AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM A BOILER

Prepared for:

Neenah Paper Michigan, Inc.
SRN: B1470

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IMPACT
COMPLIANCE & TESTING

Report Certification

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FROM A BOILER

Neenah Paper Michigan, Inc.
Munising, MI

The material and data in this document were prepared and reviewed under the supervision of the undersigned.

Report Prepared By:

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1.0 Introduction

Neenah Paper Michigan, Inc. (Neenah Paper) operates a boiler (Boiler #1) capable of burning coal and natural gas at its facility in Munising, Alger County, Michigan. The boiler is capable of burning coal and natural gas.

The State of Michigan Department of Environment, Great Lakes, and Energy-Air Quality Division (EGLE-AQD) has issued Neenah Paper Renewable Operating Permit (ROP) No. MI-ROP-B1470-2019a for the operation of Boiler #1 (emission unit identifier: EU05).

Air emission compliance testing was performed pursuant to MI-ROP-B1470-2019a. Conditions of MI-ROP-B1470-2019a require Neenah Paper to verify carbon monoxide (CO) and filterable particulate matter (PM) concentrations/emissions for Boiler #1. In addition, Neenah Paper collected a boiler fuel sample (coal) during the test event that was analyzed for mercury and gross heating value.

The compliance testing presented in this report was performed by Impact Compliance & Testing, Inc. (ICT), a Michigan-based environmental consulting and testing company. ICT representatives Tyler Wilson, Blake Beddow, and Max Fierro performed the field sampling and measurements December 7-8, 2021.

The boiler performance tests consisted of triplicate, one-hour sampling periods for CO and PM. Exhaust gas velocity, moisture, oxygen (O_2) content, and carbon dioxide (CO_2) content were determined for each test period to calculate pollutant mass emission rates.

The exhaust gas sampling and analysis was performed using procedures specified in the Emission Test Plan dated August 12, 2021, that was reviewed and approved by EGLE-AQD. Mr. Jeremy Howe of EGLE-AQD observed portions of the compliance testing.

Questions regarding this air emission test report should be directed to:

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2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of ROP No. MI-ROP-B1470-2019a and 40 CFR Part 63 Subpart JJJJJJ (Boiler GACT) require Neenah Paper to test Boiler #1 for CO and PM concentrations/emissions and mercury emissions. Boiler #1 was tested during this compliance test event.

2.2 Operating Conditions During the Compliance Tests

The testing was performed while Boiler #1 was operated at maximum routine operating conditions. Neenah Paper representatives provided process operating data for Boiler #1 in 1-minute increments for each test period.

Appendix 2 provides operating records provided by Neenah Paper representatives for the test periods.

Average process operating data for Boiler #1 are presented in Table 2.1 and Table 6.1.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from Boiler #1 were each sampled for three (3) one-hour test periods for PM and CO concentrations/emissions during the compliance testing performed December 7-8, 2021. In addition, Neenah Paper collected a boiler fuel sample (coal) during the test event that was analyzed for mercury and gross heating value.

Table 2.2 and 6.1 present the average measured CO and PM concentrations/emissions and mercury emissions for Boiler #1 (average of the three test periods).

Test results for each one-hour sampling period and comparison to the permitted CO and PM concentrations/emissions and mercury emissions are presented in Section 6.0 of this report.

Table 2.1 Average Boiler #1 operating conditions during the test periods

Process Operating Parameter	Boiler #1 (EU05)
Steam output (KPPH)	113
SDA outlet temperature (°F)	295
Opacity instant (%)	0.64
Opacity 6-minute average (%)	0.44
SDA caustic specific gravity	1.03
SDA reagent flow (gpm)	1.04
Coal throughput (lbs/hr)	10,367
Baghouse differential pressure (in. H_2O)	2.77

Table 2.2 Average measured air pollutant concentrations/emissions for Boiler #1 (three-test average)

	CO Concentration	PM Concentration	Mercury Emissions
Emission Unit	ppmvd @ 3% O_2	lbs/1,000 lbs of exhaust gases corrected to 50% excess air	lbs/MMBtu
EU05	85.4	0.01	<7.43E-07
Permit Limit	***420***	***0.30***	***2.2E-05***

3.0 Source and Sampling Location Description

3.1 General Process Description

Neenah Paper is permitted to operate a boiler (Boiler #1 / EU05) at its facility. The boiler is capable of burning coal and natural gas.

