DEECO Inc.
3404 Lake Woodard Road
Raleigh, NC 27604
(919) 250-0285 (ph); (919) 250-1835 (Fax) www.deeco.com

REPORT NO: 021624-3326

PROJECT: 24-3326

DATE: February 16, 2024

TYPE: **Emission Test Report**

Hydrogen Cyanide, Hydrogen Fluoride and Diatomic Chlorine from a Portland Cement Plant

Holcim (US) Inc.
Whitehall Facility
5160 Main Street
Whitehall, Pennsylvania 18052

AUTHOR: Scott Steinsberger, Ph.D.

TEST DATE: January 24, 2024

FIELD TEAM: Dustin Carpenter, Lee Harris, and Scott Steinsberger

PREPARED FOR: Holcim (US) Inc.
Whitehall Facility
5160 Main Street
Whitehall, Pennsylvania 18052

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

The United States Environmental Protection Agency (US EPA) has directed the portland cement industry (SIC 3241) to conduct emissions testing as part of the US EPA Risk and Technology Review (RTR). This document provides the emission test results and supporting quality assurance/quality control (QA/QC) measures used to produce standardized data having known precision and accuracy. Collection of accurate, representative, and standardized data for facilities with low emissions is necessary especially in view of MACT standard setting procedures.

The process tested at the Whitehall facility is a pyro-processing system equipped with a preheater, designated as Kiln 2. Kiln 2 (Process 282005) is a Fuller Company Model 84200 that is 195 feet long and 13.5 feet in diameter with a nominal clinker capacity of 59 tons per hour. Other kilns located at the facility are idled at this time.

The Holcim Whitehall facility operates a number of air pollution control devices which help control and lower stack emissions. The kiln is equipped with a selective non-catalytic reduction (SNCR) system and dry absorbent addition (DAA) system for oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) control, respectively. Particulate matter is captured in an Allen Shennan Hoftman baghouse (ID: C01) and returned to the kiln feed system. A water spray system between the preheater and the induced draft fan protects the baghouse from high temperatures.

A more detailed description of the processes is provided in Section 2 of the RTR Sampling and Analytical Protocol reproduced in Appendix G.

The Holcim Inc. retained DEECO Inc. (DEECO) to conduct emission tests for for hydrogen cyanide (HCN), hydrogen fluoride (HF), and diatomic chlorine (Cl_2). All sampling runs were be one hour long. Concurrent measurements to determine volumetric flow rate were made. The Whitehall facility does not have an inline raw mill so testing was conducted under a single condition.

A summary of the test results is shown in Table 1.1.

TABLE 1.1 SUMMARY OF HYDROGEN CYANIDE, HYDROGEN FLUORIDE, AND DIATOMIC CHLORINE EMISSIONS; HOLCIM INC., WHITEHALL , PA FACILITY; KILN 2; JANUARY 24, 2024

Test Parameters	Main Stack
Hydrogen Cyanide (FTIR)	
parts-per-million, dry basis corrected to 7% O_2	2.3
pounds-per-hour	0.59
pounds-per-ton of clinker	0.012
Hydrogen Fluoride (FTIR)	
parts-per-million, dry basis corrected to 7% O_2	<0.04
pounds-per-hour	<0.009
pounds-per-ton of clinker	<0.0002
Hydrogen Fluoride (Method 26A)	
parts-per-million, dry basis corrected to 7% O_2	<0.30
pounds-per-hour	<0.058
pounds-per-ton of clinker	<0.0011
Diatomic Chlorine (Method 26A)	
parts-per-million, dry basis corrected to 7% O_2	<0.11
pounds-per-hour	<0.077
pounds-per-ton of clinker	<0.0015

The sampling and analytical procedures followed are summarized in Table 1.2 and discussed in detail in Section 3.

Testing was performed on the Kiln 2 under one condition on January 24, 2024.

Sampling was conducted by personnel from DEECO, Inc. of Raleigh, North Carolina. All questions regarding sampling and analytical data should be directed to Dr. Scott Steinsberger of DEECO at (800) 733-3261. The field sampling was completed by Dustin Carpenter, Lee Harris, and Scott Steinsberger of DEECO.

The remainder of this document summarizes the results, procedures and quality control measures followed for this program. Section 2 contains tabulated air emission results for each parameter of interest. Section 3 summarizes the air emission sampling and analytical procedures performed by DEECO, with a brief description and/or reference to the applicable methodologies. Section 4 discusses the basic quality control elements in place for this program to assure the collection of representative, accurate air emission data.

The appendices provided in this document contain all of the necessary information to verify the reported results. Included as Appendices are: Appendix A - Emission Summary Tables; Appendix B - Field Data and CEM/FTIR Data; Appendix C - Ion Chromatography Analytical Report Data; Appendix D - Plant Process Data; Appendix E - Calibration Documents; Appendix F - Test Participants; Appendix G - RTR Sampling and Analytical Protocol

TABLE 1.2 SUMMARY OF SAMPLING AND ANALYTICAL PROTOCOLS HOLCIM INC., WHITEHALL , PA FACILITY

Location and Frequency	Test Parameter	Sampling Method	Sampling Procedure	Analysis Method	Analysis Procedure
Kiln 2 Main Stack	Volumetric Flow Rate and cyclonic check	EPA Methods 1 and 2	Velocity and temperature traverses	EPA Methods 1 and 2	Manometer for differential pressure and thermocouple for temperature
	Oxygen and Carbon Dioxide and Stratification Check	EPA Method 3A	Continuous; extractive sample	EPA Method 3A	Paramagnetic for O_2 and NDIR for CO_2
	Moisture	EPA Method 4	Condensation	EPA Method 4	Gravimetric
	Hydrogen Fluoride and Diatomic Chlorine (Cl_2)	EPA Method 26A	Isokinetic integrated sample	EPA Method 26A	Ion chromatography
	Hydrogen Fluoride and Hydrogen Cyanide	EPA Method 320	Continuous; extractive sample	EPA Method 320	Fourier Transform Infrared (FTIR) Spectroscopy

2. SUMMARY OF RESULTS

Emissions sampling was conducted at the Holcim Whitehall PA facility. Sampling was conducted for stack gas flow rate (EPA Methods 1 and 2), stack gas oxygen and carbon dioxide (EPA Method 3A), stack gas moisture (EPA Method 4), stack gas hydrogen fluoride and diatomic chlorine (EPA Method 26A) and stack gas hydrogen cyanide and hydrogen fluoride (EPA Method 320).

Testing was conducted on the Kiln 2 main stack under one condition and the results are summarized in Table 2.1.

TABLE 2.1 HOLCIM INC., WHITEHALL , PA FACILITY; KILN 2 MAIN STACK HYDROGEN CYANIDE, HYDROGEN FLUORIDE, AND DIATOMIC CHLORINE EMISSIONS; JANUARY 24, 2024

Test Parameter	Kiln 2 Main Stack Run 1	Kiln 2 Main Stack Run 2	Kiln 2 Main Stack Run 3	Kiln 2 Main Stack Average
Time	12:31-13:37	14:12-15:18	15:28-16:34	January 24, 2024
Flow Rate (dscfm)	74,600	73,750	74,200	74,180
Oxygen	10.2%	8.2%	9.0%	9.1%
Carbon Dioxide	18.0%	20.6%	19.8%	19.5%
Moisture	13.9%	14.6%	14.6%	14.4%
Hydrogen Cyanide (FTIR)				
ppm_{dry} at 7% O_2	2.5	2.1	2.2	2.3
pounds-per-hour	0.60	0.59	0.59	0.59
pounds-per-ton of clinker	0.013	0.011	0.011	0.012
Hydrogen Fluoride (FTIR)				
ppm_{dry} at 7% O_2	<0.05	<0.04	<0.04	<0.04
pounds-per-hour	<0.009	<0.009	<0.009	<0.009
pounds-per-ton of clinker	<0.0002	<0.0002	<0.0002	<0.0002
Hydrogen Fluoride (Method 26A)				
ppm_{dry} at 7% O_2	<0.31	<0.28	<0.31	<0.30
pounds-per-hour	<0.055	<0.059	<0.058	<0.058
pounds-per-ton of clinker	<0.0012	<0.0011	<0.0011	<0.0011
Diatomic Chlorine (Method 26A)				
ppm_{dry} at 7% O_2	<0.12	<0.11	<0.10	<0.11
pounds-per-hour	<0.076	<0.084	<0.072	<0.077
pounds-per-ton of clinker	<0.0016	<0.0016	<0.0013	<0.0015

3. SAMPLING AND ANALYTICAL PROCEDURES

Table 1.2 presents a summary of the overall sampling and analytical protocols used for the test program for the Kiln 2 main stack at Holcim's Whitehall, PA facility. All sampling and analytical methods employed for this test program were performed in accordance with the procedures outlined in the Reference Test Methods contained in the Code of Federal Regulations, Title 40, Part 60, Appendix A (40 CFR 60, Appendix A) and 40 CFR 63, Appendix A.

3.1 Sampling Point Determination - EPA Method 1

The Kiln 2 exhaust duct is a horizontally-oriented 8 feet by 4 feet rectangular stack. The stack gas sampling ports (4 total) are located approximately 1.5 diameters from the upstream disturbance and 3.76 diameters from the downstream disturbance. The location does not meet the minimum specifications for a measurement site under EPA Method 1.

Cyclonic flow checks, as described in EPA Method 1 Section 2.4, using the Type-S pitot null procedure and angle measurements was conducted at the Kiln 2 stack test location.

The 28 sampling traverse points has been used historically and calculated using EPA Method 1. Each traverse was made at each sampling location using a type-S pitot tube in accordance with EPA Methods 2 procedures. Gas temperatures were to be measured using calibrated Type K thermocouples and digital readout devices. All measurements were to be performed in accordance with the procedures in EPA Methods 2, and 26A.

A schematic of the Kiln 2 main stack is provided in Figure 3.1.

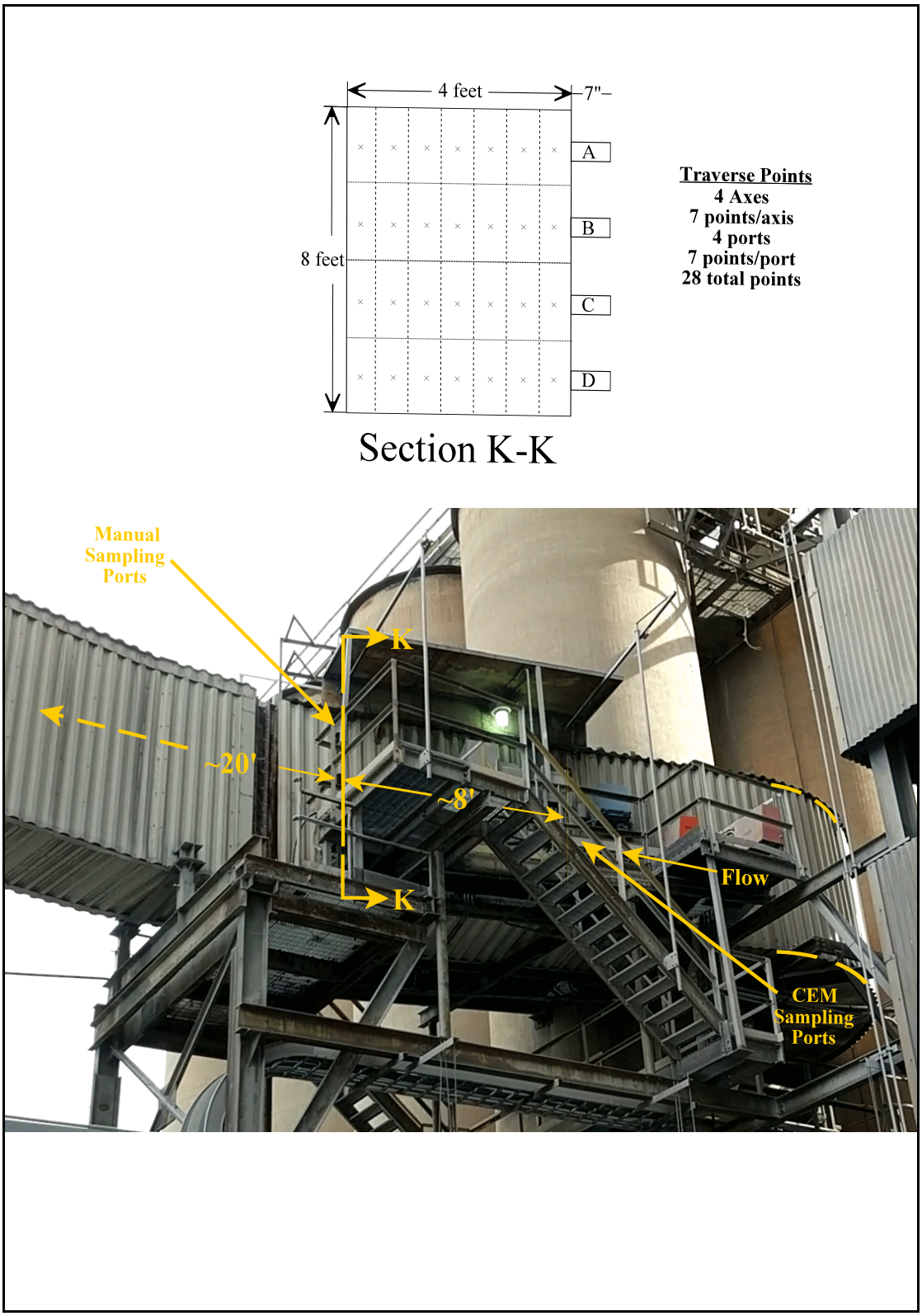


Figure 3.1 Schematic of the Kiln 2 Stack Sampling Location

3.2 Flue Gas Velocity and Volumetric Flow Rate - EPA Method 2

The flue gas velocity and volumetric flow rate were determined according to the procedures outlined in EPA Method 2. Velocity measurements were using type S pitot tubes conforming to the calibration specifications outlined in EPA Method 2, Section 10.1. Each Type-S pitot tube, calibrated according to these standards, had an assigned coefficient. Differential pressures were measured with fluid manometers. Effluent gas temperatures were measured with chromel-alumel thermocouples equipped with digital readouts.

3.3 Outlet Flue Gas Composition - EPA Method 3A

Outlet flue gas analysis for oxygen (O_2) and carbon dioxide (CO_2) concentrations, and the calculation of percent excess air and flue gas dry molecular weight was performed in accordance with EPA Method 3A.

To evaluate the sampling location and points for FTIR and O_2 sampling, a three-point O_2 concentration stratification test on a line passing through the centroidal area at (for stacks is greater than 2.4 meters) at 0.4, 1.2 and 2.0 meters from the stack or duct wall. The procedures in Section 8.1.2 of Method 7E were followed, using oxygen as allowed by fourth sentence in Section 8.1.2. The plant O_2 CEMS was used as a control. A criteria of <5% variation from combined mean for each point was used as indication of non-stratification to allow single point sampling at the point closest to the mean.

Per EPA Method 3A for determining molecular weight, continuous extractive sampling was obtained using the same Method 320 sampling system described in Section 3.6.

A portion of the hot , wet gas sample was sent through a condensing system to remove the stack moisture. A portion of the moisture-free gas sample was sent to an O_2/CO_2 analyzer.

Calibration procedures were be performed in accordance with EPA methodology. Analyzers were calibrated before and after each test and a calibration check between each test run.

The pretest calibrations consisted of the following steps:

- Internal (direct) calibration of each analyzer to adjust calibration and check linearity.
- External (through the entire sampling system) calibration to check the system bias on zero and span gases.

The post test calibration consisted of an external system bias calibration check.

The analyzer calibrated using a certified zero and span (mid or high range) gas. Zero and span gases were directed to each analyzer through the appropriate plumbing, the calibration gas flow rates were adjusted to the correct flow rate and the analyzer was adjusted with the appropriate span pot.

After the analyzer was properly adjusted the linearity was checked using a low and high range

calibration gas. The maximum allowable limit for linearity is 2% of the analyzer range and all analyzers were shown to be linear within these limits before proceeding.

The external calibration bias check were performed by placing the CEM system in sampling mode and injecting a zero and span gas into the sample line at the probe exit. This check showed if there is any sampling system related bias, and also checks the integrity of the sample line.

3.3.1 Calibration Gases

DEECO useed EPA Protocol and/or ±2% NIST Traceable gases for calibration as required by the various reference methods employed in this test program. Calibration gases were selected from previous experience with similar sources and/or from information obtained from the facility engineer prior to sampling. In some cases if the gases that are selected are out of the optimum range of operation then no significant impact of data quality is expected due to the linear nature of the analyzers that were used.

Specific HCN gases were manufactured for this test program in the range of 50-100 ppm to provide spikes in the 5-10 ppm range, or lower; with an SF_6 or appropriate tracer used to calculate the exact spike gas dilution ratio of 10% or less.

No audit gases from a federal or a state agency were provided.

3.3.2 Sampling Procedures

At the completion of the pretest calibration routine, the CEM system was ready for operation. No further adjustments of sample flow rates, analyzer zero or span adjustments, or other critical CEM operating parameters were made until testing and post test calibration were complete.

Each sampling run was one hour. At the completion for each test run, calibration gases were used to check between test runs. A zero and the upscale calibration gas closest to the actual emission concentrations were used for the pretest and post test calibrations.

3.4 Flue Gas Moisture Content - EPA Method 4

The flue gas moisture content was determined in conjunction with the EPA Method 26A trains according to the sampling and analytical procedures outlined in EPA Method 4. (**NOTE:** In order to maintain isokinetic sampling, the sampling rate used may have been required to temporarily exceed the EPA Method 4-specified maximum sampling rate of 0.75 CFM, based on observed stack gas pitot readings.) The impingers were connected in series and contained reagents as described below. The impingers were contained in an ice bath in order to assure condensation of the moisture in the flue gas stream. Any moisture that is not condensed in the impingers was captured in the silica gel, therefore all moisture was weighed and entered into moisture content calculations.

3.5 Hydrogen Fluoride and Diatomic Chlorine - EPA Method 26A

Sampling and analytical procedures were those outlined in EPA Method 26A to determine primarily diatomic chlorine (Cl_2) emissions and hydrogen fluoride (HF) emissions at main stack outlet sampling locations. Duplicate simultaneous trains (a.k.a "paired trains") for each test run were used to determine precision.

Sample was collected through a heated glass probe, followed by a heated Teflon filter, where stack gas HF and Cl_2 were collected in a series of chilled impingers. The sampling train impingers contained 100 ml of 0.1N sulfuric acid in the first and second, an empty third impinger, 100 ml of 0.1N NaOH in the fourth and fifth and 200 grams of silica gel in the last impinger

Sampling was conducted isokinetically (±10%) with readings of flue gas parameters recorded at traverse points selected according to EPA Method 1. Leak-checks on the Method 26A sampling train were performed before and after each sampling run and optionally for any port change. The sampling train leak-checks and leakage rate (where applicable) were documented on the field test data sheet for each respective run. All leak checks were acceptable.

The glass button hook nozzle and probe liner was constructed of borosilicate glass. The filter holder was constructed of borosilicate glass with a Teflon frit filter support and a sealing gasket. A PTFE-bonded glass fiber filter was used. The probe and filter housing were heated to above 248°F and not exceed an upper boundary of 273°F. Probe liners and filter holders were cleaned thoroughly prior to testing.

The Method 26A trains was operated isokinetically for a minimum of 60 minutes and collected a minimum of 1 dry, standard cubic meter (DSCM). Pretest preparations, preliminary determinations, and leak check procedures were those outlined in EPA Method 5.

After completion of sampling the train was leak checked and transferred to the sample recovery trailer. All leak checks were acceptable. The impingers were weighed to determine moisture gain in accordance with EPA Method 4.

Sample recovery involved quantitative recovery of the sulfuric acid impinger contents and the NaOH impinger contents into separate tare-weighed, precleaned polyethylene sample containers.

