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RELATIVE ACCURACY TEST AUDIT
FOR THE
KILNS 19, 20, 21, 23, WET GAS SCRUBBER,
RAW MILL 14, AND RAW MILL 15 CEMS
PREPARED FOR
LAFARGE NORTH AMERICA
AT THE
ALPENA PLANT
ALPENA, MICHIGAN
JULY 20-AUGUST 1, 2017

Prepared and Reviewed by:

Logan K. Tsotsoros

Logan Tsotsoros
AHU Support Staff

Michael Whisenhunt, QSTI
Sr. Project Manager

I, M. I Stockwell

Michael Stockwell, QSTI
Sr. Project Manager
certify that this testing was conducted and this report was created in conformance with the requirements of ASTM D7036

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APPENDICES

Relative Accuracy Test Audit
Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 CEMS
Lafarge North America
Alpena Plant
Alpena, Michigan
July 20-August 1, 2017

1.0 INTRODUCTION

Air Hygiene International, Inc. (Air Hygiene) has completed the Relative Accuracy Test Audit (RATA) for nitrogen oxides (NOx), carbon monoxide (CO), sulfur dioxide (SO_2), total hydrocarbons (THC), flow, moisture (H_2O), particulate matter (PM), carbon dioxide (CO_2), and oxygen (O_2) from the exhaust of the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 for Lafarge North America at the Alpena Plant near Alpena, Michigan. This report details the background, results, process description, and the sampling/analysis methodology of the stack sampling survey conducted on July 20-August 1, 2017.

The accumulated data from the RATA provides the figures for evaluating the acceptability of the operation of the on-site continuous emission monitoring system (CEMS) for the monitoring of NOx, CO, SO_2, THC, flow, H_2O, PM, CO_2, and O_2 from the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 for Lafarge North America at the Alpena Plant near Alpena, Michigan.

1.1 TEST PURPOSE AND OBJECTIVES

The purpose of the test was to perform the periodic quality assurance (QA) RATA on the CEMS that serves the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 for Lafarge North America at the Alpena Plant near Alpena, Michigan. Reference method (RM) testing followed the Code of Federal Regulations (CFR), Title 40 (40 CFR), Part 60 (40 CFR 60), Appendix A, Methods 1, 2, 3A, 4, 5, 6C, 7E, 10, and 25A. RM values are compared with the on-site CEMS to document performance as required in the 40 CFR 60, Appendix B, Performance Specifications (PS) and 40 CFR 75 Appendix A and B. All relative accuracies were established on-site and were governed by the following sets of rules:

In accordance with 40 CFR 60, Appendix B, PS 2, Section 13.2, the NOx RATA results are acceptable if the relative accuracy (RA) does not exceed 20.0 percent when average emissions during the test are greater than 50 percent of the emission standard or alternative relative accuracy (ARA) does not exceed 10.0 percent when the average emissions during the test are less than 50 percent of the emission standard. Part 60 further requires that the unit be operating at greater than 50 percent of normal load.

In accordance with 40 CFR 60, Appendix B, PS 6, Section 13.2, the NOx RATA results are acceptable if the relative accuracy (RA) does not exceed 20.0 percent or alternative relative accuracy (ARA) does not exceed 10.0 percent. PS 6 defines performance criteria in terms of an emissions rate (i.e. lb/hr) rather than for a specific pollutant (i.e., NOx). Part 60 further requires that the unit be operating at greater than 50 percent of normal load.

In accordance with 40 CFR 60, Appendix B, PS 3, Section 13.2, the O_2 / CO_2 RATA results are acceptable if the relative accuracy (RA) does not exceed 20.0 percent or if the average difference between the CEMS and reference method (RM) values does not exceed plus or minus 1.0 percent of the measured value.

In accordance with 40 CFR 60, Appendix B, PS 4 and 4A, Sections 13.2 of each, the CO relative accuracy (RA) test results are acceptable if the RA does not exceed 10.0 percent, if the average difference between the CEMS and reference method (RM) values plus the 2.5 percent confidence coefficient (2.5%CC) does not exceed 5.0

parts per million (ppm), or if the alternative relative accuracy (ARA) does not exceed 5.0 percent. Part 60 further requires that the unit be operating at greater than 50 percent of normal load.

