM

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	789.2	704.4	84.8
2	100 mL H2O	726.5	702.1	24.4
3	Blank	667.0	660.9	6.1
4	200g Silica Gel	995.5	986.1	9.4
		Total Weight Gain (g)		124.7
		Moisture Volume (mL)		124.7

Volume H_2O Collected: 124.7 ml
X 0.048 = 5.99 ft^3 H_2O **(Vwc)**

DGM Final 77.87 ft^3
DGM Initial 26.03 ft^3
Final - Initial = 51.84 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

$$\text{Moisture} = \frac{5.99}{(5.99 + 51.84)}$$

Moisture = 0.104 = 10.4%

SOURCE TESTING FIELD DATA SHEET

Job No.: 1218111606
Client: CertainTeed
Plant: Rock Dryer
Location: M.Adam, NB
Test: PM-1
Date: Oct. 20 2015
Operators: JJB/NGM
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.791
Start: 10:30
Finish: 12:15

Static Pressure (in.H2O): 0.20
Port Length (in): 4"
Stack Dia. (in.): 36"
Probe Length (ft): 3'
Nozzle ID (in.): 1-8 (0.234)
Console S/N: 1646

Pre-Test Leak Check: -18
Vacuum Pressure: 0
Post-Test Leak Check: -18
Vacuum Pressure: 0

K': 2.24

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				26.03						
1-1	4	151	0.47	0.89	28.13	249	227	41	56	56	-1
2	8	151	0.53	1.00	30.37	245	235	42	56	55	-1
3	12	153	0.45	0.85	32.58	254	249	42	57	55	-1
4	16	155	0.44	0.83	34.64	255	250	42	57	55	-1
5	20	152	0.46	0.87	36.67	259	258	42	58	55	-1
6	24	148	0.46	0.87	38.80	255	259	42	58	55	-1
7	28	146	0.48	0.91	40.92	257	262	42	59	56	-1
8	32	146	0.49	0.93	43.09	255	264	42	58	56	-1
9	36	144	0.48	0.91	45.25	259	265	42	60	57	-1
10	40	134	0.50	0.97	47.45	262	269	42	60	57	-1
11	44	130	0.48	0.94	49.65	256	268	42	60	57	-1
12	48	130	0.48	0.94	51.80	251	266	42	59	56	-1
2-1	52	130	0.48	0.94	53.99	248	259	42	59	56	-1
2	56	131	0.50	0.98	56.19	243	262	42	60	57	-1
3	60	133	0.50	0.98	58.40	247	265	42	59	56	-1
4	64	134	0.48	0.94	60.57	249	264	42	59	56	-1
5	68	138	0.51	0.99	62.78	245	264	42	59	56	-1
6	72	141	0.49	0.95	64.98	243	259	42	59	56	-1
7	76	143	0.49	0.95	67.14	243	262	42	59	56	-1
8	80	143	0.49	0.95	69.31	248	261	42	60	56	-1
9	84	141	0.46	0.89	71.41	244	259	42	60	57	-1
10	88	143	0.50	0.97	73.61	244	261	42	60	57	-1
11	92	148	0.50	0.95	75.76	244	263	43	60	57	-1
12	96	151	0.46	0.88	77.87	244	263	43	60	57	-1

COMBUSTION GAS ANALYSIS CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: CertainTeed
Plant: Rack Dryer
Location: McAdam, NB

Fuel Type: Natural Gas
Time Start: 10:15
Time Finish: 10:45

Test No.: 1
Date: Oct 20, 2015

Personnel: JJB

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
10:15	19.91	0.57	16	1	13	0	13	—
10:20	19.85	0.61	11	1	14	0	14	—
10:25	19.75	0.67	7	1	16	0	16	—
10:30	19.79	0.64	9	1	15	0	15	—
10:35	19.59	0.75	11	0	4	0	4	—
10:40	19.61	0.75	7	1	4	0	4	—
10:45	19.62	0.74	7	0	4	0	4	—

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: CertainTeed
Plant: Rock Dryer
Location: McAdam, NB
Test: PM-2
Date: Oct 20, 2015
Analyst: JJB/NGM

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	784.6	692.2	92.4
2	100 mL H2O	716.8	701.5	15.3
3	Blank	665.4	662.1	3.3
4	200g Silica Gel	1005.7	995.5	10.2
		Total Weight Gain (g)		121.2
		Moisture Volume (mL)		121.2

Volume H_2O Collected: 121.2 ml

X 0.048 = 5.82 ft^3 H_2O **(Vwc)**

DGM Final 125.50 ft^3

DGM Initial 78.55 ft^3

Final - Initial = 46.95 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

$$\text{Moisture} = \frac{5.82}{(5.82 + 46.95)}$$

Moisture = 0.110 = 11.0%

SOURCE TESTING FIELD DATA SHEET

Job No.: 121811606
Client: CertainTeed
Plant: Rock Dryer
Location: McAdam, NB
Test: PM-2
Date: Oct. 20, 2015
Operators: JJR/NGM
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.791
Start: 12:45
Finish: 14:45

Static Pressure (in.H2O): 0.20
Port Length (in): 4"
Stack Dia. (in.): 36"
Probe Length (ft): 3'
Nozzle ID (in.): 1-8(0.234)
Console S/N: 1646

Pre-Test Leak Check: -18
Vacuum Pressure: 0
Post-Test Leak Check: 0
Vacuum Pressure: -18

K': 2.24

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				78.55						
1-1	4	144	0.39	0.75	80.48	251	225	46	56	56	-1
2	8	146	0.37	0.71	82.42	246	228	45	57	56	-1
3	12	150	0.37	0.70	84.31	237	233	45	57	56	-1
4	16	152	0.42	0.80	86.36	236	232	42	59	56	-1
5	20	150	0.42	0.80	88.33	236	232	42	60	57	-1
6	24	148	0.40	0.76	90.37	238	235	42	60	57	-1
7	28	138	0.38	0.74	92.20	235	232	42	62	58	-1
8	32	135	0.38	0.74	94.15	231	229	42	62	58	-1
9	36	135	0.42	0.82	96.16	230	234	41	62	58	-1
10	40	135	0.42	0.82	98.20	233	234	41	62	58	-1
11	44	134	0.40	0.78	100.25	231	236	41	62	58	-1
12	48	134	0.40	0.78	102.24	230	238	41	62	58	-1
2-1	52	135	0.42	0.82	104.24	232	238	41	62	58	-1
2	56	136	0.38	0.73	106.43	231	242	43	63	59	-1
3	60	141	0.35	0.68	108.03	231	240	43	63	59	-1
4	64	146	0.35	0.68	109.89	225	233	43	63	59	-1
5	68	146	0.38	0.73	111.83	230	239	46	65	61	-1
6	72	150	0.38	0.73	113.77	232	234	46	65	61	-1
7	76	150	0.38	0.73	115.83	230	232	49	65	61	-1
8	80	151	0.42	0.81	117.70	230	234	49	65	61	-1
9	84	149	0.42	0.81	119.74	229	238	49	67	63	-1
10	88	146	0.42	0.81	121.75	229	233	49	67	63	-1
11	92	138	0.35	0.69	123.63	227	235	49	67	63	-1
12	96	136	0.35	0.69	125.50	226	237	49	67	63	-1

255/55/11
255/60/16

COMBUSTION GAS ANALYSIS CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: CertainTeed
Plant: Rock Dryer
Location: McAdam, NB

Fuel Type: Natural Gas

Time Start: 1:00
Time Finish: 1:30

Test No.: 2
Date: Oct 20, 2015

Personnel: JJB

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
1:00	19.67	0.71	11	0	3	0	3	—
1:05	19.6	0.4	15	0	3	0	3	—
1:10	19.5	1.0	23	0	4	0	4	—
1:15	19.7	0.69	10	0	3	0	3	—
1:20	19.6	0.8	9	0	2	0	2	—
1:25	19.6	1.0	13	0	4	0	4	—
1:30	19.5	1.0	16	0	3	0	3	—

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: CertainTeed
Plant: Rock Dryer
Location: M. Adam, NB
Test: PM-3
Date: Oct 21, 2015
Analyst: JJB/NGM

Stantec

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	765.5	697.9	67.6
2	100 mL H2O	714.6	703.3	11.3
3	Blank	663.6	661.5	2.1
4	200g Silica Gel	1015.2	1005.7	9.5

Total Weight Gain (g)	90.5
Moisture Volume (mL)	90.5

Volume H_2O Collected: 90.5 ml
X 0.048 = 4.34 ft^3 H_2O **(Vwc)**

DGM Final 176.20 ft^3
DGM Initial 125.74 ft^3
Final - Initial = 50.46 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

$$\text{Moisture} = \frac{4.34}{(4.34 + 50.46)}$$

Moisture = 0.079 = 7.9%

SOURCE TESTING FIELD DATA SHEET

Job No.: 121811606
Client: CERTAINTEED
Plant: MCADAM
Location: ROCK DRYER
Test: PM-3
Date: OCT. 21/2015
Operators: JJB / NG
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.791
Start: 10:30
Finish: 12:10

Static Pressure (in.H2O): 0.25
Port Length (in): 4"
Stack Dia. (in.): 36"
Probe Length (ft): 3'
Nozzle ID (in.): 1-8 (0.234)
Console S/N: 1646

Pre-Test Leak Check: 0
Vacuum Pressure: -18
Post-Test Leak Check: 0
Vacuum Pressure: -18

K': 2.24

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				125.74						
1-1	4	115	0.50	1.00	127.93	264	256	36	56	56	-1
2	8	117	0.46	0.92	130.07	250	254	36	58	56	-1
3	12	116	0.44	0.88	132.18	238	254	36	58	57	-1
4	16	121	0.44	0.88	* 134.32	228	251	36	58	57	-1
5	20	121	0.47	0.94	136.45	232	254	36	59	57	-1
6	24	121	0.42	0.84	138.48	237	251	36	60	57	-1
7	28	121	0.44	0.88	140.56	241	255	36	60	58	-1
8	32	122	0.46	0.92	142.71	237	254	36	61	58	-1
9	36	127	0.44	0.87	144.77	238	254	36	61	58	-1
10	40	134	0.45	0.88	146.88	243	255	36	61	58	-1
11	44	140	0.42	0.81	148.89	241	258	36	63	59	-1
12	48	142	0.43	0.85	150.92	230	255	36	63	59	-1
2-1	52	143	0.43	0.83	152.96	228	258	36	63	60	-1
2	56	141	0.44	0.86	155.03	233	256	36	63	60	-1
3	60	139	0.45	0.88	157.12	238	258	36	63	60	-1
4	64	136	0.45	0.88	159.21	238	260	36	64	60	-1
5	68	134	0.45	0.88	161.32	234	262	36	64	61	-1
6	72	132	0.47	0.92	163.49	238	260	36	64	61	-1
7	76	130	0.43	0.85	165.53	243	262	36	64	61	-1
8	80	128	0.46	0.91	167.67	246	264	36	65	62	-1
9	84	128	0.44	0.87	169.76	248	266	37	65	62	-1
10	88	127	0.46	0.91	171.94	243	268	37	65	62	-1
11	92	126	0.46	0.91	174.09	245	267	38	66	62	-1
12	96	127	0.45	0.89	176.20	247	268	38	66	62	-1

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: CertainTeed
Plant: Rock Dryer
Location: McAdam, NB

Fuel Type: Natural Gas

Time Start: 10:30
Time Finish: 10:00

Test No.: 3
Date: Oct 21, 2015

Personnel: JJB

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
10:30	19.8	0.64	11	0	9	0	9	—
10:35	19.9	0.60	11	0	9	0	9	—
10:40	19.7	0.67	12	0	8	0	8	—
10:45	19.7	0.67	8	0	9	0	9	—
10:50	19.6	0.71	8	0	7	0	7	—
10:55	19.6	0.71	10	0	7	0	7	—
11:00	19.6	0.71	12	0	4	0	4	—

0922-02

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: CertainTeed
Plant: Calsine
Location: McAdam, NB
Test: PM-1
Date: Oct 22, 2015
Analyst: JJB/NGM

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	959.1	699.0	260.1
2	100 mL H2O	874.8	708.0	166.8
3	Blank	680.0	661.3	18.7
4	200g Silica Gel	1043.5	1015.2	28.3
		Total Weight Gain (g)		473.9
		Moisture Volume (mL)		473.9

Volume H_2O Collected: 473.9 ml
X 0.048 = 22.75 ft^3 H_2O **(Vwc)**

DGM Final 277.73 ft^3
DGM Initial 176.36 ft^3
Final - Initial = 101.37 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

$$\text{Moisture} = \frac{22.75}{(22.75 + 101.37)}$$

Moisture = 0.183 = 18.3%

SOURCE TESTING FIELD DATA SHEET

Job No.: 121811606
Client: CertainTeed
Plant: Calcine
Location: Mt. Adam, NB
Test: PM-1
Date: Oct 27, 2015
Operators: JJR/NOM
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.783
Start: 13:20
Finish: 15:00

Static Pressure (in.H2O):
Port Length (in): 2"
Stack Dia. (in.): 36"
Probe Length (ft): 3
Nozzle ID (in.): 2-10 (0.305)
Console S/N: 1646

Pre-Test Leak Check: -18
Vacuum Pressure: 0
Post-Test Leak Check: -18
Vacuum Pressure: 0

K': 5.20

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				176.36						
1-1	4	292	1.10	3.93	180.56	240	257	43	57	57	-3
2	8	287	1.0	3.57	184.69	225	232	43	57	57	-3
3	12	287	0.97	3.50	188.76	225	237	39	58	57	-3
4	16	287	0.99	3.56	192.88	225	234	42	59	57	-3
5	20	293	1.0	3.57	197.00	225	251	45	61	58	-3
6	24	293	1.10	3.95	201.29	225	250	49	63	60	-3
7	28	293	1.10	3.95	205.60	225	251	49	63	60	-3
8	32	293	1.16	3.95	209.88	225	237	53	65	60	-3
9	36	293	1.05	3.76	214.12	226	234	55	66	60	-3
10	40	293	1.05	3.76	218.36	230	266	57	66	61	-3
11	44	292	1.05	3.80	222.60	231	266	55	67	61	-3
12	48	292	1.05	3.80	226.85	231	261	51	67	61	-3
2-1	52	293	1.10	3.98	231.10	232	269	50	68	61	-3
2	56	293	1.00	3.62	235.34	249	266	46	67	62	-3
3	60	293	1.00	3.62	239.50	247	264	43	67	62	-3
4	64	293	1.00	3.62	243.63	242	257	42	67	62	-3
5	68	293	1.10	3.99	248.00	244	260	42	68	65	-3
6	72	293	1.10	3.99	252.37	231	262	42	68	65	-3
7	76	293	1.10	3.99	256.70	231	245	43	68	62	-3
8	80	294	1.10	3.99	261.04	232	247	43	68	63	-3
9	84	294	1.00	3.62	265.24	228	243	44	68	63	-4
10	88	295	1.00	3.63	269.42	225	245	45	69	63	-4
11	92	295	1.00	3.63	273.59	232	257	45	69	63	-4
12	96	295	1.00	3.63	277.73	232	261	46	70	63	-4

COMBUSTION GAS ANALYSIS CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: Centaurtech
Plant: McAdam
Location: Calcine Mill

Fuel Type: Nat gas

Time Start: 14:00
Time Finish: 14:30

Test No.: Gas # 1
Date: Oct 22, 2025

Personnel: NGM

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
0	17.45	1.95	9	0	18			
5	17.40	1.98	12	0	16			
10	17.38	2.69	11	3	95			
15	17.44	2.62	10	3	81			
20	17.41	2.65	9	5	130			
25	17.42	2.63	9	8	153			
30	17.46	2.62	8	4	115			

0922-20

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: CertainTeed
Plant: Calcine
Location: McAdam, NB
Test: PM-2
Date: Oct 27, 2015
Analyst: NGM

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	961.4	696.0	265.4
2	100 mL H2O	962.5	704.8	257.7
3	Blank	712.0	663.3	48.7
4	200g Silica Gel	1006.4	979.6	26.8
		Total Weight Gain (g)		598.6
		Moisture Volume (mL)		598.6

Volume H_2O Collected: 598.6 ml
X 0.048 = 28.73 ft^3 H_2O **(Vwc)**

DGM Final 375.63 ft^3
DGM Initial 278.06 ft^3
Final - Initial = 97.57 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

$$\text{Moisture} = \frac{28.73}{28.73 + 97.57}$$

Moisture = 0.23 23%

SOURCE TESTING FIELD DATA SHEET

Job No.: 1218116006
Client: Certainteed
Plant: Calcium
Location: Mc Adam, N3
Test: PM-2
Date: Oct 27, 2015
Operators: JSB/NoM
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.793
Start: 10:40
Finish: 12:35

Static Pressure (In.H2O):
Port Length (in): 21
Stack Dia. (in.): 36"
Probe Length (ft): 3
Nozzle ID (In.): 2-10 (0.305)
Console S/N: 1646

Pre-Test Leak Check: -18
Vacuum Pressure: 0
Post-Test Leak Check: -18
Vacuum Pressure: 0

K': 5.20

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				278.06						
1	4	300	0.96	3.28	281.82	225	225	42	38	38	-4
2	8	300	0.98	3.31	285.73	226	230	44	45	39	-4
3	12	301	1.0	3.45	289.65	225	228	34	49	41	-4
4	16	302	1.0	3.45	293.62	228	230	34	49	41	-4
5	20	301	1.1	3.84	297.76	230	228	34	52	42	-4
6	24	300	1.1	3.84	302.03	226	233	33	54	43	-4
7	28	300	1.1	3.84	306.22	227	228	32	54	43	-4
8	32	301	0.95	3.33	310.16	228	230	38	56	45	-4
9	36	302	0.95	3.33	314.12	230	228	38	56	45	-4
10	40	302	0.95	3.35	318.08	228	226	42	60	50	-4
11	44	302	1.0	3.53	322.29	228	225	42	60	50	-4
12	48	302	1.0	3.53	326.49	229	226	42	60	50	-4
1	52	302	1.0	3.54	330.38	225	230	43	62	53	-4
2	56	299	1.0	3.90	334.41	226	230	41	62	54	-4
3	60	200	1.1	3.90	338.70	228	230	41	62	54	-4
4	64	300	1.1	3.90	343.97	225	228	41	62	54	-4
5	68	300	1.1	3.90	347.25	228	230	41	62	54	-4
6	72	301	0.95	3.38	351.25	225	228	43	64	56	-4
7	76	301	0.95	3.38	355.26	230	232	43	64	56	-4
8	80	302	0.95	3.39	359.29	227	230	45	65	58	-4
9	84	302	0.98	3.50	364.32 *	227	228	45	66	58	-4
10	88	303	0.98	3.50	367.47	225	229	45	66	58	-4
11	92	300	0.96	3.50	371.60	228	230	45	66	58	-4
12	96	300	0.96	3.50	375.63	228	230	45	66	58	-4

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: Certainteed
Plant: McAdam
Location: Calcine

Test No.: Cees # 2
Date: Oct 22, 2015

Fuel Type: No. 2 Fuel oil
Time Start: 10:40
Time Finish: 11:10

Personnel: TBH/NGM

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
0	17.43	2.65	9	4	110			
5	17.50	2.58	9	6	145			
10	17.46	2.62	9	4	119			
15	17.50	2.60	8	2	84			
20	17.53	2.55	8	1	61			
25	17.52	2.57	7	0	27			
30	17.63	2.46	7	2	24			

MOISTURE FIELD DATA SHEET

Project No.: 121411606
Client: CERTAINTEED
Plant: McADAM
Location: CALCINER
Test: Run 3
Date: OCT. 27
Analyst: NGM

Stantec

0922.-19

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	953.1	692.9	260.2
2	100 mL H2O	971.8	712.7	259.1
3	Blank	738.3	664.1	74.2
4	200g Silica Gel	881.1	877.3	3.8
		Total Weight Gain (g)		597.3
		Moisture Volume (mL)		

Volume H_2O Collected: 597.3 ml

X 0.048 = _____ ft^3 H_2O **(Vwc)**

DGM Final _____ ft^3

DGM Initial _____ ft^3

Final - Initial = _____ ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

Moisture = _____

Moisture = _____

SOURCE TESTING FIELD DATA SHEET

Job No.: 121311006
Client: Certainteed
Plant: Mt. Adam
Location: Calcine
Test: PM-3
Date: Oct 27, 2015
Operators: TB H/NGM
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.783
Start: 14:03
Finish: 15:48

Static Pressure (In.H2O):
Port Length (in): 2"
Stack Dia. (in.): 36"
Probe Length (ft): 3'
Nozzle ID (in.): 2.10 (0.305)
Console S/N: 1646

Pre-Test Leak Check: ✓
Vacuum Pressure: -10
Post-Test Leak Check: ✓
Vacuum Pressure: -18

K': 5.20

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (In.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (In.Hg)
									In	Out	
	0				375.86						
1	4	303	1.10	3.91	380.04	225	230	43	61	61	-1
2	8	306	1.30	3.91	384.30	225	231	33	61	61	-3
3	12	306	1.20	4.24	389.06	228	228	33	60	61	-3
4	16	306	1.25	4.42	393.27	231	229	36	61	61	-4
5	20	306	1.20	4.24	397.76	232	226	36	61	61	-4
6	24	306	1.15	4.06	402.13	231	225	30	63	61	-4
7	28	306	1.30	4.61	406.62	228	238	40	63	61	-4
8	32	307	1.20	4.26	411.08	231	237	43	66	62	-4
9	36	307	1.15	4.08	415.47	239	236	43	66	62	-4
10	40	307	1.10	3.90	420.11 *	229	237	43	66	62	-4
11	44	307	1.10	3.90	424.10	229	233	42	66	63	-4
12	48	307	1.00	3.55	428.21	230	236	45	68	63	-4
1	52	307	0.99	3.52	432.60 *	230	236	45	68	63	-4
2	56	306	0.90	3.49	436.00 *	237	230	46	68	63	-4
3	60	306	1.00	3.56	440.50	231	230	48	67	64	-4
4	64	306	1.10	3.92	444.79	230	230	48	67	64	-4
5	68	306	1.15	4.09	449.22	231	230	43	67	64	-4
6	72	306	1.20	4.27	453.75	225	239	48	67	64	-4
7	76	306	1.20	4.27	458.25	230	240	50	67	64	-4
8	80	306	1.20	4.30	462.75	230	240	52	68	64	-4
9	84	307	1.15	4.11	467.20	238	240	55	70	65	-5
10	88	307	1.10	3.93	471.60	230	230	55	70	65	-5
11	92	307	1.00	3.58	475.75	228	235	56	70	65	-5
12	96	308	0.90	3.50	479.79	244	232	56	70	65	-5

COMBUSTION GAS ANALYSIS CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: Certain Teed
Plant: Mc Adam
Location: Calcium Mill

Test No.: Gas # 3
Date: Oct 27, 2015

Fuel Type: No. 2 Fuel oil

Time Start: 2:30
Time Finish: 3:00

Personnel: TBH/NcM

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
0	17.35	2.78	11	2	81			
5	17.35	2.68	10	2	82			
10	17.44	2.58	10	3	85			
15	17.44	2.64	9	2	156			
20	17.47	2.68	9	6	146			
25	17.45	2.61	8	2	91			
30	17.47	2.69	8	1	75			

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: CENTRAL-FEED
Plant: MCADAM
Location: ZONE 1 DRYER
Test: PM-1
Date: OCT 28/2015
Analyst: NLM

Stantec

0922-24

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	974.8	735.6	239.2
2	100 mL H2O	979.6	726.4	253.2
3	Blank	735.6	569.5	166.1
4	200g Silica Gel	984.0	959.5	24.5
		Total Weight Gain (g)		683.0
		Moisture Volume (mL)		683.0

Volume H_2O Collected: 683.0 ml
X 0.048 = 32.784 ft^3 H_2O **(Vwc)**

DGM Final 164.79 ft^3
DGM Initial 95.45 ft^3
Final - Initial = 69.34 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

Moisture = 0.321021503

Moisture = 32%

SOURCE TESTING FIELD DATA SHEET

Job No.: 121311606
Client: certainteed
Plant: McAdam
Location: Zone 1 Dryer
Test: PM-1
Date: Oct 28, 2015
Operators: NCM
Gamma: 0.974
Delta H@: 1.585
Pitot Coeff.: 0.756
Start: 13:52
Finish:

Static Pressure (in.H2O): 0.2
Port Length (in): 4"
Stack Dia. (in.): 48"
Probe Length (ft): 4'
Nozzle ID (in.): 7-10 (0.305)
Console S/N: 1848

Pre-Test Leak Check: 0
Vacuum Pressure: -20
Post-Test Leak Check: 0
Vacuum Pressure: -20

K': 5.31

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				95.45						
1	4	285	0.45	1.65	98.39	242	244	47	51	51	-1
2	8	284	0.45	1.65	101.39	240	247	47	51	51	-1
3	12	332	0.35	1.20	103.94	237	249	43	51	51	-1
4	16	341	0.35	1.19	106.51	237	245	44	58	51	-1
5	20	346	0.30	1.01	108.87	241	250	46	54	52	-1
6	24	339	0.47	1.60	111.78	245	249	47	56	52	-1
7	28	317	0.45	1.58	114.68	245	253	48	57	52	-1
8	32	295	0.44	1.60	117.66	248	255	50	59	53	-1
9	36	288	0.41	1.60	120.59	248	257	50	59	53	-2
10	40	283	0.39	1.43	123.40	240	254	60	61	54	-2
11	44	280	0.39	1.43	126.18	240	252	60	61	54	-2
12	48	278	0.39	1.43	128.99	240	257	60	61	54	-2
1	52	279	0.45	1.68	132.01	239	256	62	63	55	-2
2	56	280	0.45	1.68	135.04	240	256	65	63	55	-2
3	60	276	0.49	1.83	138.22	233	258	67	64	56	-2
4	64	276	0.49	1.83	141.49	232	256	68	63	56	-2
5	68	275	0.35	1.31	144.16 *	237	255	64	64	57	-2
6	72	274	0.35	1.31	146.90	237	255	60	64	57	-2
7	76	276	0.35	1.31	149.63	232	250	56	64	58	-2
8	80	276	0.35	1.31	152.32	230	253	55	64	58	-2
9	84	276	2.40	1.49	155.39	232	256	55	64	58	-2
10	88	276	0.40	1.49	158.15	232	256	55	64	59	-2
11	92	275	0.52	1.94	161.47	238	254	55	64	59	-3
12	96	276	0.52	1.94	164.79	238	256	55	64	59	-3

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: CERTAINTEED
Plant: MCADAM
Location: ORYX ZONE 1

Fuel Type: 2

Time Start: 14:30
Time Finish: 15:00

Test No.: 1
Date: OCT. 28/2015

Personnel: JGM

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
14:30	14.60	4.75	12	0	138	2	136	—
14:35	14.56	4.80	13	0	140	3	137	—
14:40	14.45	4.88	12	0	141	1	140	—
14:45	14.46	4.85	13	0	140	0	140	—
14:50	14.50	4.84	13	0	142	2	140	—
14:55	14.56	4.79	20	0	140	0	140	—
15:00	14.59	4.76	18	0	140	3	137	—

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: CERTAINTEED
Plant: McADAM
Location: DRYER ZONE 1
Test: PM-2
Date: OCT 29/15
Analyst: NG

Stantec

0922-27

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1020.2	731.2	289
2	100 mL H2O	1030.3	723.1	307.2
3	Blank	663.6	570.3	93.3
4	200g Silica Gel	1010.1	972.6	37.5
		Total Weight Gain (g)		727
		Moisture Volume (mL)		727

Volume H_2O Collected: 727 ml
X 0.048 = 34.896 ft^3 H_2O **(Vwc)**

DGM Final 216.18 ft^3
DGM Initial 164.96 ft^3
Final - Initial = 51.22 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

Moisture = 0.405220864

Moisture = 40.5%

SOURCE TESTING FIELD DATA SHEET

Job No.: 12181606
Client: CERTAINTEED
Plant: NOAQA
Location: DRYER 1 ZONE)
Test: PM2
Date: OCT 28/2015
Operators: NJM
Gamma: 0.947
Delta H@: 1.575
Pitot Coeff.: 0.756
Start: 9:55
Finish: 11:45