The nozzle, probe, filter and filter housing were not recovered.

The contents of sulfuric acid impingers, including the contents if any of the empty (2^{nd} knockout or third) impinger were quantitatively transferred to the tare-weighed, precleaned polyethylene sample container, followed by three rinses with deionized (DI) water of the impingers and all connecting glassware (including the connecting glassware to the first impinger) placed in the same H_2SO_4 container. The container was labeled and weighed to determine the final sample volume.

The contents NaOH impingers were quantitatively transferred to a second tare-weighed, precleaned polyethylene sample container, followed by three rinses with DI water of the impingers

and all connecting glassware placed in the same NaOH container. The container was labeled and weighed to determine the final sample volume.

Sample recovery from each train included:

1. Container No. 1 - Contents of H_2SO_4 impingers and knockout impinger and, and DI rinse of impingers and connecting glassware; and
2. Container No. 2 - Contents NaOH impingers, and DI rinse of impingers and connecting glassware.

Additional quality control consisted of collecting and analyzing a field blank train for every three test runs. The blank train was assembled from a used train, leak checked and sat for a period equal to the sampling time (i.e, 1-hr). The blank train data was to be used to determine the method detection limit for the test program target analytes (ie. The lowest number that could be detected), and compared to stack emissions.

Reagent blanks of 0.1 N H_2SO_4, 0.1N NaOH, and DI water were collected and archived for later analysis should there be any issues with the field blank train samples

The H_2SO_4 impinger solutions were analyzed using ion chromatography techniques for fluoride ions (F^-) (EPA SW-9057). Duplicate analyses performed on the samples and field blanks. Precision was demonstrated by duplicate injection of each sample, the results of each individual analysis being within 5% of their mean to be acceptable.

The NaOH impinger solutions was treated with sodium thiosulfate to ensure complete conversion of hypochlorous acid (HClO) to chloride ions (Cl^-). The resulting solution was analyzed using ion chromatography techniques for chloride ions (EPA SW-9057). Duplicate analyses was performed on the samples and field blanks. Precision was demonstrated by duplicate injection of each sample, the results of each individual analysis being within 5% of their mean to be acceptable

All EPA Method 26A HF/Cl_2 samples were analyzed by Element One of Wilmington NC. Refer to Section 1, Figure 1.1 of the RTR Sampling and Analytical Protocol for contact information.

For this test program, the relative deviation (RD) was to be calculated as described in EPA Method 30B between the Cl_2 concentrations measured with the paired trains. A criteria of a less than 10% relative deviation or 0.2 ppm absolute difference was required.

The absolute differences between the Cl_2 concentrations measured with the paired trains is summarized in Table 3.1. For each paired run, Cl_2 concentrations met the 0.2 ppm absolute difference criteria.

TABLE 3.1 PAIRED METHOD 26A SAMPLING TRAIN DIATOMIC CHLORINE CONCENTRATION COMPARISON RESULTS FOR THE KILN 2 MAIN STACK; JANUARY 24, 2024

Run	Time	Train A Diatomic Chlorine Concentration (ppm,dry)	Train B Diatomic Chlorine Concentration (ppm,dry)	Absolute Difference (ppm,dry)
Run 1	12:31-13:37	<0.09	<0.09	0.00
Run 2	14:12-15:18	0.11	<0.09	0.02
Run 3	15:28-16:34	<0.09	<0.09	0.00

3.6 Hydrogen Cyanide and Hydrogen Fluoride - EPA Method 320

EPA Method 320 was performed to determine emissions of concentrations of HCN and HF. Three, 1-hour sampling runs were conducted under each representative process and control system operating conditions.

The gas sample was extracted from the stack through a glass-lined probe and filter heated to 375° F. For external calibration checks and analyte spikes, the gases were introduced in front of the heated filter. Any excess calibration gas was diverted through the sample probes into the source. Outflow of gas from the heated filter enclosure was transported through a Teflon sample line heated to 375° F. For these sources approximately 300' of sample line was required. The heated sample line was connected directly to the FTIR sample cell. Using heat-traced Teflon tubing the exit of the FTIR cell was connected to a sample pump with a heated stainless steel pump head. The pump discharge was directed to a proprietary chiller-type gas conditioner to remove moisture prior to delivery sample gas to the O_2/CO_2 monitor.

The distribution of the gas sample to the monitors was accomplished using a panel equipped with valves and rotometers. The gas sample was then divided and directed to the O_2/CO_2 analyzer.

FTIR sample cell was maintained at 191°C and connected to a MKS Instruments Multigas 2030 Fourier Transform Infrared Spectrometer and Detector.

The FTIR spectrometer measured vapor phase organic or inorganic compounds which absorb energy in the mid-infrared spectral region, about 400 to 4000 cm^{-1} (25 to 2.5 μm). Continuous measurement were made by matching sample absorbance bands with bands in reference spectra, and comparing sample band intensities with reference band intensities.

The principle limitation to FTIR spectroscopy are the presence of interfering compounds that also absorb energy in the mid-infrared spectral region. In a cement kiln stack gas matrix, water vapor (H_2O) and carbon dioxide (CO_2) are the primary interferents that must be incorporated into the identification and quantitation method.

The FTIR software performs the computation for a single compound by subtracting all the other compounds (interferants and target) from the absorbance spectra and quantifies the single compound based on the remain absorbance. The FTIR software provides a Standard Error Calculation (SEC) value that is an indication of how well the identification and quantitation has been performed. A high SEC indicates that other interferants have not been accounted for in the analysis method, and a low SEC is indicative of greater confidence measurement.

The instrument is operated with a resolution of 0.5 cm^{-1} with 4x zero filling. Beer-Norton Medium apodization is used with amplitude phase correction.

For this RTR test program, following specific QA/QC activities for EPA Method 320 were performed and are summarized in Table 3.2

3.6.1 Laboratory QA/QC Activities Before Field Test Program

Before field testing occurs, the following QA/QC activities were conducted;

1) Seven consecutive samples of dry nitrogen through the sampling system was acquired and used to calculate the standard deviation for each of the test program target analytes multiplied by a factor of 3. These data were considered representative of detection limits (DL) for this test program and were below the 0.5 ppm required DL for both HCN and HF;

2) From these seven dry nitrogen samples, the results for the Signal-to-Noise Ratio (SNR) @ 2500 cm^{-1} was >2500, at 64 scans and the results for single beam intensity @ 2500 cm^{-1} was >0.9; and

3) The HCN calibration gases was analyzed directly and the FTIR responses agreed with tag value within 5%

3.6.2 QA/QCActivities During Field Test Program

During the field test program, following QA/QC activities were be performed and criterium met;

1) On each test day prior to any testing, an instrument background was collected using dry nitrogen directed to the gas cell. The background was collected with at least 128 scans;

2) The probe, filter, sample line and all sample system components in contact with effluent were be maintained at or above 375ºF or 191ºC (consistent with FTIR calibration temperature) to avoid any possible "cold spots;"

3) A system zero with all sampling system components at operating temperature was performed by injecting nitrogen at the sample probe and through sample filter and entire measurement system. After zero equilibration was achieved, all measurement components were quantified for at least 128 scans;

4) The sample probe was position at effluent measurement point and sampling was continue until equilibration of the measurement system has been achieved. At this point, the effluent concentrations was quantified with two consecutive 64-scan samples as the initial native concentration for the dynamic spike;

5) Analyte spiking was conducted for HCN before the first test run, and after each successive test run for a minimum of 4 spikes per test condition. These results were used to determine accuracy and are summarized in Table 3.3;

6) The spike gas injections was maintained at 10% or less of total sample volume. The spike gas concentration and flow rate was be selected to approximately double the native effluent concentration. Spike recovery results were within ±20% of the expected value. An SF_6 tracer was used to calculate the exact spike gas dilution ratio of 10% or less;

TABLE 3.2 FTIR PRETEST AND FIELD TEST QA/QC SUMMARY

Spectrum	HCN	SF6	HF	SNR 2500	sBeam @2500
Seven consecutive samples of dry nitrogen for detection limit					
SPC__000837.LAB	-0.051		-0.002	6223.51	1.42
SPC__000838.LAB	-0.032		-0.000	5809.30	1.42
SPC__000839.LAB	0.046		-0.017	3759.60	1.42
SPC__000840.LAB	-0.011		0.016	4373.66	1.42
SPC__000841.LAB	0.080		0.002	5347.95	1.42
SPC__000842.LAB	0.059		-0.012	5012.46	1.42
SPC__000843.LAB	-0.029		-0.006	4706.13	1.42
Standard Deviation X 3	**0.156**		**0.032**		
Averages				**5033.23**	**1.42**
HCN Standard (CC768222; 49.9 ppm HCN/5.0 ppm SF6)					
SPC__156465.LAB	48.42	4.77			
SPC__156466.LAB	48.61	4.78			
SPC__156467.LAB	48.47	4.79			
SPC__156468.LAB	48.64	4.77			
Averages	48.54	4.77			
Residuals for Post HCN analyte spike native scans					
SPC_156520.LAB					
Concentration	1.58		-0.15		
MDC3	0.17		0.27		
MDC3%	NA		NA		
SPC_156521.LAB					
Concentration	1.45		-0.18		
MDC3	0.21		0.29		
MDC3%	NA		NA		
Final SNR @ 2500 cm^{-1} and single beam intensity @ 2500 cm^{-1}					
SPC__156761.LAB				4074.4	1.14

7) After the dynamic spike, nitrogen was sent through the sampling system until all traces of spike gas removed and lines proven below DL for target analytes;

8) The nitrogen purge was discontinued and the sampling system was allowed to equilibrate with stack gas before starting a test run. The first two consecutive 64-scan samples of a sample run was used for the final native concentration. Residual results for HCN and HF were verified to be less than 0.2-0.3 ppm for data acceptance, or less than 5% of the measured value, whichever was least restrictive.

9) The final SNR @ 2500 cm^{-1}, at 64 scans, and the results for single beam intensity @ 2500 cm^{-1} were verified to met the >2500 and >0.9 criterium; respectively.

TABLE 3.3 ETHYLENE CALIBRATION TRANSFER STANDARD (CTS) AND HYDROGEN CYANIDE ANALYTE SPIKING TEST RESULTS FOR THE KILN 2 MAIN STACK; JANUARY 24, 2024

Run	Time	Average Native Hydrogen Cyanide Concentration (ppm,wet)	Spike plus Average Hydrogen Cyanide Native Concentration (ppm,wet)	Hydrogen Cyanide Spike Recovery	CTS Error
Pre Run 1	11:51-12:10	1.22	2.83	95.2%	-3.5%
Post Run 1	13:28-13:44	1.18	3.18	96.6%	
Post Run 2	15:11-15:25	1.66	3.60	93.4%	
Post Run 3	16:25-16:39	1.97	4.35	111.6%	-4.1%

4. QA/QC PROCEDURES AND RESULTS

The objective of a quality assurance/quality control (QA/QC) program is to assure that the precision and accuracy of all environmental data generated by DEECO for clients are commensurate with data quality objectives (DQO's). DQO's are based on a common understanding of the intended end use(s) of the data, the measurement process, and the availability of resources. Once DQO's are established, formally or informally, QC protocol can be defined for the measurements.

In this project, the final data user is Holcim. The data quality objectives in this project are to generate scientifically sound data to be used for compliance purposes.

4.1 Sampling Equipment

All of the sampling equipment used was calibrated according to the procedures outlined in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, EPA-600/4-77-027b.

4.1.1 Manual Sampling Equipment Calibrations

For sampling Methods 1, 2, and 4 the procedures and equipment used to measure stack gas velocity and temperature measurements and the metering system used to maintain constant rate sampling conditions and to determine the sample gas volume were subjected to pretest and posttest calibrations and/or inspections as required by the appropriate EPA methods.

Barometer - Barometric pressure values were obtained from a calibrated barometer, verified by phone call to a local airport, and corrected for elevation to sample port level (0.01 inches Hg per 10 ft. elevation).

Pitot Tubes - Each pitot tube used in sampling meets the design specifications for type-S pitot tubes in EPA Method 2. Therefore, a maximum value baseline coefficient (C_p) of 0.84 is assigned to each pitot tube. Calibration by the manufacturer for pitot face-opening alignment included measuring the external tubing diameter (dimension D_t), the base-to-opening plane distance (dimensions P_a and P_b), and the face opening misalignment angles, with all terms as described in EPA Method 2. Pitot tubes were visually inspected for structural integrity at the completion of each test. Inspection sheets for pitot tubes are included in Appendix E.

Calibration Meter and Metering System - The secondary reference meter equipment arrangement for calibration is shown in Figure 5.7 of EPA Method 5. The prescribed procedures were followed. A wet test meter with a 1 ft^3/rev capacity and $\pm$ 1 percent accuracy is used as the primary calibrant. The dry gas meter's pump is run for a minimum of 5 minutes at a flow rate of 0.35 cfm to condition the interior surface of the wet test meter. Leak checks are performed and if satisfactory, triplicate runs at each of no less than five different flow rates are done. A calibration curve is prepared and the meter is recalibrated after 200 hours of operation or annually, whichever comes first.

The calibration set-up for the dry gas metering system using the secondary reference meter in lieu of the wet test meter is given in Figure 5.5 of EPA Method 5. A leak check of the metering system before calibration was performed as shown in Figure 5.4 of EPA Method 5. The metering systems's pump is operated for 5 minutes at an orifice manometer setting of 0.5 inches H_20 to heat up the pump and system to stabilize the meter inlet and outlet temperatures. Values for the orifice setting (delta H), wet test meter volume (V_w), corresponding dry test meter volume (V_d), dry test meter inlet and outlet gas temperatures (t_{di} and t_{dn}), and time are recorded for the initial calibration. Then the ratio of the wet test meter to the dry test meter (gamma) and the orifice pressure differential that equates to 0.75 cfm at standard conditions (delta H@) are calculated.

A post-test meter calibration was made on the dry gas meter used during the test to check its accuracy against the pre-test calibration. This post-test calibration check was made using the average orifice setting obtained during each test run and setting the vacuum at the maximum value obtained during each test run. These test runs were made against DEECO's secondary reference dry gas meter which was calibrated against a wet test meter. The calibration data sheets for the dry gas meters are included in Appendix E.

Thermocouples and Digital Indicators - Thermocouples were calibrated by comparing them against an ASTM-3F mercury-in-glass thermometer at approximately 32°F (ice water), ambient temperature, and at approximately 220°F. Each thermocouple was calibrated against temperature ranges to which it is typically exposed during test conditions, and they agreed within 1.5 percent (expressed in °R) of the reference thermometer throughout the entire calibration range. Also, thermocouples were checked at ambient temperature at the test site to verify calibration. The calibration data sheets for the thermocouples are included in Appendix E.

Pretest and Posttest Leak Checks of Sampling Trains - Each Method 4 sampling train was subjected to pretest leak checks and posttest leak checks. For all sampling runs the posttest leak checks were acceptable (less than 4% of the sampling rate at the highest vacuum recorded during the test run).

4.2 Analytical QA/QC Results

Analytical measurements of precision and accuracy were made on stack gas samples, and are summarized in a separate report.

Appendix A

Emission Summary Tables

Company: Holcim Whitehall PA
Source: Kiln 2 Main Stack
Job ID: 24-3326
Train Type: M26A

	1A 01/24/24 1231-1337	1B 01/24/24 1231-1337	2A 01/24/24 1412-1518	2B 01/24/24 1412-1518	3A 01/24/24 1528-1634	3B 01/24/24 1528-1634	Average
Initial Meter Volume, ft^3	445.167	52.544	492.165	101.142	539.622	149.421	
Final Meter Volume, ft^3	491.962	100.788	539.398	149.250	586.483	197.494	
Intra-Port Leak Check Volume, ft^3	0.000	0.000	0.000	0.000	0.000	0.000	
Total Sample Volume, cf	**46.795**	**48.244**	**47.233**	**48.108**	**46.861**	**48.073**	**47.552**
DGM Calibration Factor	1.014	0.973	1.014	0.973	1.014	0.973	0.994
Average DGM Temp, F	54.3	58.1	58.6	60.3	56.7	60.0	58.0
Average DGM delta H, "H2O	2.03	1.96	2.04	1.96	2.03	1.96	2.00
Barometric Pressure, "Hg	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Corrected Sample Vol,dscf	**49.068**	**48.177**	**49.118**	**47.838**	**48.909**	**47.831**	**48.490**
Corrected Sample Vol,dscm	**1.389**	**1.364**	**1.391**	**1.355**	**1.385**	**1.354**	**1.373**
Oxygen, %	10.2	10.2	8.2	8.2	9.0	9.0	9.1
Carbon Dioxide, %	18.0	18.0	20.6	20.6	19.8	19.8	19.5
Nitrogen, %	71.8	71.8	71.2	71.2	71.2	71.2	71.4
Stack Gas Excess Air, %	116.5	116.5	77.4	77.4	91.9	91.9	95.3
Total Moisture Catch Weight, grams	168.9	164.0	177.3	174.3	167.4	164.9	168.9
Stack Gas Moisture, %	**13.9**	**13.8**	**14.5**	**14.6**	**13.9**	**14.0**	**14.1**
Stack Gas Dry Molecular Weight, lb/lbmole	31.29	31.29	31.62	31.62	31.53	31.53	31.48
Stack Gas Wet Molecular Weight, lb/lbmole	29.44	29.45	29.65	29.63	29.65	29.63	29.58
Average Stack Temp, F	401.6	401.6	401.3	401.3	403.0	403.0	402.0
Stack Static (Gauge) Pressure, "H2O	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10	-1.10
Stack Gas Actual Pressure, "Hg	29.92	29.92	29.92	29.92	29.92	29.92	29.92
Average Sqrt delta P	1.024	1.024	1.024	1.024	1.024	1.024	1.024
Pitot Tube Coefficient	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Stack Gas Velocity, ft/second	**73.59**	**73.58**	**73.32**	**73.34**	**73.39**	**73.42**	**73.44**
Nozzle Inside Diameter, inches	0.250	0.250	0.250	0.250	0.250	0.250	
Total Sample Time, min	60	60	60	60	60	60	60
Isokinetic Rate, %	**103.0**	**101.1**	**104.2**	**101.6**	**103.2**	**101.0**	**102.3**
Stack Dimensions	48 x 96 in.	48 x 96 in.	48 x 96 in.	48 x 96 in.	48 x 96 in.	48 x 96 in.	
Stack Area, sq ft	32.00	32.00	32.00	32.00	32.00	32.00	32.00
Stack Gas Flow Rate, acfm	**141,300**	**141,300**	**140,800**	**140,800**	**140,900**	**141,000**	**141,017**
Stack Gas Flow Rate, acmm	4,001	4,001	3,987	3,987	3,990	3,993	3,993
Stack Gas Flow Rate, dscfm	**74,600**	**74,600**	**73,800**	**73,700**	**74,200**	**74,200**	**74,183**
Stack Gas Flow Rate, dscmm	2,112	2,112	2,090	2,087	2,101	2,101	2,101

Company: Holcim Whitehall PA
Source: Kiln 2 Main Stack
Job ID: 24-3326
Train Type: M26A

"ND()" denotes values below detection limits
NOTE: Average INCLUDES Non-detect runs' results