In accordance with 40 CFR 60, Appendix B, PS 2, Section 13.2, the SO_2 RATA results are acceptable if the relative accuracy (RA) does not exceed 20.0 percent when average emissions during the test are greater than 50 percent of the emission standard or alternative relative accuracy (ARA) does not exceed 10.0 percent when the average emissions during the test are less than 50 percent of the emission standard. Part 60 further requires that the unit be operating at greater than 50 percent of normal load.

In accordance with 40 CFR 60, Appendix B, PS 6, Section 13.2, the flow RATA results are acceptable if the relative accuracy (RA) does not exceed 20.0 percent or alternative relative accuracy (ARA) does not exceed 10.0 percent in terms of standard cubic feet per hour (scfh). PS 6 defines performance criteria in terms of an emissions rate (i.e. scfh) rather than for a specific pollutant. Part 60 further requires that the unit be operating at greater than 50 percent of normal load.

In accordance with 40 CFR 60, Appendix B, PS 8, Section 13.2, the THC RATA results are acceptable if the relative accuracy (RA) does not exceed 20.0 percent or alternative relative accuracy (ARA) does not exceed 10.0 percent. Part 60 further requires that the unit be operating at greater than 50 percent of normal load.

1.2 SUMMARY OF TEST PROGRAM

The following list details pertinent information related to this specific project:

1.2.1 Participating Organizations
- Michigan Department of Environmental Quality (MDEQ)
- Lafarge North America
- Air Hygiene

1.2.2 Industry
- Cement

1.2.3 Air Permit and Federal Requirements
- Permit Number: MI-ROP-B1477-2012
- EPA Facility ID: MID005379607
- 40 CFR 60, Appendix B, Performance Specifications (PS)

1.2.4 Plant Location
- Alpena Plant near Alpena, Michigan
  - 1435 Ford Avenue, Alpena, Michigan 49707
  - Federal Registry System / Facility Registry Service (FRS) No. – 110015742605
  - Source Classification Codes (SCC) – 30500699 and 30500613

1.2.5 Equipment Tested
- Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15

1.2.6 Emission Points
- Exhaust from the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15
- For all gases, three sample points in the exhaust stack from the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15, at 16.7, 50.0, and 83.3 percent of the diameter

1.2.7 Emission Parameters Measured
- NOx
- CO
- THC
- SO_2
- Flow
- H_2O
- CO_2
- O_2

1.2.8 Dates of Emission Test
- July 20-August 1, 2017

1.2.9 Federal and State Certifications
- Stack Testing Accreditation Council AETB Certificate No. 3796.02
- International Standard ISO/IEC 17025:2005 Certificate No. 3796.01

1.3 KEY PERSONNEL

Lafarge North America:	Travis Weide (travis.weide@lafargeholcim.com)	989-358-3321
MDEQ:	Jeremy Howe	231-876-4416
Air Hygiene:	Michael Stockwell (mstockwell@airhygiene.com)	918-307-8865
Air Hygiene:	Matt McBride	918-307-8865

2.0 SUMMARY OF TEST RESULTS

Results from the sampling conducted on Lafarge North America's Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 located at the Alpena Plant on July 20-August 1, 2017 are summarized in the following table and relate only to the items tested.

TABLE 2.1
SUMMARY OF KILN, UNIT #19 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
NOx	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 2.2%	YES / ANNUAL
NOx	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 11.8%	YES / ANNUAL
NOx	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 10.7%	YES / ANNUAL
O_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 2.1% d = -0.1 %	YES / ANNUAL
CO_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 3.7% d = -0.7 %	YES / ANNUAL
CO	ppm	Part 60	Appendix B, Performance Specification 4, 4A, from all Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 1.8% |d|+2.5%CC = 1.5 ppm	YES / ANNUAL
CO	lb/hr	Part 60	Appendix B, Performance Specification 4, 4A Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 16.5% |d|+2.5%CC = 1.5 ppm	YES / ANNUAL
SO_2	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 3.9%	YES / ANNUAL
SO_2	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 13.5%	YES / ANNUAL
SO_2	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 12.4%	YES / ANNUAL
High Flow	scfh	Part 60	Appendix B, Performance Specification 6, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 13.5%	YES / ANNUAL
Load	ton/hr	Part 60	Appendix B, Performance Specifications	> 50% max load	45.2	WITHIN TOLERANCE