3.2 Rated Capacities and Air Emission Controls

Boiler #1 has a rated heat input rate of 202 Metric Million British Thermal Units per hour (MMBTU/hr).

Boiler #1 has a maximum steam output of 150,000 pounds per hour (lbs/hr) and typically operates at approximately 125,000 lbs/hr.

The exhaust gas from Boiler #1 is directed to a baghouse for particulate matter (PM) emission reduction and a sorbent dry absorber (SDA) system for the reduction of hazardous air pollutant (HAP) emissions. The scrubber exhaust gas is exhausted to atmosphere through stack SV05.

3.3 Sampling Location

The boiler exhaust gas is released to the atmosphere through a dedicated vertical exhaust stack (stack identifier: SV05) with a vertical release point.

The exhaust stack sampling ports are located in the vertical exhaust stack, with an inner diameter of 84.0 inches. The stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location 156 inches (1.86 duct diameters) upstream and 480 inches (5.71 duct diameters) downstream from any flow disturbance.

All sample port locations satisfy the USEPA Method 1 criteria for a representative sample location. Individual traverse points were determined in accordance with USEPA Method 1.

Appendix 1 provides a diagram of the emission test sampling location with actual stack dimension measurements.

4.0 Sampling and Analytical Procedures

An Emission Test Plan for the air emission testing was submitted to EGLE-AQD prior to the compliance test event. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

4.1 Summary of Sampling Methods

USEPA Method 1	Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 5	Filterable PM was determined using an isokinetic sampling train.
USEPA Method 10	Exhaust gas CO concentration was measured using an infrared instrumental analyzer.

4.2 Exhaust Gas Velocity Determination (USEPA Methods 1 and 2)

Prior to commencing the emission measurements, stack gas sampling locations (i.e., pollutant concentration and velocity pressure measurement locations) were determined in accordance with USEPA Method 1.

The boiler exhaust stack gas velocity and volumetric flow rate was determined using USEPA Method 2 throughout each test period using an isokinetic sample probe. Gas velocity (pressure) measurements was conducted at each traverse point of the stack with an S-type Pitot tube and red-oil manometer. Temperature measurements were conducted at each traverse point using a K-type thermocouple and a calibrated digital thermometer. The Pitot tube and connective tubing were leak-checked periodically throughout the test periods to verify the integrity of the measurement system.

The absence of significant cyclonic flow at each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

Appendix 3 provides isokinetic field data sheets. Appendix 4 provides flowrate calculations.

4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

CO_2 and O_2 content in the boiler exhaust gas stream was measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex 4900 infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 4900 gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the boiler exhaust gas stream was extracted from the stack using a stainless-steel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 4 provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix 5.

4.4 Exhaust Gas Moisture Content (USEPA Method 4)

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Moisture content of the boiler exhaust gas was determined in accordance with USEPA Method 4 using the USEPA Method 5 chilled isokinetic impinger sampling train. Exhaust

gas moisture content measurements were performed concurrently with the instrumental analyzer sampling periods. At the conclusion of each sampling period the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

Appendix 4 provides moisture calculations and data sheets.

4.5 Determination of PM (USEPA Method 5)

A USEPA Method 5 sample train was used to measure filterable PM for the boiler. Exhaust gas from the boiler was drawn at an isokinetic rate through a properly sized stainless steel sampling nozzle, heated probe with stainless steel liner connected to the nozzle via stainless steel union, and heated glass fiber particulate filter. Following the particulate filter, moisture was removed from the sample gas using chilled impingers and sample gas rate was measured using a calibrated dry gas meter.