		1A 01/24/24 1231-1337	1B 01/24/24 1231-1337	2A 01/24/24 1412-1518	2B 01/24/24 1412-1518	3A 01/24/24 1528-1634	3B 01/24/24 1528-1634	Average
Hydrogen Fluoride	Catch Wt, mg	ND(0.275)	ND(0.27)	ND(0.291)	ND(0.288)	ND(0.29)	)(0.315)	ND(0.288)
	Conc., mg/dscm	ND(0.198)	ND(0.198)	ND(0.209)	ND(0.213)	ND(0.209)	)(0.233)	ND(0.210)
	Conc., mg/dscm @7% O2	ND(0.257)	ND(0.257)	ND(0.229)	ND(0.233)	ND(0.245)	)(0.272)	ND(0.249)
	Conc., mg/dscm @12% CO2	ND(0.132)	ND(0.132)	ND(0.122)	ND(0.124)	ND(0.127)	)(0.141)	ND(0.130)
	Conc., ppmvd	ND(0.238)	ND(0.238)	ND(0.252)	ND(0.256)	ND(0.252)	)(0.280)	ND(0.252)
	Conc., ppmvd @7% O2	ND(0.309)	ND(0.309)	ND(0.275)	ND(0.280)	ND(0.294)	)(0.327)	ND(0.299)
	Conc., ppmvd @12% CO2	ND(0.159)	ND(0.159)	ND(0.147)	ND(0.149)	ND(0.153)	)(0.170)	ND(0.156)
	Emission Rate, lb/hr	ND(0.055)	ND(0.055)	ND(0.058)	ND(0.059)	ND(0.058)	)(0.065)	ND(0.058)
	Clinker Rates (mtph and lbs/ton)	43.10	ND(0.0012)	47.50	ND(0.0011)	48.60	ND(0.0011)	ND(0.0011
Chlorine	Catch Wt, mg	ND(0.371)	ND(0.376)	0.456	ND(0.375)	ND(0.361)	)(0.349)	< 0.381
	Conc., mg/dscm	ND(0.267)	ND(0.276)	0.328	ND(0.277)	ND(0.261)	)(0.258)	< 0.278
	Conc., mg/dscm @7% O2	ND(0.347)	ND(0.358)	0.359	ND(0.303)	ND(0.304)	)(0.301)	< 0.329
	Conc., mg/dscm @12% CO2	ND(0.178)	ND(0.184)	0.191	ND(0.161)	ND(0.158)	)(0.156)	< 0.171
	Conc., ppmvd	ND(0.091)	ND(0.094)	0.111	ND(0.094)	ND(0.088)	)(0.087)	< 0.094
	Absolute Difference, ppmvd (<0.2 required)		0.003		0.017		0.001	
	Conc., ppmvd @7% O2	ND(0.118)	ND(0.121)	0.122	ND(0.103)	ND(0.103)	)(0.102)	< 0.112
	Conc., ppmvd @12% CO2	ND(0.060)	ND(0.062)	0.065	ND(0.055)	ND(0.054)	)(0.053)	< 0.058
	Emission Rate, lb/hr	ND(0.075)	ND(0.077)	0.091	ND(0.076)	ND(0.072)	)(0.072)	< 0.077
	Clinker Rates (mtph and lbs/ton)	43.10	ND(0.0016)	47.50	ND(0.0016)	48.60	ND(0.0013)	< 0.0015

Holcim Whitehall PA
Kiln 2 Main Stack
Run 1

Spectrum	Date	Time	HCN (200) PCA 191C 191c		HF ppm (10) 191C	SF6 (10) 191C	Ethylene (100,3000) 191C	H2O% (40) 191C	CO2% (40) 191C span
SPC__156541.LAB	01/24/24	12:32:25.361	1.710		-0.174	-0.006	0.533	13.590	16.038
SPC__156542.LAB	01/24/24	12:33:29.593	1.676		-0.187	-0.009	0.603	13.383	17.192
SPC__156543.LAB	01/24/24	12:34:33.185	1.308		-0.189	-0.010	0.592	14.216	17.600
SPC__156544.LAB	01/24/24	12:35:37.089	1.573		-0.191	-0.005	0.566	14.050	16.248
SPC__156545.LAB	01/24/24	12:36:41.086	1.670		-0.201	-0.007	0.580	14.076	15.807
SPC__156546.LAB	01/24/24	12:37:44.918	1.906		-0.176	-0.007	0.518	14.534	16.331
SPC__156547.LAB	01/24/24	12:38:48.818	1.596		-0.165	-0.007	0.509	14.389	16.726
SPC__156548.LAB	01/24/24	12:39:52.800	1.452		-0.154	-0.007	0.518	14.210	16.484
SPC__156549.LAB	01/24/24	12:40:56.640	1.587		-0.192	-0.010	0.731	14.508	17.404
SPC__156550.LAB	01/24/24	12:42:00.902	1.319		-0.192	-0.008	0.632	14.369	15.877
SPC__156551.LAB	01/24/24	12:43:04.452	0.899		-0.147	-0.006	0.531	14.680	15.943
SPC__156552.LAB	01/24/24	12:44:08.400	1.301		-0.159	-0.005	0.524	14.568	16.007
SPC__156553.LAB	01/24/24	12:45:12.307	1.462		-0.139	-0.004	0.627	14.202	15.918
SPC__156554.LAB	01/24/24	12:46:16.177	1.247		-0.198	-0.009	0.619	13.588	14.894
SPC__156555.LAB	01/24/24	12:47:20.093	1.491		-0.211	-0.007	0.545	13.509	15.012
SPC__156556.LAB	01/24/24	12:48:24.031	1.167		-0.209	-0.004	0.599	13.401	13.762
SPC__156557.LAB	01/24/24	12:49:28.227	1.349		-0.137	-0.006	0.590	12.880	13.298
SPC__156558.LAB	01/24/24	12:50:31.894	1.567		-0.125	-0.002	0.530	12.725	14.004
SPC__156559.LAB	01/24/24	12:51:35.719	1.657		-0.177	-0.004	0.617	12.792	14.332
SPC__156560.LAB	01/24/24	12:52:39.623	1.775		-0.193	-0.007	0.558	12.463	14.372
SPC__156561.LAB	01/24/24	12:53:43.617	1.918		-0.180	-0.003	0.621	12.468	14.496
SPC__156562.LAB	01/24/24	12:54:47.441	1.825		-0.175	-0.005	0.581	12.606	14.711
SPC__156563.LAB	01/24/24	12:55:51.676	1.766		-0.186	-0.006	0.583	12.334	14.168
SPC__156564.LAB	01/24/24	12:56:55.266	1.867		-0.200	-0.005	0.541	12.572	14.694
SPC__156565.LAB	01/24/24	12:57:59.167	1.784		-0.180	-0.007	0.557	12.826	15.327
SPC__156566.LAB	01/24/24	12:59:03.076	1.927		-0.190	-0.006	0.561	13.040	15.531
SPC__156567.LAB	01/24/24	13:00:06.989	2.164		-0.219	-0.007	0.641	13.005	15.588
SPC__156568.LAB	01/24/24	13:01:10.892	1.982		-0.191	-0.008	0.542	13.337	15.010
SPC__156569.LAB	01/24/24	13:02:14.799	1.975		-0.190	-0.007	0.636	12.980	15.021
SPC__156570.LAB	01/24/24	13:03:19.028	1.778		-0.182	-0.006	0.533	13.220	15.390
SPC__156571.LAB	01/24/24	13:04:22.876	1.704		-0.168	-0.003	0.576	12.966	14.884
SPC__156572.LAB	01/24/24	13:05:26.522	1.666		-0.216	-0.004	0.512	12.852	14.291
SPC__156573.LAB	01/24/24	13:06:30.435	1.557		-0.179	-0.007	0.541	13.242	15.072
SPC__156574.LAB	01/24/24	13:07:34.661	1.738		-0.196	-0.008	0.513	13.516	15.063
SPC__156575.LAB	01/24/24	13:08:38.245	1.555		-0.206	-0.005	0.625	13.721	16.476
SPC__156576.LAB	01/24/24	13:09:42.200	1.609		-0.198	-0.011	0.612	13.612	15.483
SPC__156577.LAB	01/24/24	13:10:46.420	1.613		-0.210	-0.005	0.538	13.363	15.060
SPC__156578.LAB	01/24/24	13:11:50.061	1.565		-0.178	-0.007	0.604	13.316	15.608
SPC__156579.LAB	01/24/24	13:12:53.887	1.541		-0.184	-0.008	0.600	13.398	16.314
SPC__156580.LAB	01/24/24	13:13:57.788	1.991		-0.216	-0.010	0.668	13.438	17.542
SPC__156581.LAB	01/24/24	13:15:01.694	2.224		-0.221	-0.008	0.610	13.297	17.707
SPC__156582.LAB	01/24/24	13:16:05.607	1.949		-0.216	-0.008	0.596	13.672	17.194
SPC__156583.LAB	01/24/24	13:17:09.520	1.963		-0.198	-0.007	0.599	14.352	17.641
SPC__156584.LAB	01/24/24	13:18:13.434	1.967		-0.205	-0.012	0.703	14.813	18.787
SPC__156585.LAB	01/24/24	13:19:17.341	1.749		-0.198	-0.010	0.606	14.772	18.505
SPC__156586.LAB	01/24/24	13:20:21.242	1.785		-0.205	-0.011	0.528	15.184	18.515
SPC__156587.LAB	01/24/24	13:21:25.158	1.829		-0.210	-0.013	0.573	15.082	19.007
SPC__156588.LAB	01/24/24	13:22:29.065	1.852		-0.199	-0.012	0.563	15.028	18.887
SPC__156589.LAB	01/24/24	13:23:32.970	1.923		-0.197	-0.014	0.613	14.777	18.579
SPC__156590.LAB	01/24/24	13:24:37.194	2.050		-0.217	-0.005	0.527	14.536	17.433
SPC__156591.LAB	01/24/24	13:25:40.864	1.715		-0.214	-0.010	0.598	13.928	16.942
SPC__156592.LAB	01/24/24	13:26:44.731	1.252		-0.206	-0.010	0.545	13.976	17.884
SPC__156593.LAB	01/24/24	13:27:48.930	1.161		-0.197	-0.008	0.608	14.491	17.335
SPC__156594.LAB	01/24/24	13:28:52.559	1.041		-0.185	-0.010	0.589	14.764	16.966
SPC__156595.LAB	01/24/24	13:29:56.459	1.263		-0.201	-0.006	0.590	14.677	16.095
SPC__156596.LAB	01/24/24	13:31:00.373	0.959		-0.188	-0.005	0.547	14.641	16.315
Run 1		**(actual)**	**1.641**	**<**	**0.032**	**-0.007**	**0.580**	**13.749**	**16.121**
Oxygen	**10.2%**	**(ppm,dry @7% O2)**	**2.475**	**<**	**0.048**	**-0.011**	**0.875**	**13.9**	**M26A Moisture**
DSCFM	**74,600**	**(lbs/hr)**	**0.598**	**<**	**0.009**	**-0.014**	**0.220**		
Clinker (mtons/hr)	**43.1**	**(lbs/ton clinker)**	**0.013**	**<**	**0.0002**				

Holcim Whitehall PA
Kiln 2 Main Stack
Run 2

Spectrum	Date	Time	HCN (200) PCA 191C 191c		HF ppm (10) 191C	SF6 (10) 191C	Ethylene (100,3000) 191C	H2O% (40) 191C	CO2% (40) 191C span
SPC__156635.LAB	01/24/24	14:13:11.708	1.583		-0.226	-0.009	0.513	14.240	17.626
SPC__156636.LAB	01/24/24	14:14:15.903	1.554		-0.232	-0.007	0.519	14.167	17.892
SPC__156637.LAB	01/24/24	14:15:19.526	1.683		-0.209	-0.010	0.547	14.315	17.984
SPC__156638.LAB	01/24/24	14:16:23.745	1.765		-0.225	-0.009	0.448	13.525	17.909
SPC__156639.LAB	01/24/24	14:17:27.337	1.733		-0.224	-0.008	0.489	13.940	17.893
SPC__156640.LAB	01/24/24	14:18:31.251	1.668		-0.223	-0.009	0.562	14.187	17.583
SPC__156641.LAB	01/24/24	14:19:35.162	1.731		-0.241	-0.007	0.521	14.375	17.579
SPC__156642.LAB	01/24/24	14:20:39.026	1.787		-0.212	-0.009	0.455	14.178	18.363
SPC__156643.LAB	01/24/24	14:21:42.931	1.396		-0.234	-0.011	0.411	14.162	17.564
SPC__156644.LAB	01/24/24	14:22:46.846	1.543		-0.200	-0.009	0.509	14.252	17.664
SPC__156645.LAB	01/24/24	14:23:50.758	1.456		-0.200	-0.011	0.405	14.668	18.281
SPC__156646.LAB	01/24/24	14:24:54.970	1.599		-0.221	-0.008	0.385	14.597	18.487
SPC__156647.LAB	01/24/24	14:25:58.612	1.531		-0.210	-0.011	0.417	14.586	18.486
SPC__156648.LAB	01/24/24	14:27:02.478	1.657		-0.208	-0.008	0.541	14.645	18.038
SPC__156649.LAB	01/24/24	14:28:06.383	1.549		-0.202	-0.008	0.490	14.538	17.933
SPC__156650.LAB	01/24/24	14:29:10.304	1.665		-0.230	-0.013	0.773	14.642	18.161
SPC__156651.LAB	01/24/24	14:30:14.206	2.057		-0.222	-0.010	0.559	14.708	18.721
SPC__156652.LAB	01/24/24	14:31:18.112	1.888		-0.203	-0.012	0.446	14.540	18.550
SPC__156653.LAB	01/24/24	14:32:22.055	1.555		-0.217	-0.012	0.419	14.633	18.371
SPC__156654.LAB	01/24/24	14:33:25.965	1.834		-0.229	-0.010	0.511	14.261	18.220
SPC__156655.LAB	01/24/24	14:34:29.866	1.968		-0.213	-0.010	0.490	14.217	18.439
SPC__156656.LAB	01/24/24	14:35:34.085	1.754		-0.211	-0.010	0.448	13.776	18.219
SPC__156657.LAB	01/24/24	14:36:37.639	1.569		-0.230	-0.008	0.543	13.926	18.052
SPC__156658.LAB	01/24/24	14:37:41.538	1.434		-0.192	-0.008	0.436	13.828	16.824
SPC__156659.LAB	01/24/24	14:38:45.450	1.498		-0.184	-0.007	0.424	13.605	16.995
SPC__156660.LAB	01/24/24	14:39:49.353	1.713		-0.191	-0.010	0.494	13.831	17.015
SPC__156661.LAB	01/24/24	14:40:53.304	1.584		-0.237	-0.009	0.453	13.591	17.807
SPC__156662.LAB	01/24/24	14:41:57.209	1.489		-0.216	-0.008	0.357	13.208	18.277
SPC__156663.LAB	01/24/24	14:43:01.083	1.916		-0.209	-0.008	0.438	13.612	18.461
SPC__156664.LAB	01/24/24	14:44:05.307	1.685		-0.213	-0.012	0.235	14.368	18.625
SPC__156665.LAB	01/24/24	14:45:08.908	1.513		-0.216	-0.015	0.362	14.518	18.865
SPC__156666.LAB	01/24/24	14:46:12.840	1.446		-0.207	-0.011	0.295	14.427	18.676
SPC__156667.LAB	01/24/24	14:47:16.750	1.513		-0.207	-0.012	0.434	14.234	18.577
SPC__156668.LAB	01/24/24	14:48:20.667	1.254		-0.205	-0.009	0.313	14.212	18.186
SPC__156669.LAB	01/24/24	14:49:24.560	1.197		-0.220	-0.009	0.324	14.345	18.178
SPC__156670.LAB	01/24/24	14:50:28.530	1.140		-0.221	-0.009	0.316	14.293	18.170
SPC__156671.LAB	01/24/24	14:51:32.437	1.568		-0.219	-0.013	0.489	14.276	18.375
SPC__156672.LAB	01/24/24	14:52:36.369	1.741		-0.212	-0.011	0.535	14.397	18.422
SPC__156673.LAB	01/24/24	14:53:40.150	1.982		-0.196	-0.015	0.565	14.436	18.740
SPC__156674.LAB	01/24/24	14:54:44.169	1.956		-0.198	-0.012	0.562	14.383	19.071
SPC__156675.LAB	01/24/24	14:55:47.973	1.430		-0.197	-0.010	0.378	14.548	18.799
SPC__156676.LAB	01/24/24	14:56:51.868	1.615		-0.209	-0.013	0.433	14.118	18.654
SPC__156677.LAB	01/24/24	14:57:55.782	1.534		-0.200	-0.009	0.400	14.178	18.370
SPC__156678.LAB	01/24/24	14:58:59.682	1.424		-0.202	-0.011	0.441	14.041	18.405
SPC__156679.LAB	01/24/24	15:00:03.906	1.449		-0.200	-0.008	0.448	14.307	18.667
SPC__156680.LAB	01/24/24	15:01:07.591	1.361		-0.206	-0.010	0.374	14.293	18.385
SPC__156681.LAB	01/24/24	15:02:11.407	1.520		-0.217	-0.013	0.357	13.939	18.958
SPC__156682.LAB	01/24/24	15:03:15.622	1.155		-0.198	-0.011	0.411	14.099	18.512
SPC__156683.LAB	01/24/24	15:04:19.220	1.424		-0.175	-0.010	0.393	13.757	17.909
SPC__156684.LAB	01/24/24	15:05:23.387	1.904		-0.223	-0.008	0.671	13.299	17.970
SPC__156685.LAB	01/24/24	15:06:27.026	1.789		-0.225	-0.007	0.397	13.040	17.914
SPC__156686.LAB	01/24/24	15:07:30.935	1.739		-0.219	-0.007	0.367	13.388	18.161
SPC__156687.LAB	01/24/24	15:08:34.836	1.729		-0.228	-0.007	0.431	13.279	18.087
SPC__156688.LAB	01/24/24	15:09:39.059	1.434		-0.214	-0.011	0.460	13.819	18.521
SPC__156689.LAB	01/24/24	15:10:42.720	1.581		-0.225	-0.010	0.548	14.023	18.746
SPC__156690.LAB	01/24/24	15:11:46.557	1.492		-0.206	-0.011	0.510	14.191	18.483
SPC__156691.LAB	01/24/24	15:12:50.689	2.505		-0.208	-0.009	0.446	13.906	18.162
Run 2		**(actual)**	**1.618**	**<**	**0.032**	**-0.010**	**0.454**	**14.120**	**18.211**
Oxygen	**8.2%**	**(ppm,dry @7% O2)**	**2.073**	**<**	**0.041**	**-0.013**	**0.582**	**14.6**	**M26A Moisture**
DSCFM	**73,750**	**(lbs/hr)**	**0.588**	**<**	**0.009**	**-0.019**	**0.171**		
Clinker (mtons/hr)	**47.5**	**(lbs/ton clinker)**	**0.011**	**<**	**0.0002**				