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

TABLE 2.2
SUMMARY OF KILN, UNIT #20 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
NOx	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 8.3%	YES / ANNUAL
NOx	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 14.9%	YES / ANNUAL
NOx	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 14.9%	YES / ANNUAL
O_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 0.4% d = 0 %	YES / ANNUAL
CO_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 3.3% d = -0.6 %	YES / ANNUAL
CO	ppm	Part 60	Appendix B, Performance Specification 4, 4A, from all Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 0.7% |d|+2.5%CC = 0.6 ppm	YES / ANNUAL
CO	lb/hr	Part 60	Appendix B, Performance Specification 4, 4A Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 8.2% |d|+2.5%CC = 0.6 ppm	YES / ANNUAL
SO_2	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 5.7%	YES / ANNUAL
SO_2	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 8.5%	YES / ANNUAL
SO_2	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 8.8%	YES / ANNUAL
High Flow	scfh	Part 60	Appendix B, Performance Specification 6, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 6.8%	YES / ANNUAL
Load	ton/hr	Part 60	Appendix B, Performance Specifications	> 50% max load	45.1	WITHIN TOLERANCE

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

TABLE 2.3
SUMMARY OF KILN, UNIT #21 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
NOx	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 2%	YES / ANNUAL
NOx	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 5.5%	YES / ANNUAL
NOx	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 5.5%	YES / ANNUAL
O_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 1.7% d = 0.1 %	YES / ANNUAL
CO_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 4% d = -0.5 %	YES / ANNUAL
CO	ppm	Part 60	Appendix B, Performance Specification 4, 4A, from all Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 6.9% |d|+2.5%CC = 3.9 ppm	YES / ANNUAL
CO	lb/hr	Part 60	Appendix B, Performance Specification 4, 4A Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 10.8% |d|+2.5%CC = 3.9 ppm	YES / ANNUAL
SO_2	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 3.9%	YES / ANNUAL
SO_2	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 10.3%	YES / ANNUAL
SO_2	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 10.3%	YES / ANNUAL
High Flow	scfh	Part 60	Appendix B, Performance Specification 6, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 5.2%	YES / ANNUAL
Load	ton/hr	Part 60	Appendix B, Performance Specifications	> 50% max load	41.8	WITHIN TOLERANCE

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

TABLE 2.4
SUMMARY OF KILN, UNIT #23 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
NOx	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 17.3%	YES / ANNUAL
NOx	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 10.8%	YES / ANNUAL
NOx	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 13.8%	YES / ANNUAL
O_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 4.4% d = -0.3 %	YES / ANNUAL
CO_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 1% d = 0.1 %	YES / ANNUAL
CO	ppm	Part 60	Appendix B, Performance Specification 4, 4A, from all Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 2.7% |d|+2.5%CC = 0.8 ppm	YES / ANNUAL
CO	lb/hr	Part 60	Appendix B, Performance Specification 4, 4A Section 13.2	RA ≤ 10%, or d + 2.5% CC ≤ ±5 ppmv, or ARA ≤ 5%	RA = 9.4% |d|+2.5%CC = 0.8 ppm	YES / ANNUAL
SO_2	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 4.3%	YES / ANNUAL
SO_2	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 6.6%	YES / ANNUAL
SO_2	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 6.5%	YES / ANNUAL
High Flow	scfh	Part 60	Appendix B, Performance Specification 6, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 7.5%	YES / ANNUAL
Load	ton/hr	Part 60	Appendix B, Performance Specifications	> 50% max load	75.7	WITHIN TOLERANCE

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

TABLE 2.5
SUMMARY OF WGS, UNIT #WGS 22/23 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
O_2	%	Part 60	Appendix B, Performance Specification 3, Section 13.2	RA ≤ 20%, or d ≤ ±1.0%	RA = 1.5% d = 0 %	YES / ANNUAL
SO_2	ppm	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 9.9%	YES / ANNUAL
SO_2	lb/hr	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 15.1%	YES / ANNUAL
SO_2	lb/ton	Part 60	Appendix B, Performance Specification 2, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 14.3%	YES / ANNUAL
High Flow	scfh	Part 60	Appendix B, Performance Specification 6, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 6.1%	YES / ANNUAL
Load	ton/hr	Part 60	Appendix B, Performance Specifications	> 50% max load	147.4	WITHIN TOLERANCE

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

TABLE 2.6
SUMMARY OF RAW MILL 14, UNIT #RAW MILL 14 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
THC	ppm	Part 60	Appendix B, Performance Specification 8, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 40.3% ARA = 6.5%	YES / ANNUAL