At the end of each test period the PM collected in the front half of the sampling train (from the sampling nozzle to the heated filter) was recovered in accordance with the six (6) rinse and brush procedures specified in USEPA Method 5. The impinger solutions were weighed gravimetrically for moisture content determination.

The filters and rinses were transported to ICT (Holt, MI) for analysis according to the appropriate QA/QC procedures specified in USEPA Method 5 and are included in the final laboratory report.

Diluent gas content (Method 3A O_2 and CO_2) measurements were performed with each of the PM sampling periods for the boiler.

Appendix 4 provides PM calculation sheets.

Appendix 7 provides a copy of the final laboratory report prepared by ICT.

4.6 CO Concentration Measurements (USEPA Method 10)

CO pollutant concentration in the boiler exhaust gas stream was determined using a California Analytical Instruments (CAI) Fuji ZRF infrared CO analyzer.

Throughout each test period, a continuous sample of the boiler exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix 4 provides CO calculation sheets. Raw instrument response data are provided in Appendix 5.

5.0 QA/QC Activities

5.1 Flow Measurement Equipment

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (pyrometer, Pitot tube, and scale) were calibrated to specifications in the sampling methods.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

5.2 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.3 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure CO, O_2, and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.4 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the CO, CO_2, and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless-steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.5 Determination of Exhaust Gas Stratification

A stratification test was performed for the boiler exhaust stack. The stainless-steel sample probe was positioned at sample points correlating to 16.7, 50.0 (centroid), and 83.3% of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the boiler exhaust stack indicated that the measured CO_2 concentrations did not vary by more than 5% of the mean across the stack diameter. Therefore, the boiler exhaust gas was considered to be unstratified and the compliance test sampling was performed at a single sampling location within the boiler exhaust stack.

5.6 System Response Time

The response time of the sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

Sampling periods did not commence until the sampling probe had been in place for at least twice the greatest system response time.

5.7 Meter Box Calibrations

The dry gas meter sampling console used for exhaust gas PM and moisture testing was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

5.8 PM Sampling and Analysis

The stainless-steel PM sampling nozzle diameters were determined using the three-point calibration technique.

All recovered PM brush/rinse samples were stored and transported in glass sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with permanent marker and the caps were secured closed with tape. The recovered PM glass fiber filter samples were stored and transported in sealed plastic petri dishes. Samples of the reagents used in the test project (approximately 200 milliliters of acetone) were transported to the laboratory (ICT located in Holt, MI) for analysis to verify that the reagents used to recover the samples have low PM residue values.

5.9 Cyclonic Flow Check

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at multiple velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-

sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

Appendix 6 presents test equipment quality assurance data (instrument calibration and system bias check records, calibration gas certifications, interference test results, meter box calibration records, and field equipment calibration records).

6.0 Results

6.1 Coal Properties and Use Rate

Neenah Paper provided an analytical report for a coal sample that was representative of the coal used during the test periods. The analytical results indicated that the coal had a heat content (gross calorific value, GCV) of approximately 13,463 Btu/lb.

The coal analytical results are presented in Appendix 7.

The amount of coal used during each test period was determined by the process information recorded from the continuous load cell weighing belt. The pounds of coal per hour is calculated from the total coal weight and the belt speed. Boiler #1 used approximately 5.18 tons per hour (tons/hr) coal during the test periods.

6.2 Test Results and Allowable Limits

Boiler operating data and air pollutant concentration/emission measurement results for each one-hour test period are presented in Table 6.1.