Holcim Whitehall PA
Kiln 2 Main Stack
Run 3

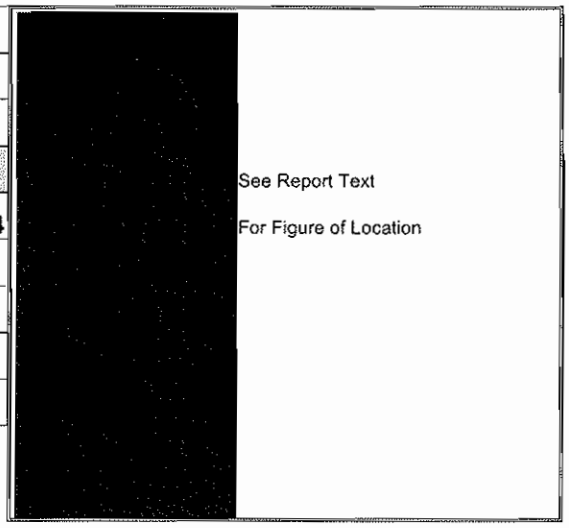
Spectrum	Date	Time	HCN (200) PCA 191C 191c		HF ppm (10) 191C	SF6 (10) 191C	Ethylene (100,3000) 191C	H2O% (40) 191C	CO2% (40) 191C span
SPC__156706.LAB	01/24/24	15:29:28.824	1.128		-0.209	-0.013	0.358	14.526	18.282
SPC__156707.LAB	01/24/24	15:30:32.467	1.080		-0.215	-0.007	0.407	14.045	18.117
SPC__156708.LAB	01/24/24	15:31:36.335	1.308		-0.210	-0.009	0.408	13.793	18.236
SPC__156709.LAB	01/24/24	15:32:40.248	1.096		-0.178	-0.010	0.414	14.167	18.084
SPC__156710.LAB	01/24/24	15:33:44.164	1.288		-0.204	-0.012	0.443	13.815	18.156
SPC__156711.LAB	01/24/24	15:34:48.381	1.419		-0.200	-0.009	0.505	13.769	18.065
SPC__156712.LAB	01/24/24	15:35:51.956	1.179		-0.201	-0.005	0.452	12.985	15.787
SPC__156713.LAB	01/24/24	15:36:55.862	1.781		-0.188	-0.007	0.506	12.171	15.029
SPC__156714.LAB	01/24/24	15:37:59.841	1.701		-0.182	-0.009	0.445	12.546	16.941
SPC__156715.LAB	01/24/24	15:39:03.645	1.302		-0.215	-0.009	0.437	13.480	18.181
SPC__156716.LAB	01/24/24	15:40:07.559	1.317		-0.199	-0.008	0.395	13.512	18.010
SPC__156717.LAB	01/24/24	15:41:11.468	1.227		-0.180	-0.008	0.428	13.763	18.337
SPC__156718.LAB	01/24/24	15:42:15.464	1.270		-0.228	-0.007	0.339	13.909	18.311
SPC__156719.LAB	01/24/24	15:43:19.268	1.294		-0.205	-0.010	0.382	13.991	18.050
SPC__156720.LAB	01/24/24	15:44:23.210	1.174		-0.226	-0.009	0.412	14.098	17.851
SPC__156721.LAB	01/24/24	15:45:27.442	1.349		-0.173	-0.006	0.410	13.300	17.749
SPC__156722.LAB	01/24/24	15:46:31.316	1.597		-0.206	-0.009	0.376	13.275	18.051
SPC__156723.LAB	01/24/24	15:47:35.001	1.300		-0.215	-0.008	0.371	13.618	17.833
SPC__156724.LAB	01/24/24	15:48:38.800	1.713		-0.210	-0.007	0.426	13.568	18.023
SPC__156725.LAB	01/24/24	15:49:42.819	1.517		-0.204	-0.010	0.454	13.692	17.807
SPC__156726.LAB	01/24/24	15:50:46.617	1.709		-0.216	-0.007	0.434	13.864	18.415
SPC__156727.LAB	01/24/24	15:51:50.518	1.439		-0.203	-0.009	0.452	13.800	18.210
SPC__156728.LAB	01/24/24	15:52:54.432	1.603		-0.191	-0.012	0.446	14.125	18.380
SPC__156729.LAB	01/24/24	15:53:58.335	1.480		-0.203	-0.010	0.464	13.954	18.403
SPC__156730.LAB	01/24/24	15:55:02.566	1.542		-0.218	-0.005	0.429	13.266	17.001
SPC__156731.LAB	01/24/24	15:56:06.471	1.924		-0.196	-0.005	0.514	12.557	15.925
SPC__156732.LAB	01/24/24	15:57:10.149	1.757		-0.190	-0.007	0.437	12.700	16.692
SPC__156733.LAB	01/24/24	15:58:14.407	1.686		-0.206	-0.012	0.403	13.314	18.201
SPC__156734.LAB	01/24/24	15:59:18.314	1.587		-0.228	-0.008	0.366	13.062	17.864
SPC__156735.LAB	01/24/24	16:00:21.761	1.748		-0.227	-0.009	0.411	13.083	17.647
SPC__156736.LAB	01/24/24	16:01:25.662	1.960		-0.234	-0.008	0.484	13.087	17.526
SPC__156737.LAB	01/24/24	16:02:29.570	1.704		-0.203	-0.008	0.433	13.309	18.188
SPC__156738.LAB	01/24/24	16:03:33.486	1.856		-0.205	-0.011	0.492	13.065	18.625
SPC__156739.LAB	01/24/24	16:04:37.388	1.804		-0.197	-0.011	0.505	13.690	18.398
SPC__156740.LAB	01/24/24	16:05:41.294	1.466		-0.207	-0.012	0.393	13.740	18.231
SPC__156741.LAB	01/24/24	16:06:45.446	1.622		-0.215	-0.013	0.476	13.341	18.109
SPC__156742.LAB	01/24/24	16:07:49.104	1.646		-0.190	-0.006	0.439	13.003	17.333
SPC__156743.LAB	01/24/24	16:08:53.233	1.606		-0.185	-0.008	0.439	13.359	17.251
SPC__156744.LAB	01/24/24	16:09:56.913	1.627		-0.219	-0.007	0.459	13.210	17.011
SPC__156745.LAB	01/24/24	16:11:01.126	1.865		-0.212	-0.008	0.390	13.099	17.540
SPC__156746.LAB	01/24/24	16:12:05.055	1.768		-0.206	-0.013	0.441	13.442	17.985
SPC__156747.LAB	01/24/24	16:13:08.936	1.585		-0.222	-0.005	0.381	13.326	16.711
SPC__156748.LAB	01/24/24	16:14:12.865	1.326		-0.198	-0.005	0.508	12.447	15.156
SPC__156749.LAB	01/24/24	16:15:16.431	1.538		-0.177	-0.005	0.539	11.598	14.922
SPC__156750.LAB	01/24/24	16:16:20.351	1.762		-0.214	-0.002	0.445	12.294	16.164
SPC__156751.LAB	01/24/24	16:17:24.254	2.155		-0.225	-0.008	0.438	13.137	17.523
SPC__156752.LAB	01/24/24	16:18:28.382	1.577		-0.209	-0.007	0.419	13.359	17.684
SPC__156753.LAB	01/24/24	16:19:32.395	1.713		-0.213	-0.009	0.530	13.910	18.137
SPC__156754.LAB	01/24/24	16:20:36.308	1.774		-0.205	-0.010	0.428	13.930	18.155
SPC__156755.LAB	01/24/24	16:21:40.213	1.920		-0.194	-0.008	0.539	13.781	18.264
SPC__156756.LAB	01/24/24	16:22:43.820	2.003		-0.204	-0.007	0.524	13.428	18.201
SPC__156757.LAB	01/24/24	16:23:48.048	2.020		-0.207	-0.012	0.481	13.488	18.045
SPC__156758.LAB	01/24/24	16:24:51.624	2.252		-0.213	-0.013	0.459	13.436	18.558
SPC__156759.LAB	01/24/24	16:25:55.831	2.455		-0.193	-0.011	0.512	13.389	18.737
SPC__156760.LAB	01/24/24	16:26:59.406	2.120		-0.227	-0.011	0.494	13.150	18.949
SPC__156761.LAB	01/24/24	16:28:03.329	2.179		-0.193	-0.008	0.460	13.491	18.686
Run 2		**(actual)**	**1.622**	**<**	**0.032**	**-0.009**	**0.443**	**13.398**	**17.709**
Oxygen	**9.0%**	**(ppm,dry @7% O2)**	**2.201**	**<**	**0.043**	**-0.012**	**0.602**	**14.0**	**M26A Moisture**
DSCFM	**74,200**	**(lbs/hr)**	**0.588**	**<**	**0.009**	**-0.017**	**0.167**		
Clinker (mtons/hr)	**48.6**	**(lbs/ton clinker)**	**0.011**	**<**	**0.0002**				

Appendix B

Field Data
and
CEM/FTIR Data

EPA Method 1
Traverse Point Location for Rectangular Ducts

Plant	LafargeHolcim Whitehall				
City	Whitehall		State	PA	
Location	Kiln 2 Duct Breaching				
Stack Depth (inches)	48	Stack Width (inches)	96		
Nipple Length	7	Equivalent Stack Diameter	64		
Nearest Upstream Disturbance (Bend, ID FAN, etc)					
Distance (inches)	128	Type of Disturbance			
Nearest Downstream Disturbance (Bend, or Stack Outlet)					
Distance (inches)	32	Type of Disturbance			



See Report Text

For Figure of Location

Stack Schematic (Draw by hand after printing)

Sampler	Old Data	Date	5/9/2019		

(Mark with an "x")

Particulate Traverse?	x	Yes		No

Number of Traverse Points Required	24 or 25			
Stack Traverse Point Array	7	# of Points	x	4 # of Ports

Traverse Point Number	Fraction of Stack Depth	Stack Depth (Inches)	Fraction x Stack Depth	Nipple Length (Inches)	Traverse Point Distance from outside Nipple	Port Number	Stack Width (Inches)	Fraction of Stack Width	Stack Port Distance from Stack Edge
1	0.071	48	3.41	7	10 3/8 in.	1	96	0.125	12 in.
2	0.214	48	10.27	7	17 1/4 in.	2	96	0.375	36 in.
3	0.357	48	17.14	7	24 1/8 in.	3	96	0.625	60 in.
4	0.5	48	24.00	7	31 in.	4	96	0.875	84 in.
5	0.643	48	30.86	7	37 7/8 in.				
6	0.786	48	37.73	7	44 3/4 in.				
7	0.929	48	44.59	7	51 5/8 in.				

Cyclonic Flow Check Data Sheet

PLANT AND CITY			DATE	SAMPLING LOCATION			SAMPLE TYPE		RUN NUMBER	
Holcim Whitehall PA			1/24/24	Kiln 2 Main Stack			Cyclonic Flow Check			
OPERATOR	Barometric Pressure (Pb (In. Hg)	STATIC PRESS (in. H2O)	AMBIENT TEMP (deg. F)	STACK ID (In.)	PITOT Cp	DGM BOX No.	DGM delta H@	DGM CAL FACTOR (gamma)		PROBE ID NO
KC/LH	30.0	-1.1	40	48 G6	0.85	CM5-18	NA	NA		5A

EPA Method 2 Data

Run Time (24 hr)	Traverse Port	Traverse Point ID	Pitot Delta P READING " H2O	STACK TEMP deg F	Absolute Angle at null (0) Delta P READING " H2O
11:30	A	1	1.0	390	10
		2	1.0	396	5
		3	1.1	399	5
		4	1.2	400	5
		5	1.3	400	8
		6	1.3	401	8
		7	1.0	402	10
	B	1	0.6	400	8
		2	0.7	401	5
		3	0.9	402	5
		4	0.9	403	0
		5	1.0	403	0
		6	1.0	400	1
		7	1.0	400	5
	C	1	0.9	400	10
		2	0.9	400	8
		3	1.0	401	5
		4	1.0	400	5
		5	1.2	400	3
		6	1.2	399	0
		7	1.0	398	10
	D	1	0.9	400	8
		2	1.0	401	10
		3	1.0	402	8
		4	1.1	402	8
		5	1.1	402	10
		6	1.1	403	10
		7	0.9	400	10
Pitot Leak Check			Acc		
Averages					

Average of Absolute Angle Readings must be < 20 degrees

METHOD 26A IMPINGER TRAIN FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Whitehall PA	1/24/24	Kiln 2 Main Stack	M26A for HF and Cl2	1

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	O2 Content %	CO2 Content %
DGC	30.0	-1.1	40	NA	48x96	0.85	5' effective with glass liner	8	19

ASSUMED MOISTURE (%)	DGM BOX No.	DGM delta H	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	NOZZLE ID Number	NOZZLE Field Cal.	NOZZLE Diameter	K Factor
17	M5-2L	1.72	1.014	5A	5 B	CEM	.001 cfm @ 12 "Hg	.001 CU. FT @ 12 "Hg	250	250.25	.250	1.94

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN:SEC)	CLOCK TIME (24-HR)	DGM READING Vm (Cu.Ft)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	PROBE TEMP (deg. F)	STACK TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL EXIT TEMP (deg. F)	FILTER EXIT (AU) TEMP (deg. F)	DGM IN / OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
-1	0	1225	445.167	.98	1.9	256	397	255	65		46	3
-2	2:10		446.81	.95	1.8	263	401	264	63		50	3
-3	4:20		448.63	1.1	2.1	257	402	258	57		50	3
-4	6:40		450.15	1.3	2.5	257	405	259	53		50	3
-5	8:50		451.95	1.4	2.7	255	405	261	50		50	4
-6	11:00		453.82	1.4	2.7	259	405	260	50		51	4
-7	13:10		455.70	1.1	2.1	256	396	257	48		51	3
	15:20											
-1	15:20	1248	457.554	.67	1.3	254	400	261	49		53	3
-2	17:30		458.99	.75	1.8	255	404	260	49		54	3
-3	19:40		460.67	.90	1.7	255	406	260	50		54	3
-4	21:50		462.17	.92	1.8	258	407	259	52		55	3
-5	24:00		463.76	.96	1.9	256	408	259	52		55	3
-6	26:10		465.48	1.0	1.9	255	407	258	52		55	3
-7	28:20		466.99	1.0	1.9	256	401	256	52		56	3
	30:30											
-1	30:30	1305	468.579	.90	1.7	255	395	260	53		55	3
-2	32:40		470.14	.94	1.8	255	403	263	53		55	3
-3	34:50		471.69	.97	1.9	258	406	265	52		55	3
-4	37:00		473.25	1.0	1.9	259	406	266	50		56	3
-5	39:10		474.91	1.3	2.5	255	407	264	50		56	4
-6	41:20		476.74	1.3	2.5	254	404	265	49		57	4
-7	43:30		478.54	1.1	2.1	256	401	265	51		57	4
	45:40											
-1	45:40	1322	480.218	.93	1.8	263	397	261	53		56	3
-2	47:50		481.79	1.0	1.9	255	400	261	54		56	3
-3	50:00		483.39	1.1	2.1	254	392	260	54		56	4
-4	52:10		485.11	1.1	2.1	250	396	262	55		56	4
-5	54:20		486.79	1.2	2.3	251	400	261	56		57	4
-6	56:30		488.55	1.2	2.3	255	400	266	57		57	4
-7	58:40		490.32	1.0	1.9	256	391	262	57		57	4
	60:50	1357	491.962									
	TOTAL TEST TIME		TOTAL DGM VOLUME (Cu.Ft.)	AVE. SQRT. delta P	AVERAGE delta H		Ave STACK TEMP F	Ave. DGM TEMP F				
	60:50											

METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- 1A
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by SC

MOISTURE

769.0

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	811.1	809.0	698.6	~~777.0~~ 777.1		889.8	grams
Initial weight	763.5	757.5	671.0	749.7	769.5	~~874.5~~	grams
Net weight	47.6	51.5	27.6	19.3	7.6	15.3	grams

Description of impinger water clear
30 % spent
B/W Sil gel color
Total moisture = 168.9 grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter ___

Probe rinse (acetone)
container no. Not Applicable
Liquid level marked/sealed X
523.2

H_2SO_4 Impinger and Knockou contents and water rinse
container no. WH-M26A- 1A H_2SO_4
Liquid level marked/sealed ✓
370.5

NaOH Impinger contents and water rinse
container no. WH-M26A- 1A NaOH
Liquid level marked/sealed ✓

Samples stored and locked ___
Remarks Deco 1 500g 500.4

METHOD 26A IMPINGER TRAIN FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Whitehall PA	11/24/24	Kiln 2 Main Stack	M26A for HF and Cl2	1 B

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	O2 Content %	CO2 Content %
Lee Harris	30.0	-1.1	40	NA	48x96	0.84	5' effective with glass liner	8	19

ASSUMED MOISTURE (%)	DGM BOX No.	DGM delta H	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	NOZZLE ID Number	NOZZLE Field Cal.	NOZZLE Diameter	K Factor
17	M5-B	1.65	0.973	5A	5B	CEM	.010 cfm @ 10 "Hg	.001 CU. FT @ 11 "Hg	.249	.250 .251	.250	1.60

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN:SEC)	CLOCK TIME (24-HR)	DGM READING Vm (Cu.Ft)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	PROBE TEMP (deg. F)	STACK TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL EXIT TEMP (deg. F)	FILTER EXIT (AU TEMP (deg. F)	DGM IN / OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
-1	0	1231	1052.544	.96	1.6	257	397	250	56 60	56 60	53	5
-2	2:10		54.27	.95	1.8	260	401	254	59	N/A	54	5
-3	4:20		55.89	1.1	2.0	260	402	255	59		54	5
-4	6:40		57.74	1.3	2.4	250	405	254	58		55	6
-5	8:50		59.65	1.4	2.6	250	405	255	57		54	7
-6	11:00		61.62	1.4	2.6	252	405	253	57		54	7
-7	13:10		63.64	1.1	2.0	254	396	256	58		55	5
	15:20	1746	65.362									
-1	15:20	1246	65.362	0.67	1.2	260	400	257	59		55	3
-2	17:30		66.75	0.95	1.6	258	404	255	58		56	4
-3	19:40		68.31	0.90	1.7	255	406	255	58		56	5
-4	21:50		69.92	0.92	1.7	251	407	254	57		57	5
-5	24:00		71.58	0.96	1.8	250	408	253	57		58	5
-6	26:10		73.17	1.0	1.9	255	407	255	58		58	5
-7	28:20		74.86	1.0	1.9	253	401	252	57		59	5
	30:30	1303	76.551									
-1	30:30	1305	76.551	0.90	1.7	250	395	256	59		58	5
-2	32:40		78.22	0.94	1.7	251	403	254	58		58	5
-3	34:50		79.80	0.97	1.8	250	406	258	59		59	5
-4	37:00		81.46	1.0	1.9	252	406	256	60		59	5
-5	39:10		83.1	1.3	2.4	254	407	255	60		59	6
-6	41:20		85.00	1.3	2.4	255	406	253	60		60	6
-7	43:30		86.92	1.1	2.0	253	401	256	60		61	5
	45:40	1320	88.656									
-1	45:40	1322	88.656	0.93	1.7	250	397	255	57		60	5
-2	47:50		90.29	1.0	1.9	252	400	253	56		61	5
-3	50:00		91.95	1.1	2.0	259	392	250	56		62	5
-4	52:10		93.67	1.1	2.0	254	396	252	57		62	5
-5	54:20		95.44	1.2	2.2	252	400	253	58		62	6
-6	56:30		97.23	1.2	2.2	250	400	251	58		63	6
-7	58:40		99.06	1.0	1.9	253	391	252	59		64	5
	60:50	1337	100.788									
	TOTAL TEST TIME		TOTAL DGM VOLUME (Cu.Ft.)	AVE. SQRT. delta P	AVERAGE delta H		Ave STACK TEMP F	Ave. DGM TEMP F				
	60:50											

`METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- 1B
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by EC5

MOISTURE

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	797.3	837.0	640.1	762.4	759.9	905.9	grams
Initial weight	761.4	776.0	610.6	743.7	752.3	894.6	grams
Net weight	75.6	21.3	29.5	18.7	7.6	11.3	grams

Description of impinger water clear
50 % spent
B/W Sil gel color
Total moisture = 164.0 grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter ___

Probe rinse (acetone)
container no. Not Applicable
Liquid level marked/sealed ___ 512.4

H_2SO_4 Impinger and Knockou contents and water rinse
container no. WH-M26A- 1B H_2SO_4
Liquid level marked/sealed ✓

NaOH Impinger contents and water rinse
container no. WH-M26A- 1B NaOH
Liquid level ✓ 376.4
marked/sealed ___

Samples stored and locked ___
Remarks ___

METHOD 26A IMPINGER TRAIN FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim, Whitehall PA	1/24/24	Kiln 2 Main Stack	M26A for HF and Cl2	2A

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	O2 Content %	CO2 Content %
WGC	30.0	-1.1	40	NA	48x96	.84	5' effective with glass liner	8	19

ASSUMED MOISTURE (%)	DGM BOX No.	DGM delta H	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	NOZZLE ID Number	NOZZLE Field Cal.	NOZZLE Diameter	K Factor
17	M5-22	1.72	1.014	5A	5A	CEM	.001 cfm @ 10 "Hg	.00 CU. FT @ 10 "Hg	.250	.250	.250	1.94