Static Pressure (in.H2O): 0.3
Port Length (in): 4
Stack Dia. (in.): 44
Probe Length (ft): 4
Nozzle ID (in.): 2-10 (0.305)
Console S/N: 1644

Pre-Test Leak Check: 0
Vacuum Pressure: -20
Post-Test Leak Check: 0
Vacuum Pressure: -20

K': 3.48

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				164.96						
1	4	340	0.35	0.80	167.01	225	225	53	65	65	-1
2	8	356	0.35	0.78	169.04	225	224	42	66	65	-1
3	12	350	0.35	0.78	170.94	225	225	42	66	65	-1
4	16	344	0.35	0.80	172.93	225	228	42	67	65	-1
5	20	308	0.35	0.83	174.92	225	230	41	67	66	-1
6	24	304	0.35	0.83	176.93	226	226	41	67	66	-1
7	28	297	0.40	0.96	179.12	225	229	43	67	66	-1
8	32	296	0.40	0.97	181.30	225	230	43	67	66	-1
9	36	296	0.35	0.85	183.34	225	228	46	68	66	-1
10	40	295	0.35	0.85	185.45	230	232	46	69	66	-1
11	44	295	0.35	0.85	187.50	228	230	46	69	66	-1
12	48	294	0.35	0.85	189.55	225	225	48	70	67	-1
1	52	297	0.35	0.85	191.62	225	226	50	70	67	-1
2	56	296	0.35	0.85	193.66	228	230	50	71	67	-1
3	60	296	0.40	0.98	195.90	225	226	50	71	67	-1
4	64	295	0.40	0.98	198.15	225	228	50	71	68	-1
5	68	295	0.42	1.03	200.43	225	227	51	72	68	-1
6	72	293	0.42	1.03	202.76	228	230	52	72	68	-1
7	76	291	0.35	0.86	205.07	228	226	52	72	68	-1
8	80	292	0.35	0.86	207.05	225	225	56	72	69	-2
9	84	293	0.35	0.86	209.13	225	228	56	72	69	-2
10	88	294	0.40	0.98	211.38	225	230	56	72	69	-2
11	92	294	0.40	0.98	213.66	225	229	56	72	69	-2
12	96	294	0.40	0.98	216.18	228	230	56	72	69	-2

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121611606
Client: CERTAINTEED
Plant: McADAM
Location: DRYER ZONE 1

Test No.: 2
Date: OCT 29/2015

Fuel Type: #2

Time Start: 10:00
Time Finish: 10:30

Personnel: NA

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
10:00	14.73	4.63	13	0	129	3	126	—
10:05	14.67	4.70	12	0	131	2	129	—
10:10	14.64	4.70	13	0	132	2	130	—
10:15	14.68	4.70	11	0	133	0	133	—
10:20	14.64	4.72	15	0	134	4	130	—
10:25	14.57	4.77	21	0	135	1	134	—
10:30	14.59	4.77	12	0	136	3	133	—

MOISTURE FIELD DATA SHEET

0922-25

Project No.: 121811606
Client: CERTAIN TEED
Plant: McADAM
Location: ZONE 1 DRYER
Test: PM-3
Date: OCT 29
Analyst: NGM

Stantec

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1029,7	724.0	
2	100 mL H2O	1028,5	715.5	
3	Blank	595.4	572.2	
4	200g Silica Gel	987,1	974.5	
		Total Weight Gain (g)		
		Moisture Volume (mL)		

Volume H_2O Collected: _____ ml

X 0.048 = _____ ft^3 H_2O **(Vwc)**

DGM Final _____ ft^3

DGM Initial _____ ft^3

Final - Initial = _____ ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\textbf{Vwc}}{\textbf{(Vwc + Vmc)}}$$

Moisture = _____

Moisture = _____

SOURCE TESTING FIELD DATA SHEET

Job No.: 121411606
Client: CERTAINTEED
Plant: MCADAM
Location: DRY ZONE 1
Test: PM 3
Date: OCT 29/15
Operators: NM
Gamma: 0.947
Delta H@: 1.585
Pitot Coeff.: 0.756
Start: 13:20
Finish:

Static Pressure (In.H2O): 0.25
Port Length (in): 4
Stack Dia. (in.): 48
Probe Length (ft): 4
Nozzle ID (in.): 2-10 (0.305)
Console S/N: 1644

Pre-Test Leak Check: 0
Vacuum Pressure: -20
Post-Test Leak Check: 0
Vacuum Pressure: -20

K': 2.81

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (In.Hg)
									In	Out	
	0				217.00						
1	4	290	0.2	0.40	218.44	225	225	55	68	68	-1
2	8	290	0.2	0.40	219.90	235	227	50	68	68	-1
3	12	288	0.25	0.49	221.53	240	239	43	68	68	-1
4	16	289	0.25	0.49	223.15	243	240	43	68		-1
5	20	290	0.25	0.50	224.77	246	244	43	69	68	-1
6	24	288	0.25	0.50	226.42	244	246	43	69		-1
7	28	288	0.25	0.50	228.06	246	247	45	69	68	-1
8	32	291	0.30	0.59	229.91	250	249	46	69	6	-1
9	36	291	0.30	0.59	231.7 *	252	254	46	69	68	-1
	40	290	0.30	0.59	233.51	252	252	48	69	68	-1
11	44	291	0.30	0.59	235.30	249	252	48	69	68	-1
12	48	289	0.30	0.59	237.12	247	254	49	69	68	-1
1	52	288	0.30	0.59	238.93	250	260	51	70	68	-1
2	56	290	0.30	0.59	240.75	254	258	52	70	68	-1
3	60	290	0.35	0.69	242.76	252	259	52	69	67	-1
4	64	289	0.35	0.69	244.69 *	252	258	52	69	67	-1
5	68	289	0.35	0.69	246.75	253	259	52	69	67	-1
6	72	288	0.35	0.69	248.68	256	260	52	69	67	-1
7	76	288	0.35	0.69	250.76	256	258	52	69	67	-1
8	80	289	0.35	0.69	252.80	257	247	49		67	-1
9	84	288	0.35	0.69	254.84	236	247	48	7	67	-1
10	88	288	0.35	0.69	256.91	226	243	48	70	67	-2
11	92	288	0.30	0.60	258.82	227	245	48	70	67	-2
12	96	288	0.30	0.60	260.73	231	243	48	70	67	-2

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: CONSTANTEC
Plant: McADAM
Location: DRYER ZONE 1

Fuel Type: 2

Time Start: 13:30
Time Finish: 14:00

Test No.: 3
Date: OCT. 29/2015

Personnel: NAM

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
13:30	14.55	4.77	12	0	144	4	140	—
13:35	14.67	4.71	13	0	143	2	141	—
13:40	14.64	4.73	12	0	143	3	140	—
13:45	14.57	4.78	13	0	144	1	143	—
13:50	14.65	4.72	18	0	143	0	143	—
13:55	14.62	4.75	13	0	146	2	144	—
14:00	14.62	4.74	19	0	145	0	145	—

MOISTURE FIELD DATA SHEET

Project No.: 121811606
Client: Certainteed
Plant: Mt. Adam
Location: Zone 2 Dryer
Test: PM 1 1
Date: Oct 29 2015
Analyst: TBH

Stantec

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1029.8	680.4	349.4
2	100 mL H2O	1035.6	691.8	343.8
3	Blank	849.2	664.2	185.0
4	200g Silica Gel	1058.2	1033.7	24.5
		Total Weight Gain (g)		902.7
		Moisture Volume (mL)		902.7

Volume H_2O Collected: 902.7 ml
X 0.048 = 43.33 ft^3 H_2O **(Vwc)**

DGM Final 524.41 ft^3
DGM Initial 524.41 ft^3
Final - Initial = _____ ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

Moisture = _____

Moisture = _____

SOURCE TESTING FIELD DATA SHEET

Job No.: 121811606
Client: Certainteed
Plant: ~~Zone 2~~ Dryer
Location: McAdam, NB
Test: PM-1
Date: ~~Oct~~ 28, 2015
Operators: TBH / AW
Gamma: 1.023
Delta H@: 1.717
Pitot Coeff.: 0.788
Start :
Finish :

Static Pressure (in.H2O): 0.20
Port Length (in): 4"
Stack Dia. (in.): 48"
Probe Length (ft): 6'
Nozzle ID (in.): 1-10 (0.306)
Console S/N: 1046

Pre-Test Leak Check: ✓
Vacuum Pressure: -18
Post-Test Leak Check: ✓
Vacuum Pressure: -18

K': 3.74

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (In.H2O)	Orifice dH (In.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (In.Hg)
									In	Out	
	0				493.94						
1	4	241	0.26	0.71	495.80	225	241	50	55	54	
2	8	242	0.31	0.84	497.77	226	242	50	55	54	
3	12	247	0.55	1.50	500.22	227	243	50	55	54	
4	16	238	0.60	1.65	503.02	228	246	51	56	54	
5	20	242	0.65	1.78	505.93	228	250	51	56	54	
6	24	242	0.74	2.03	509.08	230	248	51	56	55	
7	28	238	0.77	2.12	512.28	232	250	51	56	55	
8	32	241	0.64	1.76	515.32	238	248	52	56	55	
9	36	241	0.50	1.37	517.67	239	248	52	56	55	
10	40	242	0.54	1.48	520.52	239	250	52	57	55	
11	44	242	0.48	1.31	523.07	238	249	53	57	55	
12	48	248	0.32	0.87	525.12	234	251	53	57	56	
1	52	240	0.34	0.93	527.30	241	251	53	58	56	
2	56	246	0.47	1.29	529.54	242	260	50	58	56	
3	60	240	0.50	1.36	531.95	242	257	48	58	56	
4	64	241	0.600	1.65	534.59	241	258	47	98	56	
5	68	242	0.65	1.79	537.28	242	258	47	58	56	
6	72	242	0.65	1.79	540.31	242	251	47	58	56	
7	76	242	0.72	1.98	543.23	242	249	47	58	56	
8	80	242	0.74	2.03	546.38	242	250	48	58	56	
9	84	242	0.64	1.76	549.37	238	248	48	59	56	
10	89	241	0.52	1.43	552.02	239	247	48	59	57	
11	92	241	0.40	1.13	554.27	239	246	48	59	58	
12	96	240	0.35	0.96	556.48	235	238	48	59	58	

COMBUSTION GAS ANALYSIS CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: Certainteed
Plant: Mc Adam
Location: Zone 2 Dryer

Test No.: Gas # 1
Date: Oct 23, 2015

Fuel Type: # 2 Fuel Oil

Time Start: 3:00
Time Finish: 3:30

Personnel: TB/It

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO_2 (ppm)	NO (ppm)	THC (PPM)
0	16.91	3.03	11	1	74	1.0	73	
5	16.98	3.04	10	1	75	1.0	74	
10	16.87	3.04	10	0	79	1.0	78	
15	16.88	3.05	11	0	81	1.3	79	
20	16.44	3.37	14	0	91	1.5	89	
25	16.59	3.27	14	1	98	2.0	88	
30	16.84	3.87	12	2	84	2.3	83	

MOISTURE FIELD DATA SHEET

0922-23

Project No.: 121811601d
Client: Certain Teed
Plant: McAdam
Location: Zone 2 Dryer
Test: PM-2
Date: Oct 28, 2015
Analyst: DBH

Stantec

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1038.4	695.3	343.1
2	100 mL H2O	1011.6	719.8	291.8
3	Blank	913.3	663.8	249.5
4	200g Silica Gel	1033.6	1009.0	24.6

Total Weight Gain (g)	909.0
Moisture Volume (mL)	909

Volume H_2O Collected: 909 ml

X 0.048 = 43.632 ft^3 H_2O **(Vwc)**

DGM Final 619.18 ft^3

DGM Initial 556.62 ft^3

Final - Initial = 62.56 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\textbf{Vwc}}{\textbf{(Vwc + Vmc)}} \quad 106.192$$

Moisture = 0.41087841

Moisture = 41%

SOURCE TESTING FIELD DATA SHEET

Job No.: 124811600G
Client: Certainteed
Plant: McAdam
Location: Bone 2 Dryer
Test: PM-2
Date: Oct 28, 2015
Operators: TBH
Gamma: 1.033
Delta H@: 1.712
Pitot Coeff.: 0.788
Start: 11:05
Finish:

Static Pressure (in.H2O): 0.20
Port Length (in): 4"
Stack Dia. (in.): 48"
Probe Length (ft): 6'
Nozzle ID (in.): 1-10 (0.306)
Console S/N: 6646

Pre-Test Leak Check: ✓
Vacuum Pressure: -13
Post-Test Leak Check: ✓
Vacuum Pressure: -13

K': 3.74

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				5 556.62	225	225	✓			
1	4	251	0.25	0.68	558.48	225	225	52	56	56	-1
2	8	248	0.30	0.82	559.39	225	226	45	57	56	-1
3	12	247	0.55	1.49	561.90	237	235	47	57	56	-2
4	16	241	0.59	1.63	564.70	238	233	51	58	57	-2
5	20	239	0.68	1.88	567.61	237	231	41	58	56	-2
6	24	238	0.75	2.08	570.77	239	227	41	58	56	-2
7	28	241	0.76	2.10	573.96	240	227	42	58	57	-2
8	32	241	0.65	1.79	577.00	240	228	44	61	57	-3
9	36	241	0.50	1.38	580.34 *	240	233	44	61	57	-3
10	40	241	0.53	1.46	582.20	238	232	49	62	57	-3
11	44	241	0.45	1.24	584.72	234	235	50	62	58	-3
12	48	241	0.30	0.83	587.00 *	234	231	51	62	58	-3
1	52	241	0.35	0.97	588.94	236	232	51 51	62	58	-3
2	56	241	0.44	1.22	591.35	236	235	52	61	58	-3
3	60	242	0.51	1.41	593.99	237	236	52	62	58	-3
4	64	241	0.58	1.61	596.68	241	242	51	62	58	-3
5	68	241	0.67	1.86	599.73	240	238	52	63	58	-3
6	72	241	0.65	1.80	602.64	240	241	52	63	58	-3
7	76	241	0.71	1.97	605.78	240	240	52	63	58	-3
8	80	241	0.76	2.11	609.00	242	246	57	63	58	-3
9	84	242	0.64	1.78	611.99	243	240	57	63	58	-3
10	88	242	0.54	1.50	614.90 *	243	238	53	64	59	-4
11	92	243	0.41	1.13	617.05	246	237	53	64	59	-4
12	96	242	0.33	0.91	619.18	248	242	54	64	59	-4

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121811606
Client: Certainteed
Plant: Zone 2 Dryer
Location: McAdam

Fuel Type: #2 Fuel Oil

Time Start: 11:30
Time Finish: 12:00

Test No.: Gas #2
Date: Nov 29, 2015

Personnel: TBA

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO (ppm)	NO_2 (ppm)	THC (%)
0	16.95	3.03	10	0	75	1.5	73	
5	16.98	3.04	9	1	74	1.5	72	
10	16.82	3.07	11	1	75	1.5	73	
15	16.95	3.38	12	0	76	1.3	74	
20	16.39	3.40	11	1	69	1.3	67	
25	16.45	3.32	10	2	68	1.3	67	
30	16.99	3.00	9	1	70	1.5	68	

MOISTURE FIELD DATA SHEET

0922-21

Project No.: 121811606
Client: CERTAIN TEED
Plant: MCADAM
Location: ZONE 2 DRYER
Test: PM-03
Date: OCT 29/2015
Analyst: TBH

Stantec

Moisture Data

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1038.7	685.0	353.7
2	100 mL H2O	1020.5	692.2	328.3
3	Blank	850.7	664.1	186.6
4	200g Silica Gel	1060.2	1033.2	27.0

Total Weight Gain (g)	895.6
Moisture Volume (mL)	895.6

Volume H_2O Collected: 895.6 ml

X 0.048 = 42.9888 ft^3 H_2O **(Vwc)**

DGM Final 681.78 ft^3

DGM Initial 619.38 ft^3

Final - Initial = 62.4 ft^3 **(Vmc)**

$$\text{Moisture} = \frac{\text{Vwc}}{\text{(Vwc + Vmc)}}$$

Moisture = 0.407906722

Moisture = 40.7%

SOURCE TESTING FIELD DATA SHEET

Job No.: 14811606
Client: Graphtech
Plant: M. Adam
Location: Zone 2 Dryer
Test: PM-3
Date: Oct 29, 2015
Operators: TB H
Gamma: 1.033
Delta H@: 1.717
Pitot Coeff.: 0.798
Start: 14:15
Finish:

Static Pressure (in.H2O): 0.2
Port Length (in): 4"
Stack Dia. (in.): 48"
Probe Length (ft): 6'
Nozzle ID (in.): 1-10 (0.396)
Console S/N: 1646

Pre-Test Leak Check: ✓
Vacuum Pressure: -13
Post-Test Leak Check: ✓
Vacuum Pressure: -18

K': 3.25

Traverse Point	Time (min)	Stack Gas Temp., Ts (F)	Velocity Head, dP (in.H2O)	Orifice dH (in.H2O)	Gas Meter Volume (cu.ft)	Probe Temp. (F)	Oven Temp. (F)	Impinger Outlet Temp. (F)	Gas Meter Temp. (F)		Pump Vacuum (in.Hg)
									In	Out	
	0				619.38						
1	4	243	0.30	0.72	621.31	225	226	55	58	58	-7
2	8	243	0.48	1.15	623.68	231	234	52	60	59	-1
3	12	243	0.51	1.22	626.14	227	235	55	60	59	-1
4	16	243	0.58	1.39	628.75	228	240	54	61	59	-1
5	20	243	0.63	1.51	631.50	228	225	54	62	59	-1
6	24	243	0.68	1.63	634.34	229	236	57	63	59	-2
7	28	242	0.71	1.71	637.24	227	236	57	64	59	-2
8	32	242	0.80	1.93	640.13	228	239	57	64	60	-2
9	36	243	0.82	1.98	643.29	232	241	57	64	61	-3
10	40	242	0.68	1.64	646.15	228	242	57	64	61	-3
11	44	242	0.50	1.21	648.61	227	242	57	66	60	-3
12	48	241	0.38	0.92	650.77	227	239	57	65	60	-3
						229	240	58	65	60	-2
1	52	242	0.38	0.92	652.97	229	240	58	65	60	-2
2	56	241	0.45	1.08	655.24	231	245	56	65	60	-2
3	60	241	0.56	1.36	657.95 *	235	244	55	65	60	-2
4	64	242	0.63	1.52	660.40	231	241	56	66	61	-2
5	68	242	0.70	1.69	663.27	227	244	56	66	61	-2
6	72	241	0.75	1.81	666.26	227	243	56	65	60	-3
7	76	242	0.80	1.93	669.61 *	226	242	55	67	61	-3
8	80	243	0.69	1.67	672.28	227	248	55	68	63	-3
9	84	245	0.58	1.40	674.95	228	245	56	69	64	-3
10	88	246	0.52	1.26	677.24 *	227	240	56	69	64	-4
11	92	246	0.48	1.15	679.75	229	242	55	68	63	-3
12	96	0.3246	0.33	0.79	681.78	228	243	55	68	63	-2

COMBUSTION GAS ANALYSIS
CONCENTRATION FIELD SHEET

Sampling Methodology: Environment Canada EPS 1/RM/15

Stantec

Project No.: 121911606
Client: certainteed
Plant: Zone 2 Dryer
Location: Mt Adam

Test No.: Gas # 3
Date: Nov 29, 2015

Fuel Type: # 2 Fuel Oil

Time Start: 2:30
Time Finish: 3:00

Personnel: TBH

Time	Concentrations							
	O_2 (%)	CO_2 (%)	CO (ppm)	SO_2 (ppm)	NO_X (ppm)	NO (ppm)	NO_2 (ppm)	THC (%)
0	16.88	3.09	10	0	75	1.5	72	
5	16.75	3.21	10	0	76	1.5	73	
10	16.90	3.09	9	1	81	1.5	79	
15	16.82	3.20	10	0	81	1.5	80	
20	16.81	3.20	12	0	79	1.5	76	
25	16.79	3.22	13	1	79	1.5	77	
30	16.99	3.05	9	1	80	1.5	78	

December 16, 2015

APPENDIX F

Field Data Sheets

Source Emissions Testing 2015 – CertainTeed Gypsum Wallboard Plant, McAdam, New Brunswick

December 16, 2015

Raw Data for: CertainTeed Rock Dryer PM data

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-1
Date: 20-Oct-15
Personnel: JJB/NGM

Test Start: 10:30 AM
Test Finish: 12:15 PM

Particulate Collected from Filter (mg):	0.1
Particulate Collected from Probe Wash (mg):	1.7
Particulate Collected from Impinger Wash (mg):	0.1
Total Particulate Collected (mg):	2.0

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	789.2	704.4	84.8
2	100 mL H2O	726.5	702.1	24.4
3	Blank	667.0	660.9	6.1
4	200g Silica Gel	995.5	986.1	9.4
			Total Weight Gain (g)	124.7
			Moisture Volume (mL)	124.7

Parameters

Barometric Pressure, Pbar (in. Hg)	29.90	**O2, (%)**	19.7	**Stack Diameter, (in.)**	36.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	0.7	**Stack Area, (sq. ft.)**	7.07
Ambient Temp, (°F)	48	**N2, (%)**	79.6	**Probe Length, (ft.)**	3
H2O Volume Collected, Vw (mL)	124.7	**CO(ppm)**	9.7	**Nozzle Diameter, (in.)**	0.234
Total # Sampling Points,	24	**NOx (ppm)**	10.0	**Pitot Coefficient, (Cp)**	0.791
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.7	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	4.000
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						26.030		
Traverse 1	**1**	4	151	0.47	0.89	28.130	56	55
	2	8	151	0.53	1.00	30.370	56	56
	3	12	153	0.45	0.85	32.580	57	55
	4	16	155	0.44	0.83	34.640	57	55
	5	20	152	0.46	0.87	36.670	58	55
	6	24	148	0.46	0.87	38.800	58	55
	7	28	146	0.48	0.91	40.920	59	55
	8	32	146	0.49	0.93	43.090	58	56
	9	36	144	0.48	0.91	45.250	60	56
	10	40	134	0.50	0.97	47.445	60	57
	11	44	130	0.48	0.94	49.650	60	57
	12	48	130	0.48	0.94	51.800	59	57
						51.800		
Traverse 2	**1**	52	130	0.48	0.94	53.990	59	56
	2	56	131	0.50	0.98	56.190	60	57
	3	60	133	0.50	0.98	58.400	59	56
	4	64	134	0.48	0.94	60.587	59	56
	5	68	138	0.51	0.99	62.780	59	56
	6	72	141	0.49	0.95	64.980	59	56
	7	76	143	0.49	0.95	67.140	59	56
	8	80	143	0.49	0.95	69.310	60	56
	9	84	141	0.46	0.89	71.410	60	57
	10	88	143	0.50	0.97	73.610	60	57
	11	92	148	0.50	0.95	75.760	60	57
	12	96	151	0.46	0.88	77.870	60	57

Calculations for: CertainTeed Rock Dryer PM data

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-1
Date: 20-Oct-15
Personnel: JJB/NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.91
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	28.90
Volume of Water Vapour Collected, Vwc (cu.ft)	5.986
Stack Gas Moisture Content (% as decimal)	0.097
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	27.84

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	611	0.47	0.89	39.63	29.97	516	2.100	2.263	100.43
	2	8	611	0.53	1.00	42.09	29.97	516	2.240	2.412	100.80
	3	12	613	0.45	0.85	38.85	29.96	516	2.210	2.379	108.07
	4	16	615	0.44	0.83	38.47	29.96	516	2.060	2.218	102.03
	5	20	612	0.46	0.87	39.24	29.96	517	2.030	2.183	98.01
	6	24	608	0.46	0.87	39.11	29.96	517	2.130	2.291	102.50
	7	28	606	0.48	0.91	39.89	29.97	517	2.120	2.278	99.62
	8	32	606	0.49	0.93	40.30	29.97	517	2.170	2.332	100.93
	9	36	604	0.48	0.91	39.82	29.97	518	2.160	2.317	101.14
	10	40	594	0.50	0.97	40.31	29.97	519	2.195	2.352	99.78
	11	44	590	0.48	0.94	39.36	29.97	519	2.205	2.363	101.95
	12	48	590	0.48	0.94	39.36	29.97	518	2.150	2.306	99.51
Traverse 2	**1**	52	590	0.48	0.94	39.36	29.97	518	2.190	2.351	101.46
	2	56	591	0.50	0.98	40.21	29.97	519	2.200	2.358	99.76
	3	60	593	0.50	0.98	40.27	29.97	518	2.210	2.373	100.58
	4	64	594	0.48	0.94	39.49	29.97	518	2.187	2.348	101.66
	5	68	598	0.51	0.99	40.85	29.97	518	2.193	2.355	99.24
	6	72	601	0.49	0.95	40.14	29.97	518	2.200	2.362	101.81
	7	76	603	0.49	0.95	40.20	29.97	518	2.160	2.319	100.13
	8	80	603	0.49	0.95	40.20	29.97	518	2.170	2.328	100.49
	9	84	601	0.46	0.89	38.89	29.97	519	2.100	2.250	100.09
	10	88	603	0.50	0.97	40.61	29.97	519	2.200	2.358	100.77
	11	92	608	0.50	0.95	40.78	29.97	519	2.150	2.304	98.88
	12	96	611	0.46	0.88	39.21	29.96	519	2.110	2.261	101.40
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	602	0.48	0.93	39.86	29.97	517	51.840	55.662	100.88

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-1
Date: 20-Oct-15
Personnel: JJB/NGM

Test Start: 10:15 AM
Test Finish: 10:45 AM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	19.9	0.6	16.0	1.0	13.0	0.0	13
5	19.9	0.6	11.0	1.0	14.0	0.0	14
10	19.8	0.7	7.0	1.0	16.0	0.0	16
15	19.8	0.6	9.0	1.0	15.0	0.0	15
20	19.6	0.8	11.0	0.0	4.0	0.0	4
25	19.6	0.8	7.0	1.0	4.0	0.0	4
30	19.6	0.7	7.0	0.0	4.0	0.0	4
Average:	**19.7**	**0.7**	**9.7**	**0.7**	**10.0**	**0.0**	**10**

Raw Data for: CertainTeed Rock Dryer PM data

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-2
Date: 20-Oct-15
Personnel: JJB/NGM

Test Start: 12:45 PM
Test Finish: 2:45 PM

Particulate Collected from Filter (mg):	0.0
Particulate Collected from Probe Wash (mg):	0.0
Particulate Collected from Impinger Wash (mg):	1.0
Total Particulate Collected (mg):	1.0

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	784.6	692.2	92.4
2	100 mL H2O	716.8	701.5	15.3
3	Blank	665.4	662.1	3.3
4	200g Silica Gel	1005.7	995.5	10.2
			Total Weight Gain (g)	121.2
			Moisture Volume (mL)	121.2

Parameters

Barometric Pressure, Pbar (in. Hg)	29.80	**O2, (%)**	19.6	**Stack Diameter, (in.)**	36.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	0.9	**Stack Area, (sq. ft.)**	7.07
Ambient Temp, (°F)	53	**N2, (%)**	79.5	**Probe Length, (ft.)**	3
H2O Volume Collected, Vw (mL)	121.2	**CO(ppm)**	13.9	**Nozzle Diameter, (in.)**	0.234
Total # Sampling Points,	24	**NOx (ppm)**	3.1	**Pitot Coefficient, (Cp)**	0.791
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.0	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	4
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						78.550		
Traverse 1	**1**	4	144	0.39	0.75	80.480	56	56
	2	8	146	0.38	0.71	82.420	57	56
	3	12	158	0.38	0.70	84.310	57	56
	4	16	152	0.42	0.80	86.360	59	56
	5	20	150	0.42	0.80	88.330	60	57
	6	24	148	0.40	0.76	90.370	60	57
	7	28	138	0.38	0.74	92.200	62	58
	8	32	135	0.38	0.74	94.150	62	58
	9	36	135	0.42	0.82	96.160	62	58
	10	40	135	0.42	0.82	98.200	62	58
	11	44	134	0.40	0.78	100.250	62	58
	12	48	134	0.40	0.78	102.240	62	58
						102.240		
Traverse 2	**1**	52	135	0.42	0.82	104.240	62	58
	2	56	136	0.37	0.73	106.430	63	59
	3	60	141	0.35	0.68	108.030	63	59
	4	64	146	0.35	0.68	109.890	63	59
	5	68	148	0.38	0.73	111.830	65	61
	6	72	150	0.38	0.73	113.590	65	61
	7	76	150	0.64	0.73	115.830	65	61
	8	80	151	0.42	0.81	117.700	65	61
	9	84	149	0.42	0.81	119.740	67	63
	10	88	145	0.42	0.81	121.750	67	63
	11	92	138	0.35	0.69	123.630	67	63
	12	96	136	0.35	0.69	125.500	67	63