Boiler #1 / EU05 has the following allowable limits specified in MI-ROP-B1470-2019a:

- 420 parts per million by volume, dry basis, corrected to 3% O_2 (ppmvd @ 3% O_2) for CO;
- 0.30 pounds per 1,000 pounds (lbs/1,000 lbs) of exhaust gases corrected to 50% excess air for PM; and
- 2.2E-05 pounds per million British thermal units (lbs/MMBtu).

The measured air pollutant concentrations/emissions for Boiler #1 / EU05 are less than the allowable limits specified in MI-ROP-B1470-2019a.

6.3 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the submitted Emission Test Plan. The boiler was operated continuously and at a relatively constant rate, and no variations from normal operating conditions occurred during the boiler test periods.

This compliance test event took place Tuesday December 7, 2021, through Wednesday December 8, 2021. Testing was originally scheduled to be completed Tuesday December 7, 2021, but due to miscellaneous testing delays, one (1) of the three (3) compliance tests was completed Wednesday December 8, 2021, in order to test only during daylight hours, with regards to the safety of the test crew.

There were several test pauses during this compliance test event, due to stack testing equipment freeze-ups from below freezing weather conditions. Following each test pause, the test resumed after the analyzer sample probe was in position in the boiler exhaust stack for at least twice the greatest system response time.

The analyzer portion (CO, O2, and CO2) of Test No. 3 was performed for 21-minutes (rather than 60-minutes). Following the 21-minutes of sampling for CO, O2, and CO2 for Test No. 3, the below freezing weather conditions caused the analyzer sampling system to fail. The analyzer sampling system was unable to be repaired in the field. The 3-test average measured CO concentration (85.4 ppmvd @ 3% O2) for Test No. 1 (60-minutes), Test No. 2 (60-minutes), and Test No. 3 (21-minutes) is approximately 20% of the limit (420 ppmvd @ 3% O2).

All of the variations from normal sampling procedures listed above were discussed with and approved by Mr. Jeremy Howe of EGLE-AQD.

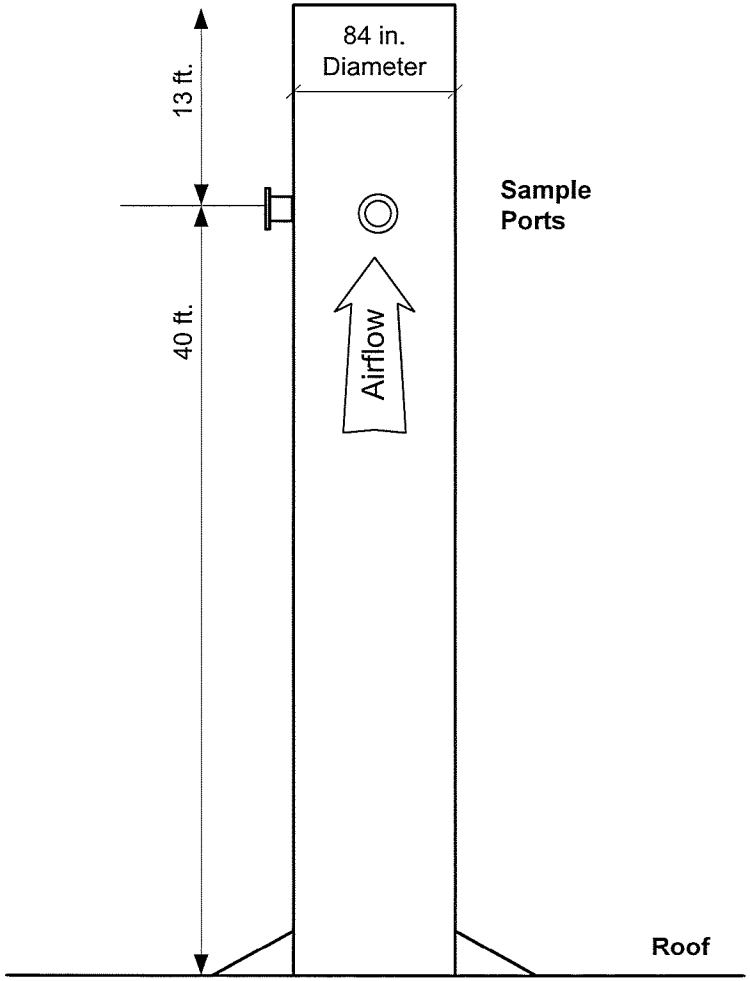
Table 6.1 Measured exhaust gas conditions, and CO and PM concentrations/emissions, and Mercury emissions for Boiler #1 (EU05)