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

TABLE 2.7
SUMMARY OF RAW MILL 15, UNIT #RAW MILL 15 RATA RESULTS

Pollutant	Units	Criteria			Results	Passed / Test Frequency
		CFR	Specification / Section	Standard		
THC	ppm	Part 60	Appendix B, Performance Specification 8, Section 13.2	RA ≤ 20%, or ARA ≤ 10%	RA = 48.3% ARA = 6.8%	YES / ANNUAL

Notes: RA = relative accuracy, ARA = alternative relative accuracy, RM = reference method value, d = difference between RM and CEMS value, CC = confidence coefficient, v = velocity, BAF = bias adjustment factor

The RATA passed for all pollutants (NOx, CO, SO_2, THC, flow, and O_2) in all units (ppm, lb/hr, lb/ton, scfh, and %) under all 40 CFR 60 criteria.

3.0 SOURCE OPERATION

3.1 PROCESS DESCRIPTION

The Lafarge Cement facility is located in Alpena, MI. The Raw Mill System mixes and grinds the raw materials (limestone, sand, bauxite, Bell shale, gypsum) and alternate raw materials (slag, iron ore, fly ash, and CKD) then sends the materials to the kilns.

Lafarge operates five rotary kilns, which manufacture Portland cement clinker using the dry process. A mixture of pulverized bituminous coal and petroleum coke, with a heating value of approximately 11,750 Btu per pound, serves as the primary fuel fed to the kilns. Coal and coke are fed to a Raymond bowl mill and ground to a fineness of approximately 95% passing a 200-mesh sieve.

Kiln Group 5:

Kiln Group 5 at the Lafarge Alpena plant consists of three rotary kilns (#19, #20, and #21). Specific components of Kiln Group 5 are:

- Coal/petroleum coke and combustion air delivery;
- Raw mix preparation and delivery;
- Three rotary kilns;
- Kiln burners; and
- Air pollution control system, consisting of the following components:
  - Boiler;
  - Multiclone dust collectors;
  - Baghouses;
  - SNCR;
  - Induced draft (ID) fans; and
  - Exhaust stacks.

Allis Chalmers manufactured all kilns identified as #19, #20, and #21. Each kiln is 460.5 feet long. Each kiln shell has an inside diameter of 15 feet at the feed end and 13 feet at the firing end. The kilns in Kiln Group 5 rotate at speeds of greater than 40 revolutions per hour and are driven by an electric motor.

Dracco manufactured the baghouse for Kiln 19. The baghouse has two parallel sets of six chambers and a design airflow of 175,000 cubic feet per minute (cfm) at 400°F. The maximum operating temperature is 550°F. The baghouses for kilns 20 and 21, manufactured by Wheelbrator-Frye are identical in design and construction, with two parallel sets of six chambers. Each baghouse has a design air flow of 166,000 cfm at 400°F. The maximum operating temperature is 550°F.

Kiln Group 6:

Kiln Group 6 at the Lafarge Alpena plant consists of two rotary kilns (#22 and #23). Specific components of Kiln Group 6 are:

- Coal/petroleum coke and combustion air delivery;
- Raw mix preparation and delivery;
- Two rotary kilns;
- Kiln burners; and
- Air pollution control system, consisting of the following components:
  - Boiler;
  - SNCR (mid-kiln);
  - Multiclone dust collectors;
  - Baghouses;
  - Induced draft (ID) fans; and
  - Wet gas Scrubber (WGS);
  - Common exhaust stack.

The pulverized coal/coke is pneumatically conveyed by heated air, recycled from the clinker cooler, through the outer ring of a concentric burner torch. Both rotary kilns in KilnGroup 6 were manufactured by Fuller Co. and are identical in design and operation.The kilns are 500 feet long and have a 19.5-foot outer diameter. The kilns are lined with high-temperature refractory brick. The kiln design is based on a throughput of 4.8 million Btu per ton of clinker. An induced draft fan pulls combustion gases from each kiln. After exiting the kiln, the gases pass through a set of multicyclones and then enter a fabric filter baghouse. After exiting the baghouse, the gases are routed through a breeching duct that connects the baghouse to a common reinforced concrete stack and exhaust to a wet FDG (scrubber).

The kilns rotate at a rate up to 80 revolutions per hour using two 350-hp motors.The kilns' associated air pollution control systems (APCS) are identical to one another in all aspects of design, operation, and maintenance. The APCS for Kilns 22 and 23 are identical ten-compartment baghouses. Each baghouse, manufactured by Wheelbrator-Frye, consists of two parallel sets of five chambers and has design airflow of 285,000 cfm at 400°F. Figure 2-2 provides a process flow diagram of Kiln Group 6.