Calculations for: CertainTeed Rock Dryer PM data

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-2
Date: 20-Oct-15
Personnel: JJB/NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.81
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	28.92
Volume of Water Vapour Collected, Vwc (cu.ft)	5.818
Stack Gas Moisture Content (% as decimal)	0.104
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	27.78

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	604	0.39	0.75	35.99	29.86	516	1.930	2.070	101.15
	2	8	606	0.38	0.71	35.59	29.85	517	1.940	2.079	103.07
	3	12	618	0.38	0.70	35.94	29.85	517	1.890	2.025	101.40
	4	16	612	0.42	0.80	37.60	29.86	518	2.050	2.193	103.93
	5	20	610	0.42	0.80	37.54	29.86	519	1.970	2.103	99.52
	6	24	608	0.40	0.76	36.57	29.86	519	2.040	2.178	105.41
	7	28	598	0.38	0.74	35.35	29.85	520	1.830	1.948	95.93
	8	32	595	0.38	0.74	35.26	29.85	520	1.950	2.076	101.97
	9	36	595	0.42	0.82	37.07	29.86	520	2.010	2.140	100.00
	10	40	595	0.42	0.82	37.07	29.86	520	2.040	2.172	101.49
	11	44	594	0.40	0.78	36.15	29.86	520	2.050	2.182	104.41
	12	48	594	0.40	0.78	36.15	29.86	520	1.990	2.118	101.35
Traverse 2	**1**	52	595	0.42	0.82	37.07	29.86	520	2.000	2.129	99.50
	2	56	596	0.37	0.73	34.83	29.85	521	2.190	2.327	115.93
	3	60	601	0.35	0.68	34.01	29.85	521	1.600	1.700	87.44
	4	64	606	0.35	0.68	34.16	29.85	521	1.860	1.976	102.07
	5	68	608	0.38	0.73	35.65	29.85	523	1.940	2.053	101.96
	6	72	610	0.38	0.73	35.71	29.85	523	1.760	1.863	92.65
	7	76	610	0.64	0.73	46.27	29.85	523	2.240	2.371	91.00
	8	80	611	0.42	0.81	37.57	29.86	523	1.870	1.979	93.73
	9	84	609	0.42	0.81	37.51	29.86	525	2.040	2.151	101.69
	10	88	605	0.42	0.81	37.38	29.86	525	2.010	2.119	99.87
	11	92	598	0.35	0.69	33.93	29.85	525	1.880	1.982	101.70
	12	96	596	0.35	0.69	33.87	29.85	525	1.870	1.971	100.99
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	603	0.40	0.75	36.43	29.86	521	46.950	49.905	100.34

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-2
Date: 20-Oct-15
Personnel: JJB/NGM

Test Start: 1:00 PM
Test Finish: 1:30 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	19.7	0.7	11.0	0.0	3.0	0.0	3
5	19.6	0.8	15.0	0.0	3.0	0.0	3
10	19.5	1.0	23.0	0.0	4.0	0.0	4
15	19.7	0.7	10.0	0.0	3.0	0.0	3
20	19.6	0.8	9.0	0.0	2.0	0.0	2
25	19.6	1.0	13.0	0.0	4.0	0.0	4
30	19.5	1.0	16.0	0.0	3.0	0.0	3
Average:	**19.6**	**0.9**	**13.9**	**0.0**	**3.1**	**0.0**	**3**

Raw Data for: CertainTeed Rock Dryer PM data

Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-3
Date: 21-Oct-15
Personnel: JJB/NGM

Test Start: 10:30 AM
Test Finish: 12:10 PM

Particulate Collected from Filter (mg):	0.0
Particulate Collected from Probe Wash (mg):	1.2
Particulate Collected from Impinger Wash (mg):	1.5
Total Particulate Collected (mg):	2.7

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	765.5	697.9	67.6
2	100 mL H2O	714.6	703.3	11.3
3	Blank	663.6	661.5	2.1
4	200g Silica Gel	1015.2	1005.7	9.5
			Total Weight Gain (g)	90.5
			Moisture Volume (mL)	90.5

Parameters

Barometric Pressure, Pbar (in. Hg)	30.20	**O2, (%)**	19.7	**Stack Diameter, (in.)**	36.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	0.7	**Stack Area, (sq. ft.)**	7.07
Ambient Temp, (°F)	45.60	**N2, (%)**	79.6	**Probe Length, (ft.)**	3
H2O Volume Collected, Vw (mL)	90.50	**CO(ppm)**	10.3	**Nozzle Diameter, (in.)**	0.234
Total # Sampling Points,	24	**NOx (ppm)**	7.6	**Pitot Coefficient, (Cp)**	0.791
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.0	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	4
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						125.740		
Traverse 1	**1**	4	115	0.50	1.00	127.930	56	56
	2	8	117	0.46	0.92	130.070	58	56
	3	12	118	0.44	0.88	132.180	58	57
	4	16	121	0.44	0.88	134.320	58	57
	5	20	121	0.47	0.94	136.450	59	57
	6	24	121	0.42	0.84	138.480	60	57
	7	28	121	0.44	0.88	140.560	60	58
	8	32	122	0.46	0.92	142.710	61	58
	9	36	127	0.44	0.87	144.770	61	58
	10	40	134	0.45	0.88	146.880	61	58
	11	44	140	0.42	0.81	148.890	63	59
	12	48	142	0.43	0.83	150.920	63	59
						150.920		
Traverse 2	**1**	52	143	0.43	0.83	152.960	63	60
	2	56	141	0.44	0.86	155.030	63	60
	3	60	139	0.45	0.88	157.120	63	60
	4	64	136	0.45	0.86	159.210	64	60
	5	68	134	0.45	0.88	161.320	64	61
	6	72	132	0.47	0.92	163.490	64	61
	7	76	130	0.43	0.85	165.530	64	61
	8	80	128	0.46	0.91	167.670	65	62
	9	84	128	0.44	0.87	169.760	65	62
	10	88	127	0.46	0.91	171.940	65	62
	11	92	126	0.46	0.91	174.090	66	62
	12	96	127	0.45	0.89	176.200	66	62

Calculations for: CertainTeed Rock Dryer PM data
Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-3
Date: 21-Oct-15
Personnel: JJB/NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	30.21
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	28.90
Volume of Water Vapour Collected, Vwc (cu.ft)	4.344
Stack Gas Moisture Content (% as decimal)	0.074
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	28.09

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Gas Meter Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	575	0.50	1.00	39.28	30.27	516	2.190	2.382	96.89
	2	8	577	0.46	0.92	37.75	30.27	517	2.140	2.323	98.67
	3	12	578	0.44	0.88	36.95	30.26	518	2.110	2.288	99.45
	4	16	581	0.44	0.88	37.04	30.26	518	2.140	2.320	101.13
	5	20	581	0.47	0.94	38.29	30.27	518	2.130	2.308	97.31
	6	24	581	0.42	0.84	36.19	30.26	519	2.030	2.197	97.99
	7	28	581	0.44	0.88	37.04	30.26	519	2.080	2.249	98.01
	8	32	582	0.46	0.92	37.91	30.27	520	2.150	2.322	99.08
	9	36	587	0.44	0.87	37.23	30.26	520	2.060	2.225	97.47
	10	40	594	0.45	0.88	37.88	30.26	520	2.110	2.279	99.31
	11	44	600	0.42	0.81	36.78	30.26	521	2.010	2.164	98.11
	12	48	602	0.43	0.83	37.28	30.26	521	2.030	2.186	98.10
Traverse 2	**1**	52	603	0.43	0.83	37.31	30.20	522	2.040	2.190	98.37
	2	56	601	0.44	0.86	37.68	30.26	522	2.070	2.227	98.71
	3	60	599	0.45	0.88	38.04	30.26	522	2.090	2.249	98.40
	4	64	596	0.45	0.86	37.94	30.26	522	2.090	2.247	98.06
	5	68	594	0.45	0.88	37.88	30.26	523	2.110	2.266	98.73
	6	72	592	0.47	0.92	38.65	30.26	523	2.170	2.330	99.19
	7	76	590	0.43	0.85	36.90	30.27	523	2.040	2.191	97.34
	8	80	588	0.46	0.91	38.10	30.26	524	2.140	2.294	98.35
	9	84	588	0.44	0.87	37.27	30.27	524	2.090	2.240	98.22
	10	88	587	0.46	0.91	38.07	30.26	524	2.180	2.337	100.11
	11	92	586	0.46	0.91	38.04	30.27	524	2.150	2.302	98.56
	12	96	587	0.45	0.89	37.65	30.27	524	2.110	2.260	97.88
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	589	0.45	0.88	37.63	30.26	521	50.460	54.375	98.48

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Rock Dryer Stack
Location: McAdam, NB
Test: PM-3
Date: 21-Oct-15
Personnel: JJB/NGM

Test Start: 10:30 AM
Test Finish: 11:00 AM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	19.8	0.6	11.0	0.0	9.0	0.0	9
5	19.9	0.6	11.0	0.0	9.0	0.0	9
10	19.7	0.7	12.0	0.0	8.0	0.0	8
15	19.7	0.7	8.0	0.0	9.0	0.0	9
20	19.6	0.7	8.0	0.0	7.0	0.0	7
25	19.6	0.7	10.0	0.0	7.0	0.0	7
30	19.6	0.7	12.0	0.0	4.0	0.0	4
Average:	**19.7**	**0.7**	**10.3**	**0.0**	**7.6**	**0.0**	**8**

DATA ENTRY

CertainTeed

McAdam, NB

Fuel: # 2 Fuel oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 7 m

Stack Diameter: 0.9 m

Reference Temperature, Tref (F): 77
(K): 298
Reference Pressure, Pref (in.Hg): 29.92
(Bar): 1.0

Parameter	Symbol	Units	Test 1	Test 2	Test 3	Average
Test ID	-	-	PM-1	PM-2	PM-3	-
Date	-	-	20-Oct-15	20-Oct-15	21-Oct-15	n/a
Start Time	-	-	10:30 AM	12:45 PM	10:30 AM	n/a
End Time	-	-	12:15 PM	2:45 PM	12:10 PM	n/a
Total Sampling Time	-	min	96	96	96	96
Stack Diameter	D	in.	36	36	36	36
Average Stack Gas Temperature	Ts	F	142	143	129	138
Average Dry Gas Meter Temperature	Tm	F	57	61	61	60
Barometric Pressure	Pbar	in.Hg	29.90	29.80	30.20	29.97
Stack Static Pressure	Pstatic	in.H2O	0.20	0.20	0.20	0.20
Average Pressure Drop (Head)	dP	in.H2O	0.48	0.40	0.45	0.44
Average deltaH Orifice	dH	in.H2O	0.93	0.75	0.88	0.86
Average Meter Temperature	Tm	F	57	61	61	60
Gas Sample Volume	Vm	cu.ft	51.84	46.95	50.46	49.75
Average Isokinetics	I	%	100.88	100.34	98.48	99.90
Nozzle Diameter	Dn	in.	0.234	0.234	0.234	0.234
Pitot Coefficient	Cp	-	0.791	0.791	0.791	0.791
Gamma, meter constant	y	-	1.033	1.033	1.033	1.033
Reference Temperature	Tref	R	537	537	537	537
Reference Pressure	Pref	in.Hg	29.92	29.92	29.92	29.92
Stack Gas Oxygen Content	Co2	%	19.7	19.6	19.7	19.7
Stack Gas Carbon Dioxide Content	Cco2	%	0.7	0.9	0.7	0.7
Stack Gas Nitrogen Content	Cn2	%	79.6	79.5	79.6	79.6
Stack Gas Sulphur Dioxide Content	Cso2	ppm	0.7	0.0	0.0	0.2
Stack Gas Nitrogen Oxides Content	Cnox	ppm	10.0	3.1	7.6	6.9
Stack Gas Carbon Monoxide Content	Cco	ppm	9.7	13.9	10.3	11.3
Volume of Water Collected	Vw	mL	124.7	121.2	90.5	112.1
Particulate Collected from Filter	-	mg	0.1	0.0	0.0	0.0
Particulate Collected from Probe Wash	-	mg	1.7	0.0	1.2	1.0
Particulate Collected from Impinger Wash	-	mg	0.11	1.02	1.47	0.87
Total Particulate Collected (excl. impingers)	Mp	mg	1.85	0.00	1.20	1.02

Legend:
F - degrees Fahrenheit
K - degrees Kelvin
Bar - bars
in.Hg - inches of mercury
in. - inches
in.H2O - inches of water
cu.ft - cubic feet
R - degrees Rankin
NOx - as NO2

CALCULATIONS

CertainTeed

McAdam, NB

Fuel: # 2 Fuel oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 7 m

Stack Diameter: 0.9 m

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Stack Area	As	sq.ft	As = Pi x ((D/12)^2)/ 4	7.07	7.07	7.07	7.07
		sq.m	As (sq.ft) x 0.0929	0.66	0.66	0.66	0.66
Barometric Pressure	Pbar	kPa	Pbar (kPa) = Pbar (in.Hg) x 3.386	101.2	100.9	102.3	101.5
Stack Static Pressure	Pstatic	kPa	Pstatic (kPa) = Pstatic (in.H2O) x 0.249	0.05	0.05	0.05	0.05
Avg. Stack Temperature	Ts	R	Ts (R) = Ts (F) + 460	602	603	589	598.1
Avg. Meter Temperature	Tm	R	Tm (R) = Tm (F) + 460	517	521	521	519.6
Nozzle Diameter	Dn	mm	Dn (mm) = Dn (in.) x 25.4	6	6	6	5.9
Gas Meter Pressure	Pm	in.Hg	Pm = Pbar + (dH / 13.6)	29.97	29.86	30.27	30.0
Sample Volume at Ref Cond	Vmc	cu.ft	Vmc = Tref/Pref x (Vm x Pm x y) / Tm	55.66	49.90	54.38	53.3
		cu.m	Vmc (cu.m) = 0.02832 x Vmc (cu.ft)	1.58	1.41	1.54	1.51
Volume of Water Vapour	Vwc	cu.ft	Vwc = 0.0480 x Vw	5.99	5.82	4.34	5.4
Water Fraction	Bwo	-	Bwo = Vwc / (Vwc + Vmc)	0.097	0.104	0.074	0.1
Molecular Weight, Dry	Md	lb/lb-mol	Md = 0.44 (Cco2) + 0.32 (Co2) + 0.28 (Cn2)	28.90	28.92	28.90	28.9
Molecular Weight, Wet	Ms	lb/lb-mol	Ms = Md (1 - Bwo) + (18 x Bwo)	27.84	27.78	28.09	27.9
Stack Pressure	Ps	in.Hg	Ps = Pbar + (Pstatic / 13.6)	29.91	29.81	30.21	30.0
Stack Gas Velocity	Us	ft/s	Us = 85.33 x Cp x ((dP x Ts)/(Ps x Ms))^0.5	39.86	36.43	37.63	38.0
		m/s	Us (m/s) = 0.3048 x Us (ft/s)	12.15	11.10	11.47	11.6
Actual Stack Gas Flow Rate	Q	acfm	Q = 60 x Us x As	16,906	15,449	15,960	16,105
		acmm	Q(acmm) = Q(acfm) x 0.02831685	479	437	452	456
Dry Stack Gas Flow Rate	Qs	Rcfm	Qs = Q x (1-Bwo) x (Tref/Ts) x (Ps/Pref)	13,606	12,277	13,613	13,165
		Rcms	Qs (Rcms) = 0.000472 x Qs (Rcfm)	6.42	5.79	6.43	6.2
Sulphur Dioxide - SO2							
SO2 Measured Concentration	Cso2	ppm	Measurement from Flue Gas Analyzer	0.71	0.00	0.00	0.24
Uncorrected @ Ref Cond	Cso2	mg/Rcm	Cso2 (mg/Rcm) = Cso2 (ppm) x 2.62	1.87	0.00	0.00	0.62
SO2 Emission Rate	ERso2	g/s	ERso2 = Cso2/1000 x Qs	0.01	0.00	0.00	0.00
		kg/hr	ERso2 (kg/hr) = 3.6 x ERso2 (g/s)	0.04	0.00	0.00	0.01
SO2 Concentration							
Corrected to 11% O2	Cso2	mg/Rcm	Cso2 (11% O2) = Cso2 (mg/Rcm) x (20.9-11) / (20.9-Co2)	15.85	0.00	0.00	5.28
Corrected to 3% O2	Cso2	mg/Rcm	Cso2 (3% O2) = Cso2 (mg/Rcm) x (20.9-3) / (20.9-Co2)	28.67	0.00	0.00	9.56
Corrected to 12% CO2	Cso2	mg/Rcm	Cso2 (12% CO2) = Cso2 (mg/Rcm) x (12/Cco2)	33.23	0.00	0.00	11.08
Nitrogen Oxides - NOx							
NOx Measured Concentration	Cnox	ppm	Measurement from Flue Gas Analyzer	10.00	3.14	7.57	6.90
Uncorrected @ Ref Cond	Cnox	mg/Rcm	Cnox (mg/Rcm) = Cnox (ppm) x 1.882	18.82	5.91	14.25	12.99
NOx Emission Rate	ERnox	g/s	ERnox = Cnox/1000 x Qs	0.12	0.03	0.09	0.08
		kg/hr	ERnox (kg/hr) = 3.6 x ERnox (g/s)	0.44	0.12	0.33	0.30
NOx Concentration							
Corrected to 11% O2	Cnox	mg/Rcm	Cnox (11% O2) = Cnox (mg/Rcm) x (20.9-11) / (20.9-Co2)	159.44	44.90	117.56	107.30
Corrected to 3% O2	Cnox	mg/Rcm	Cnox (3% O2) = Cnox (mg/Rcm) x (20.9-3) / (20.9-Co2)	288.28	81.18	212.55	194.00
Corrected to 12% CO2	Cnox	mg/Rcm	Cnox (12% CO2) = Cnox (mg/Rcm) x (12/Cco2)	334.22	82.81	254.13	223.72
Carbon Monoxide - CO							
CO Measured Concentration	Cco	ppm	Measurement from Flue Gas Analyzer	9.71	13.86	10.29	11.29
Uncorrected @ Ref Cond	Cco	mg/Rcm	Cco (mg/Rcm) = Cco (ppm) x 1.145	11.12	15.87	11.78	12.92
CO Emission Rate	ERco	g/s	ERco = Cco/1000 x Qs	0.07	0.09	0.08	0.08
		kg/hr	ERco (kg/hr) = 3.6 x ERco (g/s)	0.26	0.33	0.27	0.29
CO Concentration							
Corrected to 11% O2	Cco	mg/Rcm	Cco (11% O2) = Cco (mg/Rcm) x (20.9-11) / (20.9-Co2)	94.23	120.43	97.16	103.94
Corrected to 3% O2	Cco	mg/Rcm	Cco (3% O2) = Cco (mg/Rcm) x (20.9-3) / (20.9-Co2)	170.38	217.75	175.68	187.93
Corrected to 12% CO2	Cco	mg/Rcm	Cco (12% CO2) = Cco (mg/Rcm) x (12/Cco2)	197.53	222.13	210.04	209.90
Particulate Concentration	Cs	mg/Rcm	Cs = Mp / Vmc	1.17	0.00	0.78	0.65
Particulate Emission Rate	ERp	g/s	ERp = Cs/1000 x Qs	0.01	0.00	0.01	0.00
		kg/hr	ERp (kg/hr) = 3.6 x ERp (g/s)	0.03	0.00	0.02	0.02
Particulate Concentration							
Corrected to 11% O2	Cs	mg/Rcm	Cs (11% O2) = Cs x (20.9-11) / (20.9-Co2)	9.94	0.00	6.43	5.46
Corrected to 3% O2	Cs	mg/Rcm	Cs (3% O2) = Cs x (20.9-3) / (20.9-Co2)	17.98	0.00	11.62	9.87
Corrected to 12% CO2	Cs	mg/Rcm	Cs (12% CO2) = Cs x (12/Cco2)	20.84	0.00	13.90	11.58

Legend:

sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
ppm - parts per million
in.Hg - inches of mercury
cu.ft - cubic feet
cu.m - cubic metres
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
Rcfm - dry Reference cubic feet per minute
mg/Rcm - miligrams per dry Reference cubic metre
g/s - grams per second
NOx - as NO2
acfm - actual cubic feet per minute
Rcms - dry Reference cubic metres per second

OFFICIAL STACK TESTING RESULTS
CertainTeed
McAdam, NB

Fuel: # 2 Fuel oil
Operating Conditions: Normal
Emission Control Equipment:
Stack Height from Grade: 7 m
Stack Diameter: 0.9 m

Parameter	Test 1	Test 2	Test 3	Average	NBDELG Limits
Test ID	PM-1	PM-2	PM-3	-	-
Test Date	20-Oct-15	20-Oct-15	21-Oct-15	-	-
Stack Gas Temperature (C)	61.3	61.7	53.8	58.9	-
Moisture Content (%)	9.7	10.4	7.4	9.2	-
Velocity (m/s)	12.1	11.1	11.5	11.6	-
Volumetric Flow (Rcms)	6.42	5.79	6.43	6.21	-
Oxygen - O2 (%)	19.7	19.6	19.7	19.7	-
Carbon Dioxide - CO2 (%)	0.68	0.86	0.67	0.74	-
Sulphur Dioxide - SO2					
SO2 Measured Concentration (ppm)	0.71	0.00	0.00	0.24	-
Uncorrected at Ref Cond (mg/Rcm)	1.87	0.00	0.00	0.62	-
Emission Rate (kg/hr)	0.04	0.00	0.00	0.01	-
Nitrogen Oxides - NOx					
NOx Measured Concentration (ppm)	10.0	3.14	7.57	6.90	-
Uncorrected at Ref Cond (mg/Rcm)	18.8	5.91	14.2	13.0	-
Emission Rate (kg/hr)	0.44	0.12	0.33	0.30	-
Carbon Monoxide - CO					
CO Measured Concentration (ppm)	9.71	13.9	10.3	11.3	-
Uncorrected at Ref Cond (mg/Rcm)	11.1	15.9	11.8	12.9	-
Emission Rate (kg/hr)	0.26	0.33	0.27	0.29	-
Particulate Matter - PM					
Particulate Concentration (mg/Rcm)	1.17	0.00	0.78	0.65	-
Particulate Emission Rate (kg/hr)	0.03	0.00	0.02	0.02	-

Legend:
C - degrees Celsius
m/s - metres per second
Rcms - dry Reference cubic metres per second
ppm - parts per million
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
mg/Rcm - miligrams per dry Reference cubic metre
NOx - as NO2
ND - non-detectable

Particulate Recoveries: Impinger Catch, Probe Wash, Filter Catch

Client: CertainTeed
Facility: Rock Dryer Stack
Location: McAdam, NB
Job Number: 121811606

IMPINGER CATCH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Sample + Rinse (g)	Jar Tare (g)	Sample Collected (g)	Rinse Water (g)	Total Rinse Water (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
M2	110.8394	110.8394		110.8394	PM-1	616.2	389.5	124.7	7.7	109.7	110.8406	110.8406		110.8406	0.0012	0.0001
C4	112.6437	112.6440		112.6439	PM-2	601.0	390.0	121.2	8.3	98.1	112.6461	112.6456		112.6459	0.0020	0.0010
I6	107.9291	107.9290		107.9291	PM-3	579.3	390.6	90.5	10.3	108.5	107.9318	107.9314		107.9316	0.0025	0.0015
																Conc. (g/mL)
D6	110.4609	110.4610		110.4610	WB	455.3	390.0	65.3		65.3	110.4617	110.4615		110.4616	0.0007	0.000010

PROBE WASH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Acetone (g)	Jar Tare (g)	Recovered Acetone (g)	Rinse Acetone	Total Acetone (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
C3	113.2742	113.2741		113.2742	PM-1	421.9	321.0	100.9	3.9	104.8	113.2759	113.2758		113.2759	0.0017	0.0017
W4	110.3543	110.3545		110.3544	PM-2	384.1	323.7	60.4	5.0	65.4	110.3526	110.3531		110.3529	-0.0016	0.0000
Q1	116.8836	116.8835		116.8836	PM-3	362.4	324.3	38.1	4.7	42.8	116.8845	116.8850		116.8848	0.0012	0.0012
																Conc. (g/mL)
G1	117.3946	117.3947		117.3947	AB	355.6	326.2	29.4		29.4	117.3931	117.3926		117.3929	-0.0018	0.000000

Density of Acetone: 0.7850 g/ml

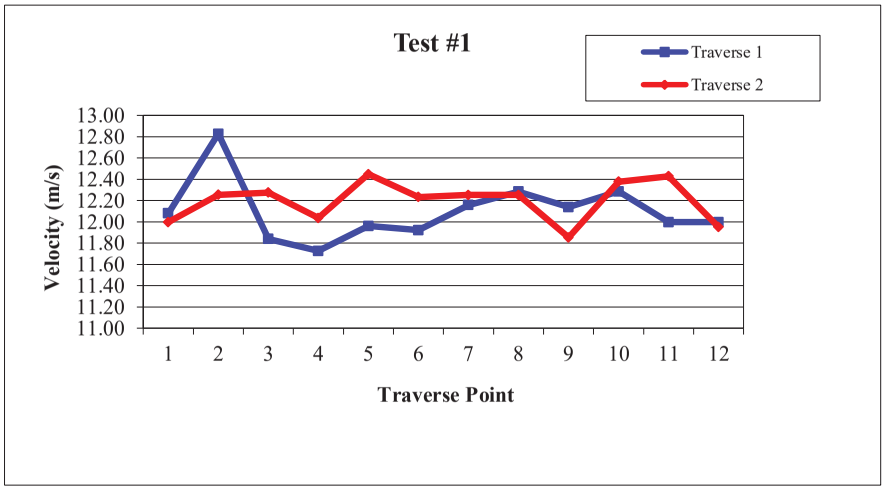
FILTER CATCH

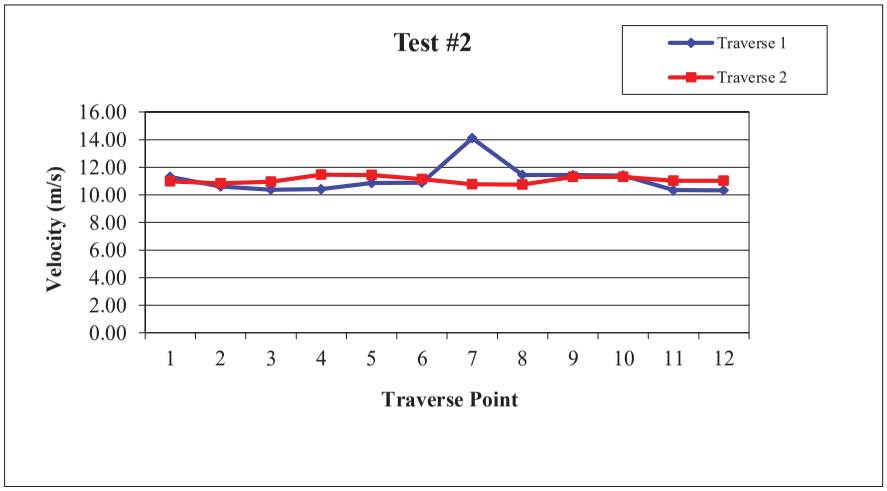
Filter ID	Pre Weights (g) Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID *	Post Weights (g) Date: Analysed by Trial 1	Trial 2	Trial 3	Average	Particulate Weight from Filter (g)
0922-04	0.3759	0.3761		0.3760	PM-1	0.3762	0.3761		0.3762	0.0001
0922-03	0.3726	0.3728		0.3727	PM-2	0.3725	0.3723		0.3724	0.0000
0922-05	0.3726	0.3727		0.3727	PM-3	0.3720	0.3719		0.3720	0.0000