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN:SEC)	CLOCK TIME (24-HR)	DGM READING Vm (Cu.Ft)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	PROBE TEMP (deg. F)	STACK TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL EXIT TEMP (deg. F)	FILTER EXIT (AU TEMP (deg. F)	DGM IN / OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
1412 -1	0	~~1355~~	~~492.165~~	.93	1.8	256	396	2605	50		54	3
-2	2:10	493.71	~~493.71~~	1.0	1.9	259	397	258	48		54	3
-3	4:20		495.43	1.1	2.1	260	400	260	45		55	4
-4	6:40		497.22	1.1	2.1	260	402	261	45		55	4
-5	8:50		498.91	1.2	2.3	255	400	260	44		55	4
-6	11:00		500.66	1.2	2.3	255	405	263	44		56	4
-7	13:10		502.41	1.0	1.9	254	402	263	43		56	3
	15:20											
-1	15:20	1429	504.038	.98	1.9	255	400	260	45		57	3
-2	17:30		505.666	.95	1.8	255	403	264	46		57	3
-3	19:40		507.24	1.1	2.1	259	405	266	46		57	4
-4	21:50		508.91	1.3	2.5	261	402	260	49		59	5
-5	24:00		510.72	1.4	2.7	260	403	257	48		59	5
-6	26:10		512.59	1.4	2.7	254	400	255	48		60	5
-7	28:20		514.54	1.1	2.1	256	399	255	47		60	4
	30:30											
-1	30:30	1446	516.438	.67	1.3	259	400	263	49		59	3
-2	32:40		518.32	.85	1.8	260	397	260	49		60	4
-3	34:50		519.63	.90	1.7	261	396	259	51		60	4
-4	37:00		521.18	.92	1.8	258	400	260	51		60	4
-5	39:10		522.96	.96	1.9	255	400	266	51		61	4
-6	41:20		524.36	1.0	1.9	251	397	267	52		61	4
-7	43:30		525.98	1.0	1.9	253	401	266	53		61	4
	45:40											
-1	45:40	1503	527.605	.90	1.7	256	406	262	49		60	4
-2	47:50	529.17	~~529.17~~	.94	1.8	255	406	260	49		60	4
-3	50:00		530.80	.97	1.9	255	407	265	48		60	4
-4	52:10		532.43	1.0	1.9	250	403	260	48		61	4
-5	54:20		534.08	1.3	2.5	254	405	264	49		61	5
-6	56:30		535.88	1.3	2.5	259	402	261	50		62	5
-7	58:40		537.70	1.1	2.1	260	400	257	50		62	5
	60:50		539.394									
	TOTAL TEST TIME		TOTAL DGM VOLUME (Cu.Ft.)	AVE. SQRT. delta P	AVERAGE delta H		Ave STACK TEMP F	Ave. DGM TEMP F				
	60:50											

`METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- 2A
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by SCS

MOISTURE

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	823.6	811.6	666.0	764.3	758.4	1004.9	grams
Initial weight	744.6	755.8	647.9	756.0	755.5	991.7	grams
Net weight	79.0	55.8	18.1	8.3	2.9	13.2	grams

Description of impinger water Clear
10 % spent
B/W Sil gel color
Total moisture = 177.3 grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter ___

Probe rinse (acetone)
container no. Not Applicable
Liquid level marked/sealed ___

H_2SO_4 Impinger and Knockou contents and water rinse
container no. WH-M26A- 2A H_2SO_4
Liquid level marked/sealed ✓ 552.7

NaOH Impinger contents and water rinse
container no. WH-M26A- 2A NaOH
Liquid level marked/sealed ✓ 338.1

Samples stored and locked ___
Remarks ___

METHOD 26A IMPINGER TRAIN FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Whitehall PA	1/24/19	Kiln 2 Main Stack	M26A for HF and Cl2	2B

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	O2 Content %	CO2 Content %
LL. Harris	30.0	-1.1	40	NA	48x96	0.84	5' effective with glass liner	8	19

ASSUMED MOISTURE (%)	DGM BOX No.	DGM delta H	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	NOZZLE ID Number	NOZZLE Field Cal.	NOZZLE Diameter	K Factor
17	M5-H	1.65	0.973	5A	5A	CEM	.001 cfm @ 12 "Hg	.001 CU. FT @ 10 "Hg	.249	.250 .251	.250	1.80

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN:SEC)	CLOCK TIME (24-HR)	DGM READING Vm (Cu.Ft)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	PROBE TEMP (deg. F)	STACK TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL EXIT TEMP (deg. F)	FILTER EXIT (AU TEMP (deg. F)	DGM IN / OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
-1	0	1352	101.142	.98	1.8	260	396	260	57	NA	57	4
-2	2:10		102.91	.96	1.8	257	397	257	55		57	4
-3	4:20		104.51	1.1	2.0	250	400	257	56		58	5
-4	6:40		106.27	1.3	2.4	250	402	254	54		58	5
-5	8:50		108.23	1.4	2.6	252	400	255	50		59	5
-6	11:00		110.23	1.4	2.6	256	405	256	49		58	6
-7	13:10		112.32	1.1	2.0	257	402	254	50		59	5
	15:20	1427	113.946									
-1	15:20	1429	113.946	0.67	1.2	252	400	257	51		60	3
-2	17:30		115.32	0.85	1.6	249	405	253	52		59	4
-3	19:40		116.74	0.90	1.7	251	405	251	53		59	4
-4	21:50		118.49	0.92	1.7	254	402	255	54		59	4
-5	24:00		120.08	0.96	1.8	250	405	256	54		60	4
-6	26:10		121.71	1.0	1.9	251	400	256	55		60	4
-7	28:20		123.35	1.0	1.9	254	399	252	55		59	4
	30:30	1444	125.036									
-1	30:30	1446	125.036	0.90	1.7	252	400	252	54		60	4
-2	32:40		126.67	0.79	1.7	260	397	257	55		59	4
-3	34:50		128.54	0.97	1.8	255	396	256	56		61	4
-4	37:00		129.92	1.0	1.9	251	400	254	56		62	4
-5	39:10		131.64	1.3	2.4	254	400	251	57		62	5
-6	41:20		133.51	1.3	2.4	251	397	254	58		62	5
-7	43:30		135.36	1.1	2.0	259	401	255	59		63	5
	45:40	1501	137.110									
-1	45:40	1503	137.110	0.93	1.7	250	406	250	60		62	4
-2	47:50		138.74	1.0	1.9	254	406	256	60		63	4
-3	50:00		140.41	1.2	2.0	251	407	254	61		65	5
-4	52:10		142.14	1.2	2.0	253	403	250	62		62	5
-5	54:20		143.92	1.2	2.2	250	405	251	61		63	5
-6	56:30		145.72	1.2	2.2	249	402	250	60		62	5
-7	58:40		147.54	1.0	1.9	255	400	259	61		61	4
	60:50	1516	149.250									
	TOTAL TEST TIME		TOTAL DGM VOLUME (Cu.Ft.)	AVE. SQRT. delta P	AVERAGE delta H		Ave STACK TEMP F	Ave. DGM TEMP F				
	60:50											

METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- 2B
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by SCS

MOISTURE

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	811.9	837.2	620.1	784.7	781.7	920.2	grams
Initial weight	759.0	769.6	598.8	769.1	777.4	907.6	grams
Net weight	52.9	67.6	21.3	15.6	4.3	12.6	grams

Description of impinger water Clear
60 % spent
B/G Sil gel color
Total moisture = 174.3 grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter ___

Probe rinse (acetone)
container no. Not Applicable
Liquid level marked/sealed ___

H_2SO_4 Impinger and Knockou contents and water rinse
container no. WH-M26A- 2B H_2SO_4
Liquid level marked/sealed ✓ 547.8

NaOH Impinger contents and water rinse
container no. WH-M26A- 2B NaOH
Liquid level marked/sealed ✓ 375.1

Samples stored and locked ___
Remarks ___

METHOD 26A IMPINGER TRAIN FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Whitehall PA	1/24/24	Kiln 2 Main Stack	M26A for HF and Cl2	3A

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	O2 Content %	CO2 Content %
D O C	30.0	-1.1	40	NA	48x96	.84	5' effective with glass liner	8	19

ASSUMED MOISTURE (%)	DGM BOX No.	DGM delta H	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	NOZZLE ID Number	NOZZLE Field Cal.	NOZZLE Diameter	K Factor
17	M5-22	1.72	1.017	5A	5A	CEM	.001 cfm @ 10 "Hg	.001 CU. FT @ 10 "Hg	0.250	0.250	.250	1.94

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN:SEC)	CLOCK TIME (24-HR)	539.622 DGM READING Vm (Cu.Ft)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	PROBE TEMP (deg. F)	STACK TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL EXIT TEMP (deg. F)	FILTER EXIT (AU TEMP (deg. F)	DGM IN / OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
-1	0	1528	~~539.622~~	.90	1.7	254	400	266	47		53	3
-2	2:10		541.22	.94	1.8	255	400	266	47		53	3
-3	4:20		542.79	.97	1.9	255	405	259	45		54	3
-4	6:40		544.53	1.0	1.9	255	403	260	45		54	3
-5	8:50		546.10	1.3	2.5	258	404	262	45		54	5
-6	11:00		547.91	1.3	2.5	259	402	265	44		54	5
-7	13:10		549.76	1.1	2.1	255	400	264	44		54	4
	15:20											
-1	15:20	1545	551.455	.98	1.9	257	401	265	45		53	4
-2	17:30		553.11	.95	1.8	257	398	264	46		55	4
-3	19:40		554.65	1.1	2.1	259	400	266	46		55	4
-4	21:50		556.32	1.3	2.5	260	404	266	48		55	5
-5	24:00		558.15	1.4	2.7	260	405	263	48		56	5
-6	26:10		560.32	1.4	2.7	258	403	261	50		56	5
-7	28:20		561.97	1.1	2.1	255	402	260	51		56	4
	30:30											
-1	30:30	1602	563.665	.67	1.3	255	406	259	50		55	3
-2	32:40		565.05	.95	1.8	250	407	259	49		56	4
-3	34:50		566.65	.90	1.7	250	407	255	49		56	3
-4	37:00		568.16	.92	1.8	251	405	260	49		57	4
-5	39:10		569.69	.96	1.9	254	400	262	49		58	4
-6	41:20		571.47	1.0	1.9	255	401	260	50		59	4
-7	43:30		573.03	1.0	1.9	255	399	265	50		59	4
	45:40											
-1	45:40	1614	574.659	.93	1.9	255	406	261	50		60	4
-2	47:50		576.24	1.0	1.9	258	405	260	50		60	4
-3	50:00		577.85	1.1	2.1	260	405	259	50		60	4
-4	52:10		579.56	1.1	2.1	259	402	262	52		61	4
-5	54:20		581.25	1.2	2.3	255	407	265	52		61	5
-6	56:30		583.09	1.2	2.3	254	405	266	53		61	5
-7	58:40		584.84	1.0	1.9	255	400	266	53		61	4
	60:50		586.453									

TOTAL TEST TIME	TOTAL DGM VOLUME (Cu.Ft.)	AVE. SQRT. delta P	AVERAGE delta H	Ave STACK TEMP F	Ave. DGM TEMP F
60:50					

`METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- 3A
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by SCS

MOISTURE

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	880.4	796.2	670.4	752.2	758.0	963.6	grams
Initial weight	776.9	757.8	661.9	748.2	756.0	952.6	grams
Net weight	103.5	38.4	8.5	4.0	2.0	11.0	grams

Description of impinger water Clear
40 % spent
B/W Sil gel color
Total moisture = 167.4 grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter ___

Probe rinse (acetone)
container no. Not Applicable
Liquid level marked/sealed ___

H_2SO_4 Impinger and Knockou contents and water rinse
container no. WH-M26A- 3A H_2SO_4
Liquid level marked/sealed ✓ 550.4

NaOH Impinger contents and water rinse
container no. WH-M26A- 3A NaOH
Liquid level marked/sealed ✓ 361.2

Samples stored and locked ___
Remarks ___

METHOD 26A IMPINGER TRAIN FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Whitehall PA	1/24/24	Kiln 2 Main Stack	M26A for HF and Cl2	3B

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESS (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	O2 Content %	CO2 Content %
Joe Morris	30.0	-1.1	40	NA	48x96	0.84	5' effective with glass liner	8	19

ASSUMED MOISTURE (%)	DGM BOX No.	DGM delta H	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	NOZZLE ID Number	NOZZLE Field Cal.	NOZZLE Diameter	K Factor
17	M5-BB	1.65	0.975	5A	5A	CEM	.001 cfm @ 11 "Hg	.001 CU. FT @ 12 "Hg	.249	.256	.251	.250	1.96

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN:SEC)	CLOCK TIME (24-HR)	DGM READING Vm (Cu.Ft)	delta P VELOCITY HEAD (In. H2O)	delta H ORIFICE (In. H2O)	PROBE TEMP (deg. F)	STACK TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	SIL GEL EXIT TEMP (deg. F)	FILTER EXIT (AU) TEMP (deg. F)	DGM IN / OUT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
-1	0	1525	149.421	0.90	1.7	250	398	257	59	N/A	57	4
-2	2:10		151.04	0.94	1.7	249	401	251	56		58	4
-3	4:20		152.69	0.97	1.8	253	400	250	55		58	4
-4	6:40		154.43	1.0	1.9	258	402	255	55		59	4
-5	8:50		156.12	1.3	2.4	254	404	257	54		59	6
-6	11:00		157.96	1.3	2.4	256	403	255	55		60	6
-7	13:10		159.89	1.1	2.0	252	400	255	54		60	5
	15:20	1543	161.625									
-1	15:20	1545	161.625	0.93	1.7	250	400	253	54		60	4
-2	17:30		162.83	1.0	1.9	252	404	251	53		59	4
-3	19:40		164.86	1.1	2.0	252	406	249	53		59	5
-4	21:50		166.59	1.1	2.0	257	402	250	54		59	5
-5	24:00		168.33	1.2	2.2	252	403	250	54		60	5
-6	26:10		170.13	1.2	2.2	254	402	252	55		61	5
-7	28:20		171.95	1.0	1.9	253	397	250	56		61	4
	30:30	1600	173.634									
-1	30:30	1602	173.634	0.67	1.2	252	401	254	57		60	3
-2	32:40		175.00	0.85	1.6	250	404	254	57		59	4
-3	34:50		176.67	0.90	1.7	249	403	256	57		59	4
-4	37:00		178.17	0.92	1.7	254	399	255	60		59	4
-5	39:10		179.78	0.96	1.8	257	401	253	603		60	4
-6	41:20		181.64	1.0	1.9	259	402	250	61		59	4
-7	43:30		183.13	1.0	1.9	251	404	252	60		59	4
	45:40	1617	184.842									
-1	45:40	1619	184.842	0.98	1.8	251	402	254	62		60	4
-2	47:50		186.52	0.95	1.8	255	400	258	60		63	4
-3	50:00		188.17	1.1	2.0	254	400	253	59		63	5
-4	52:10		189.88	1.3	2.4	252	400	252	60		63	6
-5	54:20		191.76	1.4	2.6	250	402	252	601		62	6
-6	56:30		193.57	1.4	2.6	259	401	250	602		62	6
-7	58:40		195.18	1.1	2.0	257	405	255	603		63	5
	60:50	1634	197.444									
	TOTAL TEST TIME		TOTAL DGM VOLUME (Cu.Ft.)	AVE. SQRT. delta P	AVERAGE delta H		Ave STACK TEMP F	Ave. DGM TEMP F				
	60:50											

METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- 3B
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by GCS

MOISTURE

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	825.4	826.9	692.0	762.2	762.2	900.3	grams
Initial weight	769.9	761.5	671.0	753.0	759.1	889.6	grams
Net weight	55.5	65.4	21.0	9.2	3.1	10.7	grams

Description of impinger water clear
80 % spent
Blue Sil gel color
Total moisture = 164.9 grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter ___

Probe rinse (acetone)
container no. Not Applicable
Liquid level marked/sealed ___

H_2SO_4 Impinger and Knockou contents and water rinse
container no. WH-M26A- 3B H_2SO_4
Liquid level marked/sealed ✓ 598.9

NaOH Impinger contents and water rinse
container no. WH-M26A- 3B NaOH
Liquid level marked/sealed ✓ 348.9

Samples stored and locked ___
Remarks ___

METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Whitehall PA
Sample Location Kiln 2
Run No. WH-M26A- FB
Filter Number(s) NA

Sample Date 1/24/24
Recovery Date 1/24/24
Recovered by GC

MOISTURE

Impingers	1 100 ml 0.1N H_2SO_4 Tipped	2 100 ml 0.1N H_2SO_4 Tipped	3 Knockout Empty Untipped	4 100 mL 0.1N NaOH Untipped	5 100 mL 0.1N NaOH Untipped	6 Silica gel Untipped	
Final weight	~~752.5~~	774.9	610.6	~~738.0~~	753.8	905.6	grams
Initial weight		775.0	610.7	737.9	754.3	905.8	grams
Net weight							grams

Description of impinger water _____ _____ % spent
_____ _____ Sil gel color
Total moisture = _____ grams

RECOVERED SAMPLE

Filter container number(s) Not Applicable Sealed ___
Description of particulate on filter _____
_____

Probe rinse (acetone) Liquid level
container no. Not Applicable marked/sealed _____
H_2SO_4 Impinger and Knockou contents
and water rinse Liquid level ✓ 403.0
container no. WH-M26A- FB H_2SO_4 marked/sealed ✓
NaOH Impinger contents and water rinse Liquid level ✓ 366.1
container no. WH-M26A- FB NaOH marked/sealed ✓
Samples stored and locked _____
Remarks From Train CB

Client: Holcim Whitehall PA
Test Location: Kiln 2 Main Stack
Date: Jan 24 24 Start Time: 12:31:07
Run number 1
One Minute Averages

	O2 %,dry	CO2 %,dry
12:32:05 PM	10.8	17.0
12:33:05 PM	10.3	18.0
12:34:05 PM	9.6	19.2
12:35:05 PM	9.4	19.6
12:36:05 PM	10.6	17.9
12:37:05 PM	10.9	17.5
12:38:05 PM	10.3	18.2
12:39:05 PM	10.0	18.6
12:40:05 PM	10.0	18.4
12:41:05 PM	9.3	19.6
12:42:05 PM	10.2	17.8
12:43:05 PM	10.1	18.0
12:44:05 PM	10.3	17.7
12:45:05 PM	10.2	18.1
12:46:05 PM	10.9	17.0
12:47:05 PM	11.1	16.5
12:48:05 PM	11.1	16.2
12:49:05 PM	11.8	15.0
12:50:05 PM	12.1	14.7
12:51:05 PM	11.7	15.4
12:52:05 PM	11.5	15.7
12:53:05 PM	11.5	15.7
12:54:05 PM	11.5	15.8
12:55:05 PM	11.4	16.2
12:56:05 PM	11.8	15.5
12:57:05 PM	11.7	15.7
12:58:05 PM	11.1	16.8
12:59:05 PM	11.0	17.0
1:00:05 PM	10.9	17.1
1:01:05 PM	11.1	17.0
1:02:05 PM	11.4	16.3
1:03:05 PM	11.2	16.8
1:04:05 PM	11.2	16.9
1:05:05 PM	11.6	16.2
1:06:05 PM	11.8	15.8
1:07:05 PM	11.3	16.7
1:08:05 PM	11.3	16.7
1:09:05 PM	10.1	18.5
1:10:05 PM	11.0	17.2
1:11:05 PM	11.4	16.6
1:12:05 PM	11.0	17.1
1:13:05 PM	10.7	17.8
1:14:05 PM	10.0	19.0
1:15:05 PM	9.5	19.8
1:16:05 PM	9.9	19.3
1:17:05 PM	10.0	19.2
1:18:05 PM	9.3	20.2
1:19:05 PM	8.3	21.7
1:20:05 PM	9.1	20.8
1:21:05 PM	8.9	21.4
1:22:05 PM	8.8	21.4
1:23:05 PM	8.7	21.5
1:24:05 PM	8.9	20.8
1:25:05 PM	9.5	19.5
1:26:05 PM	9.7	18.8
1:27:05 PM	9.0	19.8
1:28:05 PM	9.1	19.4
1:29:05 PM	9.2	19.2
1:30:05 PM	9.6	18.0
1:31:05 PM	9.5	18.1
Run Avgs	10.4	17.9
Cal Gas	12.1	18.2
Initial Zero	0.4	0.1
Final Zero	0.4	0.4
Initial cal.	12.2	18.1
Final Cal.	12.3	18.0
Corrected Average	10.2	18.0