Kiln Process Instrumentation:

Instruments used to monitor kiln operating parameters are located throughout the kiln system. Parameters that will be recorded during testing are the baghouse inlet temperature, production rate, and baghouse change in pressure (delta P). Each kiln system is equipped with a differential pressure indicator system, with measurement points located in the duct prior to and exiting the baghouse. The differential pressure devices are used to monitor the pressure drop across the baghouse.

Raw Mill:

The Raw Mill System mixes and grinds the raw materials (limestone, sand, bauxite, Bell shale, gypsum) and alternate raw materials (slag, iron ore, fly ash, and CKD) then sends the materials to the kilns.

EU RAW MILL 14 (Raw Mill 14), and EU RAW MILL 15 (Raw Mill 15), further grind the raw and alternate raw materials using ball mills. The raw mix powder is then sent to one of four storage silos before the materials are sent to the kilns via air slides, screw elevators and pumps. Two storage silos are associated with Kilns 19, 20, 21, and two storage silos are associated with Kilns 22, 23.Figure 2.3 illustrates the process flow of the raw mill operations.

Clinker Coolers:

A Clinker Cooler cools the clinker, reclaims the hot air for return to the kilns, and moves clinker to FG CLINKER SYS. As the clinker is conveyed toward the clinker storage building, the recovered heat from Clinker Cooler (92) and (93) is re-circulated back to Kiln Group 5 (KG 5), the recovered heat from Clinker Cooler 22 is re-circulated back to Kiln 22, and the recovered heat from Clinker Cooler 23 is re-circulated back to Kiln 23. Figure 2-1 portrays the location of the clinker coolers within the process line.

3.2 SAMPLING LOCATION

KILN SAMPLING LOCATIONS:

The baghouse breeching ducts have been demonstrated as acceptable locations to conduct EPA reference method testing on all kilns. For each location the stack sampling location is in the breaching duct between each kiln's baghouse and discharge stack. Ductwork geometry is adequate for collecting a representative sample of gaseous constituents at this point. Further descriptions of all sampling locations for this test program are provided in Appendix C.

RAW MILL SAMPLING LOCATIONS:

The THC monitors installed in the raw mill stacks will extract a representative flue gas sample from the existing exhaust stack (Raw Mill 14 and 15). Test ports for the hydrocarbon monitor are installed. An extraction probe and filter meeting the specifications have been placed in the new test port. The test ports location meet the minimum EPA Method 1 flow disturbance criteria. The probe will extend a minimum of 1 meter into the 69 inch diameter duct. A picture of raw mill monitoring location(s) with the new ports existing test ports is indicated in Appendix C. The sample point location is suitable under Part 60 for gaseous sampling. The installed heated sampling lines to each of the raw grind test locations have an extra (spare) line in the tube bundle. This extra line (heated) will be used to extract the flue gas to measure SO_2 which is a permit requirement (every 5 years). Appendix C.

CLINKER COOLER SAMPLING LOCATIONS:

The existing test ports from both KG5 and KG6 clinker coolers will be used to measure manual PM with EPA Method 5 during the annual re-certification test period. A total of 3 EPA Method 5 test runs with full particulate traverses will be conducted on each of the four clinker coolers. The signal output (mA) from each PCMS (PM monitor) will be recorded every minute during the corresponding Method 5 test runs from PM monitor from the Lafarge DHAS system. The average signal output will be used to confirm the value established for the CPMS per the PC MACT regulation. A picture of the clinker cooler sampling locations for KG 5 and the clinker coolers for KG 6 are provided in Appendix C.

4.0 SAMPLING AND ANALYTICAL PROCEDURES

4.1 TEST METHODS

The emission test on the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 at the Alpena Plant was performed following United States Environmental Protection Agency (EPA) methods described by the Code of Federal Regulations (CFR). Table 4.1 outlines the specific methods performed on July 20-August 1, 2017.