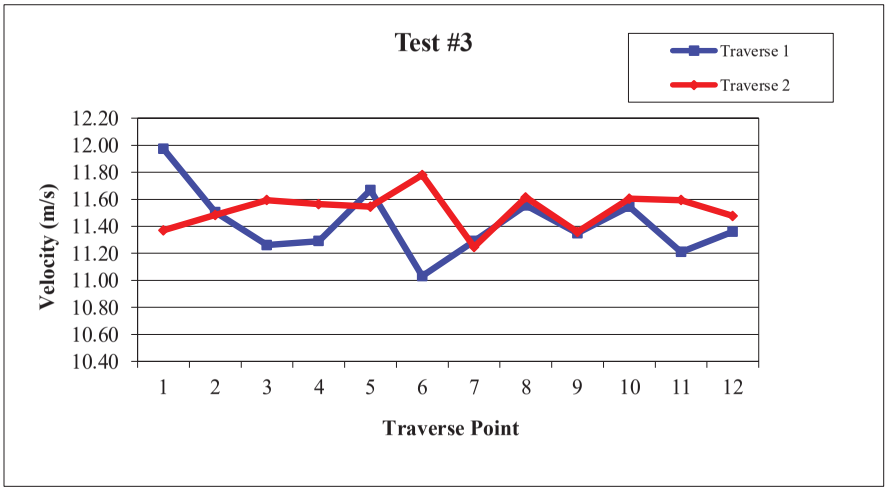
CertainTeed
Rock Dryer Stack

121811606

Stack Gas Velocity Profiles
McAdam, NB







Raw Data for: Certainteed McAdam Calcine Mill PM data

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-1
Date: 22-Oct-15
Personnel: NGM/JJB

Test Start: 1:20 PM
Test Finish: 3:00 PM

Particulate Collected from Filter (mg):	5.2
Particulate Collected from Probe Wash (mg):	5.0
Particulate Collected from Impinger Wash (mg):	5.9
Total Particulate Collected (mg):	16.1

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	959.1	699.0	260.1
2	100 mL H2O	874.8	708.0	166.8
3	Blank	680.0	661.3	18.7
4	200g Silica Gel	1043.5	1015.2	28.3
			Total Weight Gain (g)	473.9
			Moisture Volume (mL)	473.9

Parameters

Barometric Pressure, Pbar (in. Hg)	30.00	**O2, (%)**	17.4	**Stack Diameter, (in.)**	36.00
Stack Static Pressure, Pstatic (in. H2O)	0.10	**CO2, (%)**	2.4	**Stack Area, (sq. ft.)**	7.07
Ambient Temp, (°F)	52	**N2, (%)**	80.1	**Probe Length, (ft.)**	3
H2O Volume Collected, Vw (mL)	473.9	**CO(ppm)**	9.7	**Nozzle Diameter, (in.)**	0.305
Total # Sampling Points,	24	**NOx (ppm)**	86.9	**Pitot Coefficient, (Cp)**	0.783
Sampling Time per Point, (min)	4	**SO2 (ppm)**	3.3	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	2.000
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						176.360		
Traverse 1	**1**	4	292	1.10	3.93	180.560	57	57
	2	8	287	1.00	3.57	184.690	57	57
	3	12	287	0.97	3.50	188.760	58	57
	4	16	287	0.99	3.56	192.880	59	57
	5	20	293	1.00	3.57	197.000	61	58
	6	24	293	1.10	3.95	201.290	63	60
	7	28	293	1.10	3.95	205.600	63	60
	8	32	293	1.10	3.95	209.880	65	60
	9	36	293	1.05	3.76	214.120	66	60
	10	40	293	1.05	3.76	218.360	66	61
	11	44	292	1.05	3.80	222.600	67	61
	12	48	292	1.05	3.80	226.850	67	61
						226.850		
Traverse 2	**1**	52	293	1.10	3.98	231.100	68	61
	2	56	293	1.00	3.62	235.340	67	62
	3	60	293	1.00	3.62	239.500	67	62
	4	64	293	1.00	3.62	243.630	67	62
	5	68	293	1.10	3.99	248.000	68	65
	6	72	293	1.10	3.99	252.370	68	65
	7	76	293	1.10	3.99	256.700	68	62
	8	80	294	1.10	3.99	261.040	68	63
	9	84	294	1.00	3.62	265.240	68	63
	10	88	295	1.00	3.63	269.420	69	63
	11	92	295	1.00	3.63	273.590	69	63
	12	96	295	1.00	3.63	277.730	70	63

Calculations for: Certainteed McAdam Calcine Mill PM data

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-1
Date: 22-Oct-15
Personnel: NGM/JJB

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	30.01
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.09
Volume of Water Vapour Collected, Vwc (cu.ft)	22.747
Stack Gas Moisture Content (% as decimal)	0.173
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	27.17

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	752	1.10	3.93	67.30	30.29	517	4.200	4.562	94.00
	2	8	747	1.00	3.57	63.95	30.26	517	4.130	4.482	96.54
	3	12	747	0.97	3.50	62.99	30.26	518	4.070	4.412	96.48
	4	16	747	0.99	3.56	63.63	30.26	518	4.120	4.462	96.60
	5	20	753	1.00	3.57	64.21	30.26	520	4.120	4.450	96.22
	6	24	753	1.10	3.95	67.34	30.29	522	4.290	4.620	95.25
	7	28	753	1.10	3.95	67.34	30.29	522	4.310	4.641	95.70
	8	32	753	1.10	3.95	67.34	30.29	523	4.280	4.600	94.85
	9	36	753	1.05	3.76	65.79	30.28	523	4.240	4.551	96.04
	10	40	753	1.05	3.76	65.79	30.28	524	4.240	4.546	95.95
	11	44	752	1.05	3.80	65.75	30.28	524	4.240	4.543	95.80
	12	48	752	1.05	3.80	65.75	30.28	524	4.250	4.553	96.03
Traverse 2	**1**	52	753	1.10	3.98	67.34	30.29	525	4.250	4.551	93.83
	2	56	753	1.00	3.62	64.21	30.27	525	4.240	4.536	98.09
	3	60	753	1.00	3.62	64.21	30.27	525	4.160	4.451	96.24
	4	64	753	1.00	3.62	64.21	30.27	525	4.130	4.419	95.55
	5	68	753	1.10	3.99	67.34	30.29	527	4.370	4.662	96.12
	6	72	753	1.10	3.99	67.34	30.29	527	4.370	4.662	96.12
	7	76	753	1.10	3.99	67.34	30.29	525	4.330	4.632	95.51
	8	80	754	1.10	3.99	67.39	30.29	526	4.340	4.639	95.70
	9	84	754	1.00	3.62	64.25	30.27	526	4.200	4.485	97.05
	10	88	755	1.00	3.63	64.29	30.27	526	4.180	4.459	96.56
	11	92	755	1.00	3.63	64.29	30.27	526	4.170	4.449	96.33
	12	96	755	1.00	3.63	64.29	30.27	527	4.140	4.412	95.55
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	752	1.04	3.77	65.57	30.28	523	101.370	108.778	95.92

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-1
Date: 22-Oct-15
Personnel: NGM/JJB

Test Start: 2:00 PM
Test Finish: 2:30 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)
0	17.5	2.0	9.0	0.0	18.0
5	17.4	2.0	12.0	0.0	16.0
10	17.4	2.7	11.0	3.0	95.0
15	17.4	2.6	10.0	3.0	81.0
20	17.4	2.7	9.0	5.0	130.0
25	17.4	2.6	9.0	8.0	153.0
30	17.5	2.6	8.0	4.0	115.0
Average:	**17.4**	**2.4**	**9.7**	**3.3**	**86.9**

Raw Data for: Certainteed McAdam Calcine Mill PM data

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-2
Date: 27-Oct-15
Personnel: NGM

Test Start: 10:40 AM
Test Finish: 12:35 PM

Particulate Collected from Filter (mg):	9.9
Particulate Collected from Probe Wash (mg):	5.9
Particulate Collected from Impinger Wash (mg):	5.8
Total Particulate Collected (mg):	21.6

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	961.4	696.0	265.4
2	100 mL H2O	962.5	704.8	257.7
3	Blank	712.0	663.3	48.7
4	200g Silica Gel	1006.4	979.6	26.8
			Total Weight Gain (g)	598.6
			Moisture Volume (mL)	598.6

Parameters

Barometric Pressure, Pbar (in. Hg)	30.50	**O2, (%)**	17.5	**Stack Diameter, (in.)**	36.00
Stack Static Pressure, Pstatic (in. H2O)	0.10	**CO2, (%)**	2.6	**Stack Area, (sq. ft.)**	7.07
Ambient Temp, (°F)	43	**N2, (%)**	79.9	**Probe Length, (ft.)**	3
H2O Volume Collected, Vw (mL)	598.6	**CO(ppm)**	8.1	**Nozzle Diameter, (in.)**	0.305
Total # Sampling Points,	24	**NOx (ppm)**	81.4	**Pitot Coefficient, (Cp)**	0.783
Sampling Time per Point, (min)	4	**SO2 (ppm)**	2.7	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	2
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						278.060		
Traverse 1	**1**	4	300	0.96	3.28	281.820	38	38
	2	8	300	0.96	3.31	285.730	45	39
	3	12	301	1.00	3.45	289.650	49	41
	4	16	302	1.00	3.45	293.620	49	41
	5	20	301	1.10	3.84	297.760	52	42
	6	24	300	1.10	3.84	302.030	54	43
	7	28	300	1.10	3.84	306.220	54	43
	8	32	301	0.95	3.33	310.160	56	45
	9	36	302	0.95	3.33	314.120	56	45
	10	40	302	0.95	3.35	318.080	60	50
	11	44	302	1.00	3.53	322.290	60	50
	12	48	302	1.00	3.53	326.490	60	50
						326.490		
Traverse 2	**1**	52	302	1.00	3.54	330.380	62	53
	2	56	299	1.10	3.54	334.410	62	54
	3	60	300	1.10	3.90	338.700	62	54
	4	64	300	1.10	3.90	342.970	62	54
	5	68	300	1.10	3.90	347.250	62	54
	6	72	301	0.95	3.38	351.250	64	56
	7	76	301	0.95	3.38	355.260	64	56
	8	80	302	0.95	3.39	359.290	65	58
	9	84	302	0.98	3.50	363.320	65	58
	10	88	303	0.98	3.50	367.470	66	58
	11	92	300	0.98	3.50	371.600	66	58
	12	96	300	0.98	3.50	375.630	66	58

Calculations for: Certainteed McAdam Calcine Mill PM data

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-2
Date: 27-Oct-15
Personnel: NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	30.51
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.11
Volume of Water Vapour Collected, Vwc (cu.ft)	28.733
Stack Gas Moisture Content (% as decimal)	0.210
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	26.78

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	760	0.96	3.28	63.14	30.74	498	3.760	4.303	98.33
	2	8	760	0.96	3.31	63.14	30.74	502	3.910	4.440	101.44
	3	12	761	1.00	3.45	64.48	30.75	505	3.920	4.426	99.15
	4	16	762	1.00	3.45	64.52	30.75	505	3.970	4.482	100.49
	5	20	761	1.10	3.84	67.63	30.78	507	4.140	4.660	99.55
	6	24	760	1.10	3.84	67.58	30.78	509	4.270	4.792	102.30
	7	28	760	1.10	3.84	67.58	30.78	509	4.190	4.703	100.38
	8	32	761	0.95	3.33	62.85	30.74	511	3.940	4.399	101.12
	9	36	762	0.95	3.33	62.89	30.74	511	3.960	4.422	101.70
	10	40	762	0.95	3.35	62.89	30.75	515	3.960	4.383	100.82
	11	44	762	1.00	3.53	64.52	30.76	515	4.210	4.662	104.51
	12	48	762	1.00	3.53	64.52	30.76	515	4.200	4.651	104.26
Traverse 2	**1**	52	762	1.00	3.54	64.52	30.76	518	3.890	4.287	96.10
	2	56	759	1.10	3.54	67.54	30.76	518	4.030	4.437	94.65
	3	60	760	1.10	3.90	67.58	30.79	518	4.290	4.727	100.91
	4	64	760	1.10	3.90	67.58	30.79	518	4.270	4.705	100.44
	5	68	760	1.10	3.90	67.58	30.79	518	4.280	4.716	100.67
	6	72	761	0.95	3.38	62.85	30.75	520	4.000	4.385	100.80
	7	76	761	0.95	3.38	62.85	30.75	520	4.010	4.396	101.05
	8	80	762	0.95	3.39	62.89	30.75	522	4.030	4.406	101.33
	9	84	762	0.98	3.50	63.88	30.76	522	4.030	4.407	99.79
	10	88	763	0.98	3.50	63.92	30.76	522	4.150	4.534	102.73
	11	92	760	0.98	3.50	63.79	30.76	522	4.130	4.512	102.04
	12	96	760	0.98	3.50	63.79	30.76	522	4.030	4.402	99.57
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	761	1.01	3.54	64.77	30.76	514	97.570	108.237	100.59

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-2
Date: 27-Oct-15
Personnel: NGM

Test Start: 10:40 AM
Test Finish: 11:10 AM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)
0	17.4	2.7	9.0	4.0	110.0
5	17.5	2.6	9.0	6.0	145.0
10	17.5	2.6	9.0	4.0	119.0
15	17.5	2.6	8.0	2.0	84.0
20	17.5	2.6	8.0	1.0	61.0
25	17.5	2.6	7.0	0.0	27.0
30	17.6	2.5	7.0	2.0	24.0
Average:	**17.5**	**2.6**	**8.1**	**2.7**	**81.4**

Raw Data for: Certainteed McAdam Calcine Mill PM data

Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-3
Date: 27-Oct-15
Personnel: NGM

Test Start: 2:03 PM
Test Finish: 3:45 PM

Particulate Collected from Filter (mg):	10.7
Particulate Collected from Probe Wash (mg):	7.4
Particulate Collected from Impinger Wash (mg):	5.8
Total Particulate Collected (mg):	24.0

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	953.1	692.9	260.2
2	100 mL H2O	971.8	712.7	259.1
3	Blank	738.3	664.1	74.2
4	200g Silica Gel	881.1	877.3	3.8
			Total Weight Gain (g)	597.3
			Moisture Volume (mL)	597.3

Parameters

Barometric Pressure, Pbar (in. Hg)	30.40	**O2, (%)**	17.4	**Stack Diameter, (in.)**	36.00
Stack Static Pressure, Pstatic (in. H2O)	0.10	**CO2, (%)**	2.7	**Stack Area, (sq. ft.)**	7.07
Ambient Temp, (°F)	47.70	**N2, (%)**	79.9	**Probe Length, (ft.)**	3
H2O Volume Collected, Vw (mL)	597.30	**CO(ppm)**	9.3	**Nozzle Diameter, (in.)**	0.305
Total # Sampling Points,	24	**NOx (ppm)**	102.3	**Pitot Coefficient, (Cp)**	0.783
Sampling Time per Point, (min)	4	**SO2 (ppm)**	2.6	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	2
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						375.860		
Traverse 1	**1**	4	303	1.10	3.91	380.040	61	61
	2	8	306	1.10	3.91	384.300	61	61
	3	12	306	1.20	4.24	389.060	60	61
	4	16	306	1.25	4.42	393.270	61	61
	5	20	306	1.20	4.24	397.760	61	61
	6	24	306	1.15	4.06	402.130	63	61
	7	28	306	1.30	4.61	406.620	63	61
	8	32	307	1.20	4.26	411.080	66	62
	9	36	307	1.15	4.08	415.470	66	62
	10	40	307	1.10	3.90	420.110	66	62
	11	44	307	1.10	3.90	424.100	66	63
	12	48	307	1.00	3.55	428.210	68	63
						428.210		
Traverse 2	**1**	52	307	0.99	3.52	432.600	68	63
	2	56	306	0.98	3.49	436.000	68	63
	3	60	306	1.00	3.56	440.500	67	64
	4	64	306	1.10	3.92	444.790	67	64
	5	68	306	1.15	4.09	449.220	67	64
	6	72	306	1.20	4.27	453.750	67	64
	7	76	306	1.20	4.27	458.250	67	64
	8	80	306	1.20	4.30	462.750	68	64
	9	84	307	1.15	4.11	467.200	70	65
	10	88	307	1.10	3.93	471.630	70	65
	11	92	307	1.00	3.56	475.750	70	65
	12	96	308	0.98	3.50	479.769	70	65

Calculations for: Certainteed McAdam Calcine Mill PM data
Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-3
Date: 27-Oct-15
Personnel: NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	30.41
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.12
Volume of Water Vapour Collected, Vwc (cu.ft)	28.670
Stack Gas Moisture Content (% as decimal)	0.203
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	26.87

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Gas Meter: Meter Press., Pm (in. Hg)	Gas Meter: Avg. Temp, Tm (R)	Gas Meter: Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	763	1.10	3.91	67.72	30.69	521	4.180	4.565	97.09
	2	8	766	1.10	3.91	67.85	30.69	521	4.260	4.652	99.14
	3	12	766	1.20	4.24	70.87	30.71	521	4.760	5.207	106.25
	4	16	766	1.25	4.42	72.33	30.73	521	4.210	4.603	92.02
	5	20	766	1.20	4.24	70.87	30.71	521	4.490	4.907	100.12
	6	24	766	1.15	4.06	69.38	30.70	522	4.370	4.765	99.31
	7	28	766	1.30	4.61	73.76	30.74	522	4.490	4.902	96.10
	8	32	767	1.20	4.26	70.92	30.71	524	4.460	4.847	98.95
	9	36	767	1.15	4.08	69.42	30.70	524	4.390	4.769	99.45
	10	40	767	1.10	3.90	67.90	30.69	524	4.640	5.038	107.43
	11	44	767	1.10	3.90	67.90	30.69	525	3.990	4.328	92.30
	12	48	767	1.00	3.55	64.74	30.66	526	4.110	4.446	99.44
Traverse 2	**1**	52	767	0.99	3.52	64.41	30.40	526	4.390	4.708	105.84
	2	56	766	0.98	3.49	64.04	30.66	526	3.400	3.678	83.04
	3	60	766	1.00	3.56	64.69	30.66	526	4.500	4.867	108.79
	4	64	766	1.10	3.92	67.85	30.66	526	4.290	4.641	98.90
	5	68	766	1.15	4.09	69.38	30.69	526	4.430	4.796	99.97
	6	72	766	1.20	4.27	70.87	30.70	526	4.530	4.907	100.12
	7	76	766	1.20	4.27	70.87	30.71	526	4.500	4.876	99.49
	8	80	766	1.20	4.30	70.87	30.71	526	4.500	4.872	99.40
	9	84	767	1.15	4.11	69.42	30.72	528	4.450	4.804	100.20
	10	88	767	1.10	3.93	67.90	30.70	528	4.430	4.780	101.94
	11	92	767	1.00	3.56	64.74	30.69	528	4.120	4.444	99.39
	12	96	768	0.98	3.50	64.13	30.66	528	4.019	4.331	97.92
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	766	1.12	3.98	68.45	30.68	524	103.909	112.733	99.28

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Calcine Mill
Location: McAdam, NB
Test: PM-3
Date: 27-Oct-15
Personnel: NGM

Test Start: 2:30 PM
Test Finish: 3:00 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)
0	17.4	2.8	11.0	2.0	81.0
5	17.4	2.7	10.0	2.0	82.0
10	17.4	2.6	10.0	3.0	85.0
15	17.4	2.6	9.0	2.0	156.0
20	17.5	2.7	9.0	6.0	146.0
25	17.5	2.6	8.0	2.0	91.0
30	17.5	2.7	8.0	1.0	75.0
Average:	**17.4**	**2.7**	**9.3**	**2.6**	**102.3**

DATA ENTRY

CertainTeed

McAdam, NB

Fuel: #2 Fuel Oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 6.5 m

Stack Diameter: 0.9 m

Reference Temperature, Tref (F): 77
(K): 298
Reference Pressure, Pref (in.Hg): 29.92
(Bar): 1.0

Parameter	Symbol	Units	Test 1	Test 2	Test 3	Average
Test ID	-	-	PM-1	PM-2	PM-3	-
Date	-	-	22-Oct-15	27-Oct-15	27-Oct-15	n/a
Start Time	-	-	1:20 PM	10:40 AM	2:03 PM	n/a
End Time	-	-	3:00 PM	12:35 PM	3:45 PM	n/a
Total Sampling Time	-	min	96	96	96	96
Stack Diameter	D	in.	36	36	36	36
Average Stack Gas Temperature	Ts	F	292	301	306	300
Average Dry Gas Meter Temperature	Tm	F	63	54	64	61
Barometric Pressure	Pbar	in.Hg	30.00	30.50	30.40	30.30
Stack Static Pressure	Pstatic	in.H2O	0.10	0.10	0.10	0.10
Average Pressure Drop (Head)	dP	in.H2O	1.04	1.01	1.12	1.06
Average deltaH Orifice	dH	in.H2O	3.77	3.54	3.98	3.76
Average Meter Temperature	Tm	F	63	54	64	61
Gas Sample Volume	Vm	cu.ft	101.37	97.57	103.91	100.95
Average Isokinetics	I	%	95.92	100.59	99.28	98.59
Nozzle Diameter	Dn	in.	0.305	0.305	0.305	0.305
Pitot Coefficient	Cp	-	0.783	0.783	0.783	0.783
Gamma, meter constant	y	-	1.033	1.033	1.033	1.033
Reference Temperature	Tref	R	537	537	537	537
Reference Pressure	Pref	in.Hg	29.92	29.92	29.92	29.92
Stack Gas Oxygen Content	Co2	%	17.4	17.5	17.4	17.5
Stack Gas Carbon Dioxide Content	Cco2	%	2.4	2.6	2.7	2.6
Stack Gas Nitrogen Content	Cn2	%	80.1	79.9	79.9	80.0
Stack Gas Sulphur Dioxide Content	Cso2	ppm	3.3	2.7	2.6	2.9
Stack Gas Nitrogen Oxides Content	Cnox	ppm	86.9	81.4	102.3	90.2
Stack Gas Carbon Monoxide Content	Cco	ppm	9.7	8.1	9.3	9.0
Volume of Water Collected	Vw	mL	473.9	598.6	597.3	556.6
Particulate Collected from Filter	-	mg	5.2	9.9	10.7	8.6
Particulate Collected from Probe Wash	-	mg	5.0	5.9	7.4	6.1
Particulate Collected from Impinger Wash	-	mg	5.91	5.79	5.81	5.83
Total Particulate Collected (excl. impingers)	Mp	mg	10.1	15.9	18.1	14.7

Legend:
F - degrees Fahrenheit
K - degrees Kelvin
Bar - bars
in.Hg - inches of mercury
in. - inches
in.H2O - inches of water
cu.ft - cubic feet
R - degrees Rankin
NOx - as NO2

CALCULATIONS

CertainTeed

McAdam, NB

Fuel: #2 Fuel Oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 6.5 m

Stack Diameter: 0.9 m

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Stack Area	As	sq.ft	As = Pi x ((D/12)^2)/ 4	7.07	7.07	7.07	7.07
		sq.m	As (sq.ft) x 0.0929	0.66	0.66	0.66	0.66
Barometric Pressure	Pbar	kPa	Pbar (kPa) = Pbar (in.Hg) x 3.386	101.6	103.3	102.9	102.6
Stack Static Pressure	Pstatic	kPa	Pstatic (kPa) = Pstatic (in.H2O) x 0.249	0.02	0.02	0.02	0.02
Avg. Stack Temperature	Ts	R	Ts (R) = Ts (F) + 460	752	761	766	759.9
Avg. Meter Temperature	Tm	R	Tm (R) = Tm (F) + 460	523	514	524	520.5
Nozzle Diameter	Dn	mm	Dn (mm) = Dn (in.) x 25.4	8	8	8	7.7
Gas Meter Pressure	Pm	in.Hg	Pm = Pbar + (dH / 13.6)	30.28	30.76	30.69	30.6
Sample Volume at Ref Cond	Vmc	cu.ft	Vmc = Tref/Pref x (Vm x Pm x y) / Tm	108.78	108.24	112.76	109.9
		cu.m	Vmc (cu.m) = 0.02832 x Vmc (cu.ft)	3.08	3.07	3.19	3.11
Volume of Water Vapour	Vwc	cu.ft	Vwc = 0.0480 x Vw	22.75	28.73	28.67	26.7
Water Fraction	Bwo	-	Bwo = Vwc / (Vwc + Vmc)	0.173	0.210	0.203	0.2
Molecular Weight, Dry	Md	lb/lb-mol	Md = 0.44 (Cco2) + 0.32 (Co2) + 0.28 (Cn2)	29.09	29.11	29.12	29.1
Molecular Weight, Wet	Ms	lb/lb-mol	Ms = Md (1 - Bwo) + (18 x Bwo)	27.17	26.78	26.87	26.9
Stack Pressure	Ps	in.Hg	Ps = Pbar + (Pstatic / 13.6)	30.01	30.51	30.41	30.3
Stack Gas Velocity	Us	ft/s	Us = 85.33 x Cp x ((dP x Ts)/(Ps x Ms))^0.5	65.57	64.77	68.45	66.3
		m/s	Us (m/s) = 0.3048 x Us (ft/s)	19.99	19.74	20.86	20.2
Actual Stack Gas Flow Rate	Q	acfm	Q = 60 x Us x As	27,810	27,471	29,031	28,104
		acmm	Q(acmm) = Q(acfm) x 0.02831685	787	778	822	796
Dry Stack Gas Flow Rate	Qs	Rcfm	Qs = Q x (1-Bwo) x (Tref/Ts) x (Ps/Pref)	16,462	15,620	16,484	16,189
		Rcms	Qs (Rcms) = 0.000472 x Qs (Rcfm)	7.77	7.37	7.78	7.6
Sulphur Dioxide - SO2							
SO2 Measured Concentration	Cso2	ppm	Measurement from Flue Gas Analyzer	3.29	2.71	2.57	2.86
Uncorrected @ Ref Cond	Cso2	mg/Rcm	Cso2 (mg/Rcm) = Cso2 (ppm) x 2.62	8.61	7.11	6.74	7.49
SO2 Emission Rate	ERso2	g/s	ERso2 = Cso2/1000 x Qs	0.07	0.05	0.05	0.06
		kg/hr	ERso2 (kg/hr) = 3.6 x ERso2 (g/s)	0.24	0.19	0.19	0.21
SO2 Concentration							
Corrected to 11% O2	Cso2	mg/Rcm	Cso2 (11% O2) = Cso2 (mg/Rcm) x (20.9-11) / (20.9-Co2)	24.51	20.77	19.21	21.49
Corrected to 3% O2	Cso2	mg/Rcm	Cso2 (3% O2) = Cso2 (mg/Rcm) x (20.9-3) / (20.9-Co2)	44.32	37.55	34.72	38.86
Corrected to 12% CO2	Cso2	mg/Rcm	Cso2 (12% CO2) = Cso2 (mg/Rcm) x (12/Cco2)	42.19	33.10	30.34	35.21
Nitrogen Oxides - NOx							
NOx Measured Concentration	Cnox	ppm	Measurement from Flue Gas Analyzer	86.86	81.43	102.29	90.19
Uncorrected @ Ref Cond	Cnox	mg/Rcm	Cnox (mg/Rcm) = Cnox (ppm) x 1.882	163.47	153.25	192.50	169.74
NOx Emission Rate	ERnox	g/s	ERnox = Cnox/1000 x Qs	1.27	1.13	1.50	1.30
		kg/hr	ERnox (kg/hr) = 3.6 x ERnox (g/s)	4.57	4.07	5.39	4.68
NOx Concentration							
Corrected to 11% O2	Cnox	mg/Rcm	Cnox (11% O2) = Cnox (mg/Rcm) x (20.9-11) / (20.9-Co2)	465.41	447.54	548.76	487.24
Corrected to 3% O2	Cnox	mg/Rcm	Cnox (3% O2) = Cnox (mg/Rcm) x (20.9-3) / (20.9-Co2)	841.50	809.19	992.20	880.97
Corrected to 12% CO2	Cnox	mg/Rcm	Cnox (12% CO2) = Cnox (mg/Rcm) x (12/Cco2)	801.11	713.30	867.03	793.81
Carbon Monoxide - CO							
CO Measured Concentration	Cco	ppm	Measurement from Flue Gas Analyzer	9.71	8.14	9.29	9.05
Uncorrected @ Ref Cond	Cco	mg/Rcm	Cco (mg/Rcm) = Cco (ppm) x 1.145	11.12	9.32	10.63	10.36
CO Emission Rate	ERco	g/s	ERco = Cco/1000 x Qs	0.09	0.07	0.08	0.08
		kg/hr	ERco (kg/hr) = 3.6 x ERco (g/s)	0.31	0.25	0.30	0.29
CO Concentration							
Corrected to 11% O2	Cco	mg/Rcm	Cco (11% O2) = Cco (mg/Rcm) x (20.9-11) / (20.9-Co2)	31.67	27.23	30.31	29.74
Corrected to 3% O2	Cco	mg/Rcm	Cco (3% O2) = Cco (mg/Rcm) x (20.9-3) / (20.9-Co2)	57.26	49.23	54.80	53.76
Corrected to 12% CO2	Cco	mg/Rcm	Cco (12% CO2) = Cco (mg/Rcm) x (12/Cco2)	54.51	43.40	47.89	48.60
Particulate Concentration	Cs	mg/Rcm	Cs = Mp / Vmc	3.29	5.17	5.68	4.72
Particulate Emission Rate	ERp	g/s	ERp = Cs/1000 x Qs	0.03	0.04	0.04	0.04
		kg/hr	ERp (kg/hr) = 3.6 x ERp (g/s)	0.09	0.14	0.16	0.13
Particulate Concentration							
Corrected to 11% O2	Cs	mg/Rcm	Cs (11% O2) = Cs x (20.9-11) / (20.9-Co2)	9.38	15.10	16.20	13.56
Corrected to 3% O2	Cs	mg/Rcm	Cs (3% O2) = Cs x (20.9-3) / (20.9-Co2)	16.96	27.30	29.29	24.52
Corrected to 12% CO2	Cs	mg/Rcm	Cs (12% CO2) = Cs x (12/Cco2)	16.15	24.07	25.60	21.94