Client: Holcim Whitehall PA
Test Location: Kiln 2 Main Stack
Date: Jan 24 24 Start Time: 14:12:13
Run number 2
One Minute Averages

	O2 %,dry	CO2 %,dry
2:13:11 PM	8.7	19.4
2:14:11 PM	8.4	19.7
2:15:11 PM	8.3	20.1
2:16:11 PM	8.5	19.8
2:17:11 PM	8.4	20.0
2:18:11 PM	8.5	19.6
2:19:11 PM	8.6	19.6
2:20:11 PM	8.5	19.8
2:21:11 PM	8.1	20.5
2:22:11 PM	8.8	19.5
2:23:11 PM	8.6	19.7
2:24:11 PM	8.2	20.4
2:25:11 PM	8.0	20.9
2:26:11 PM	8.0	20.7
2:27:11 PM	8.3	20.3
2:28:11 PM	8.4	20.1
2:29:11 PM	8.5	20.2
2:30:11 PM	7.6	21.5
2:31:11 PM	8.1	20.9
2:32:11 PM	8.3	20.9
2:33:11 PM	8.5	20.4
2:34:11 PM	8.5	20.6
2:35:11 PM	8.4	20.5
2:36:11 PM	8.4	20.2
2:37:11 PM	8.6	19.9
2:38:11 PM	9.3	18.5
2:39:11 PM	9.0	18.8
2:40:11 PM	9.0	18.8
2:41:11 PM	8.7	19.5
2:42:11 PM	8.2	20.3
2:43:11 PM	8.2	20.3
2:44:11 PM	8.1	20.9
2:45:11 PM	7.9	21.1
2:46:11 PM	8.1	21.2
2:47:11 PM	8.2	20.9
2:48:11 PM	8.4	20.5
2:49:11 PM	8.5	20.3
2:50:11 PM	8.5	20.2
2:51:11 PM	8.5	20.3
2:52:11 PM	8.3	20.6
2:53:11 PM	8.4	20.6
2:54:11 PM	8.0	21.1
2:55:11 PM	7.9	21.5
2:56:11 PM	8.2	21.1
2:57:11 PM	8.3	20.9
2:58:11 PM	8.7	20.4
2:59:11 PM	8.6	20.6
3:00:11 PM	8.4	20.8
3:01:11 PM	8.5	20.7
3:02:11 PM	8.5	20.7
3:03:11 PM	8.3	21.1
3:04:11 PM	8.8	20.3
3:05:11 PM	9.3	19.6
3:06:11 PM	8.7	20.3
3:07:11 PM	8.9	20.0
3:08:11 PM	9.0	19.9
3:09:11 PM	8.9	20.1
3:10:11 PM	8.6	20.6
3:11:11 PM	8.3	21.0
3:12:11 PM	8.5	20.7
Run Avgs	8.5	20.3
Cal Gas	12.1	18.2
Initial Zero	0.4	0.4
Final Zero	0.4	0.4
Initial cal.	12.3	18.0
Final Cal.	12.2	18.0
Corrected Average	8.2	20.6

Client: Holcim Whitehall PA
Test Location: Kiln 2 Main Stack
Date: Jan 24 24 Start Time: 15:28:05
Run number 3
One Minute Averages

	O2 %,dry	CO2 %,dry
3:29:03 PM	8.4	21.0
3:30:03 PM	8.8	20.2
3:31:03 PM	8.8	20.2
3:32:03 PM	8.8	20.2
3:33:03 PM	8.9	20.0
3:34:03 PM	8.7	20.2
3:35:03 PM	8.7	20.2
3:36:03 PM	10.3	17.5
3:37:03 PM	11.0	16.2
3:38:03 PM	10.2	17.7
3:39:03 PM	8.6	20.3
3:40:03 PM	9.1	19.6
3:41:03 PM	8.5	20.6
3:42:03 PM	8.8	20.2
3:43:03 PM	8.8	20.3
3:44:03 PM	9.0	19.9
3:45:03 PM	9.2	19.8
3:46:03 PM	9.3	19.6
3:47:03 PM	8.9	20.1
3:48:03 PM	9.2	19.7
3:49:03 PM	9.0	19.9
3:50:03 PM	9.0	19.8
3:51:03 PM	8.6	20.5
3:52:03 PM	8.9	20.2
3:53:03 PM	8.7	20.5
3:54:03 PM	8.7	20.5
3:55:03 PM	9.3	19.4
3:56:03 PM	10.0	18.0
3:57:03 PM	10.4	17.4
3:58:03 PM	9.1	19.5
3:59:03 PM	8.9	20.1
4:00:03 PM	9.5	19.4
4:01:03 PM	9.4	19.5
4:02:03 PM	9.4	19.4
4:03:03 PM	9.0	20.3
4:04:03 PM	8.8	20.6
4:05:03 PM	8.9	20.3
4:06:03 PM	8.9	20.3
4:07:03 PM	9.1	20.0
4:08:03 PM	9.7	19.0
4:09:03 PM	9.6	19.1
4:10:03 PM	9.7	18.8
4:11:03 PM	9.6	19.1
4:12:03 PM	9.0	19.9
4:13:03 PM	9.3	19.3
4:14:03 PM	10.7	17.0
4:15:03 PM	11.1	16.3
4:16:03 PM	11.2	16.2
4:17:03 PM	9.5	18.9
4:18:03 PM	9.3	19.3
4:19:03 PM	9.1	19.8
4:20:03 PM	8.9	20.2
4:21:03 PM	8.9	20.3
4:22:03 PM	8.9	20.3
4:23:03 PM	8.9	20.2
4:24:03 PM	9.2	19.9
4:25:03 PM	9.0	20.6
4:26:03 PM	9.0	20.8
4:27:03 PM	8.9	21.0
4:28:03 PM	9.1	20.8
Run Avgs	9.2	19.6
Cal Gas	12.1	18.2
Initial Zero	0.4	0.4
Final Zero	0.4	0.4
Initial cal.	12.2	18.0
Final Cal.	12.2	18.0
Corrected Average	9.0	19.8

Holcim, Whitehall PA Kiln 2 Main Stack January 24, 2024 Operator SCG

Cylinder ID	Gas Type	Value	Internal Response	Cal Error	Run No. 1 12:31-13:31 (EST) Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift	Run No. 2 14:12-15:12 Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift	Run No. 3 15:28-16:28 Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift
	O2 Zero	Zero N2	0.0%	0.00%	0.4%	1.83%	0.4%	1.83%	0.00%	0.4%	1.83%	0.4%	1.83%	0.00%	0.4%	1.83%	0.4%	1.83%	0.00%
EB0070764	O2 Mid	12.1%	12.1%	0.00%	12.2%	0.46%	12.3%	0.91%	0.46%	12.3%	0.91%	12.2%	0.46%	-0.46%	12.2%	0.46%	12.2%	0.46%	0.00%
ALM056015	O2 Span	21.9%	21.9%	0.00%															
	CO2 Zero	Zero N2	0.0%	0.00%	0.1%	0.28%	0.4%	1.14%	0.85%	0.4%	1.14%	0.4%	1.14%	0.00%	0.4%	1.14%	0.4%	1.14%	0.00%
ALM056015	CO2 Mid	18.2%	18.2%	0.00%	18.1%	-0.28%	18.0%	-0.57%	-0.28%	18.0%	-0.57%	18.0%	-0.57%	0.00%	18.0%	-0.57%	18.0%	-0.57%	0.00%
CC714737	CO2 Span	35.1%	35.0%	-0.28%															

Holcim
Whitehall PA
Kiln 2 Main Stack
HCN Analyte Spikes

	Date	**01/24/24**	**01/24/24**	**01/24/24**	**01/24/24**
	Time	**11:51-12:10**	**13:28-13:44**	**15:11-15:25**	**16:25-16:39**
		Pre Run 1	**Post Run 1**	**Post Run 2**	**Post Run 3**
	CC768222	**HCN**	**HCN**	**HCN**	**HCN**
Cs	Spike Direct, ppm	48.54	48.54	48.54	48.54
	SF6 Tracer Direct, ppm	4.77	4.77	4.77	4.77
SF6	Diluted SF6 Tracer, ppm	0.174	0.214	0.219	0.220
	Diluted SF6 Tracer, ppm	0.167	0.204	0.205	0.214
	Average Diluted SF6 Tracer, ppm	0.171	0.209	0.212	0.217
DF	Dilution Ratio	27.98	22.82	22.50	21.98
	Total, ppm	2.849	3.019	3.652	4.223
	Total, ppm	2.803	3.334	3.548	4.470
Ct	Average Total, ppm	2.826	3.177	3.600	4.347
	Pre Spike Native , ppm	0.981	1.161	1.581	2.252
	Pre Spike Native , ppm	0.862	1.041	1.492	2.455
	Post Spike Native , ppm	1.585	1.166	1.895	1.934
	Post Spike Native , ppm	1.446	1.330	1.669	1.245
Cn	Average Native , ppm	1.219	1.175	1.659	1.972
	Spike Recovery	**95.2%**	**96.6%**	**93.4%**	**111.6%**
	CTS Direct (CC426155)				
	Ethylene Expected (ppm)	75.47			75.47
	Ethylene Measured (ppm)	72.85			72.38
	CTS Error	**-3.5%**			**-4.1%**

Holcim Whitehall PA
Kiln 2 Main Stack
Pre Run 1 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__156502.LAB	01/24/24	11:50:07.486	0.894	-0.101	-0.015
SPC__156503.LAB	01/24/24	11:51:11.397	0.981	-0.132	-0.011
SPC__156504.LAB	01/24/24	11:52:15.307	0.862	-0.129	-0.010
SPC__156505.LAB	01/24/24	11:53:19.267	1.055	-0.173	-0.010
SPC__156506.LAB	01/24/24	11:54:23.121	1.667	-0.143	0.027
SPC__156507.LAB	01/24/24	11:55:27.030	2.849	-0.171	0.174
SPC__156508.LAB	01/24/24	11:56:31.274	2.803	-0.153	0.167
SPC__156509.LAB	01/24/24	11:57:35.184	2.531	-0.158	0.130
SPC__156510.LAB	01/24/24	11:58:39.099	0.871	-0.159	-0.012
SPC__156511.LAB	01/24/24	11:59:42.765	2.500	-0.032	0.064
SPC__156512.LAB	01/24/24	12:00:46.723	0.418	-0.015	0.003
SPC__156513.LAB	01/24/24	12:01:50.461	-0.033	0.005	-0.009
SPC__156514.LAB	01/24/24	12:02:54.363	-0.090	-0.007	-0.006
SPC__156515.LAB	01/24/24	12:03:58.453	0.296	0.010	-0.018
SPC__156516.LAB	01/24/24	12:05:02.189	1.064	-0.005	-0.012
SPC__156517.LAB	01/24/24	12:06:06.092	0.119	-0.021	-0.013
SPC__156518.LAB	01/24/24	12:07:10.196	1.860	-0.013	-0.008
SPC__156519.LAB	01/24/24	12:08:14.271	1.309	-0.151	-0.007
SPC__156520.LAB	01/24/24	12:09:17.878	1.585	-0.154	-0.008
SPC__156521.LAB	01/24/24	12:10:21.789	1.446	-0.180	-0.006

Holcim Whitehall PA
Kiln 2 Main Stack
Post Run 1 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__156592.LAB	01/24/24	13:26:44.731	1.252	-0.206	-0.010
SPC__156593.LAB	01/24/24	13:27:48.930	1.161	-0.197	-0.008
SPC__156594.LAB	01/24/24	13:28:52.559	1.041	-0.185	-0.010
SPC__156595.LAB	01/24/24	13:29:56.459	1.263	-0.201	-0.006
SPC__156596.LAB	01/24/24	13:31:00.373	0.959	-0.188	-0.005
SPC__156597.LAB	01/24/24	13:32:04.276	3.302	-0.204	0.085
SPC__156598.LAB	01/24/24	13:33:08.239	2.869	-0.140	0.220
SPC__156599.LAB	01/24/24	13:34:12.091	3.019	-0.145	0.214
SPC__156600.LAB	01/24/24	13:35:15.998	3.334	-0.190	0.204
SPC__156601.LAB	01/24/24	13:36:20.161	2.590	-0.042	0.142
SPC__156602.LAB	01/24/24	13:37:24.097	0.248	-0.009	0.005
SPC__156603.LAB	01/24/24	13:38:27.700	-0.022	-0.003	-0.008
SPC__156604.LAB	01/24/24	13:39:31.604	0.067	-0.023	-0.013
SPC__156605.LAB	01/24/24	13:40:35.488	-0.139	-0.019	-0.008
SPC__156606.LAB	01/24/24	13:41:39.725	1.221	-0.196	-0.002
SPC__156607.LAB	01/24/24	13:42:43.310	1.166	-0.203	-0.005
SPC__156608.LAB	01/24/24	13:43:47.226	1.330	-0.169	-0.006

Holcim Whitehall PA
Kiln 2 Main Stack
Post Run 2 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__156689.LAB	01/24/24	15:10:42.720	1.581	-0.225	-0.010
SPC__156690.LAB	01/24/24	15:11:46.557	1.492	-0.206	-0.011
SPC__156691.LAB	01/24/24	15:12:50.689	2.505	-0.208	-0.009
SPC__156692.LAB	01/24/24	15:13:54.372	3.596	-0.210	0.222
SPC__156693.LAB	01/24/24	15:14:58.369	3.652	-0.216	0.219
SPC__156694.LAB	01/24/24	15:16:02.496	3.548	-0.206	0.205
SPC__156695.LAB	01/24/24	15:17:06.062	3.309	-0.192	0.167
SPC__156696.LAB	01/24/24	15:18:09.965	0.221	-0.052	0.002
SPC__156697.LAB	01/24/24	15:19:13.910	-0.019	-0.008	-0.018
SPC__156698.LAB	01/24/24	15:20:17.818	0.122	-0.023	-0.015
SPC__156699.LAB	01/24/24	15:21:21.684	-0.011	-0.029	-0.007
SPC__156700.LAB	01/24/24	15:22:25.702	2.169	-0.049	-0.010
SPC__156701.LAB	01/24/24	15:23:29.600	1.895	-0.185	-0.016
SPC__156702.LAB	01/24/24	15:24:33.426	1.669	-0.205	-0.013

Holcim Whitehall PA
Kiln 2 Main Stack
Post Run 3 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__156758.LAB	01/24/24	16:24:51.624	2.252	-0.213	-0.013
SPC__156759.LAB	01/24/24	16:25:55.831	2.455	-0.193	-0.011
SPC__156760.LAB	01/24/24	16:26:59.406	2.120	-0.227	-0.011
SPC__156761.LAB	01/24/24	16:28:03.329	2.179	-0.193	-0.008
SPC__156762.LAB	01/24/24	16:29:07.226	4.223	-0.231	0.220
SPC__156763.LAB	01/24/24	16:30:11.461	4.470	-0.231	0.214
SPC__156764.LAB	01/24/24	16:31:15.304	3.169	-0.228	0.095
SPC__156765.LAB	01/24/24	16:32:18.952	1.571	-0.033	0.062
SPC__156766.LAB	01/24/24	16:33:23.150	0.332	-0.008	0.003
SPC__156767.LAB	01/24/24	16:34:26.737	0.197	-0.006	0.002
SPC__156768.LAB	01/24/24	16:35:30.627	0.022	-0.009	-0.011
SPC__156769.LAB	01/24/24	16:36:34.529	1.131	0.034	-0.012
SPC__156770.LAB	01/24/24	16:37:38.463	1.934	-0.181	-0.015
SPC__156771.LAB	01/24/24	16:38:42.654	1.245	-0.195	-0.011

Holcim Whitehall PA
Kiln 2 Main Stack
Post Run 3 CTS

Spectrum	Date	Time	Ethylene (100,3000) 191C
SPC__156784.LAB	01/24/24	16:53:12.081	72.377
SPC__156785.LAB	01/24/24	16:54:16.069	72.374

Holcim Whitehall PA
Kiln 2 Main Stack
CTS and HCN Analyte Spike Direct

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C	Ethylene (100,3000) 191C
SPC__156446BKG.LAB	01/24/24	10:39:21.585	0.000	0.000	0.000	0.000
SPC__156447.LAB	01/24/24	10:40:31.445	0.094	-0.010	-0.001	-0.030
SPC__156448.LAB	01/24/24	10:41:35.540	-0.121	-0.009	0.001	-0.025
SPC__156449BKG.LAB	01/24/24	10:43:54.164	0.000	0.000	0.000	0.000
SPC__156450.LAB	01/24/24	10:45:04.184	-0.114	-0.007	-0.001	0.036
SPC__156451BKG.LAB	01/24/24	10:47:49.926	0.000	0.000	0.000	0.000
SPC__156452.LAB	01/24/24	10:48:59.723	0.047	-0.001	0.000	-0.037
SPC__156453.LAB	01/24/24	10:50:03.627	-0.047	0.002	-0.016	54.851
SPC__156454.LAB	01/24/24	10:51:07.536	-0.299	0.012	-0.011	72.880
SPC__156455.LAB	01/24/24	10:52:11.449	-0.250	0.011	-0.008	72.825
SPC__156456.LAB	01/24/24	10:53:15.354	-0.250	0.007	-0.009	72.850
Ethylene CTS (CC426155)						**72.851**
SPC__156457.LAB	01/24/24	10:54:19.264	-0.072	0.003	-0.009	72.762
SPC__156458.LAB	01/24/24	10:55:23.177	24.731	0.010	2.472	26.213
SPC__156459.LAB	01/24/24	10:56:27.081	47.422	0.015	4.776	-0.516
SPC__156460.LAB	01/24/24	10:57:31.172	48.128	0.006	4.782	-0.537
SPC__156461.LAB	01/24/24	10:58:34.906	47.989	-0.002	4.778	-0.578
SPC__156462.LAB	01/24/24	10:59:38.811	47.840	0.020	4.747	-0.439
SPC__156463.LAB	01/24/24	11:00:43.092	48.057	0.013	4.780	-0.580
SPC__156464.LAB	01/24/24	11:03:17.005	48.287	0.003	4.782	-0.586
SPC__156465.LAB	01/24/24	11:04:20.913	48.424	0.012	4.765	-0.635
SPC__156466.LAB	01/24/24	11:05:24.827	48.614	0.009	4.777	-0.577
SPC__156467.LAB	01/24/24	11:06:28.728	48.472	0.014	4.788	-0.617
SPC__156468.LAB	01/24/24	11:07:32.637	48.643	0.007	4.765	-0.582
HCN Analyte Spike (CC768222)			**48.538**		**4.774**	

Appendix C

Ion Chromatography Analytical Report Data

Deeco, Inc.

3404 Lake Woodard Drive
Raleigh, NC 27604

Project ID: 24-3323
Holcim Whitehall

Hydrogen Fluoride & Chlorine

EPA Method 26A Analysis

Analytical Report
41949

el1

Element One, Inc.
6319-D Carolina Beach Rd., Wilmington, NC 28412
910-793-0128 FAX: 910-792-6853 e1lab@e1lab.com

The following data for Analytical Report 41949
has been reviewed for completeness, accuracy,
adherence to method protocol,
and compliance with quality assurance guidelines.