TABLE 4.1
SUMMARY OF SAMPLING METHODS

Pollutant or Parameter	Sampling Method	Analysis Method
Sample Point Location	EPA Method 1	Equal Area Method
Stack Flow Rate	EPA Method 2	S-Type Pitot Tube
Oxygen	EPA Method 3A	Paramagnetic Cell
Carbon Dioxide	EPA Method 3A	Nondispersive Infrared Analyzer
Stack Moisture Content	EPA Method 4	Gravimetric Analysis or Section 16.4 FFactor Based Calculation
Sulfur Dioxide	EPA Method 6C	Ultraviolet
Nitrogen Oxides	EPA Method 7E	Chemiluminescent Analyzer
Carbon Monoxide	EPA Method 10	Nondispersive Infrared Analyzer
Total Hydrocarbons	EPA Method 25A	Flame Ionization Detector

4.2 INSTRUMENT CONFIGURATION AND OPERATIONS FOR GAS ANALYSIS

The sampling and analysis procedures used during these tests conform with the methods outlined in the Code of Federal Regulations (CFR), Title 40, Part 60, Appendix A, Methods 1, 2, 3A, 4, 5, 6C, 7E, 10, and 25A.

Figure 4.1 depicts the sample system used for the real-time gas analyzer tests. The gas sample was continuously pulled through the probe and transported, via heat-traced Teflon® tubing, then to a stainless steel minimum-contact condenser designed to dry the sample. Transportation of the sample, through Teflon® tubing, continued into the sample manifold within the mobile laboratory via a stainless steel/Teflon® diaphragm pump. From the manifold, the sample was partitioned to the real-time analyzers through rotameters that controlled the flow rate of the sample. Exhaust samples were routed to the wet based analyzer prior to gas conditioning.

Figure 4.1 shows that the sample system was also equipped with a separate path through which a calibration gas could be delivered to the probe and back through the entire sampling system. This allowed for convenient performance of system bias checks as required by the testing methods.

All instruments were housed in an air-conditioned, trailer-mounted mobile laboratory. Gaseous calibration standards were provided in aluminum cylinders with the concentrations certified by the vendor. EPA Protocol No. 1 was used to determine the cylinder concentrations where applicable (i.e. NOx calibration gases).

Table 4.2 provides a description of the analyzers used for the instrument portion of the tests. All data from the continuous monitoring instruments were recorded on a Logic Beach Portable Data Logging System which retrieves calibrated electronic data from each instrument every one second and reports an average of the collected data every 30 seconds. For target compounds measured with the Fourier transform infrared (FTIR) spectrometer, interferograms consisting of 27 co-added scans were recorded continuously during the test periods, and provided

approximately 30-second average concentrations. Spectral data was analyzed by the MKS MG2000 software. Data records can be found in Appendix A and B of this report.

Figure 4.2 represents the sample system used for the wet chemistry tests (flow and moisture). Flow rates are monitored with oil filled manometers and total sample volumes are measured with a dry gas meter.

Ten to twelve test runs of approximately 21 minutes each were conducted on the Kilns 19, 20, 21, 23, Wet Gas Scrubber, Raw Mill 14, and Raw Mill 15 at the maximum test load for NOx, CO, SO_2, THC, flow, H_2O, PM, CO_2, and O_2. The unit operation was greater than 50 percent of capacity as required by the 40 CFR 60, Performance Specifications. The unit operation was at the normal / alternative normal load as required by 40 CFR 75.

The stack gas analysis for O_2 and CO_2 concentrations was performed in accordance with procedures set forth in EPA Method 3A. The O_2 analyzer uses a paramagnetic cell detector and the CO_2 analyzer uses a continuous nondispersive infrared analyzer.

EPA Method 6C was used to determine the concentrations of SO_2. An ultraviolet analyzer was used to determine the sulfur dioxide concentrations in the gas stream.