Test No.	1	2	3	
Test date	12/7/2021	12/7/2021	12/82021	
CO Test period (24-hr clock)	1040-1106, 1251-1323	1515,1547 1555-1624	905-925	Three Test Avg.
PM Test period (24-hr clock)	1040-1110, 1251-1321	1518-1548, 1555-1625	905-935, 1025-1055	
Steam output (KPPH)	114	113	113	113
SDA outlet temperature (°F)	295	295	295	295
Opacity instant (%)	0.61	0.61	0.69	0.64
Opacity 6-minute average (%)	0.41	0.45	0.47	0.44
SDA caustic specific gravity	1.03	1.03	1.03	1.03
SDA reagent flow (gpm)	0.85	0.81	1.46	1.04
Coal throughput (lbs/hr)	10,770	11,206	9,100	10,367
Baghouse differential pressure (in. H_2O)	1.98	3.17	3.22	2.77
Exhaust Gas Composition				
CO_2 content (% vol)	12.3	12.6	12.0	12.3
O_2 content (% vol)	7.46	7.21	7.58	7.42
Moisture (% vol)	6.43	6.79	6.53	6.59
Exhaust gas temperature (°F)	276	277	274	276
Exhaust gas flowrate (dscfm)	38,065	37,815	44,696	40,192
Exhaust gas flowrate (scfm)	40,683	40,572	47,820	43,025
Isokinetic Sample Train Data				
Sample volume (dscf)	40.8	40.4	47.3	42.8
Total PM catch (mg)	14.2	9.0	9.9	11.0
Filterable Particulate Matter				
PM emission rate (lb/hr)	1.75	1.11	1.24	1.37
PM conc. (lbs/1,000 lbs dry gas)*	0.01	0.01	0.01	0.01
*PM conc. limit (lbs/1,000 lbs dry gas)**	-	-	-	*0.30*
Carbon Monoxide				
CO conc. (ppmvd)	80.9	21.4	89.7	64.0
CO conc. (ppmvd @ 3% O_2)	108	27.9	121	85.4
CO conc. limit (ppmvd @ 3% O_2)	-	-	-	*420*
Mercury				
Coal mercury content (µg/g)		<0.01		
Mercury emission rate (lb/MMBtu)		<7.43E-07		
Mercury emission rate limit (lb/MMBtu)		*2.2E-05*		

*Note: PM concentration is corrected to 50% excess air.

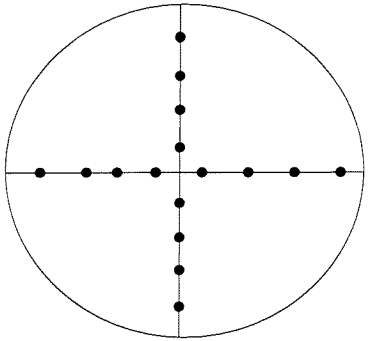
APPENDIX 1

- Boiler #1 Sample Port Diagram



Boiler #1 Sampling and Measurement Locations

Stack Diameter 84 in.



Traverse Points

Sampling Point	Distance from Stack Wall (in)
1	2.2
2	6.9
3	12.3
4	19.0
5	28.7
6	55.3
7	65.0
8	71.7
9	77.1
10	81.8

Neenah Paper Boiler #1
Sampling Location Diagram

Scale	Sheet
None	1 of 1

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