Review by:

Linda Ann Webb, M.S. Analytical Chemist
February 02, 2024

Report Reviewed and Finalized by:

Ken Smith, Laboratory Director
February 02, 2024

SUMMARY OF RESULTS

Summary of Analysis

Summary of Method 26A Analysis

Element	WH-M26A-R1A e41949-1 Total mg	WH-M26A-R2A e41949-2 Total mg	WH-M26A-R3A e41949-3 Total mg
HF	< 0.275	< 0.291	< 0.290
Cl_2	< 0.371	0.456	< 0.361

Element	WH-M26A-R1B e41949-4 Total mg	WH-M26A-R2B e41949-5 Total mg	WH-M26A-R3B e41949-6 Total mg
HF	< 0.270	< 0.288	< 0.315
Cl_2	< 0.376	< 0.375	< 0.349

Element	WH-M26A-FB e41949-7 Total mg
HF	< 0.212
Cl_2	< 0.183

ANALYTICAL NARRATIVE

Element One Analytical Narrative

Client:	Deeco, Inc.	Element One #:	41949
Client ID:	24-3323 Holcim Whitehall	Analyst:	LAW, MNB
Method:	M26A	Dates Received:	01.29.24
Analytes:	HF, Cl_2	Dates Analyzed:	01.31.24-02.01.24

Summary of Analysis

The samples were prepared and analyzed according to Method 26A protocol. The samples were analyzed for fluoride and chloride on Metrohm 930/858 and 881/858 ion chromatograph systems respectively.

Detection Limits

The Metrohm reporting limit was 0.1 µg/mL for fluoride and chloride.

Analysis QA/QC

Duplicate analyses relative percent difference (RPD), spike recovery and second source verification data are summarized in the Quality Control section. All QA/QC data was within the criteria of the method.

Additional Comments

The reported results have not been corrected for any blank values or spike recovery values. Due to the sample matrix, it was necessary to analyze all samples at a minimum five-fold dilution to reduce interferences and to preserve the anion column. Due to matrix interference, it was necessary to analyze the field samples for Cl_2 at a minimum ten-fold dilution. The reported results relate only to the items tested or calibrated.

QUALITY CONTROL SUMMARY

Summary of Quality Control Data

Summary of Method 26A Duplicate Analysis RPD

(Method 26A QC limits: <5% for RPD)

Element	WH-M26A-R1A RPD	WH-M26A-R2A RPD	WH-M26A-R3A RPD
HF	NA	NA	NA
Cl_2	NA	0.0%	NA

Element	WH-M26A-R1B RPD	WH-M26A-R2B RPD	WH-M26A-R3B RPD
HF	NA	NA	NA
Cl_2	NA	NA	NA

Element	WH-M26A-FB RPD
HF	NA
Cl_2	NA

Summary of Method 26A Spike Recoveries

(Method 26A QC limits: 90-110% for Spike Recoveries)

Element	WH-M26A-R3A Recovery	WH-M26A-R3B Recovery
HF	97%	101%
Cl_2	105%	102%

Second Source Calibration Verification

*(*Laboratory QC limits: 90-110%)*

Element	DL 0.1mg/L Recovery	*QC 5.0mg/L Recovery
HF	105%	101%
Cl_2	109%	105%

SAMPLE CUSTODY

DEECO, Inc

3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

41949

Date:	01/26/23
Lab:	Element One
Train:	EPA Method 26

Plant Name: Holcim | Plant Location: Whitehall PA | Project Name: 24-3323

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
	1/29/24		1.29.24	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
WH-1A-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 523.2 mL	Element One
WH-1A-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 370.5 mL **Sodium thiosulfate NOT ADDED!**	Element One
WH-1B-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 512.4 mL	Element One
WH-1B-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 376.4 mL **Sodium thiosulfate NOT ADDED!**	Element One
WH-2A-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 552.7 mL	Element One
WH-2A-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 338.1 mL **Sodium thiosulfate NOT ADDED!**	Element One
WH-2B-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 547.7 mL	Element One
WH-2B-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 375.1 mL **Sodium thiosulfate NOT ADDED!**	Element One

Samples received in good condition in Env. Express containers. No empty containers.

DEECO, Inc

41949

3404 Lake Woodard Dr.
Raleigh, NC 27604
919-250-0285

Date:	01/26/23
Lab:	Element One
Train:	EPA Method 26

Plant Name: Holcim | Plant Location: Whitehall PA | Project Name: 24-3323

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
	1/29/24		1.29.24	
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments

Field Sample No.	Date	Composite or Grab	Analysis Required	Sampling Train	Sample Description	Special Notes	Lab
WH-3A-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 550.4 mL	Element One
WH-3A-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 361.2 mL **Sodium thiosulfate NOT ADDED!**	Element One
WH-3B-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 598.9 mL	Element One
WH-3B-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 348.9mL **Sodium thiosulfate NOT ADDED!**	Element One
WH-FB-H_2SO_4	01/24/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 403.0 mL	Element One
WH-FB-NaOH	01/24/24	Comp.	Chloride ion as Chlorine (Cl_2)	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 366.1 mL **Sodium thiosulfate NOT ADDED!**	Element One

ANALYTICAL DATA

Analytical Calculations

HF -

$$\textbf{Total HX (mg)} = \frac{[\textbf{X Results (µg/mL)*Dilution*Beginning Vol (mL)}]*\textbf{Correction Factor}}{\textbf{1000}}$$

Where-

X Results= Raw sample concentration (ppm) — *IC Data Sheet*

Dilution= $\frac{\text{Diluted Volume}}{\text{Aliquot}}$ —*IC Run Sheet*

Beginning Volume--*Sample Submission*

1.053= Correction factor for hydrogen fluoride

Cl_2 -

$$\textbf{Total } X_2 \textbf{ (mg)} = \frac{\textbf{X Results (µg/mL)*Dilution*Beginning Volume (mL)}}{\textbf{1000}}$$

Where-

X Results= Raw sample concentration (ppm)—*Cl_2 IC Data Sheet*

Dilution= $\frac{\text{Diluted Volume}}{\text{Aliquot}}$ —*IC Run Sheet*

Beginning Volume--*Sample Submission*

Analytical Calculations

Spike Recovery-

$$\textbf{Spike (\%)} = \frac{\textbf{(Spiked Result (µg/mL) – Sample Result (µg/mL))}}{\textbf{Spike Amount (µg/mL)}} \textbf{ X100}$$

Where-

Spike Result = Raw sample concentration (ppm)--*IC-Data Sheet*

Sample Result = Raw sample concentration (ppm)--*IC-Data Sheet*

Spike Amount—*IC-Data Sheet*

Duplicate Analysis RPD-

$$\textbf{RPD (\%)} = \frac{\textbf{(Duplicate Result (µg/mL) - Sample Result (µg/mL))}}{\textbf{Average (µg/mL)}} \textbf{ X100}$$

Where-

Sample Result and Duplicate Results=Raw sample concentration (ppm)--*IC-Data Sheet*

Average= $\frac{\textit{(Duplicate + Sample Results)}}{2}$

elementOne **AIR TESTING SAMPLE SUBMISSION FORM** **Lab ID 41949**

Analysis Due Date 02.06.24
QA/QC/Report Due Date 02.08.24

Client:	Deeco, Inc.
Project No	24-3323

Date Rec	01.29.24
Time Rec	1200

Volume Marked		Volume Loss			FH pH < 2		BH pH > 8		Ref. Method:
Y	N	Y	N	?	Y	N	Y	N	26A

Sample Identification

1	WH-M26A-R1A	4	WH-M26A-R1B	7	WH-M26A-FB
2	WH-M26A-R2A	5	WH-M26A-R2B		
3	WH-M26A-R3A	6	WH-M26A-R3B		
	WH-M26A-R3A Spike		WH-M26A-R3B Spike		

Analyses Requested	Samples 1-7	HF
	Samples 1-7	Cl_2

Runs/FB

	FH Impinger 1 (or Combined Imp)		FH Impinger 2		FH Impinger 3		BH Impinger 4 (or Combined Imp)		BH Impinger 5	
Lab ID	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml	BV, ml	FV, ml
1	523.2						370.5			
2	552.7						338.1			
3.S	550.4						361.2			
4	512.4						376.4			
5	547.7						375.1			
6.S	598.9						348.9			
7	403.0						366.1			

Reagent Blanks

Lab ID	Fractions	BV, ml	FV, ml	Notes
	0.1 N H_2SO_4			
	0.1 N NaOH			
	DI H_2O			

Lab Communications

Volumes on COC

Rec Runs/FB: H2SO4; NaOH; No RB received---01.29.24 LLB

SS Page 1 of 1
SS by LLB
1/30/2024 1:53:03 PM

Imp 1, 2, &3 Prep By / Date hmp 1.31.24
Imp 4 & 5 Prep By / Date LAW 01.31.24
Labeled By/Date KLG 1.30.24
ID Verification By/Date LAW 01.30.24

Metrohm 930/858 Ion Chromatograph System

elementOne

M26A-HF IC Data Sheet

Lab ID #: 41949

Client: Deeco
Date: 02.02.24
Analyst: LAW/MNB
Detection Limit, (µg/ml): 0.10

Column: Metrosep A Supp 19
Eluent: 8.0 mM Na_2CO_3/ 0.25 mM $NaHCO_3$
Flow Rate: 0.7 mL/min.
F^- to HF factor: 1.053

Sample ID	F^- µg/ml	Dilution	Final Vol, ml	HF, Total mg	Spike, µg/ml	% Recovery/ RPD	File Name	Date Time
LRB	0.00	1	10	< 0.001			-3d15fc8a:18d60c0ae	1/31/2024 19:08
LRB	0.00	1	10	< 0.001		NA	-3d15fc8a:18d60c0ae	1/31/2024 19:28
LRB SPK	5.07	1	10	0.053	5.00	101%	-3d15fc8a:18d60c0ae	1/31/2024 19:49
LRB SPK	5.07	1	10	0.053	5.00	101%	-3d15fc8a:18d60c0ae	1/31/2024 20:09
41949-1	0.00	5	523.2	< 0.275			-3d15fc8a:18d60c0ae	1/31/2024 20:30
41949-1 DUP	0.00	5	523.2	< 0.275		NA	-3d15fc8a:18d60c0ae	1/31/2024 20:50
41949-2	0.00	5	552.7	< 0.291			-3d15fc8a:18d60c0ae	1/31/2024 21:11
41949-2 DUP	0.00	5	552.7	< 0.291		NA	-3d15fc8a:18d60c0ae	1/31/2024 21:31
41949-3	0.00	5	550.4	< 0.29			-3d15fc8a:18d60c0ae	2/1/2024 10:27
41949-3 DUP	0.00	5	550.4	< 0.29		NA	-3d15fc8a:18d60c0ae	2/1/2024 10:48
41949-3 SPK	4.93	5	550.4	14.29	5.00	99%	-3d15fc8a:18d60c0ae	2/1/2024 11:08
41949-3 SPK DUP	4.81	5	550.4	13.93	5.00	96%	-3d15fc8a:18d60c0ae	2/1/2024 11:29
41949-4	0.00	5	512.4	< 0.27			-3d15fc8a:18d60c0ae	1/31/2024 21:52
41949-4 DUP	0.00	5	512.4	< 0.27		NA	-3d15fc8a:18d60c0ae	1/31/2024 22:12
41949-5	0.00	5	547.7	< 0.288			-3d15fc8a:18d60c0ae	2/1/2024 11:49
41949-5 DUP	0.00	5	547.7	< 0.288		NA	-3d15fc8a:18d60c0ae	2/1/2024 12:10
41949-6	0.00	5	598.9	< 0.315			-3d15fc8a:18d60c0ae	2/1/2024 12:30
41949-6 DUP	0.00	5	598.9	< 0.315		NA	-3d15fc8a:18d60c0ae	2/1/2024 12:51
41949-6 SPK	4.99	5	598.9	15.74	5.00	100%	-3d15fc8a:18d60c0ae	2/1/2024 13:11
41949-6 SPK DUP	5.03	5	598.9	15.86	5.00	101%	-3d15fc8a:18d60c0ae	2/1/2024 13:32
41949-7 FB	0.00	5	403.0	< 0.212			-3d15fc8a:18d60c0ae	2/1/2024 15:14
41949-7 FB DUP	0.00	5	403.0	< 0.212		NA	-3d15fc8a:18d60c0ae	2/1/2024 15:35

Metrohm 930/858 Ion Chromatograph System

elementOne **M26A-HF IC Data Sheet** **Lab ID #: 41949**

Client: Deeco
Date: 02.02.24
Analyst: LAW/MNB
Detection Limit, (µg/ml): 0.10

Column: Metrosep A Supp 19
Eluent: 8.0 mM Na_2CO_3/ 0.25 mM $NaHCO_3$
Flow Rate: 0.7 mL/min.
F^- to HF factor: 1.053

Standards	F^- µg/ml	Dilution	QC, µg/ml	% Relative Error	% Recovery	File Name	Date Time
0.0	0.000					-3d15fc8a:18d60c0ae	1/31/2024 15:02
0.1	0.101			1.0%	101%	5fc8a:18d60c0aef3:-7	1/31/2024 15:23
1.0	0.971			-2.9%	97%	5fc8a:18d60c0aef3:-7	1/31/2024 15:43
3.0	3.08			2.6%	103%	15fc8a:18d60c0aef3:-7	1/31/2024 16:04
5.0	4.94			-1.2%	99%	5fc8a:18d60c0aef3:-7	1/31/2024 16:24
10.0	10.0			0.1%	100%	5fc8a:18d60c0aef3:-7	1/31/2024 16:45
0.1	0.104			4.0%	104%	5fc8a:18d60c0aef3:-7	2/1/2024 17:37
1.0	0.991			-0.9%	99%	5fc8a:18d60c0aef3:-7	2/1/2024 17:58
3.0	3.10			3.2%	103%	15fc8a:18d60c0aef3:-7	2/1/2024 18:18
5.0	5.31			6.2%	106%	5fc8a:18d60c0aef3:-7	2/1/2024 18:39
10.0	10.1			1.0%	101%	5fc8a:18d60c0aef3:-7	2/1/2024 18:59
Correlation-	0.999922						
QC	5.05		5.00		101%	5fc8a:18d60c0aef3:-7	1/31/2024 17:05
QC	5.04		5.00		101%	5fc8a:18d60c0aef3:-7	1/31/2024 17:26
QC	5.12		5.00		102%	5fc8a:18d60c0aef3:-7	1/31/2024 22:32
QC	5.13		5.00		103%	5fc8a:18d60c0aef3:-7	1/31/2024 22:53
QC	4.82		5.00		96%	5fc8a:18d60c0aef3:-7	2/1/2024 10:07
QC	5.10		5.00		102%	5fc8a:18d60c0aef3:-7	2/1/2024 13:52
QC	5.06		5.00		101%	5fc8a:18d60c0aef3:-7	2/1/2024 14:13
QC	5.07		5.00		101%	5fc8a:18d60c0aef3:-7	2/1/2024 16:36
QC	5.06		5.00		101%	5fc8a:18d60c0aef3:-7	2/1/2024 19:20
DL	0.105		0.10		105%	15fc8a:18d60c0aef3:-7	1/31/2024 18:27
DL	0.106		0.10		106%	5fc8a:18d60c0aef3:-7	1/31/2024 18:47
DL	0.103		0.10		103%	5fc8a:18d60c0aef3:-7	2/1/2024 16:56
DL	0.105		0.10		105%	5fc8a:18d60c0aef3:-7	2/1/2024 19:40
36738-5 QC	6.62	1	6.96		100%	5fc8a:18d60c0aef3:-7	2/1/2024 15:55
36738-5 QC	6.64	1	6.96		100%	5fc8a:18d60c0aef3:-7	2/1/2024 16:15
BLK	0.00					-3d15fc8a:18d60c0ae	1/31/2024 17:46
BLK	0.00					-3d15fc8a:18d60c0ae	1/31/2024 18:06
BLK	0.00					-3d15fc8a:18d60c0ae	1/31/2024 23:13
BLK	0.00					-3d15fc8a:18d60c0ae	1/31/2024 23:34
BLK	0.00					-3d15fc8a:18d60c0ae	2/1/2024 14:33
BLK	0.00					-3d15fc8a:18d60c0ae	2/1/2024 14:54
BLK	0.00					-3d15fc8a:18d60c0ae	2/1/2024 17:17
BLK	0.00					-3d15fc8a:18d60c0ae	2/1/2024 20:01

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41949

930/858

Date: 1.31.24 Column: IonPac AS14A Instrument: ~~Dc1/788~~

Analyst: LAN/mmb Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# IC11-1062-1

Batch name: 013124-41949 10mL Conc. Eluent Diluted to FV=1L with filtered UPDI

Regenerant: 100 mM H_3PO_4 Lot # IC11-117-2

Flow Rate: 1.0 mL/min. Method: 300/26A

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
1	0.0			QC	manf.	R²	
2	0.1		HF	BBCJ11574	sigma aldrich.	0.99999	22
3	1.0						
4	3.0						
5	5.0						
6	10.0						
7	QC						
8	QC						
9	BLK						
10	BLK						
11	DL						
12	DL						
13	LRB						
14	LRB						
15	LRB+						
16	LRB+						
17	41949-1	Deeco	HF		—	5x	
18	-1d	↓	↓		=	↓	
19	-2				—		
20	-2d				—		
21	-4				—		
22	-4d	↓	↓		—	↓	
23	QC						
24	QC						
25	BLK						

Manual integrations noted by M

Curve IC Lot # IC11-124-1 Comments: pg 1 of 3

Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: **IC ME Solution** 2303029-250 **IC NO2 Solution** 2308942-250

QC: Spike 50 uL from 1000 ug/mL F, Cl, Br, and SQ Std. to 10mL sample; lot #'s listied above.

QC: Spike 20 uL from 1000 ug/mL NO_2, NO_3, and PO_4 Std. to 10mL sample; lot #'s listed above.

Submitted for QC- Date: 2.2.24 Time: 820 By: MMB QC Review- Date: ✓ Time: _____ By: _____

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41949

930,1858

Date: 1.31.24 Column: IonPac AS14A Instrument: ~~Dx1788~~

Analyst: LAM/MMD Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# IC 11.102.1

Batch name: 013124-41949 10mL Conc. Eluent Diluted to FV=1L with filtered UPDI

Regenerant: 100 mM H_3PO_4 Lot # IC11.117.2

Flow Rate: 1.0 mL/min. Method: 300/26A

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
26	BLK						
27	41949-3	Deeco	HF		—	5X	
28	-3d	↓	↓		—	↓	
29	-3+				4.934		
30	-3+d				4.808		
31	-5				—		
32	-5d				—		
33	-6				—		
34	-6d				—		
35	-6+				4.994		
36	-6+d	↓	↓		5.032	↓	
37	QC						
38	QC						
39	BLK						
40	BLK						
41	41949-7 FB	deeco	HF		—	5X	
42	-7 FBd	↓	↓		—	↓	
43	316738-5 QC				6.618	1X	TV=6.916
44	-5QCd				6.643	↓	d
45	QC						
46	DL						
47	BLK						
48	0.1						
49	1.0						
50	3.0						

Manual integrations noted by M

Curve IC Lot #_____ Comments: pg 2 of 3

Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s:**IC ME Solution** _____ **IC NO2 Solution** _____

QC: Spike 50 uL from 1000 ug/mL F, Cl, Br, and SO_4 Std. to 10mL sample; lot #'s listied above.

QC: Spike 20 uL from 1000 ug/mL NO_2, NO_3, and PO_4 Std. to 10mL sample; lot #'s listed above.