Legend:

sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
ppm - parts per million
in.Hg - inches of mercury
cu.ft - cubic feet
cu.m - cubic metres
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
Rcfm - dry Reference cubic feet per minute
mg/Rcm - miligrams per dry Reference cubic metre
g/s - grams per second
NOx - as NO2
acfm - actual cubic feet per minute
Rcms - dry Reference cubic metres per second

OFFICIAL STACK TESTING RESULTS
CertainTeed
McAdam, NB

Fuel: #2 Fuel Oil
Operating Conditions: Normal
Emission Control Equipment:
Stack Height from Grade: 6.5 m
Stack Diameter: 0.9 m

Parameter	Test 1	Test 2	Test 3	Average	NBDELG Limits
Test ID	PM-1	PM-2	PM-3	-	-
Test Date	22-Oct-15	27-Oct-15	27-Oct-15	-	-
Stack Gas Temperature (C)	145	149	152	149	-
Moisture Content (%)	17.3	21.0	20.3	19.5	-
Velocity (m/s)	19.99	19.74	20.86	20.20	-
Volumetric Flow (Rcms)	7.77	7.37	7.78	7.64	-
Oxygen - O2 (%)	17.4	17.5	17.4	17.5	-
Carbon Dioxide - CO2 (%)	2.45	2.58	2.66	2.56	-
Sulphur Dioxide - SO2					
SO2 Measured Concentration (ppm)	3.29	2.71	2.57	2.86	-
Uncorrected at Ref Cond (mg/Rcm)	8.61	7.11	6.74	7.49	-
Emission Rate (kg/hr)	0.24	0.19	0.19	0.21	-
Nitrogen Oxides - NOx					
NOx Measured Concentration (ppm)	86.9	81.4	102.3	90.2	-
Uncorrected at Ref Cond (mg/Rcm)	163	153	193	170	-
Emission Rate (kg/hr)	4.57	4.07	5.39	4.68	-
Carbon Monoxide - CO					
CO Measured Concentration (ppm)	9.71	8.14	9.29	9.05	-
Uncorrected at Ref Cond (mg/Rcm)	11.1	9.32	10.6	10.4	-
Emission Rate (kg/hr)	0.31	0.25	0.30	0.29	-
Particulate Matter - PM					
Particulate Concentration (mg/Rcm)	3.29	5.17	5.68	4.72	-
Particulate Emission Rate (kg/hr)	0.09	0.14	0.16	0.13	-

Legend:
C - degrees Celsius
m/s - metres per second
Rcms - dry Reference cubic metres per second
ppm - parts per million
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
mg/Rcm - miligrams per dry Reference cubic metre
NOx - as NO2
ND - non-detectable

Particulate Recoveries: Impinger Catch, Probe Wash, Filter Catch

Client: CertainTeed
Facility: Calcine Mill
Location: McAdam, NB
Job Number: 121811606

IMPINGER CATCH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Sample + Rinse (g)	Jar Tare (g)	Sample Collected (g)	Rinse Water (g)	Total Rinse Water (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
V2	109.1720	109.1721		109.1721	PM-1	944.9	389.2	473.9	7.8	89.6	109.1791	109.1786		109.1789	0.0068	0.0059
H6	109.4407	109.4410		109.4409	PM-2	1150.8	389.2	598.6	8.9	171.9	109.4486	109.4481		109.4484	0.0075	0.0058
G2	107.7214	107.7216		107.7215	PM-3	1134.5	391.5	597.3	9.4	155.1	107.7291	107.7286		107.7289	0.0074	0.0058
																Conc. (g/mL)
D6	110.4609	110.4610		110.4610	WB	455.3	390.0	65.3		65.3	110.4617	110.4615		110.4616	0.0007	0.000010

PROBE WASH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Acetone (g)	Jar Tare (g)	Recovered Acetone (g)	Rinse Acetone	Total Acetone (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
E5	107.0972	107.0977		107.0975	PM-1	385.9	324.2	61.7	3.1	64.8	107.1027	107.1022		107.1025	0.0050	0.0050
K6	112.1856	112.1861		112.1859	PM-2	351.8	301.8	50.0	2.8	52.8	112.1920	112.1915		112.1918	0.0059	0.0059
C1	113.6647	113.6647		113.6647	PM-3	388.2	323.7	64.5	2.9	67.4	113.6724	113.6719		113.6722	0.0074	0.0074
									3							Conc. (g/mL)
G1	117.3946	117.3947		117.3947	AB	355.6	326.2	29.4		29.4	117.3931	117.3926		117.3929	-0.0018	0.000000

Density of Acetone: 0.7850 g/ml

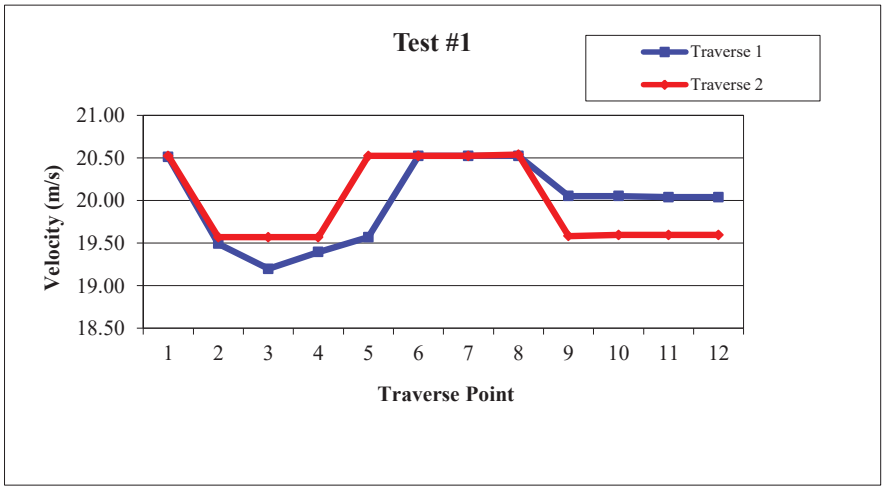
FILTER CATCH

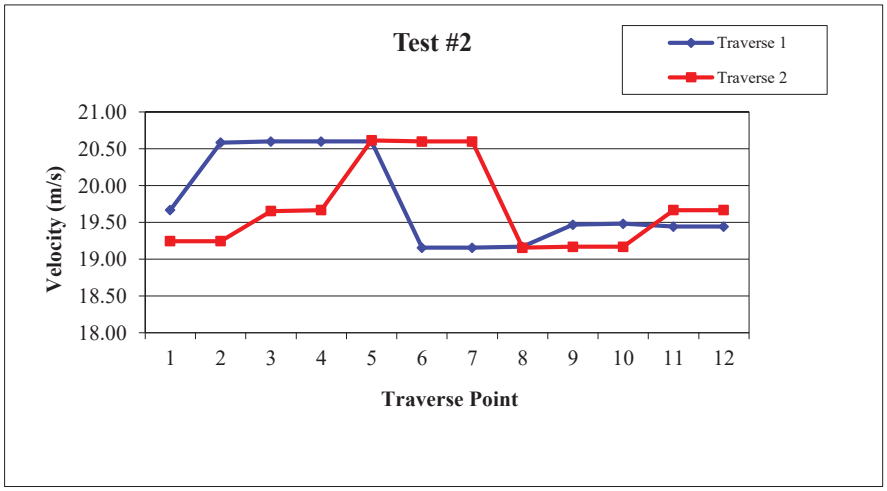
Filter ID	Pre Weights (g) Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID *	Post Weights (g) Date: Analysed by Trial 1	Trial 2	Trial 3	Average	Particulate Weight from Filter (g)
0922-02	0.3725	0.3725		0.3725	PM-1	0.3775	0.3778		0.3777	0.0052
0922-20	0.3739	0.3734		0.3737	PM-2	0.3836	0.3836		0.3836	0.0099
0922-19	0.3717	0.3713		0.3715	PM-3	0.3822	0.3822		0.3822	0.0107

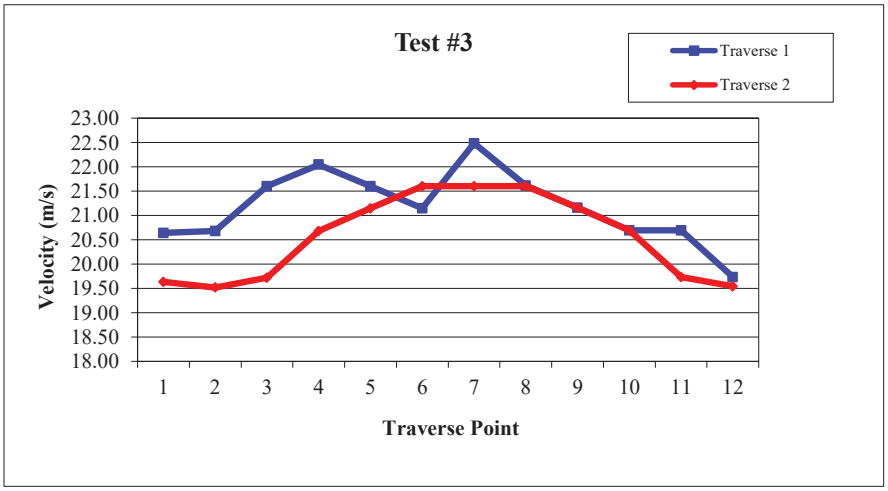
CertainTeed
Calcine Mill

121811606

Stack Gas Velocity Profiles
McAdam, NB







Raw Data for: CetainTeed Zone 1 Dryer PM

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-1
Date: 28-Oct-15
Personnel: TBH

Test Start: 1:52 PM
Test Finish: 3:30 PM

Particulate Collected from Filter (mg):	17.0
Particulate Collected from Probe Wash (mg):	2.8
Particulate Collected from Impinger Wash (mg):	44.5
Total Particulate Collected (mg):	64.2

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	974.8	735.6	239.2
2	100 mL H2O	979.6	726.4	253.2
3	Blank	735.6	569.5	166.1
4	200g Silica Gel	984.0	959.5	24.5
			Total Weight Gain (g)	683.0
			Moisture Volume (mL)	683.0

Parameters

Barometric Pressure, Pbar (in. Hg)	30.02	**O2, (%)**	14.5	**Stack Diameter, (in.)**	48.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	4.8	**Stack Area, (sq. ft.)**	12.57
Ambient Temp, (°F)	75	**N2, (%)**	80.7	**Probe Length, (ft.)**	4
H2O Volume Collected, Vw (mL)	683.0	**CO(ppm)**	14.4	**Nozzle Diameter, (in.)**	0.305
Total # Sampling Points,	24	**NOx (ppm)**	140.1	**Pitot Coefficient, (Cp)**	0.756
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.0	**Gamma, meter constant**	0.974
Readings Taken Every __ mins	4			**Port length (in.)**	4.000
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						95.445		
Traverse 1	**1**	4	285	0.45	1.65	98.390	51	51
	2	8	284	0.45	1.65	101.390	51	51
	3	12	332	0.35	1.20	103.940	51	51
	4	16	341	0.35	1.19	106.510	53	51
	5	20	346	0.30	1.01	108.870	54	52
	6	24	339	0.47	1.60	111.780	56	52
	7	28	317	0.45	1.58	114.680	57	52
	8	32	295	0.44	1.60	117.660	59	53
	9	36	288	0.44	1.60	120.590	59	53
	10	40	283	0.39	1.43	123.400	61	54
	11	44	280	0.39	1.43	126.180	61	54
	12	48	278	0.39	1.46	128.990	61	54
						128.990		
Traverse 2	**1**	52	279	0.45	1.68	132.010	63	55
	2	56	280	0.45	1.68	135.040	63	55
	3	60	276	0.49	1.83	138.220	64	56
	4	64	276	0.49	1.83	141.490	63	56
	5	68	275	0.35	1.31	144.180	64	57
	6	72	275	0.35	1.31	146.900	64	57
	7	76	276	0.64	1.31	149.630	64	58
	8	80	276	0.35	1.31	152.320	64	58
	9	84	276	0.40	1.49	155.390	64	58
	10	88	276	0.40	1.49	158.150	64	59
	11	92	275	0.52	1.94	161.470	64	59
	12	96	276	0.52	1.94	164.790	64	59

Calculations for: CetainTeed Zone 1 Dryer PM

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-1
Date: 28-Oct-15
Personnel: TBH

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	30.03
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.35
Volume of Water Vapour Collected, Vwc (cu.ft)	32.784
Stack Gas Moisture Content (% as decimal)	0.317
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	25.75

Isokineticity Checks

Check range	**Outside of Criteria**
Check average	**Outside of Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	745	0.45	1.65	42.47	30.14	511	2.945	3.037	118.85
	2	8	744	0.45	1.65	42.44	30.14	511	3.000	3.093	120.99
	3	12	792	0.35	1.20	38.62	30.11	511	2.550	2.626	120.18
	4	16	801	0.35	1.19	38.84	30.11	512	2.570	2.642	121.57
	5	20	806	0.30	1.01	36.07	30.09	513	2.360	2.420	120.67
	6	24	799	0.47	1.60	44.95	30.14	514	2.910	2.983	118.30
	7	28	777	0.45	1.58	43.37	30.14	515	2.900	2.969	118.69
	8	32	755	0.44	1.60	42.28	30.14	516	2.980	3.043	121.24
	9	36	748	0.44	1.60	42.08	30.14	516	2.930	2.992	118.65
	10	40	743	0.39	1.43	39.49	30.13	518	2.810	2.860	120.06
	11	44	740	0.39	1.43	39.41	30.13	518	2.780	2.829	118.54
	12	48	738	0.39	1.46	39.35	30.13	518	2.810	2.860	119.66
Traverse 2	**1**	52	739	0.45	1.68	42.30	30.14	519	3.020	3.066	119.53
	2	56	740	0.45	1.68	42.33	30.14	519	3.030	3.076	120.00
	3	60	736	0.49	1.83	44.05	30.15	520	3.180	3.224	120.18
	4	64	736	0.49	1.83	44.05	30.15	520	3.270	3.318	123.70
	5	68	735	0.35	1.31	37.20	30.12	521	2.690	2.721	119.94
	6	72	735	0.35	1.31	37.20	30.12	521	2.720	2.751	121.28
	7	76	736	0.64	1.31	50.15	30.12	521	2.730	2.759	90.34
	8	80	736	0.35	1.31	37.23	30.12	521	2.690	2.718	119.90
	9	84	736	0.40	1.49	39.80	30.13	521	3.070	3.104	128.06
	10	88	736	0.40	1.49	39.80	30.13	522	2.760	2.788	115.02
	11	92	735	0.52	1.94	45.35	30.16	522	3.320	3.357	121.40
	12	96	736	0.52	1.94	45.38	30.16	522	3.320	3.357	121.48
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	751	0.43	1.52	41.43	30.13	517	69.345	70.591	119.09

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-1
Date: 28-Oct-15
Personnel: TBH

Test Start: 2:30 PM
Test Finish: 3:00 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	14.6	4.8	12.0	0.0	138.0	2.0	136
5	14.6	4.8	13.0	0.0	140.0	3.0	137
10	14.5	4.9	12.0	0.0	141.0	1.0	140
15	14.5	4.9	13.0	0.0	140.0	0.0	140
20	14.5	4.8	13.0	0.0	142.0	2.0	140
25	14.6	4.8	20.0	0.0	140.0	0.0	140
30	14.6	4.8	18.0	0.0	140.0	3.0	137
Average:	**14.5**	**4.8**	**14.4**	**0.0**	**140.1**	**1.6**	**139**

Raw Data for: CetainTeed Zone 1 Dryer PM

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-2
Date: 29-Oct-15
Personnel: NGM

Test Start: 9:55 AM
Test Finish: 11:45 AM

Particulate Collected from Filter (mg):	17.8
Particulate Collected from Probe Wash (mg):	3.3
Particulate Collected from Impinger Wash (mg):	49.6
Total Particulate Collected (mg):	70.7

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1020.2	731.2	289.0
2	100 mL H2O	1030.3	723.1	307.2
3	Blank	663.6	570.3	93.3
4	200g Silica Gel	1010.1	972.6	37.5
			Total Weight Gain (g)	727.0
			Moisture Volume (mL)	727.0

Parameters

Barometric Pressure, Pbar (in. Hg)	29.98	**O2, (%)**	14.7	**Stack Diameter, (in.)**	48.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	4.7	**Stack Area, (sq. ft.)**	12.57
Ambient Temp, (°F)	70	**N2, (%)**	80.6	**Probe Length, (ft.)**	4
H2O Volume Collected, Vw (mL)	727.0	**CO(ppm)**	13.9	**Nozzle Diameter, (in.)**	0.305
Total # Sampling Points,	24	**NOx (ppm)**	132.9	**Pitot Coefficient, (Cp)**	0.756
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.0	**Gamma, meter constant**	0.974
Readings Taken Every __ mins	4			**Port length (in.)**	4
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						164.960		
Traverse 1	**1**	4	340	0.35	0.80	167.010	65	65
	2	8	250	0.35	0.78	169.080	66	65
	3	12	250	0.35	0.78	170.940	66	65
	4	16	344	0.35	0.80	172.930	67	65
	5	20	308	0.35	0.83	174.920	67	66
	6	24	304	0.35	0.83	176.930	67	66
	7	28	297	0.40	0.96	179.120	67	66
	8	32	296	0.40	0.97	181.300	68	66
	9	36	296	0.35	0.85	183.380	69	66
	10	40	295	0.35	0.85	185.450	69	66
	11	44	295	0.35	0.85	187.500	69	66
	12	48	294	0.35	0.85	189.550	70	67
						189.550		
Traverse 2	**1**	52	297	0.35	0.85	191.620	70	67
	2	56	296	0.35	0.85	193.660	71	69
	3	60	296	0.40	0.98	195.900	71	67
	4	64	295	0.40	0.98	198.150	72	68
	5	68	295	0.42	1.03	200.430	72	68
	6	72	293	0.42	1.03	202.760	72	68
	7	76	291	0.35	0.86	204.870	72	68
	8	80	292	0.35	0.86	207.050	72	69
	9	84	293	0.35	0.86	209.130	72	69
	10	88	294	0.40	0.98	211.380	72	69
	11	92	294	0.40	0.98	213.660	72	69
	12	96	294	0.40	0.98	215.800	72	69

Calculations for: CetainTeed Zone 1 Dryer PM

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-2
Date: 29-Oct-15
Personnel: NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.99
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.34
Volume of Water Vapour Collected, Vwc (cu.ft)	34.896
Stack Gas Moisture Content (% as decimal)	0.408
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	24.71

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	800	0.35	0.80	39.65	30.04	525	2.050	2.050	106.70
	2	8	710	0.35	0.78	37.35	30.04	526	2.070	2.068	101.40
	3	12	710	0.35	0.78	37.35	30.04	526	1.860	1.859	91.11
	4	16	804	0.35	0.80	39.75	30.04	526	1.990	1.987	103.64
	5	20	768	0.35	0.83	38.85	30.04	527	1.990	1.985	101.20
	6	24	764	0.35	0.83	38.75	30.04	527	2.010	2.005	101.95
	7	28	757	0.40	0.96	41.23	30.05	527	2.190	2.185	103.46
	8	32	756	0.40	0.97	41.21	30.05	527	2.180	2.173	102.83
	9	36	756	0.35	0.85	38.55	30.04	528	2.080	2.071	104.76
	10	40	755	0.35	0.85	38.52	30.04	528	2.070	2.061	104.18
	11	44	755	0.35	0.85	38.52	30.04	528	2.050	2.041	103.18
	12	48	754	0.35	0.85	38.49	30.04	529	2.050	2.037	102.91
Traverse 2	**1**	52	757	0.35	0.85	38.57	30.04	529	2.070	2.057	104.12
	2	56	756	0.35	0.85	38.55	30.04	530	2.040	2.021	102.26
	3	60	756	0.40	0.98	41.21	30.05	529	2.240	2.225	105.26
	4	64	755	0.40	0.98	41.18	30.05	530	2.250	2.230	105.46
	5	68	755	0.42	1.03	42.20	30.06	530	2.280	2.260	104.31
	6	72	753	0.42	1.03	42.14	30.06	530	2.330	2.310	106.45
	7	76	751	0.35	0.86	38.42	30.04	530	2.110	2.091	105.42
	8	80	752	0.35	0.86	38.44	30.04	531	2.180	2.158	108.88
	9	84	753	0.35	0.86	38.47	30.04	531	2.080	2.059	103.96
	10	88	754	0.40	0.98	41.15	30.05	531	2.250	2.228	105.29
	11	92	754	0.40	0.98	41.15	30.05	531	2.280	2.258	106.70
	12	96	754	0.40	0.98	41.15	30.05	531	2.140	2.119	100.15
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	756	0.37	0.89	39.62	30.05	528	50.840	50.539	103.57

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-2
Date: 29-Oct-15
Personnel: NGM

Test Start: 10:00 AM
Test Finish: 10:30 AM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	14.7	4.6	13.0	0.0	129.0	3.0	126
5	14.7	4.7	12.0	0.0	131.0	2.0	129
10	14.7	4.7	13.0	0.0	132.0	2.0	130
15	14.7	4.7	11.0	0.0	133.0	0.0	133
20	14.7	4.7	15.0	0.0	134.0	4.0	130
25	14.6	4.8	21.0	0.0	135.0	1.0	134
30	14.6	4.8	12.0	0.0	136.0	3.0	133
Average:	**14.7**	**4.7**	**13.9**	**0.0**	**132.9**	**2.1**	**131**

Raw Data for: CetainTeed Zone 1 Dryer PM

Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-3
Date: 29-Oct-15
Personnel: NGM

Test Start: 1:20 PM
Test Finish: 3:00 PM

Particulate Collected from Filter (mg):	11.6
Particulate Collected from Probe Wash (mg):	0.7
Particulate Collected from Impinger Wash (mg):	42.7
Total Particulate Collected (mg):	55.0

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1029.7	724.0	305.7
2	100 mL H2O	1028.5	715.5	313.0
3	Blank	595.4	572.2	23.2
4	200g Silica Gel	987.1	974.5	12.6
			Total Weight Gain (g)	654.5
			Moisture Volume (mL)	654.5

Parameters

Barometric Pressure, Pbar (in. Hg)	29.90	**O2, (%)**	14.6	**Stack Diameter, (in.)**	48.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	4.7	**Stack Area, (sq. ft.)**	12.57
Ambient Temp, (°F)	77.40	**N2, (%)**	80.6	**Probe Length, (ft.)**	4
H2O Volume Collected, Vw (mL)	654.50	**CO(ppm)**	14.3	**Nozzle Diameter, (in.)**	0.305
Total # Sampling Points,	24	**NOx (ppm)**	144.0	**Pitot Coefficient, (Cp)**	0.756
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.0	**Gamma, meter constant**	0.974
Readings Taken Every __ mins	4			**Port length (in.)**	4
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						217.000		
Traverse 1	**1**	4	290	0.20	0.40	218.440	68	68
	2	8	290	0.20	0.40	219.900	68	68
	3	12	288	0.25	0.49	221.530	68	68
	4	16	289	0.25	0.49	223.150	68	68
	5	20	290	0.25	0.50	224.770	69	68
	6	24	288	0.25	0.50	226.420	69	68
	7	28	288	0.25	0.50	228.060	69	68
	8	32	291	0.30	0.59	229.910	69	68
	9	36	291	0.30	0.59	231.770	69	68
	10	40	290	0.30	0.59	233.510	69	68
	11	44	291	0.30	0.59	235.300	69	68
	12	48	289	0.30	0.59	237.120	69	68
						237.120		
Traverse 2	**1**	52	288	0.30	0.59	238.930	70	69
	2	56	290	0.30	0.59	240.750	70	69
	3	60	290	0.35	0.69	242.760	69	67
	4	64	289	0.35	0.69	244.890	69	67
	5	68	289	0.35	0.69	246.750	69	67
	6	72	288	0.35	0.69	248.680	69	67
	7	76	288	0.35	0.69	250.760	69	67
	8	80	289	0.35	0.69	252.800	70	67
	9	84	288	0.35	0.69	254.840	70	67
	10	88	288	0.35	0.69	256.910	70	67
	11	92	288	0.30	0.60	258.820	70	67
	12	96	288	0.30	0.60	260.730	70	67

Calculations for: CetainTeed Zone 1 Dryer PM
Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-3
Date: 29-Oct-15
Personnel: NGM

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.91
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.34
Volume of Water Vapour Collected, Vwc (cu.ft)	31.416
Stack Gas Moisture Content (% as decimal)	0.420
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	24.58

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Gas Meter Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	750	0.20	0.40	29.14	29.93	528	1.440	1.427	96.93
	2	8	750	0.20	0.40	29.14	29.93	528	1.460	1.447	98.28
	3	12	748	0.25	0.49	32.54	29.94	528	1.630	1.616	98.03
	4	16	749	0.25	0.49	32.56	29.94	528	1.620	1.606	97.49
	5	20	750	0.25	0.50	32.58	29.94	529	1.620	1.604	97.47
	6	24	748	0.25	0.50	32.54	29.94	529	1.650	1.634	99.14
	7	28	748	0.25	0.50	32.54	29.94	529	1.640	1.624	98.54
	8	32	751	0.30	0.59	35.71	29.94	529	1.850	1.832	101.70
	9	36	751	0.30	0.59	35.71	29.94	529	1.860	1.842	102.25
	10	40	750	0.30	0.59	35.69	29.94	529	1.740	1.723	95.59
	11	44	751	0.30	0.59	35.71	29.94	529	1.790	1.773	98.40
	12	48	749	0.30	0.59	35.66	29.94	529	1.820	1.803	99.91
Traverse 2	**1**	52	748	0.30	0.59	35.64	29.90	530	1.810	1.787	98.97
	2	56	750	0.30	0.59	35.69	29.94	530	1.820	1.799	99.79
	3	60	750	0.35	0.69	38.55	29.94	528	2.010	1.993	102.32
	4	64	749	0.35	0.69	38.52	29.95	528	2.130	2.112	108.39
	5	68	749	0.35	0.69	38.52	29.95	528	1.860	1.844	94.65
	6	72	748	0.35	0.69	38.50	29.95	528	1.930	1.914	98.14
	7	76	748	0.35	0.69	38.50	29.95	528	2.080	2.063	105.77
	8	80	749	0.35	0.69	38.52	29.95	529	2.040	2.021	103.71
	9	84	748	0.35	0.69	38.50	29.95	529	2.040	2.021	103.64
	10	88	748	0.35	0.69	38.50	29.95	529	2.070	2.051	105.16
	11	92	748	0.30	0.60	35.64	29.95	529	1.910	1.892	104.81
	12	96	748	0.30	0.60	35.64	29.94	529	1.910	1.892	104.79
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	749	0.30	0.59	35.43	29.94	528	43.730	43.318	100.58