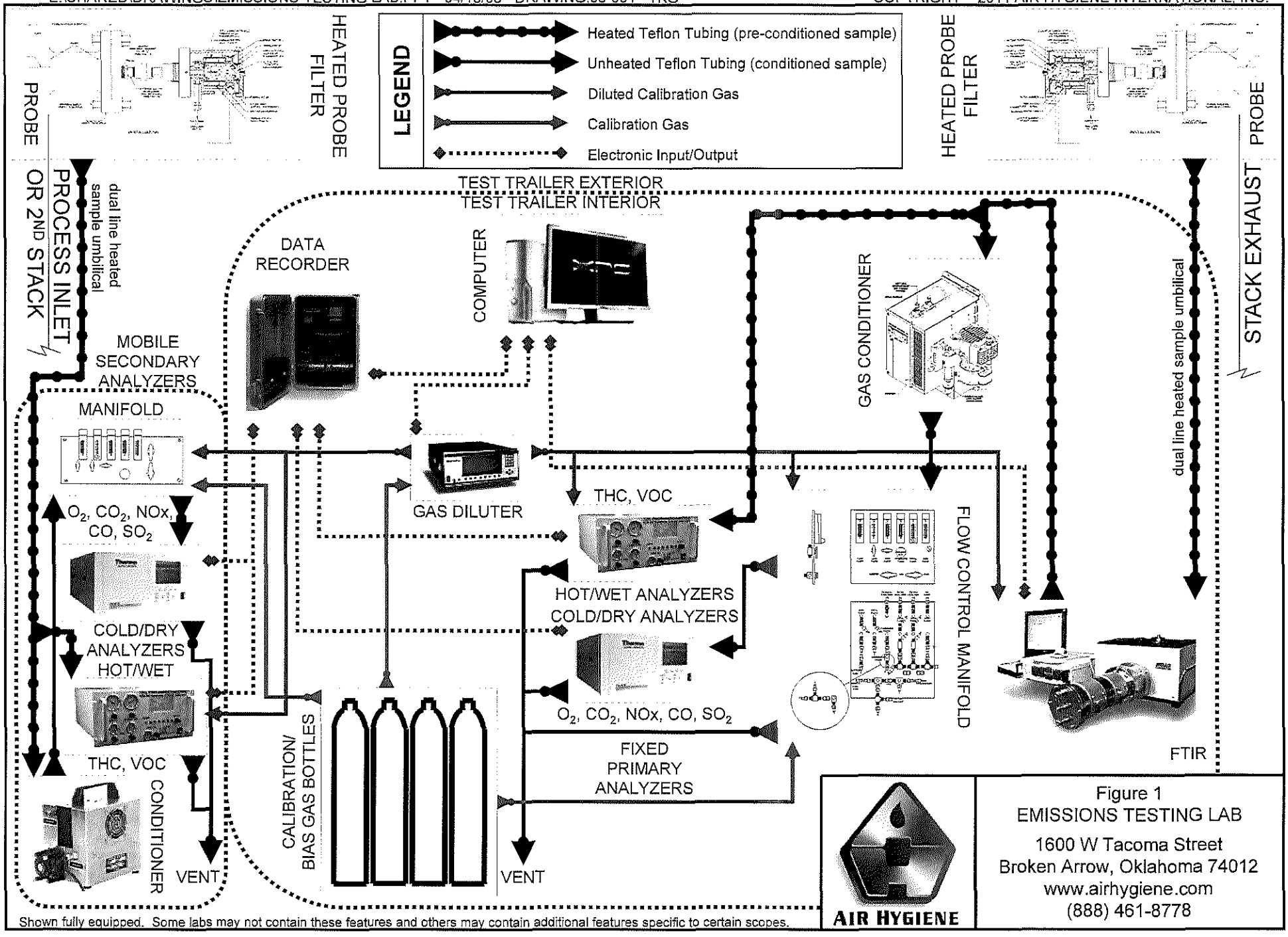
EPA Method 7E was used to determine concentrations of NOx. A chemiluminescent analyzer was used to determine the nitrogen oxides concentration in the gas stream. A NO_2 in nitrogen certified gas cylinder was used to verify at least a 90 percent NO_2 conversion on the day of the test.

CO emission concentrations were quantified in accordance with procedures set forth in EPA Method 10. A continuous nondispersive infrared (NDIR) analyzer was used for this purpose.

THC emission concentrations were quantified in accordance with procedures set forth in EPA Method 25A. A continuous flame ionization (FID) analyzer was used for this purpose. VOC emission concentrations were quantified in conjunction with procedures outlined in EPA Method 18 for Tedlar bag sampling and analysis of methane and ethane content. These results were then subtracted from the THC concentrations to determine VOC concentrations.

TABLE 4.2
ANALYTICAL INSTRUMENTATION

Parameter	Manufacturer and Model	Range	Sensitivity	Detection Principle
NOx	THERMO 42i-HL	User may select up to 5,000 ppm	0.1 ppm	Thermal reduction of NO_2 to NO. Chemiluminescence of reaction of NO with O_3. Detection by PMT. Inherently linear for listed ranges.
CO	THERMO 48i	User may select up to 10,000 ppm	0.1 ppm	Infrared absorption, gas filter correlation detector, microprocessor based linearization.
CO_2	SERVOMEX 1440	0-20%	0.1%	Nondispersive infrared
SO_2	AMETEK 721M	User may select up to 10,000 ppm	0.1 ppm	Ultraviolet
THC	THERMO 51i-HT	User may select up to 10,000 ppm	0.1 ppm	Flame Ionization Detector
O_2	SERVOMEX 1440	0-25%	0.1%	Paramagnetic cell, inherently linear.