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Zone 1 Dryer
Location: McAdam, NB
Test: PM-3
Date: 29-Oct-15
Personnel: NGM

Test Start: 1:30 PM
Test Finish: 2:00 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	14.6	4.8	12.0	0.0	144.0	4.0	140
5	14.7	4.7	13.0	0.0	143.0	2.0	141
10	14.6	4.7	12.0	0.0	143.0	3.0	140
15	14.6	4.8	13.0	0.0	144.0	1.0	143
20	14.7	4.7	18.0	0.0	143.0	0.0	143
25	14.6	4.8	13.0	0.0	146.0	2.0	144
30	14.6	4.7	19.0	0.0	145.0	0.0	145
Average:	**14.6**	**4.7**	**14.3**	**0.0**	**144.0**	**1.7**	**142**

DATA ENTRY

CertainTeed

McAdam, NB

Fuel: #2 Fuel Oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 6.7 m

Stack Diameter: 1.22 m

Reference Temperature, Tref (F): 77
(K): 298
Reference Pressure, Pref (in.Hg): 29.92
(Bar): 1.0

Parameter	Symbol	Units	Test 1	Test 2	Test 3	Average
Test ID	-	-	PM-1	PM-2	PM-3	-
Date	-	-	28-Oct-15	29-Oct-15	29-Oct-15	n/a
Start Time	-	-	1:52 PM	9:55 AM	1:20 PM	n/a
End Time	-	-	3:30 PM	11:45 AM	3:00 PM	n/a
Total Sampling Time	-	min	96	96	96	96
Stack Diameter	D	in.	48	48	48	48
Average Stack Gas Temperature	Ts	F	291	296	289	292
Average Dry Gas Meter Temperature	Tm	F	57	68	68	65
Barometric Pressure	Pbar	in.Hg	30.02	29.98	29.90	29.97
Stack Static Pressure	Pstatic	in.H2O	0.20	0.20	0.20	0.20
Average Pressure Drop (Head)	dP	in.H2O	0.43	0.37	0.30	0.37
Average deltaH Orifice	dH	in.H2O	1.52	0.89	0.59	1.00
Average Meter Temperature	Tm	F	57	68	68	65
Gas Sample Volume	Vm	cu.ft	69.35	50.84	43.73	54.64
Average Isokinetics	I	%	119.09	103.57	100.58	107.75
Nozzle Diameter	Dn	in.	0.305	0.305	0.305	0.305
Pitot Coefficient	Cp	-	0.756	0.756	0.756	0.756
Gamma, meter constant	y	-	0.974	0.974	0.974	0.974
Reference Temperature	Tref	R	537	537	537	537
Reference Pressure	Pref	in.Hg	29.92	29.92	29.92	29.92
Stack Gas Oxygen Content	Co2	%	14.5	14.7	14.6	14.6
Stack Gas Carbon Dioxide Content	Cco2	%	4.8	4.7	4.7	4.8
Stack Gas Nitrogen Content	Cn2	%	80.7	80.6	80.6	80.6
Stack Gas Sulphur Dioxide Content	Cso2	ppm	0.0	0.0	0.0	0.0
Stack Gas Nitrogen Oxides Content	Cnox	ppm	140.1	132.9	144.0	139.0
Stack Gas Carbon Monoxide Content	Cco	ppm	14.4	13.9	14.3	14.2
Volume of Water Collected	Vw	mL	683.0	727.0	654.5	688.2
Particulate Collected from Filter	-	mg	17.0	17.8	11.6	15.4
Particulate Collected from Probe Wash	-	mg	2.8	3.3	0.7	2.3
Particulate Collected from Impinger Wash	-	mg	44.5	49.6	42.7	45.6
Total Particulate Collected (excl. impingers)	Mp	mg	19.7	21.1	12.3	17.7

Legend:
F - degrees Fahrenheit
K - degrees Kelvin
Bar - bars
in.Hg - inches of mercury
in. - inches
in.H2O - inches of water
cu.ft - cubic feet
R - degrees Rankin
NOx - as NO2

CALCULATIONS

CertainTeed

McAdam, NB

Fuel: #2 Fuel Oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 6.7 m

Stack Diameter: 1.22 m

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Stack Area	As	sq.ft	As = Pi x ((D/12)^2)/ 4	12.57	12.57	12.57	12.57
		sq.m	As (sq.m) = As (sq.ft) x 0.0929	1.17	1.17	1.17	1.17
Barometric Pressure	Pbar	kPa	Pbar (kPa) = Pbar (in.Hg) x 3.386	101.6	101.5	101.2	101.5
Stack Static Pressure	Pstatic	kPa	Pstatic (kPa) = Pstatic (in.H2O) x 0.249	0.05	0.05	0.05	0.05
Avg. Stack Temperature	Ts	R	Ts (R) = Ts (F) + 460	751	756	749	752.0
Avg. Meter Temperature	Tm	R	Tm (R) = Tm (F) + 460	517	528	528	524.7
Nozzle Diameter	Dn	mm	Dn (mm) = Dn (in.) x 25.4	8	8	8	7.7
Gas Meter Pressure	Pm	in.Hg	Pm = Pbar + (dH / 13.6)	30.13	30.05	29.94	30.0
Sample Volume at Ref Cond	Vmc	cu.ft	Vmc = Tref/Pref x (Vm x Pm x y) / Tm	70.60	50.54	43.32	54.8
		cu.m	Vmc (cu.m) = 0.02832 x Vmc (cu.ft)	2.00	1.43	1.23	1.55
Volume of Water Vapour	Vwc	cu.ft	Vwc = 0.0480 x Vw	32.78	34.90	31.42	33.0
Water Fraction	Bwo	-	Bwo = Vwc / (Vwc + Vmc)	0.317	0.408	0.420	0.4
Molecular Weight, Dry	Md	lb/lb-mol	Md = 0.44 (Cco2) + 0.32 (Co2) + 0.28 (Cn2)	29.35	29.34	29.34	29.3
Molecular Weight, Wet	Ms	lb/lb-mol	Ms = Md (1 - Bwo) + (18 x Bwo)	25.75	24.71	24.58	25.0
Stack Pressure	Ps	in.Hg	Ps = Pbar + (Pstatic / 13.6)	30.03	29.99	29.91	30.0
Stack Gas Velocity	Us	ft/s	Us = 85.33 x Cp x ((dP x Ts)/(Ps x Ms))^0.5	41.43	39.62	35.43	38.8
		m/s	Us (m/s) = 0.3048 x Us (ft/s)	12.63	12.08	10.80	11.8
Actual Stack Gas Flow Rate	Q	acfm	Q = 60 x Us x As	31,234	29,872	26,710	29,272
		acmm	Q(acmm) = Q(acfm) x 0.02831685	884	846	756	829
Dry Stack Gas Flow Rate	Qs	Rcfm	Qs = Q x (1-Bwo) x (Tref/Ts) x (Ps/Pref)	15,310	12,587	11,097	12,998
		Rcms	Qs (Rcms) = 0.000472 x Qs (Rcfm)	7.23	5.94	5.24	6.1
Sulphur Dioxide - SO2							
SO2 Measured Concentration	Cso2	ppm	Measurement from Flue Gas Analyzer	0.00	0.00	0.00	0.00
Uncorrected @ Ref Cond	Cso2	mg/Rcm	Cso2 (mg/Rcm) = Cso2 (ppm) x 2.62	0.00	0.00	0.00	0.00
SO2 Emission Rate	ERso2	g/s	ERso2 = Cso2/1000 x Qs	0.00	0.00	0.00	0.00
		kg/hr	ERso2 (kg/hr) = 3.6 x ERso2 (g/s)	0.00	0.00	0.00	0.00
SO2 Concentration							
Corrected to 11% O2	Cso2	mg/Rcm	Cso2 (11% O2) = Cso2 (mg/Rcm) x (20.9-11) / (20.9-Co2)	0.00	0.00	0.00	0.00
Corrected to 3% O2	Cso2	mg/Rcm	Cso2 (3% O2) = Cso2 (mg/Rcm) x (20.9-3) / (20.9-Co2)	0.00	0.00	0.00	0.00
Corrected to 12% CO2	Cso2	mg/Rcm	Cso2 (12% CO2) = Cso2 (mg/Rcm) x (12/Cco2)	0.00	0.00	0.00	0.00
Nitrogen Oxides - NOx							
NOx Measured Concentration	Cnox	ppm	Measurement from Flue Gas Analyzer	140.14	132.86	144.00	139.00
Uncorrected @ Ref Cond	Cnox	mg/Rcm	Cnox (mg/Rcm) = Cnox (ppm) x 1.882	263.75	250.04	271.01	261.60
NOx Emission Rate	ERnox	g/s	ERnox = Cnox/1000 x Qs	1.91	1.49	1.42	1.60
		kg/hr	ERnox (kg/hr) = 3.6 x ERnox (g/s)	6.86	5.35	5.11	5.77
NOx Concentration							
Corrected to 11% O2	Cnox	mg/Rcm	Cnox (11% O2) = Cnox (mg/Rcm) x (20.9-11) / (20.9-Co2)	410.00	396.60	427.03	411.21
Corrected to 3% O2	Cnox	mg/Rcm	Cnox (3% O2) = Cnox (mg/Rcm) x (20.9-3) / (20.9-Co2)	741.31	717.09	772.11	743.50
Corrected to 12% CO2	Cnox	mg/Rcm	Cnox (12% CO2) = Cnox (mg/Rcm) x (12/Cco2)	658.00	636.65	685.68	660.11
Carbon Monoxide - CO							
CO Measured Concentration	Cco	ppm	Measurement from Flue Gas Analyzer	14.43	13.86	14.29	14.19
Uncorrected @ Ref Cond	Cco	mg/Rcm	Cco (mg/Rcm) = Cco (ppm) x 1.145	16.52	15.87	16.36	16.25
CO Emission Rate	ERco	g/s	ERco = Cco/1000 x Qs	0.12	0.09	0.09	0.10
		kg/hr	ERco (kg/hr) = 3.6 x ERco (g/s)	0.43	0.34	0.31	0.36
CO Concentration							
Corrected to 11% O2	Cco	mg/Rcm	Cco (11% O2) = Cco (mg/Rcm) x (20.9-11) / (20.9-Co2)	25.68	25.17	25.77	25.54
Corrected to 3% O2	Cco	mg/Rcm	Cco (3% O2) = Cco (mg/Rcm) x (20.9-3) / (20.9-Co2)	46.43	45.50	46.60	46.18
Corrected to 12% CO2	Cco	mg/Rcm	Cco (12% CO2) = Cco (mg/Rcm) x (12/Cco2)	41.22	40.40	41.39	41.00
Particulate Concentration	Cs	mg/Rcm	Cs = Mp / Vmc	9.85	14.71	10.03	11.53
Particulate Emission Rate	ERp	g/s	ERp = Cs/1000 x Qs	0.07	0.09	0.05	0.07
		kg/hr	ERp (kg/hr) = 3.6 x ERp (g/s)	0.26	0.31	0.19	0.25
Particulate Concentration							
Corrected to 11% O2	Cs	mg/Rcm	Cs (11% O2) = Cs x (20.9-11) / (20.9-Co2)	15.32	23.33	15.80	18.15
Corrected to 3% O2	Cs	mg/Rcm	Cs (3% O2) = Cs x (20.9-3) / (20.9-Co2)	27.69	42.18	28.56	32.81
Corrected to 12% CO2	Cs	mg/Rcm	Cs (12% CO2) = Cs x (12/Cco2)	24.58	37.44	25.37	29.13

Legend:

sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
ppm - parts per million

in.Hg - inches of mercury
cu.ft - cubic feet
cu.m - cubic metres
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
Rcfm - dry Reference cubic feet per minute

mg/Rcm - miligrams per dry Reference cubic metre
g/s - grams per second
NOx - as NO2
acfm - actual cubic feet per minute
Rcms - dry Reference cubic metres per second

OFFICIAL STACK TESTING RESULTS
CertainTeed
McAdam, NB

Fuel: #2 Fuel Oil
Operating Conditions: Normal
Emission Control Equipment:
Stack Height from Grade: 6.7 m
Stack Diameter: 1.22 m

Parameter	Test 1	Test 2	Test 3	Average	NBDELG Limits
Test ID	PM-1	PM-2	PM-3	-	-
Test Date	28-Oct-15	29-Oct-15	29-Oct-15	-	-
Stack Gas Temperature (C)	144	147	143	144	-
Moisture Content (%)	31.7	40.8	42.0	38.2	-
Velocity (m/s)	12.6	12.1	10.8	11.8	-
Volumetric Flow (Rcms)	7.23	5.94	5.24	6.14	-
Oxygen - O2 (%)	14.5	14.7	14.6	14.6	-
Carbon Dioxide - CO2 (%)	4.81	4.71	4.74	4.76	-
Sulphur Dioxide - SO2					
SO2 Measured Concentration (ppm)	0.0	0.0	0.0	0.0	-
Uncorrected at Ref Cond (mg/Rcm)	0.0	0.0	0.0	0.0	-
Emission Rate (kg/hr)	0.00	0.00	0.00	0.00	-
Nitrogen Oxides - NOx					
NOx Measured Concentration (ppm)	140	133	144	139	-
Uncorrected at Ref Cond (mg/Rcm)	264	250	271	262	-
Emission Rate (kg/hr)	6.86	5.35	5.11	5.77	-
Carbon Monoxide - CO					
CO Measured Concentration (ppm)	14.4	13.9	14.3	14.2	-
Uncorrected at Ref Cond (mg/Rcm)	16.5	15.9	16.4	16.2	-
Emission Rate (kg/hr)	0.43	0.34	0.31	0.36	-
Particulate Matter - PM					
Particulate Concentration (mg/Rcm)	9.85	14.7	10.0	11.5	-
Particulate Emission Rate (kg/hr)	0.26	0.31	0.19	0.25	-

Legend:
C - degrees Celsius
m/s - metres per second
Rcms - dry Reference cubic metres per second
ppm - parts per million
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
mg/Rcm - miligrams per dry Reference cubic metre
NOx - as NO2
ND - non-detectable

Particulate Recoveries: Impinger Catch, Probe Wash, Filter Catch

Client: CertainTeed
Facility: Zone 1 Dryer
Location: McAdam, NB
Job Number: 121811606

IMPINGER CATCH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Sample + Rinse (g)	Jar Tare (g)	Sample Collected (g)	Rinse Water (g)	Total Rinse Water (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
C5	113.1450	113.1452		113.1451	PM-1	1173.9	391.4	683.0	6.9	106.4	113.1904	113.1909		113.1907	0.0456	0.0445
A1	106.0705	106.0704		106.0705	PM-2	1198.2	389.6	727.0	8.6	90.2	106.1207	106.1212		106.1210	0.0505	0.0496
T4	109.2395	109.2396		109.2396	PM-3	1141.1	391.2	654.5	6.9	102.3	109.2830	109.2835		109.2833	0.0437	0.0427
																Conc. (g/mL)
D6	110.4609	110.4610		110.4610	WB	455.3	390.0	65.3		65.3	110.4617	110.4615		110.4616	0.0007	0.000010

PROBE WASH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Acetone (g)	Jar Tare (g)	Recovered Acetone (g)	Rinse Acetone	Total Acetone (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
Q3	111.5955	111.5955		111.5955	PM-1	398.9	324.6	74.3		74.3	111.5980	111.5985		111.5983	0.0028	0.0028
T2	112.1702	112.1705		112.1704	PM-2	362.9	300.2	62.7		62.7	112.1734	112.1739		112.1737	0.0033	0.0033
L3	111.2861	111.2864		111.2863	PM-3	344.2	299.8	44.4		44.4	111.2867	111.2872		111.2870	0.0007	0.0007
																Conc. (g/mL)
G1	117.3946	117.3947		117.3947	AB	355.6	326.2	29.4		29.4	117.3931	117.3926		117.3929	-0.0018	0.000000

Density of Acetone: 0.7850 g/ml

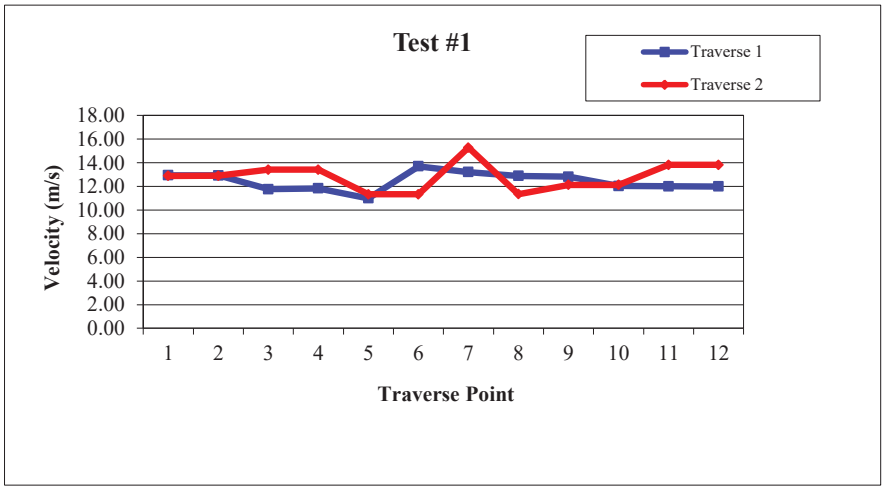
FILTER CATCH

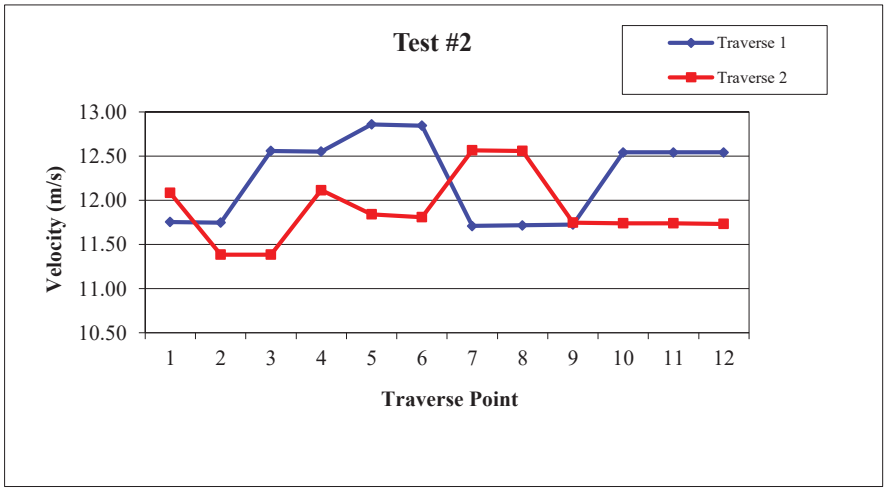
Filter ID	Pre Weights (g) Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID *	Post Weights (g) Date: Analysed by Trial 1	Trial 2	Trial 3	Average	Particulate Weight from Filter (g)
1005-21	0.3717	0.3718		0.3718	PM-1	0.3888	0.3886		0.3887	0.0170
0922-27	0.3691	0.3686		0.3689	PM-2	0.3867	0.3865		0.3866	0.0178
0922-25	0.3707	0.3703		0.3705	PM-3	0.3820	0.3822		0.3821	0.0116

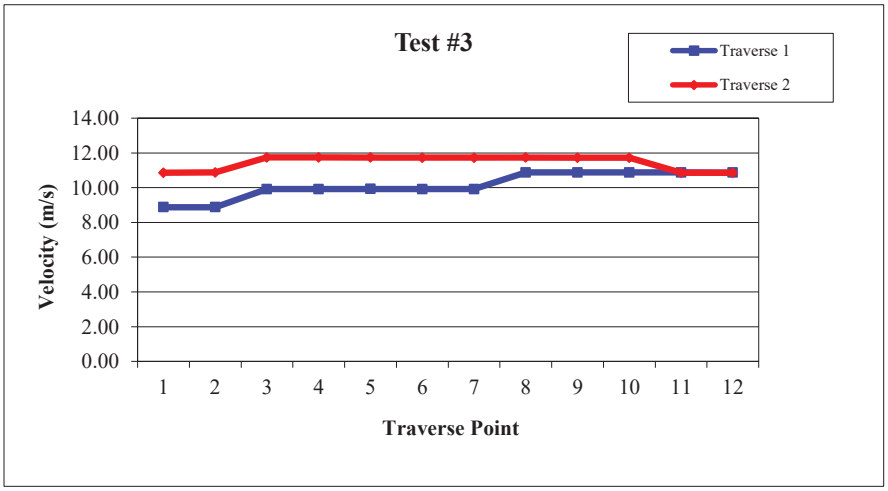
CertainTeed
Zone 1 Dryer

121811606

Stack Gas Velocity Profiles
McAdam, NB







Raw Data for: Certainteed McAdam Zone 2 Dryer PM

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-1
Date: 28-Oct-15
Personnel: TBH

Test Start: 2:45 PM
Test Finish: 4:30 PM

Particulate Collected from Filter (mg):	17.8
Particulate Collected from Probe Wash (mg):	0.9
Particulate Collected from Impinger Wash (mg):	72.4
Total Particulate Collected (mg):	91.1

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1029.8	680.4	349.4
2	100 mL H2O	1035.6	691.8	343.8
3	Blank	849.2	664.2	185.0
4	200g Silica Gel	1058.2	1033.7	24.5
			Total Weight Gain (g)	902.7
			Moisture Volume (mL)	902.7

Parameters

Barometric Pressure, Pbar (in. Hg)	30.02
Stack Static Pressure, Pstatic (in. H2O)	0.20
Ambient Temp, (°F)	75
H2O Volume Collected, Vw (mL)	902.7
Total # Sampling Points,	24
Sampling Time per Point, (min)	4
Readings Taken Every __ mins	4
Regulatory Agency	NBDELG

O2, (%)	16.8
CO2, (%)	3.2
N2, (%)	80.0
CO(ppm)	11.7
NOx (ppm)	83.1
SO2 (ppm)	0.7

Stack Diameter, (in.)	48.00
Stack Area, (sq. ft.)	12.57
Probe Length, (ft.)	6
Nozzle Diameter, (in.)	0.306
Pitot Coefficient, (Cp)	0.788
Gamma, meter constant	1.033
Port length (in.)	4.000

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						493.94		
Traverse 1	**1**	4	241	0.26	0.71	495.80	55	54
	2	8	242	0.31	0.84	497.72	55	54
	3	12	242	0.55	1.50	500.22	55	54
	4	16	238	0.60	1.65	503.02	56	54
	5	20	242	0.65	1.78	505.93	56	54
	6	24	242	0.74	2.03	509.08	56	55
	7	28	238	0.77	2.12	512.28	56	55
	8	32	241	0.64	1.76	515.32	56	55
	9	36	241	0.50	1.37	517.67	56	55
	10	40	242	0.54	1.48	520.52	57	55
	11	44	242	0.48	1.31	523.04	57	55
	12	48	248	0.32	0.87	525.12	57	56
						525.12		
Traverse 2	**1**	52	240	0.34	0.93	527.30	58	56
	2	56	240	0.47	1.29	529.54	58	56
	3	60	240	0.50	1.38	531.95	58	56
	4	64	241	0.60	1.65	534.59	58	56
	5	68	242	0.65	1.79	537.28	58	56
	6	72	242	0.65	1.79	540.31	58	56
	7	76	242	0.72	1.98	543.23	58	56
	8	80	242	0.74	2.03	546.38	58	56
	9	84	242	0.64	1.76	549.37	59	56
	10	88	241	0.52	1.43	552.02	59	57
	11	92	241	0.40	1.13	554.27	59	58
	12	96	240	0.35	0.96	556.48	59	58

Calculations for: Certainteed McAdam Zone 2 Dryer PM

Test #1

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-1
Date: 28-Oct-15
Personnel: TBH

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	30.03
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.19
Volume of Water Vapour Collected, Vwc (cu.ft)	43.330
Stack Gas Moisture Content (% as decimal)	0.390
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	24.82

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	701	0.26	0.71	33.25	30.07	515	1.860	2.016	105.53
	2	8	702	0.31	0.84	36.33	30.08	515	1.920	2.081	99.86
	3	12	702	0.55	1.50	48.39	30.13	515	2.500	2.714	97.78
	4	16	698	0.60	1.65	50.40	30.14	515	2.800	3.038	104.49
	5	20	702	0.65	1.78	52.60	30.15	515	2.910	3.159	104.66
	6	24	702	0.74	2.03	56.13	30.17	516	3.150	3.418	106.14
	7	28	698	0.77	2.12	57.09	30.18	516	3.200	3.473	105.43
	8	32	701	0.64	1.76	52.16	30.15	516	3.040	3.296	110.00
	9	36	701	0.50	1.37	46.10	30.12	516	2.350	2.546	96.11
	10	40	702	0.54	1.48	47.95	30.13	516	2.850	3.085	112.16
	11	44	702	0.48	1.31	45.21	30.12	516	2.520	2.727	105.15
	12	48	708	0.32	0.87	37.07	30.08	517	2.080	2.246	106.53
Traverse 2	**1**	52	700	0.34	0.93	37.99	30.09	517	2.180	2.352	107.62
	2	56	700	0.47	1.29	44.67	30.11	517	2.240	2.419	94.13
	3	60	700	0.50	1.38	46.07	30.12	517	2.410	2.603	98.21
	4	64	701	0.60	1.65	50.50	30.14	517	2.640	2.854	98.35
	5	68	702	0.65	1.79	52.60	30.15	517	2.690	2.909	96.38
	6	72	702	0.65	1.79	52.60	30.15	517	3.030	3.276	108.56
	7	76	702	0.72	1.98	55.36	30.17	517	2.920	3.159	99.45
	8	80	702	0.74	2.03	56.13	30.17	517	3.150	3.408	105.84
	9	84	702	0.64	1.76	52.20	30.15	518	2.990	3.230	107.85
	10	88	701	0.52	1.43	47.02	30.13	518	2.650	2.857	105.78
	11	92	701	0.40	1.13	41.24	30.10	519	2.250	2.422	102.23
	12	96	700	0.35	0.96	38.55	30.09	519	2.210	2.378	107.22
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	701	0.54	1.48	47.40	30.13	516	62.540	67.666	103.56

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-1
Date: 28-Oct-15
Personnel: TBH

Test Start: 3:00 PM
Test Finish: 3:30 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	16.9	3.0	11.0	1.0	74.0	1.0	73
5	17.0	3.0	10.0	1.0	75.0	1.0	74
10	16.9	3.0	10.0	0.0	79.0	1.0	78
15	16.9	3.1	11.0	0.0	81.0	1.3	79
20	16.4	3.4	14.0	0.0	91.0	1.5	89
25	16.6	3.3	14.0	1.0	98.0	2.0	88
30	16.8	3.9	12.0	2.0	84.0	2.3	83
Average:	**16.8**	**3.2**	**11.7**	**0.7**	**83.1**	**1.4**	**81**

Raw Data for: Certainteed McAdam Zone 2 Dryer PM

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-2
Date: 28-Oct-15
Personnel: TBH/AW

Test Start: 11:05 AM
Test Finish: 12:45 PM

Particulate Collected from Filter (mg):	20.0
Particulate Collected from Probe Wash (mg):	16.0
Particulate Collected from Impinger Wash (mg):	46.9
Total Particulate Collected (mg):	83.0

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1038.4	695.3	343.1
2	100 mL H2O	1011.6	719.8	291.8
3	Blank	913.3	663.8	249.5
4	200g Silica Gel	1033.6	1009.0	24.6
			Total Weight Gain (g)	909.0
			Moisture Volume (mL)	909.0

Parameters

Barometric Pressure, Pbar (in. Hg)	29.98	**O2, (%)**	16.7	**Stack Diameter, (in.)**	48.00
Stack Static Pressure, Pstatic (in. H2O)	0.20	**CO2, (%)**	3.2	**Stack Area, (sq. ft.)**	12.57
Ambient Temp, (°F)	70	**N2, (%)**	80.1	**Probe Length, (ft.)**	6
H2O Volume Collected, Vw (mL)	909.0	**CO(ppm)**	10.3	**Nozzle Diameter, (in.)**	0.306
Total # Sampling Points,	24	**NOx (ppm)**	72.4	**Pitot Coefficient, (Cp)**	0.788
Sampling Time per Point, (min)	4	**SO2 (ppm)**	0.9	**Gamma, meter constant**	1.033
Readings Taken Every __ mins	4			**Port length (in.)**	4
Regulatory Agency	NBDELG				

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						556.500		
Traverse 1	**1**	4	251	0.25	0.68	558.050	56	56
	2	8	248	0.25	0.68	559.390	57	56
	3	12	247	0.55	1.49	561.900	57	56
	4	16	241	0.59	1.63	564.700	58	57
	5	20	239	0.68	1.88	567.610	58	56
	6	24	238	0.75	2.08	570.770	58	56
	7	28	241	0.76	2.10	573.960	58	57
	8	32	241	0.65	1.79	577.000	61	57
	9	36	241	0.50	1.38	579.440	61	57
	10	40	241	0.53	1.46	582.200	62	57
	11	44	241	0.46	1.24	584.721	62	58
	12	48	241	0.30	0.83	587.000	62	58
						587.000		
Traverse 2	**1**	52	241	0.35	0.97	588.940	62	58
	2	56	241	0.44	1.22	591.350	62	58
	3	60	242	0.52	1.41	593.990	63	58
	4	64	241	0.58	1.61	596.680	63	58
	5	68	241	0.67	1.86	599.730	63	58
	6	72	241	0.65	1.80	602.640	63	58
	7	76	241	0.71	1.97	605.780	63	58
	8	80	241	0.76	2.11	609.000	63	58
	9	84	242	0.64	1.78	611.990	63	59
	10	88	242	0.54	1.50	614.800	64	59
	11	92	243	0.41	1.13	617.050	64	59
	12	96	242	0.33	0.91	619.180	64	59

Calculations for: Certainteed McAdam Zone 2 Dryer PM

Test #2

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-2
Date: 28-Oct-15
Personnel: TBH/AW

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.99
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.18
Volume of Water Vapour Collected, Vwc (cu.ft)	43.632
Stack Gas Moisture Content (% as decimal)	0.393
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	24.79

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Meter Press., Pm (in. Hg)	Gas Meter Avg. Temp, Tm (R)	Gas Meter Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	711	0.25	0.68	32.88	30.03	516	1.550	1.672	90.34
	2	8	708	0.25	0.68	32.81	30.03	517	1.340	1.444	77.86
	3	12	707	0.55	1.49	48.63	30.09	517	2.510	2.711	98.46
	4	16	701	0.59	1.63	50.15	30.10	518	2.800	3.019	105.42
	5	20	699	0.68	1.88	53.76	30.12	517	2.910	3.143	102.07
	6	24	698	0.75	2.08	56.42	30.13	517	3.160	3.415	105.52
	7	28	701	0.76	2.10	56.92	30.13	518	3.190	3.444	105.95
	8	32	701	0.65	1.79	52.64	30.11	519	3.040	3.270	108.78
	9	36	701	0.50	1.38	46.17	30.08	519	2.440	2.622	99.45
	10	40	701	0.53	1.46	47.53	30.09	520	2.760	2.964	109.17
	11	44	701	0.46	1.24	44.04	30.07	520	2.521	2.703	107.46
	12	48	701	0.30	0.83	35.76	30.04	520	2.279	2.441	119.52
Traverse 2	**1**	52	701	0.35	0.97	38.63	30.05	520	1.940	2.079	94.23
	2	56	701	0.44	1.22	43.31	30.07	520	2.410	2.584	104.46
	3	60	702	0.52	1.41	47.16	30.08	521	2.640	2.829	105.19
	4	64	701	0.58	1.61	49.73	30.10	521	2.690	2.884	101.56
	5	68	701	0.67	1.86	53.44	30.12	521	3.050	3.272	107.20
	6	72	701	0.65	1.80	52.64	30.11	521	2.910	3.121	103.83
	7	76	701	0.71	1.97	55.02	30.12	521	3.140	3.369	107.24
	8	80	701	0.76	2.11	56.92	30.14	521	3.220	3.456	106.33
	9	84	702	0.64	1.78	52.27	30.11	521	2.990	3.204	107.48
	10	88	702	0.54	1.50	48.01	30.09	522	2.810	3.006	109.78
	11	92	703	0.41	1.13	41.87	30.06	522	2.250	2.405	100.86
	12	96	702	0.33	0.91	37.53	30.05	522	2.130	2.275	106.30
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	702	0.54	1.48	47.26	30.09	519	62.680	67.333	103.52

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-2
Date: 28-Oct-15
Personnel: TBH/AW

Test Start: 11:30 AM
Test Finish: 12:00 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	17.0	3.3	10.0	0.0	75.0	1.5	73
5	17.0	3.0	9.0	1.0	74.0	1.5	72
10	16.8	3.0	11.0	1.0	75.0	1.5	73
15	16.5	3.4	12.0	0.0	76.0	1.3	74
20	16.4	3.4	11.0	1.0	69.0	1.3	67
25	16.5	3.3	10.0	2.0	68.0	1.3	67
30	17.0	3.0	9.0	1.0	70.0	1.5	68
Average:	**16.7**	**3.2**	**10.3**	**0.9**	**72.4**	**1.4**	**71**

Raw Data for: Certainteed McAdam Zone 2 Dryer PM

Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-3
Date: 29-Oct-15
Personnel: TBH/AW

Test Start: 2:15 PM
Test Finish: 4:00 PM

Particulate Collected from Filter (mg):	12.6
Particulate Collected from Probe Wash (mg):	5.2
Particulate Collected from Impinger Wash (mg):	38.1
Total Particulate Collected (mg):	55.9

Impinger No.	Impinger Contents	Final Weight (g)	Tare Weight (g)	Weight of Moisture (g)
1	100 mL H2O	1038.7	685.0	353.7
2	100 mL H2O	1020.5	692.2	328.3
3	Blank	850.7	664.1	186.6
4	200g Silica Gel	1060.2	1033.2	27.0
			Total Weight Gain (g)	895.6
			Moisture Volume (mL)	895.6

Parameters

Barometric Pressure, Pbar (in. Hg)	29.90
Stack Static Pressure, Pstatic (in. H2O)	0.20
Ambient Temp, (°F)	77.40
H2O Volume Collected, Vw (mL)	895.60
Total # Sampling Points,	24
Sampling Time per Point, (min)	4
Readings Taken Every __ mins	4
Regulatory Agency	NBDELG

O2, (%)	16.8
CO2, (%)	3.2
N2, (%)	80.0
CO(ppm)	10.4
NOx (ppm)	78.7
SO2 (ppm)	0.3

Stack Diameter, (in.)	48.00
Stack Area, (sq. ft.)	12.57
Probe Length, (ft.)	6
Nozzle Diameter, (in.)	0.306
Pitot Coefficient, (Cp)	0.788
Gamma, meter constant	1.033
Port length (in.)	4

	Traverse Point	Time (min)	Stack Gas Temp, Ts (°F)	S-type Pitot delta P (in. H2O)	Orifice delta H (in. H2O)	Gas Meter Volume (cu. ft.)	Gas Meter Temp Inlet (°F)	Gas Meter Temp Outlet (°F)
						619.380		
Traverse 1	**1**	4	243	0.30	0.72	621.310	58	58
	2	8	243	0.48	1.15	623.680	60	59
	3	12	243	0.51	1.22	626.140	60	59
	4	16	243	0.58	1.39	628.750	61	59
	5	20	243	0.63	1.51	631.500	62	59
	6	24	243	0.68	1.63	634.340	63	59
	7	28	242	0.71	1.71	637.240	64	59
	8	32	242	0.80	1.93	640.130	64	60
	9	36	243	0.82	1.98	643.290	64	61
	10	40	242	0.68	1.64	646.150	64	61
	11	44	242	0.50	1.21	648.610	66	60
	12	48	241	0.38	0.92	650.770	65	60
						650.770		
Traverse 2	**1**	52	242	0.38	0.92	652.970	65	60
	2	56	241	0.45	1.08	655.240	65	60
	3	60	241	0.56	1.36	657.950	65	60
	4	64	242	0.63	1.52	660.400	66	61
	5	68	242	0.70	1.69	663.270	66	61
	6	72	241	0.75	1.81	666.260	65	60
	7	76	242	0.80	1.93	669.610	67	61
	8	80	243	0.69	1.67	672.280	68	63
	9	84	245	0.58	1.40	674.950	69	64
	10	88	246	0.52	1.26	677.240	69	64
	11	92	246	0.48	1.15	679.750	68	63
	12	96	246	0.33	0.79	681.780	68	63

Calculations for: Certainteed McAdam Zone 2 Dryer PM
Test #3

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-3
Date: 29-Oct-15
Personnel: TBH/AW

Calculated Parameters

Stack Gas Pressure, Ps (in.Hg)	29.91
Stack Gas Molecular Weight, Dry Basis, Md (lb/lb-mole)	29.18
Volume of Water Vapour Collected, Vwc (cu.ft)	42.989
Stack Gas Moisture Content (% as decimal)	0.393
Stack Gas Molecular Weight, Wet Basis, Ms (lb/lb-mole)	24.79

Isokineticity Checks

Check range	**Within Criteria**
Check average	**Within Criteria**

	Traverse Point	Time (min)	Stack Gas Temp, Ts (R)	S-type Pitot, delta P (in. H2O)	Orifice delta H (in. H2O)	Stack Gas Velocity, Us (ft/s)	Gas Meter: Meter Press., Pm (in. Hg)	Gas Meter: Avg. Temp, Tm (R)	Gas Meter: Volume, Vm (cu. ft.)	Vol. @ Ref., Vmc (cu. ft.)	Isokinetics I (%)
Traverse 1	**1**	4	703	0.30	0.72	35.86	29.95	518	1.930	2.069	101.55
	2	8	703	0.48	1.15	45.36	29.98	520	2.370	2.536	98.40
	3	12	703	0.51	1.22	46.76	29.99	520	2.460	2.633	99.10
	4	16	703	0.58	1.39	49.86	30.00	520	2.610	2.792	98.54
	5	20	703	0.63	1.51	51.97	30.01	521	2.750	2.940	99.56
	6	24	703	0.68	1.63	53.99	30.02	521	2.840	3.034	98.90
	7	28	702	0.71	1.71	55.13	30.03	522	2.900	3.096	98.69
	8	32	702	0.80	1.93	58.52	30.04	522	2.890	3.084	92.61
	9	36	703	0.82	1.98	59.29	30.05	523	3.160	3.369	100.01
	10	40	702	0.68	1.64	53.95	30.02	523	2.860	3.047	99.24
	11	44	702	0.50	1.21	46.26	29.99	523	2.460	2.615	99.35
	12	48	701	0.38	0.92	40.30	29.97	523	2.160	2.297	100.02
Traverse 2	**1**	52	702	0.38	0.92	40.33	29.90	523	2.200	2.334	101.71
	2	56	701	0.45	1.08	43.86	29.97	523	2.270	2.414	96.59
	3	60	701	0.56	1.36	48.93	29.98	523	2.710	2.883	103.41
	4	64	702	0.63	1.52	51.93	30.00	524	2.450	2.603	88.09
	5	68	702	0.70	1.69	54.74	30.01	524	2.870	3.050	97.94
	6	72	701	0.75	1.81	56.62	30.02	523	2.990	3.185	98.73
	7	76	702	0.80	1.93	58.52	30.03	524	3.350	3.560	106.91
	8	80	703	0.69	1.67	54.39	30.04	526	2.670	2.830	91.58
	9	84	705	0.58	1.40	49.93	30.02	527	2.670	2.823	99.78
	10	88	706	0.52	1.26	47.31	30.00	527	2.290	2.419	90.38
	11	92	706	0.48	1.15	45.46	29.99	526	2.510	2.656	103.27
	12	96	706	0.33	0.79	37.69	29.98	526	2.030	2.148	100.70
		Total	**Average**	**Average**	**Average**	**Average**	**Average**	**Average**	**Total**	**Total**	**Average**
		96	703	0.58	1.40	49.46	30.00	523	62.400	66.416	98.54

Combustion Gas Data for: CertainTeed

Client: CertainTeed
Job Number: 121811606

Plant: Zone 2 Dryer
Location: McAdam, NB
Test: PM-3
Date: 29-Oct-15
Personnel: TBH/AW

Test Start: 2:30 PM
Test Finish: 3:00 PM

Time (min)	O2 (%)	CO2 (%)	CO (ppm)	SO2 (ppm)	NOx (ppm)	NO (ppm)	NO2 (ppm)
0	16.9	3.1	10.0	0.0	75.0	1.5	72
5	16.8	3.2	10.0	0.0	76.0	1.5	73
10	16.9	3.1	9.0	0.1	81.0	1.5	79
15	16.8	3.2	10.0	0.0	81.0	1.5	80
20	16.8	3.2	12.0	0.0	79.0	1.5	76
25	16.7	3.2	13.0	1.0	79.0	1.5	77
30	17.0	3.1	9.0	1.0	80.0	1.5	78
Average:	**16.8**	**3.2**	**10.4**	**0.3**	**78.7**	**1.5**	**76**

DATA ENTRY

CertainTeed

McAdam, NB

Fuel: #2 Fuel oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 6.7 m

Stack Diameter: 1.22 m

Reference Temperature, Tref (F): 77
(K): 298
Reference Pressure, Pref (in.Hg): 29.92
(Bar): 1.0

Parameter	Symbol	Units	Test 1	Test 2	Test 3	Average
Test ID	-	-	PM-1	PM-2	PM-3	-
Date	-	-	28-Oct-15	28-Oct-15	29-Oct-15	n/a
Start Time	-	-	2:45 PM	11:05 AM	2:15 PM	n/a
End Time	-	-	4:30 PM	12:45 PM	4:00 PM	n/a
Total Sampling Time	-	min	96	96	96	96
Stack Diameter	D	in.	48	48	48	48
Average Stack Gas Temperature	Ts	F	241	242	243	242
Average Dry Gas Meter Temperature	Tm	F	56	59	63	59
Barometric Pressure	Pbar	in.Hg	30.02	29.98	29.90	29.97
Stack Static Pressure	Pstatic	in.H2O	0.20	0.20	0.20	0.20
Average Pressure Drop (Head)	dP	in.H2O	0.54	0.54	0.58	0.55
Average deltaH Orifice	dH	in.H2O	1.48	1.48	1.40	1.45
Average Meter Temperature	Tm	F	56	59	63	59
Gas Sample Volume	Vm	cu.ft	62.54	62.68	62.40	62.54
Average Isokinetics	I	%	103.56	103.52	98.54	101.87
Nozzle Diameter	Dn	in.	0.306	0.306	0.306	0.306
Pitot Coefficient	Cp	-	0.788	0.788	0.788	0.788
Gamma, meter constant	y	-	1.033	1.033	1.033	1.033
Reference Temperature	Tref	R	537	537	537	537
Reference Pressure	Pref	in.Hg	29.92	29.92	29.92	29.92
Stack Gas Oxygen Content	Co2	%	16.8	16.7	16.8	16.8
Stack Gas Carbon Dioxide Content	Cco2	%	3.2	3.2	3.2	3.2
Stack Gas Nitrogen Content	Cn2	%	80.0	80.1	80.0	80.0
Stack Gas Sulphur Dioxide Content	Cso2	ppm	0.7	0.9	0.3	0.6
Stack Gas Nitrogen Oxides Content	Cnox	ppm	83.1	72.4	78.7	78.1
Stack Gas Carbon Monoxide Content	Cco	ppm	11.7	10.3	10.4	10.8
Volume of Water Collected	Vw	mL	902.7	909.0	895.6	902.4
Particulate Collected from Filter	-	mg	17.8	20.0	12.6	16.8
Particulate Collected from Probe Wash	-	mg	0.9	16.0	5.2	7.4
Particulate Collected from Impinger Wash	-	mg	72.4	46.9	38.1	52.5
Total Particulate Collected (excl. impingers)	Mp	mg	18.7	36.0	17.8	24.2

Legend:
F - degrees Fahrenheit
K - degrees Kelvin
Bar - bars
in.Hg - inches of mercury
in. - inches
in.H2O - inches of water
cu.ft - cubic feet
R - degrees Rankin
NOx - as NO2

CALCULATIONS

CertainTeed

McAdam, NB

Fuel: #2 Fuel oil

Operating Conditions: Normal

Emission Control Equipment:

Stack Height from Grade: 6.7 m

Stack Diameter: 1.22 m

Variable	Symbol	Units	Calculation	Test 1	Test 2	Test 3	Average
Stack Area	As	sq.ft	As = Pi x ((D/12)^2)/ 4	12.57	12.57	12.57	12.57
		sq.m	As (sq.ft) x 0.0929	1.17	1.17	1.17	1.17
Barometric Pressure	Pbar	kPa	Pbar (kPa) = Pbar (in.Hg) x 3.386	101.6	101.5	101.2	101.5
Stack Static Pressure	Pstatic	kPa	Pstatic (kPa) = Pstatic (in.H2O) x 0.249	0.05	0.05	0.05	0.05
Avg. Stack Temperature	Ts	R	Ts (R) = Ts (F) + 460	701	702	703	702.0
Avg. Meter Temperature	Tm	R	Tm (R) = Tm (F) + 460	516	519	523	519.4
Nozzle Diameter	Dn	mm	Dn (mm) = Dn (in.) x 25.4	8	8	8	7.8
Gas Meter Pressure	Pm	in.Hg	Pm = Pbar + (dH / 13.6)	30.13	30.09	30.00	30.1
Sample Volume at Ref Cond	Vmc	cu.ft	Vmc = Tref/Pref x (Vm x Pm x y) / Tm	67.66	67.33	66.42	67.1
		cu.m	Vmc (cu.m) = 0.02832 x Vmc (cu.ft)	1.92	1.91	1.88	1.90
Volume of Water Vapour	Vwc	cu.ft	Vwc = 0.0480 x Vw	43.33	43.63	42.99	43.3
Water Fraction	Bwo	-	Bwo = Vwc / (Vwc + Vmc)	0.390	0.393	0.393	0.4
Molecular Weight, Dry	Md	lb/lb-mol	Md = 0.44 (Cco2) + 0.32 (Co2) + 0.28 (Cn2)	29.19	29.18	29.18	29.2
Molecular Weight, Wet	Ms	lb/lb-mol	Ms = Md (1 - Bwo) + (18 x Bwo)	24.82	24.79	24.79	24.8
Stack Pressure	Ps	in.Hg	Ps = Pbar + (Pstatic / 13.6)	30.03	29.99	29.91	30.0
Stack Gas Velocity	Us	ft/s	Us = 85.33 x Cp x ((dP x Ts)/(Ps x Ms))^0.5	47.40	47.26	49.46	48.0
		m/s	Us (m/s) = 0.3048 x Us (ft/s)	14.45	14.41	15.07	14.6
Actual Stack Gas Flow Rate	Q	acfm	Q = 60 x Us x As	35,739	35,634	37,290	36,221
		acmm	Q(acmm) = Q(acfm) x 0.02831685	1,012	1,009	1,056	1,026
Dry Stack Gas Flow Rate	Qs	Rcfm	Qs = Q x (1-Bwo) x (Tref/Ts) x (Ps/Pref)	16,745	16,581	17,294	16,873
		Rcms	Qs (Rcms) = 0.000472 x Qs (Rcfm)	7.90	7.83	8.16	8.0
Sulphur Dioxide - SO2							
SO2 Measured Concentration	Cso2	ppm	Measurement from Flue Gas Analyzer	0.71	0.86	0.30	0.62
Uncorrected @ Ref Cond	Cso2	mg/Rcm	Cso2 (mg/Rcm) = Cso2 (ppm) x 2.62	1.87	2.25	0.79	1.63
SO2 Emission Rate	ERso2	g/s	ERso2 = Cso2/1000 x Qs	0.01	0.02	0.01	0.01
		kg/hr	ERso2 (kg/hr) = 3.6 x ERso2 (g/s)	0.05	0.06	0.02	0.05
SO2 Concentration							
Corrected to 11% O2	Cso2	mg/Rcm	Cso2 (11% O2) = Cso2 (mg/Rcm) x (20.9-11) / (20.9-Co2)	4.50	5.32	1.92	3.91
Corrected to 3% O2	Cso2	mg/Rcm	Cso2 (3% O2) = Cso2 (mg/Rcm) x (20.9-3) / (20.9-Co2)	8.14	9.61	3.46	7.07
Corrected to 12% CO2	Cso2	mg/Rcm	Cso2 (12% CO2) = Cso2 (mg/Rcm) x (12/Cco2)	6.92	8.39	2.99	6.10
Nitrogen Oxides - NOx							
NOx Measured Concentration	Cnox	ppm	Measurement from Flue Gas Analyzer	83.14	72.43	78.71	78.10
Uncorrected @ Ref Cond	Cnox	mg/Rcm	Cnox (mg/Rcm) = Cnox (ppm) x 1.882	156.47	136.31	148.14	146.98
NOx Emission Rate	ERnox	g/s	ERnox = Cnox/1000 x Qs	1.24	1.07	1.21	1.17
		kg/hr	ERnox (kg/hr) = 3.6 x ERnox (g/s)	4.45	3.84	4.35	4.22
NOx Concentration							
Corrected to 11% O2	Cnox	mg/Rcm	Cnox (11% O2) = Cnox (mg/Rcm) x (20.9-11) / (20.9-Co2)	376.65	322.73	361.10	353.49
Corrected to 3% O2	Cnox	mg/Rcm	Cnox (3% O2) = Cnox (mg/Rcm) x (20.9-3) / (20.9-Co2)	681.01	583.52	652.90	639.14
Corrected to 12% CO2	Cnox	mg/Rcm	Cnox (12% CO2) = Cnox (mg/Rcm) x (12/Cco2)	578.90	509.28	564.09	550.75
Carbon Monoxide - CO							
CO Measured Concentration	Cco	ppm	Measurement from Flue Gas Analyzer	11.71	10.29	10.43	10.81
Uncorrected @ Ref Cond	Cco	mg/Rcm	Cco (mg/Rcm) = Cco (ppm) x 1.145	13.41	11.78	11.94	12.38
CO Emission Rate	ERco	g/s	ERco = Cco/1000 x Qs	0.11	0.09	0.10	0.10
		kg/hr	ERco (kg/hr) = 3.6 x ERco (g/s)	0.38	0.33	0.35	0.35
CO Concentration							
Corrected to 11% O2	Cco	mg/Rcm	Cco (11% O2) = Cco (mg/Rcm) x (20.9-11) / (20.9-Co2)	32.29	27.88	29.11	29.76
Corrected to 3% O2	Cco	mg/Rcm	Cco (3% O2) = Cco (mg/Rcm) x (20.9-3) / (20.9-Co2)	58.38	50.42	52.63	53.81
Corrected to 12% CO2	Cco	mg/Rcm	Cco (12% CO2) = Cco (mg/Rcm) x (12/Cco2)	49.62	44.00	45.47	46.36
Particulate Concentration	Cs	mg/Rcm	Cs = Mp / Vmc	9.76	18.91	9.46	12.71
Particulate Emission Rate	ERp	g/s	ERp = Cs/1000 x Qs	0.08	0.15	0.08	0.10
		kg/hr	ERp (kg/hr) = 3.6 x ERp (g/s)	0.28	0.53	0.28	0.36
Particulate Concentration							
Corrected to 11% O2	Cs	mg/Rcm	Cs (11% O2) = Cs x (20.9-11) / (20.9-Co2)	23.49	44.76	23.07	30.44
Corrected to 3% O2	Cs	mg/Rcm	Cs (3% O2) = Cs x (20.9-3) / (20.9-Co2)	42.48	80.94	41.71	55.04
Corrected to 12% CO2	Cs	mg/Rcm	Cs (12% CO2) = Cs x (12/Cco2)	36.11	70.64	36.04	47.59

Legend:

sq.ft - square feet
sq.m - square metres
Pi - 3.142
R - degrees Rankin
ppm - parts per million
in.Hg - inches of mercury
cu.ft - cubic feet
cu.m - cubic metres
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
Rcfm - dry Reference cubic feet per minute
mg/Rcm - miligrams per dry Reference cubic metre
g/s - grams per second
NOx - as NO2
acfm - actual cubic feet per minute
Rcms - dry Reference cubic metres per second

OFFICIAL STACK TESTING RESULTS
CertainTeed
McAdam, NB

Fuel: #2 Fuel oil
Operating Conditions: Normal
Emission Control Equipment:
Stack Height from Grade: 6.7 m
Stack Diameter: 1.22 m

Parameter	Test 1	Test 2	Test 3	Average	NBDELG Limits
Test ID	PM-1	PM-2	PM-3	-	-
Test Date	28-Oct-15	28-Oct-15	29-Oct-15	-	-
Stack Gas Temperature (C)	116	117	117	117	-
Moisture Content (%)	39.0	39.3	39.3	39.2	-
Velocity (m/s)	14.4	14.4	15.1	14.6	-
Volumetric Flow (Rcms)	7.90	7.83	8.16	7.96	-
Oxygen - O2 (%)	16.8	16.7	16.8	16.8	-
Carbon Dioxide - CO2 (%)	3.24	3.21	3.15	3.20	-
Sulphur Dioxide - SO2					
SO2 Measured Concentration (ppm)	0.71	0.86	0.30	0.62	-
Uncorrected at Ref Cond (mg/Rcm)	1.87	2.25	0.79	1.63	-
Emission Rate (kg/hr)	0.05	0.06	0.02	0.05	-
Nitrogen Oxides - NOx					
NOx Measured Concentration (ppm)	83.1	72.4	78.7	78.1	-
Uncorrected at Ref Cond (mg/Rcm)	156	136	148	147	-
Emission Rate (kg/hr)	4.45	3.84	4.35	4.22	-
Carbon Monoxide - CO					
CO Measured Concentration (ppm)	11.7	10.3	10.4	10.8	-
Uncorrected at Ref Cond (mg/Rcm)	13.4	11.8	11.9	12.4	-
Emission Rate (kg/hr)	0.38	0.33	0.35	0.35	-
Particulate Matter - PM					
Particulate Concentration (mg/Rcm)	9.76	18.9	9.46	12.7	-
Particulate Emission Rate (kg/hr)	0.28	0.53	0.28	0.36	-

Legend:
C - degrees Celsius
m/s - metres per second
Rcms - dry Reference cubic metres per second
ppm - parts per million
Ref Cond - Reference temperature and pressure (25 C and 101.3 kPa)
mg/Rcm - miligrams per dry Reference cubic metre
NOx - as NO2
ND - non-detectable

Particulate Recoveries: Impinger Catch, Probe Wash, Filter Catch

Client: CertainTeed
Facility: Zone 2 Dryer
Location: McAdam, NB
Job Number: 121811606

IMPINGER CATCH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Sample + Rinse (g)	Jar Tare (g)	Sample Collected (g)	Rinse Water (g)	Total Rinse Water (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
G5	112.8749	112.8750		112.8750	PM-1	1345.9	376.0	902.7	9.6	76.8	112.9479	112.9484		112.9482	0.0732	0.0724
D3	107.1630	107.1630		107.1630	PM-2	1390.5	378.1	909.0	20.4	123.8	107.2109	107.2114		107.2112	0.0482	0.0469
D2	112.1295	112.1296		112.1296	PM-3	1335.7	378.3	895.6	16.9	78.7	112.1682	112.1687		112.1685	0.0389	0.0381
																Conc. (g/mL)
D6	110.4609	110.4610		110.4610	WB	455.3	390.0	65.3		65.3	110.4617	110.4615		110.4616	0.0007	0.000010