Shown fully equipped. Some labs may not contain these features and others may contain additional features specific to certain scopes.

AIR HYGIENE

Figure 1
EMISSIONS TESTING LAB

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(888) 461-8778

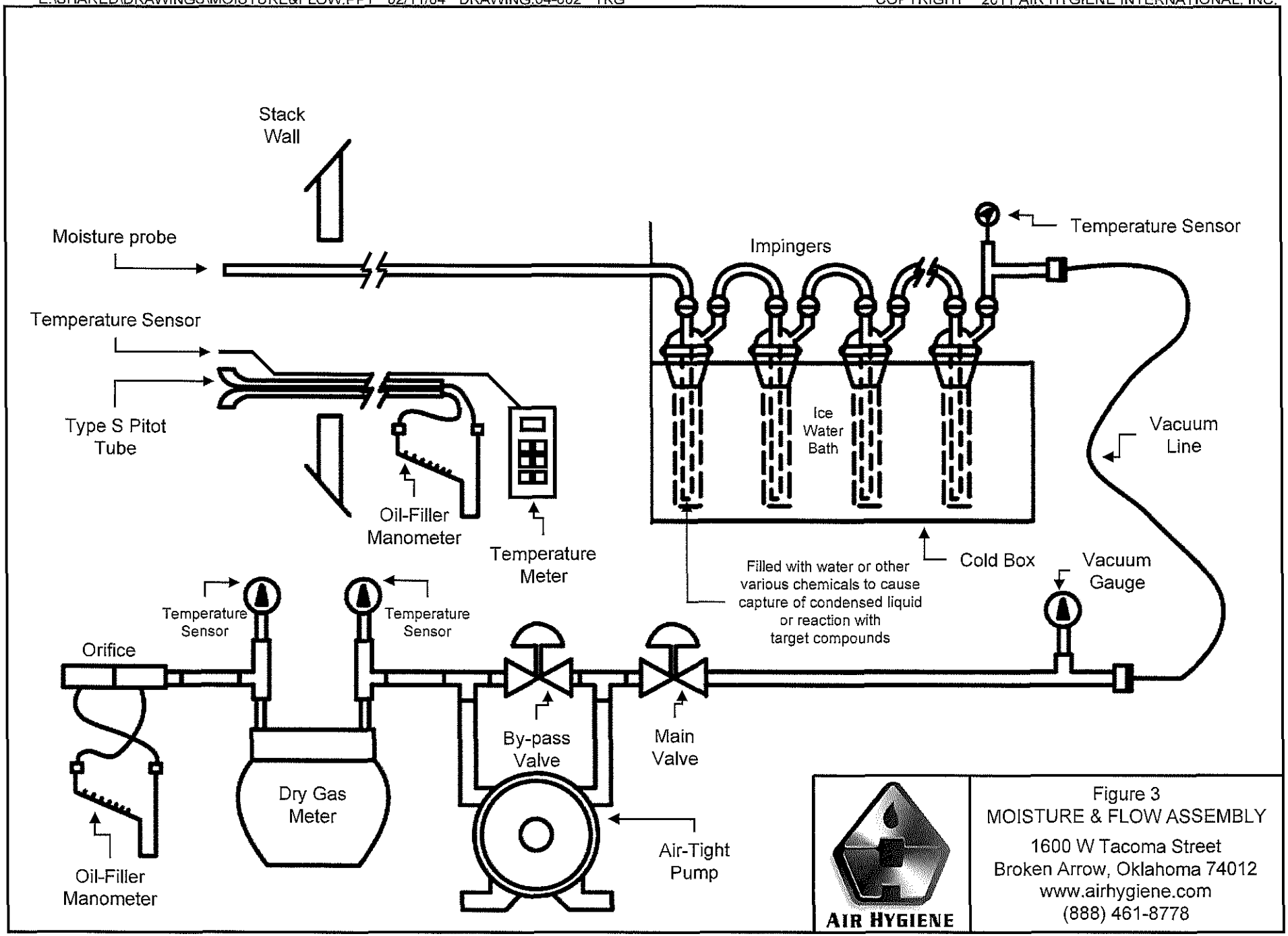

Figure 3
MOISTURE & FLOW ASSEMBLY

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APPENDIX A

TEST RESULTS AND CALCULATIONS