PROBE WASH

Container ID	Beaker Pre Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID	Recoveries Jar + Acetone (g)	Jar Tare (g)	Recovered Acetone (g)	Rinse Acetone	Total Acetone (g)	Beaker Post Weights (g) Date Analysed by Trial 1	Trial 2	Trial 3	Average	Uncorrected Particulate Weight (g)	Corrected Particulate Weight (g)
N1	112.7058	112.7057		112.7058	PM-1	352.8	302.3	50.5		50.5	112.7064	112.7069		112.7067	0.0009	0.0009
S5	108.9285	108.9283		108.9284	PM-2	424.3	301.6	122.7		122.7	108.9442	108.9447		108.9445	0.0160	0.0160
L6	109.8359	109.8359		109.8359	PM-3	386.7	299.1	87.6		87.6	109.8408	109.8413		109.8411	0.0052	0.0052
																Conc. (g/mL)
G1	117.3946	117.3947		117.3947	AB	355.6	326.2	29.4		29.4	117.3931	117.3926		117.3929	-0.0018	0.000000

Density of Acetone: 0.7850 g/ml

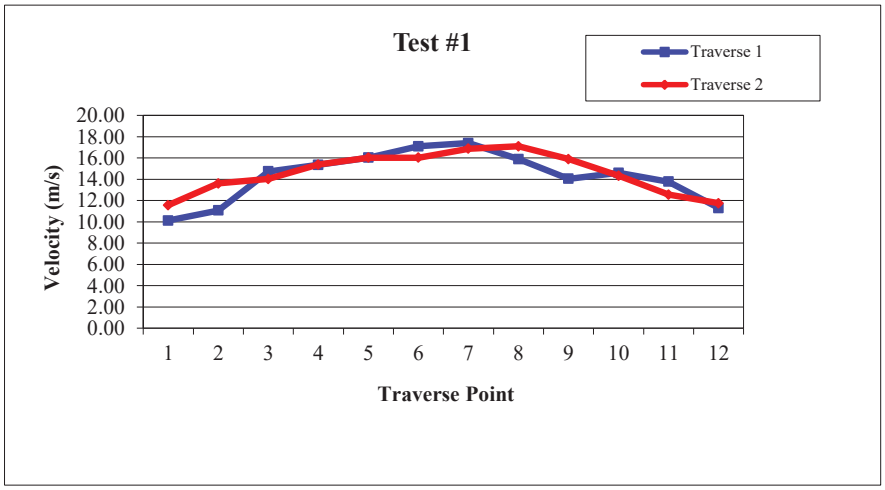
FILTER CATCH

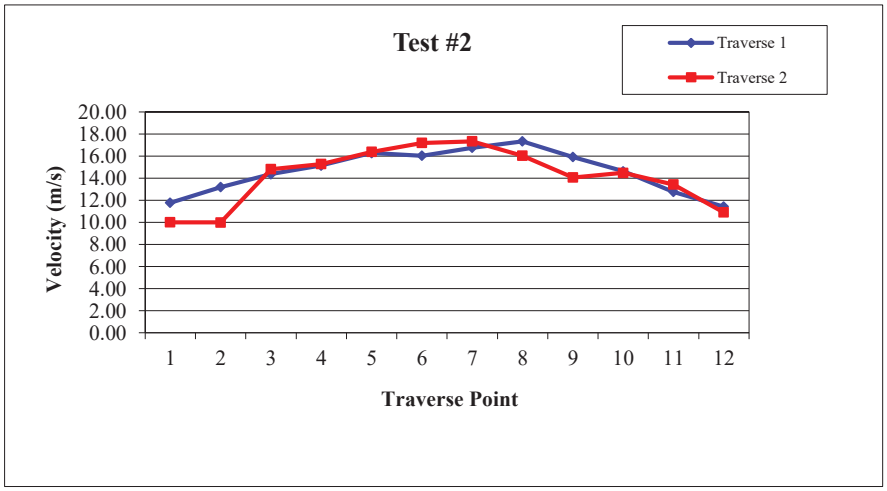
Filter ID	Pre Weights (g) Analysed by Trial 1	Trial 2	Trial 3	Average	Sample ID *	Post Weights (g) Date: Analysed by Trial 1	Trial 2	Trial 3	Average	Particulate Weight from Filter (g)
0922-26	0.3698	0.3693		0.3696	PM-1	0.3873	0.3874		0.3874	0.0178
0922-23	0.3704	0.3700		0.3702	PM-2.1	0.3750	0.3751		0.3751	0.0049
0922-30	0.3689	0.3686		0.3688	PM-2.2	0.3835	0.3843		0.3839	0.0152
0922-21	0.3698	0.3694		0.3696	PM-3	0.3820	0.3825		0.3823	0.0126

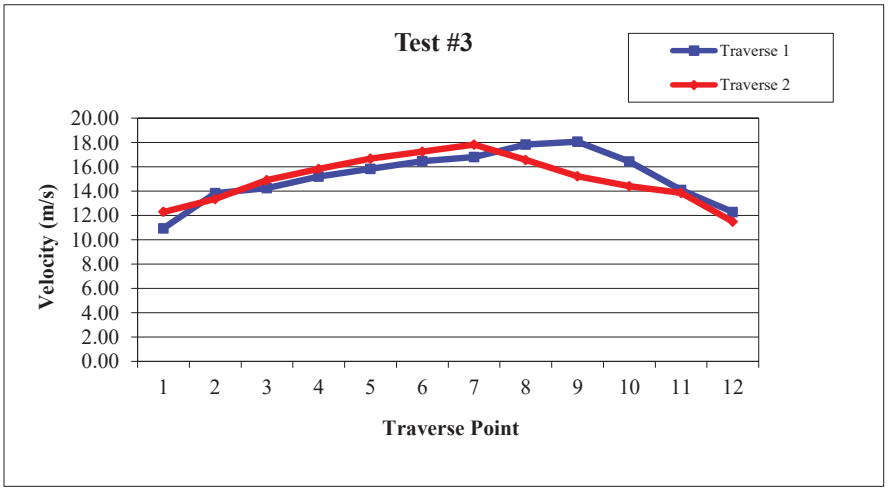
CertainTeed
Zone 2 Dryer

121811606

Stack Gas Velocity Profiles
McAdam, NB







Project: 121311606 Certainteed
Test: Zone 1 Dryer PM-2
Date: Dec 11, 2015
Analyst: TBH

Absolute stack gas pressure (Ps) in in.Hg is:

$$Ps = P_{bar} + \frac{P_{static}\ in.H_2O}{13.6\ in.H_2O/in.Hg}$$

$$Ps = \frac{29.98}{} + \frac{0.20}{13.6}$$

A $Ps = 29.99$ in.Hg

The molecular weight of the stack gas on a dry basis (Md) in lb/lb-mole is:

$$Md = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ [(\%N_2)]$$

$$Md = 0.44 \times 4.71 + 0.32 \times 14.66 + 0.28\ (80.63 + \ /\ ) + 0.40\ (\ /\ + \ /\ )$$

$$Md = 2.07 + 4.69 + 27.58 + \ /$$

B $Md = 29.34$ lb/lb-mole

The volume of water vapour collected at reference conditions (Vwc) in ft^3 is:

$$Vwc = 0.0480\ ft^3/mL \times \text{volume of moisture collected mL.}$$

$$Vwc = 0.0480 \times 727.0$$

C $Vwc = 34.90\ ft^3$

The average _H orifice in in.H_2O is:

$$\text{\_H orifice}_{avg.} = \frac{\Sigma \text{ H orifice}}{\text{\# points}}$$

$$\text{\_H orifice}_{avg.} = \frac{21.39}{24}$$

D $$\text{\_H orifice}_{avg.} = 0.966 \text{ in.}H_2O$$

The pressure at the gas meter (Pm) in in.Hg is:

$$Pm = P_{bar} + \frac{\text{\_H orifice}_{avg.} \text{ in.}H_2O}{13.6 \text{ in.}H_2O/\text{in.Hg}}$$

$$Pm = 29.98 + \frac{0.986}{13.6}$$

$$Pm = 29.98 + 0.071$$

E $$Pm = 30.05 \text{ in.Hg}$$

The temperature of the gas meter (Tm) in °R is:

$$Tm = \frac{\Sigma \text{ meter temp. °F}}{\text{\# points}} + 460$$

$$Tm = \frac{3279}{48} + 460$$

$$Tm = 68.31 + 460$$

F $$Tm = 528.31 \text{ °R}$$

The total volume of gas metered (Vm) in ft^3 is:

Vm = Vf ft^3 - Vi ft^3

Vm = 215.80 - 164.96

G Vm = 50.84 ft^3

The dry gas volume at reference conditions (Vmc) in ft^3 is:

$$Vmc = \frac{T_{ref}\ °R}{P_{ref}\ in.Hg} \times \frac{Pm\ in.Hg \times Vm\ ft^3 \times y}{Tm\ °R}$$

$$Vmc = \frac{537}{29.92} \times \frac{30.05 \times 50.84 \times 0.974}{528.31}$$

H Vmc = 50.55 ft^3 x 1 m^3 / 35.31 ft^3 = 1.43 m^3

The stack gas moisture content, i.e. the proportion by volume of water vapour in the gas stream (Bwo) is:

$$Bwo = \frac{Vwc\ ft^3}{Vwc\ ft^3 + Vmc\ ft^3}$$

$$Bwo = \frac{34.90}{34.90 + 50.84}$$

Bwo = 0.407

I Bwo = 0.407

The Molecular weight of the stack gas on a wet basis (Ms) in lb/lb-mole is:

Ms = Md lb/lb-mole (1-Bwo) + 18 lb/lb-mole x Bwo

Ms = 29.34 x (1 - 0.407) + 18 x (0.407)

Ms = 29.34 x 0.59 + 7.32

J Ms = 24.72 lb/lb-mole

The average temperature of the stack ($Ts_{avg.}$) in °R is:

$Ts_{avg.} = \frac{\Sigma Ts\ °F}{\#\ points} + 460$

$Ts_{avg.} = \frac{7099}{24} + 460$

$Ts_{avg.} = 295.79 + 460$

K $Ts_{avg.} = 755.79$ °R

The average velocity ($Us_{avg.}$) of the stack in ft/s is:

T2-1

$Us_{avg.} = \frac{\Sigma V}{\#\ points}$

$U_{S1} = 85.33 C_P \sqrt{\frac{\Delta P_1 \cdot T_{S1}}{P_S \cdot M_S}} = 85.33(0.75)\sqrt{\frac{(0.35)(759}{(29.99)(24.7}}$

$U_{S1} =$ 38.52 ft/s ✓

$Us_{avg.} = \frac{950.86}{24}$

L $Us_{avg.} =$ 39.62 ft/s x 1 m / 3.281 ft = 12.07 m/s

The cross-sectional area of the stack (As) in ft^2 is:

As = $\frac{\Pi (D\ ft)^2}{4}$

As = $\frac{\Pi}{4}$ x (48/12)^2

As = 0.7854 x 16

As = 12.57 ft^2

The volumetric stack gas flowrate on a dry basis at reference conditions (Qs) in ft^3/hr is:

Qs = 3600 s/hr x Us ft/s x As ft^2 x (1-Bwo) x $\frac{T_{ref}\ °R}{Ts_{avg.}\ °R}$ x $\frac{Ps\ in.Hg}{P_{ref}\ in.Hg}$

Qs = 3600 x 39.62 x 12.57 x (1 - 0.407) x $\frac{537}{759.79}$ x $\frac{29.99}{29.92}$

Qs = 3600 x 39.62 x 12.57 x 0.59 x 0.71 x 1.002

Qs = 757 220 ft^3/hr x 1 hr / 60 min = 12 587 ft^3/min

Qs = 12587 ft^3/min x 1 m^3 / 35.31 ft^3 x 1 min / 60 s = 5.94 m^3/s

The total amount of particulate matter collected (Mp) in mg is:

Mp = 21.1 mg

The concentration of the particulate matter in the stack gas on a dry basis at reference conditions (Cp) in lb/ft^3 is:

$$Cp = 2.205 \times 10^{-6} \text{ lb/mg} \times \frac{Mp \text{ mg}}{Vmc \text{ ft}^3}$$

$$Cp = 2.205 \times 10^{-6} \text{ lb/mg} \times \frac{21.1}{5055}$$

Cp = 9.20×10^{-7} lb/ft^3 x 453,590 mg / lb x 35.31 ft^3 / m^3 = 14.7 mg/m^3

The emission rate of the particulate matter from the stack on a dry basis at reference conditions (ERp) in lb/hr is:

Erp = Cp lb/ft^3 x Qs ft^3/hr

ERp = 9.20×10^{-7} x 757 220

ERp = 0.695 lb/hr x 1 kg / 2.20 lb = 0.31 kg/hr

Appendix M-2
Greenhouse Gas Emissions, 2017 & 2018

Report Preview

Company Details

Name

CertainTeed Canada, Inc.

Report Details

Report Status:

Ready to Submit -

Reporting Period:

2017

Facility Name:

McAdam Wallboard Plant

Facility Address:

57 Quality Way McAdam (New Brunswick) E6J 1B1Canada

Report Type:

Report ECCC & NB

Report Update Comments:

Verify Facility Information

Please verify the following information.

Company Information

Legal Name *	CertainTeed Canada, Inc.
English Trade Name	CertainTeed Gypsum
French Trade Name	
Business Number	808787147
DUNS Number	

Facility Details

Facility Name *	McAdam Wallboard Plant
Physical Address *	57 Quality Way McAdam (New Brunswick) E6J 1B1 Canada 45.59360 -67.30960
Primary NAICS Code *	327420
GHGRP ID	0 (GHGRP ID to be assigned by ECCC)
NPRI ID	5095

Reporter

Name *	Stephen Dennis
Position *	Snr Automation Specialist
Mailing Address *	57 Quality Way Mcadam (New Brunswick), E6J 1B1, Canada
Physical Address *	57 Quality Way Mcadam (New Brunswick), E6J 1B1, Canada
Email Address *	steve.dennis@saint-gobain.com
Telephone Number *	5067847008
Ext.	

Authorized Signing Officer (Certifying Official)

Name *	Alexey Avdyushin
Position *	Regional Manager, EHS&S
Mailing Address *	2424 Lakeshore Road West, Mississauga (Ontario), L5J 1K4, Canada
Physical Address *	2424 Lakeshore Road West, Mississauga (Ontario), L5J 1K4, Canada
Email Address *	alexey.avdyushin@saint-gobain.com
Telephone Number *	9054032797
Ext.	

Parent Company Information

SAINT-GOBAIN CORPORATION

Legal Name *	SAINT-GOBAIN CORPORATION
Percentage of ownership of the reporting company *	100.00
Physical Address *	750 E Swedesford Road Valley Forge (Pennsylvania), 19482, United States
Business Number **	121891469
DUNS Number	

Facility Activities

Activities

You must select at least one activity

None of the above

Section A

Report the direct greenhouse gas emissions for this facility for the period identified above.
Click Validate to check for errors and Save/Continue to save the information. If there are any errors, they will be flagged. If there are no errors, the page will be Complete.
N/A = Not ApplicableMDM = Monitoring or Direct MeasurementMB = Mass BalanceEF = Emission FactorsEE = Engineering Estimates

Stationary Fuel Combustion Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☐	Carbon Dioxide (CO2)	☐	☐	☒	☐	12898.4	12898.4
☐	Methane (CH4)	☐	☐	☒	☐	0.336	8.400
☐	Nitrous Oxide (N2O)	☐	☐	☒	☐	0.225	67.050

Sub-total 12973.850

Industrial Process Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Venting Emissions (including vented Formation CO2)

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Flaring Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		

☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Leakage Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

On-site Transportation Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☐	Carbon Dioxide (CO2)	☐	☐	☒	☐	88.2	88.2
☐	Methane (CH4)	☐	☐	☒	☐	0.03728	0.93200
☐	Nitrous Oxide (N2O)	☐	☐	☒	☐	0.05203	15.50494

Sub-total 104.63694

Waste Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)

☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Wastewater Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Section B

Report the direct greenhouse gas emissions for this facility for the period identified above.Click Validate to check for errors and Save/Continue to save the information. If there are any errors, they will be flagged. If there are no errors, the page will be Complete.

Note: CO2 emissions from biomass combustion are not included in the total reported to Environment and Climate Change Canada.

N/A = Not ApplicableMDM = Monitoring or Direct MeasurementMB = Mass BalanceEF = Emission FactorsEE = Engineering Estimates

Biomass Combustion Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)

☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		

Section C

Report the direct emissions of HFCs, PFCs and SF6 from industrial processes and industrial product use only for this facility for the period identified above.
Click Validate to check for errors and Save/Continue to save the information. If there are any errors, they will be flagged. If there are no errors, the page will be Complete.
N/A = Not ApplicableMDM = Monitoring or Direct MeasurementMB = Mass BalanceEF = Emission FactorsEE = Engineering Estimates

Hydrofluorocarbon (HFC) Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	HFC-23 (CHF3)	☐	☐	☐	☐		
☒	HFC-32 (CH2F2)	☐	☐	☐	☐		
☒	HFC-41 (CH3F)	☐	☐	☐	☐		
☒	HFC-43-10mee (C5H2F10)	☐	☐	☐	☐		
☒	HFC-125 (C2HF5)	☐	☐	☐	☐		
☒	HFC-134 (C2H2F4)	☐	☐	☐	☐		
☒	HFC-134a (C2H2F4)	☐	☐	☐	☐		
☒	HFC-143 (C2H3F3)	☐	☐	☐	☐		
☒	HFC-143a	☐	☐	☐	☐		

	(C2H3F3)						
☒	HFC-152a (C2H4F2)	☐	☐	☐	☐		
☒	HFC-227ea (C3HF7)	☐	☐	☐	☐		
☒	HFC-236fa (C3H2F6)	☐	☐	☐	☐		
☒	HFC-245ca (C3H3F5)	☐	☐	☐	☐		
Total							

Perfluorocarbon (PFC) Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Perfluoromethane (CF4)	☐	☐	☐	☐		
☒	Perfluoroethane (C2F6)	☐	☐	☐	☐		
☒	Perfluoropropane (C3F8)	☐	☐	☐	☐		
☒	Perfluorobutane (C4F10)	☐	☐	☐	☐		
☒	Perfluorocyclobutane (c-C4F8)	☐	☐	☐	☐		
☒		☐	☐	☐	☐		

	Perfluoropentane (C5F12)						
☒	Perfluorohexane (C6F14)	☐	☐	☐	☐		

Total

Sulphur Hexafluoride (SF6) Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Sulphur hexafluoride (SF6)	☐	☐	☐	☐		

Summary

No input required - GHG totals are calculated automatically.

Total GHG Emissions for the Facility

	Emissions (t)	Emissions (t CO2e)
Carbon Dioxide (CO2)	12986.6	12986.6
Methane (CH4)	0.37328	9.33200
Nitrous Oxide (N2O)	0.27703	82.55494
Hydrofluorocarbons (HFCs)		
Perfluorocarbons (PFCs)		
Sulphur hexafluoride (SF6)		

Facility Total reported to Environment and Climate Change Canada: 13078.48694

Carbon dioxide (CO2) from biomass combustion:

Facility Total reported to New Brunswick: 13078.48694

Comments

This section is optional.

Enter any comments you wish to include related to the information you have reported.
General Comments will not be published.

General Comments

Comments: (max 4000 characters)

Reasons for Changes in GHG Emissions from Previous Year

Select the applicable reason or reasons

Additional Information: **

File Name

Date

Confidentiality Request

Environment and Climate Change Canada Confidentiality Request

The Canada Gazette Notice indicated that the Minister of the Environment intends to publish GHG emission totals by gas, by facility. Under the Canadian Environmental Protection Act, 1999 (CEPA 1999), you can request that part or all of the information that you have provided in this report be treated as confidential. You must provide appropriate justification to support this request (see Help for more information).

Are you requesting confidentiality of this report under CEPA 1999? *

No

If yes, you must upload a document containing your written request to Environment and Climate Change Canada with your report submission that includes:
- Identification of the specific information that you wish to keep confidential

- Appropriate justification and supporting documentation

An Environment and Climate Change Canada representative will be in contact with you regarding your request.

Click on the icon located to the right of your screen to upload your Environment and Climate Change Canada Confidentiality Request.

File Name	Date

Report Preview

Company Details

Name

CertainTeed Canada, Inc.

Report Details

Report Status:

Ready to Submit -

Reporting Period:

2018

Facility Name:

McAdam Wallboard Plant

Facility Address:

57 Quality Way McAdam (New Brunswick) E6J 1B1Canada

Report Type:

Report ECCC & NB

Report Update Comments:

Verify Facility Information

Please verify the following information.

Company Information

Legal Name *	CertainTeed Canada, Inc.
English Trade Name	CertainTeed Gypsum
French Trade Name	
Business Number	808787147
DUNS Number	

Facility Details

Facility Name *	McAdam Wallboard Plant
Physical Address *	57 Quality Way McAdam (New Brunswick) E6J 1B1 Canada 45.59360 -67.30960
Primary NAICS Code *	327420
GHGRP ID	0 (GHGRP ID to be assigned by ECCC)
NPRI ID	5095

Reporter

Name *	Stephen Dennis
Position *	Snr Automation Specialist
Mailing Address *	57 Quality Way Mcadam (New Brunswick), E6J 1B1, Canada
Physical Address *	57 Quality Way Mcadam (New Brunswick), E6J 1B1, Canada
Email Address *	steve.dennis@saint-gobain.com
Telephone Number *	5067847008
Ext.	

Authorized Signing Officer (Certifying Official)

Name *	Alexey Avdyushin
Position *	Regional Manager, EHS&S
Mailing Address *	2424 Lakeshore Road West, Mississauga (Ontario), L5J 1K4, Canada
Physical Address *	2424 Lakeshore Road West, Mississauga (Ontario), L5J 1K4, Canada
Email Address *	alexey.avdyushin@saint-gobain.com
Telephone Number *	9054032797
Ext.	

Parent Company Information

SAINT-GOBAIN CORPORATION

Legal Name *	SAINT-GOBAIN CORPORATION
Percentage of ownership of the reporting company *	100.00
Physical Address *	750 E Swedesford Road Valley Forge (Pennsylvania), 19482, United States
Business Number **	121891469
DUNS Number	

Facility Activities

Activities

You must select at least one activity

None of the above

Section A

Report the direct greenhouse gas emissions for this facility for the period identified above.
Click Validate to check for errors and Save/Continue to save the information. If there are any errors, they will be flagged. If there are no errors, the page will be Complete.
N/A = Not ApplicableMDM = Monitoring or Direct MeasurementMB = Mass BalanceEF = Emission FactorsEE = Engineering Estimates

Stationary Fuel Combustion Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☐	Carbon Dioxide (CO2)	☐	☐	☒	☐	15669.3	15669.3
☐	Methane (CH4)	☐	☐	☒	☐	0.4	10.0
☐	Nitrous Oxide (N2O)	☐	☐	☒	☐	0.2695	80.3110

Sub-total 15759.6110

Industrial Process Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Venting Emissions (including vented Formation CO2)

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Flaring Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		

☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Leakage Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

On-site Transportation Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☐	Carbon Dioxide (CO2)	☐	☐	☒	☐	109.2	109.2
☐	Methane (CH4)	☐	☐	☒	☐	0.04612	1.15300
☐	Nitrous Oxide (N2O)	☐	☐	☒	☐	0.00627	1.86846

Sub-total 112.22146

Waste Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)

☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Wastewater Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		
☒	Methane (CH4)	☐	☐	☐	☐		
☒	Nitrous Oxide (N2O)	☐	☐	☐	☐		

Sub-total

Section B

Report the direct greenhouse gas emissions for this facility for the period identified above.Click Validate to check for errors and Save/Continue to save the information. If there are any errors, they will be flagged. If there are no errors, the page will be Complete.

Note: CO2 emissions from biomass combustion are not included in the total reported to Environment and Climate Change Canada.

N/A = Not ApplicableMDM = Monitoring or Direct MeasurementMB = Mass BalanceEF = Emission FactorsEE = Engineering Estimates

Biomass Combustion Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)

☒	Carbon Dioxide (CO2)	☐	☐	☐	☐		

Section C

Report the direct emissions of HFCs, PFCs and SF6 from industrial processes and industrial product use only for this facility for the period identified above.
Click Validate to check for errors and Save/Continue to save the information. If there are any errors, they will be flagged. If there are no errors, the page will be Complete.
N/A = Not ApplicableMDM = Monitoring or Direct MeasurementMB = Mass BalanceEF = Emission FactorsEE = Engineering Estimates

Hydrofluorocarbon (HFC) Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	HFC-23 (CHF3)	☐	☐	☐	☐		
☒	HFC-32 (CH2F2)	☐	☐	☐	☐		
☒	HFC-41 (CH3F)	☐	☐	☐	☐		
☒	HFC-43-10mee (C5H2F10)	☐	☐	☐	☐		
☒	HFC-125 (C2HF5)	☐	☐	☐	☐		
☒	HFC-134 (C2H2F4)	☐	☐	☐	☐		
☒	HFC-134a (C2H2F4)	☐	☐	☐	☐		
☒	HFC-143 (C2H3F3)	☐	☐	☐	☐		
☒	HFC-143a	☐	☐	☐	☐		

	(C2H3F3)						
☒	HFC-152a (C2H4F2)	☐	☐	☐	☐		
☒	HFC-227ea (C3HF7)	☐	☐	☐	☐		
☒	HFC-236fa (C3H2F6)	☐	☐	☐	☐		
☒	HFC-245ca (C3H3F5)	☐	☐	☐	☐		

Total

Perfluorocarbon (PFC) Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Perfluoromethane (CF4)	☐	☐	☐	☐		
☒	Perfluoroethane (C2F6)	☐	☐	☐	☐		
☒	Perfluoropropane (C3F8)	☐	☐	☐	☐		
☒	Perfluorobutane (C4F10)	☐	☐	☐	☐		
☒	Perfluorocyclobutane (c-C4F8)	☐	☐	☐	☐		
☒		☐	☐	☐	☐		

	Perfluoropentane (C5F12)						
☒	Perfluorohexane (C6F14)	☐	☐	☐	☐		

Total

Sulphur Hexafluoride (SF6) Emissions

N/A	Substance Name	MDM **	MB **	EF **	EE **	Emissions (t) **	Emissions(t CO2e)
☒	Sulphur hexafluoride (SF6)	☐	☐	☐	☐		

Summary

No input required - GHG totals are calculated automatically.

Total GHG Emissions for the Facility

	Emissions (t)	Emissions (t CO2e)
Carbon Dioxide (CO2)	15778.5	15778.5
Methane (CH4)	0.44612	11.15300
Nitrous Oxide (N2O)	0.27577	82.17946
Hydrofluorocarbons (HFCs)		
Perfluorocarbons (PFCs)		
Sulphur hexafluoride (SF6)		

Facility Total reported to Environment and Climate Change Canada: 15871.83246

Carbon dioxide (CO2) from biomass combustion:

Facility Total reported to New Brunswick: 15871.83246

Comments

This section is optional.

Enter any comments you wish to include related to the information you have reported.
General Comments will not be published.

General Comments

Comments: (max 4000 characters)

Reasons for Changes in GHG Emissions from Previous Year

Select the applicable reason or reasons

Additional Information: **

File Name

Date

Confidentiality Request

Environment and Climate Change Canada Confidentiality Request

The Canada Gazette Notice indicated that the Minister of the Environment intends to publish GHG emission totals by gas, by facility. Under the Canadian Environmental Protection Act, 1999 (CEPA 1999), you can request that part or all of the information that you have provided in this report be treated as confidential. You must provide appropriate justification to support this request (see Help for more information).

Are you requesting confidentiality of this report under CEPA 1999? *

No

If yes, you must upload a document containing your written request to Environment and Climate Change Canada with your report submission that includes:
- Identification of the specific information that you wish to keep confidential

- Appropriate justification and supporting documentation

An Environment and Climate Change Canada representative will be in contact with you regarding your request.

Click on the icon located to the right of your screen to upload your Environment and Climate Change Canada Confidentiality Request.

File Name	Date