Submitted for QC- Date:_____ Time:_____ By:_____ QC Review- Date:_____ Time:_____ By:_____

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41949

Date: 1.31.24 Column: IonPac AS14A Instrument: 930/858
Analyst: MW/MMW Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# 1011.108.1
Batch name: 013124-41949 10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Regenerant: 100 mM H_3PO_4 Lot # 1011.117.2
Flow Rate: 1.0 mL/min. Method: 300/26A

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
S1	5.0						
S2	10.0						
S3	QC						
S4	DL						
S5	BLK						

Manual integrations noted by M
Curve IC Lot #_____ Comments: pg 3 of 3
Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: **IC ME Solution** _____ **IC NO2 Solution** _____
QC: Spike 50 uL from 1000 ug/mL F, Cl, Br, and SO4 Std. to 10mL sample; lot #'s listied above.
QC: Spike 20 uL from 1000 ug/mL NO_2, NO_3, and PO_4 Std. to 10mL sample; lot #'s listed above.
Submitted for QC- Date:_____ Time:_____ By:_____ QC Review- Date:_____ Time:_____ By:_____

Metrohm 881/858 Ion Chromatograph System

elementOne **M26A-Cl_2 IC Data Sheet** **Lab ID #: 41949**

Client: TRC
Date: 02.01.24
Analyst: LAW
Detection Limit, (µg/ml): 0.10

Column: IonPac AS14A
Eluent: 8.0 mM Na_2CO_3/ 1.0 mM $NaHCO_3$
Flow Rate: 1.0 mL/min.

Sample ID	Cl^- µg/ml	Dilution	Final Vol, ml	Cl_2, Total mg	Spike, µg/ml	% RPD/ Recovery	File Name	Date Time
LRB	0.008	1	10	< 0.001			606a3a2b:18d5fe7e2af:-7ac4	1/31/2024 16:22
LRB	-0.002	1	10	< 0.001		NA	606a3a2b:18d5fe7e2af:-7ac2	1/31/2024 16:45
LRB SPK	5.22	1	10	0.052	5.00	104%	606a3a2b:18d5fe7e2af:-7ac0	1/31/2024 17:09
LRB SPK	5.33	1	10	0.053	5.00	107%	606a3a2b:18d5fe7e2af:-7abe	1/31/2024 17:32
41949-1	0.088	10	370.5	< 0.371			606a3a2b:18d5fe7e2af:-7abc	1/31/2024 17:56
41949-1 DUP	0.082	10	370.5	< 0.371		NA	606a3a2b:18d5fe7e2af:-7aba	1/31/2024 18:19
41949-2	0.135	10	338.1	0.456			606a3a2b:18d5fe7e2af:-7aa8	1/31/2024 21:50
41949-2 DUP	0.135	10	338.1	0.456		0.0%	606a3a2b:18d5fe7e2af:-7aa6	1/31/2024 22:14
41949-3	0.073	10	361.2	< 0.361			606a3a2b:18d5fe7e2af:-7ab8	1/31/2024 18:43
41949-3 DUP	0.063	10	361.2	< 0.361		NA	606a3a2b:18d5fe7e2af:-7ab6	1/31/2024 19:06
41949-3 SPK	5.32	10	361.2	19.2	5.00	105%	606a3a2b:18d5fe7e2af:-7ab4	1/31/2024 19:30
41949-3 SPK DUP	5.31	10	361.2	19.2	5.00	105%	606a3a2b:18d5fe7e2af:-7ab2	1/31/2024 19:53
41949-4	0.076	10	376.4	< 0.376			606a3a2b:18d5fe7e2af:-7aa4	1/31/2024 22:37
41949-4 DUP	0.091	10	376.4	< 0.376		NA	606a3a2b:18d5fe7e2af:-7aa2	1/31/2024 23:01
41949-5	0.086	10	375.1	< 0.375			606a3a2b:18d5fe7e2af:-7aa0	1/31/2024 23:24
41949-5 DUP	0.081	10	375.1	< 0.375		NA	606a3a2b:18d5fe7e2af:-7a9e	1/31/2024 23:48
41949-6	0.083	10	348.9	< 0.349			606a3a2b:18d5fe7e2af:-7a9c	2/1/2024 0:11
41949-6 DUP	0.068	10	348.9	< 0.349		NA	606a3a2b:18d5fe7e2af:-7a9a	2/1/2024 0:35
41949-6 SPK	5.19	10	348.9	18.1	5.00	102%	606a3a2b:18d5fe7e2af:-7a98	2/1/2024 0:58
41949-6 SPK DUP	5.12	10	348.9	17.9	5.00	101%	606a3a2b:18d5fe7e2af:-7a96	2/1/2024 1:22
41949-7 FB	-0.032	5	366.1	< 0.183			606a3a2b:18d5fe7e2af:-7a8c	2/1/2024 3:19
41949-7 FB DUP	-0.033	5	366.1	< 0.183		NA	606a3a2b:18d5fe7e2af:-7a8a	2/1/2024 3:43

Cl_2-Data 1 of 2

elementOne
e 41949-Cl_2

Metrohm 881/858 Ion Chromatograph System

elementOne **M26A-Cl_2 IC Data Sheet** **Lab ID #: 41949**

Client: TRC
Date: 02.01.24
Analyst: LAW
Detection Limit, (µg/ml): 0.10

Column: IonPac AS14A
Eluent: 8.0 mM Na_2CO_3/ 1.0 mM $NaHCO_3$
Flow Rate: 1.0 mL/min.

Standards	Cl^- µg/ml	Dilution	QC µg/ml	%Relative Error	% Recovery	File Name	Date Time
0.0	0.00					606a3a2b:18d5fe7e2af:-7a37	1/31/2024 11:40
0.1	0.100			0.0%	100%	606a3a2b:18d5fe7e2af:-7a35	1/31/2024 12:03
1.0	0.931			-6.9%	93%	606a3a2b:18d5fe7e2af:-7a33	1/31/2024 12:27
3.0	3.05			1.7%	102%	606a3a2b:18d5fe7e2af:-7a31	1/31/2024 12:50
5.0	5.04			0.9%	101%	606a3a2b:18d5fe7e2af:-7a2f	1/31/2024 13:14
10.0	9.97			-0.3%	100%	606a3a2b:18d5fe7e2af:-7a2d	1/31/2024 13:37
0.1	0.102			2.0%	102%	606a3a2b:18d5fe7e2af:-7a7e	2/1/2024 6:04
1.0	1.04			4.1%	104%	606a3a2b:18d5fe7e2af:-7a7c	2/1/2024 6:27
3.0	3.14			4.5%	105%	606a3a2b:18d5fe7e2af:-7a7a	2/1/2024 6:51
5.0	5.21			4.2%	104%	606a3a2b:18d5fe7e2af:-7a78	2/1/2024 7:14
10.0	10.2			1.6%	102%	606a3a2b:18d5fe7e2af:-7a76	2/1/2024 7:38
Correlation-	0.999939						
QC	5.27		5.00		105%	606a3a2b:18d5fe7e2af:-7dff	1/31/2024 14:01
QC	5.24		5.00		105%	606a3a2b:18d5fe7e2af:-7dfd	1/31/2024 14:24
QC	5.26		5.00		105%	606a3a2b:18d5fe7e2af:-7ab0	1/31/2024 20:17
QC	5.25		5.00		105%	606a3a2b:18d5fe7e2af:-7aae	1/31/2024 20:40
QC	5.10		5.00		102%	606a3a2b:18d5fe7e2af:-7a94	2/1/2024 1:45
QC	5.13		5.00		103%	606a3a2b:18d5fe7e2af:-7a92	2/1/2024 2:09
QC	5.25		5.00		105%	606a3a2b:18d5fe7e2af:-7a2b	2/1/2024 8:01
QC	5.19		5.00		104%	606a3a2b:18d5fe7e2af:-7a76	2/1/2024 7:38
DL	0.109		0.10		109%	606a3a2b:18d5fe7e2af:-7ac8	1/31/2024 15:35
DL	0.108		0.10		108%	606a3a2b:18d5fe7e2af:-7ac6	1/31/2024 15:58
DL	0.108		0.10		108%	606a3a2b:18d5fe7e2af:-7a82	2/1/2024 5:17
DL	0.097		0.10		97%	606a3a2b:18d5fe7e2af:-7a29	2/1/24 8:25
41949-7 QC	4.038	20	78.0		104%	606a3a2b:18d5fe7e2af:-7a88	2/1/2024 4:06
41949-7 QC DUP	3.775	20	78.0		97%	606a3a2b:18d5fe7e2af:-7a86	2/1/2024 4:30
BLK	-0.110					606a3a2b:18d5fe7e2af:-7dfb	1/31/2024 14:48
BLK	-0.108					606a3a2b:18d5fe7e2af:-7df9	1/31/2024 15:11
BLK	-0.100					606a3a2b:18d5fe7e2af:-7aac	1/31/2024 21:03
BLK	-0.102					606a3a2b:18d5fe7e2af:-7aaa	1/31/2024 21:27
BLK	-0.127					606a3a2b:18d5fe7e2af:-7a90	2/1/2024 2:32
BLK	-0.110					606a3a2b:18d5fe7e2af:-7a8e	2/1/2024 2:56
BLK	-0.106					606a3a2b:18d5fe7e2af:-7a80	2/1/2024 5:40
BLK	-0.107					606a3a2b:18d5fe7e2af:-7a27	2/1/2024 8:48

Cl_2-Data 2 of 2

elementOne
e 41949-Cl_2

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41949

Date: 01.31.24 Column: IonPac AS14A Instrument: 881/858
Analyst: LMW Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# IC 11-106-1
10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Batch name: 013124-41949 Regenerant: 100mM H_3PO_4 Lot # IC11-117-2
Flow Rate: 1.0 mL/min. Method: 26A NaOH

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
1	0.0			QC	MANF	R2	
2	0.1		Cl^-	4305859	RICCA	999939	
3	1.0						
4	3.0						
5	5.0						
6	10.0						
7	GC						
8	GE						
9	BLK						
10	BLK						
11	DL						
12	DL						
13	LCB						
14	LCB						
15	LCBS						
16	LCBS						
17	41949-1	Deeco	Cl_2		—	10x	
18	-1D	↓	↓		—	↓	
19	-3				—		
20	-3D				~		
21	-3+				5.322		
22	-3+D	↓	↓		5.314	↓	
23	GC						
24	GE						
25	BLK						

Manual integrations noted by M
Curve IC Lot # IC11-123-4 Sodium Thiosulfate Lot # IC11-73-4 Comments: pg 1 of 3
Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: IC ME Solution 230302A-250 HP's
QC: Spike 50 uL from 1000 ug/mL Br Std. to 10mL sample; lot #'s listied above.
Submitted for QC- Date: 02.01.24 Time: 9:19 By: LMW QC Review- Date:_____ Time:_____ By:_____

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41949

Date: 01.31.24
Analyst: LAW
Batch name: 013124-41948

Column: IonPac AS14A
Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$
10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Regenerant: 100mM H_3PO_4
Flow Rate: 1.0 mL/min.

Instrument: 881/858
Lot# 1C11-106-1
Lot # 1C11-117-2
Method: 26A NaOH

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
26	BLK						
27	41949-2	Deeco	Cl2		0.135	10X	
28	-2D	↓	↓		0.135	↓	
29	-4				—		
30	-4D				—		
31	-5				—		
32	-5D				—		
33	-6				—		
34	-6D				—		
35	-6+				5.192	↓	
36	-6+D	↓	↓		5.122	↓	
37	QC						
38	QC						
39	BLK						
40	BLK						
41	41949-7FB	Deeco	Cl2		—	5X	
42	-7FBD	↓	↓		—	↓	
43	40034-7 QC		↓		4.038	20X	TV=78.00
44	-7QCD		↓		3.775	↓	
45	QC						
46	DL						
47	BLK						
48	0.1						
49	1.0						
50	3.0						

Manual integra
Curve IC Lot #_____ Sodium Thiosulfate Lot #_____ Comments: pg 2 of 3
Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: **IC ME Solution** _____
QC: Spike 50 uL from 1000 ug/mL Br Std. to 10mL sample; lot #'s listied above.
Submitted for QC- Date:_____ Time:_____ By:_____ QC Review- Date:_____ Time:_____ By:_____

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41949

Date: 01.31.24 Column: IonPac AS14A Instrument: 8811858
Analyst: LMO Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# 1C11-106-1
10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Batch name: 013124-41948 Regenerant: 100mM H_3PO_4 Lot # 1C11-117-2
Flow Rate: 1.0 mL/min. Method: 26A NaOH

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
51	5.0						
52	10.0						
53	CC						
54	DL						
55	BLK						

Manual integra
Curve IC Lot #_____ Sodium Thiosulfate Lot #_____ Comments: pg 3 of 3
Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: **IC ME Solution** _____
QC: Spike 50 uL from 1000 ug/mL Br Std. to 10mL sample; lot #'s listed above.
Submitted for QC- Date:_____ Time:_____ By:_____ QC Review- Date:_____ Time:_____ By:_____

Appendix D

Plant Process Data

Holcim
Whitehall PA
Kiln 2; Run 1

Date/Time	CLINKER_PROD_RAW (MTHR) Raw Value
01/24/2024 13:31	44.3
01/24/2024 13:32	44.7
01/24/2024 13:33	44.6
01/24/2024 13:34	44.9
01/24/2024 13:35	44.0
01/24/2024 13:36	44.2
01/24/2024 13:37	44.1
01/24/2024 13:38	44.2
01/24/2024 13:39	44.1
01/24/2024 13:40	43.7
01/24/2024 13:41	43.8
01/24/2024 13:42	43.5
01/24/2024 13:43	43.5
01/24/2024 13:44	44.3
01/24/2024 13:45	43.6
01/24/2024 13:46	43.9
01/24/2024 13:47	43.6
01/24/2024 13:48	44.1
01/24/2024 13:49	44.1
01/24/2024 13:50	44.7
01/24/2024 13:51	45.2
01/24/2024 13:52	44.8
01/24/2024 13:53	44.7
01/24/2024 13:54	44.5
01/24/2024 13:55	44.0
01/24/2024 13:56	43.9
01/24/2024 13:57	44.0
01/24/2024 13:58	44.1
01/24/2024 13:59	44.0
01/24/2024 14:00	44.6
01/24/2024 14:01	44.4
01/24/2024 14:02	43.9
01/24/2024 14:03	43.9
01/24/2024 14:04	44.2
01/24/2024 14:05	44.2
01/24/2024 14:06	43.6
01/24/2024 14:07	44.1
01/24/2024 14:08	43.6
01/24/2024 14:09	43.4

Holcim
Whitehall PA
Kiln 2; Run 1

Date/Time	CLINKER_PROD_RAW (MTHR) Raw Value
01/24/2024 14:10	44.6
01/24/2024 14:11	44.0
01/24/2024 14:12	44.6
01/24/2024 14:13	44.4
01/24/2024 14:14	44.6
01/24/2024 14:15	45.2
01/24/2024 14:16	44.4
01/24/2024 14:17	44.6
01/24/2024 14:18	44.3
01/24/2024 14:19	44.0
01/24/2024 14:20	44.0
01/24/2024 14:21	43.6
01/24/2024 14:22	43.5
01/24/2024 14:23	42.2
01/24/2024 14:24	41.3
01/24/2024 14:25	38.6
01/24/2024 14:26	38.8
01/24/2024 14:27	39.0
01/24/2024 14:28	38.2
01/24/2024 14:29	39.2
01/24/2024 14:30	39.2
01/24/2024 14:31	38.9
01/24/2024 14:32	39.1
01/24/2024 14:33	39.9
01/24/2024 14:34	39.4
01/24/2024 14:35	38.5
01/24/2024 14:36	39.0
01/24/2024 14:37	39.2
Average	**43.1**

Holcim
Whitehall PA
Kiln 2; Run 2

Date/Time	CLINKER_PROD_RAW (MTHR) Raw Value
01/24/2024 15:12	45.9
01/24/2024 15:13	45.6
01/24/2024 15:14	46.1
01/24/2024 15:15	45.2
01/24/2024 15:16	45.9
01/24/2024 15:17	46.0
01/24/2024 15:18	45.9
01/24/2024 15:19	45.6
01/24/2024 15:20	45.6
01/24/2024 15:21	45.5
01/24/2024 15:22	46.4
01/24/2024 15:23	46.8
01/24/2024 15:24	46.7
01/24/2024 15:25	46.6
01/24/2024 15:26	46.0
01/24/2024 15:27	46.5
01/24/2024 15:28	46.5
01/24/2024 15:29	47.3
01/24/2024 15:30	47.2
01/24/2024 15:31	47.2
01/24/2024 15:32	47.5
01/24/2024 15:33	47.3
01/24/2024 15:34	47.9
01/24/2024 15:35	47.2
01/24/2024 15:36	46.5
01/24/2024 15:37	47.0
01/24/2024 15:38	46.9
01/24/2024 15:39	46.2
01/24/2024 15:40	46.5
01/24/2024 15:41	46.8
01/24/2024 15:42	46.7
01/24/2024 15:43	46.7
01/24/2024 15:44	46.8
01/24/2024 15:45	47.7
01/24/2024 15:46	48.9
01/24/2024 15:47	48.3
01/24/2024 15:48	48.1
01/24/2024 15:49	48.1
01/24/2024 15:50	48.7

Holcim
Whitehall PA
Kiln 2; Run 2

Date/Time	CLINKER_PROD_RAW (MTHR) Raw Value
01/24/2024 15:51	48.1
01/24/2024 15:52	48.2
01/24/2024 15:53	49.2
01/24/2024 15:54	49.6
01/24/2024 15:55	48.8
01/24/2024 15:56	49.0
01/24/2024 15:57	49.1
01/24/2024 15:58	48.8
01/24/2024 15:59	48.7
01/24/2024 16:00	48.2
01/24/2024 16:01	48.0
01/24/2024 16:02	48.0
01/24/2024 16:03	47.9
01/24/2024 16:04	48.3
01/24/2024 16:05	48.4
01/24/2024 16:06	48.4
01/24/2024 16:07	49.2
01/24/2024 16:08	48.3
01/24/2024 16:09	48.3
01/24/2024 16:10	48.7
01/24/2024 16:11	48.6
01/24/2024 16:12	49.3
01/24/2024 16:13	48.7
01/24/2024 16:14	48.6
01/24/2024 16:15	48.2
01/24/2024 16:16	48.6
01/24/2024 16:17	48.3
01/24/2024 16:18	47.9
Average	**47.5**

Holcim
Whitehall PA
Kiln 2; Run 3

Date/Time	CLINKER_PROD_RAW (MTHR) Raw Value
01/24/2024 16:28	48.3
01/24/2024 16:29	48.2
01/24/2024 16:30	47.8
01/24/2024 16:31	48.9
01/24/2024 16:32	48.2
01/24/2024 16:33	48.2
01/24/2024 16:34	48.2
01/24/2024 16:35	49.3
01/24/2024 16:36	48.0
01/24/2024 16:37	49.1
01/24/2024 16:38	48.9
01/24/2024 16:39	48.8
01/24/2024 16:40	48.8
01/24/2024 16:41	48.2
01/24/2024 16:42	48.4
01/24/2024 16:43	48.1
01/24/2024 16:44	49.2
01/24/2024 16:45	48.3
01/24/2024 16:46	48.6
01/24/2024 16:47	48.4
01/24/2024 16:48	48.8
01/24/2024 16:49	48.9
01/24/2024 16:50	48.7
01/24/2024 16:51	48.5
01/24/2024 16:52	48.7
01/24/2024 16:53	49.2
01/24/2024 16:54	49.6
01/24/2024 16:55	49.8
01/24/2024 16:56	49.1
01/24/2024 16:57	49.6
01/24/2024 16:58	49.4
01/24/2024 16:59	49.4
01/24/2024 17:00	49.1
01/24/2024 17:01	49.4
01/24/2024 17:02	49.2
01/24/2024 17:03	48.4
01/24/2024 17:04	48.5
01/24/2024 17:05	48.0
01/24/2024 17:06	48.0

Holcim
Whitehall PA
Kiln 2; Run 3

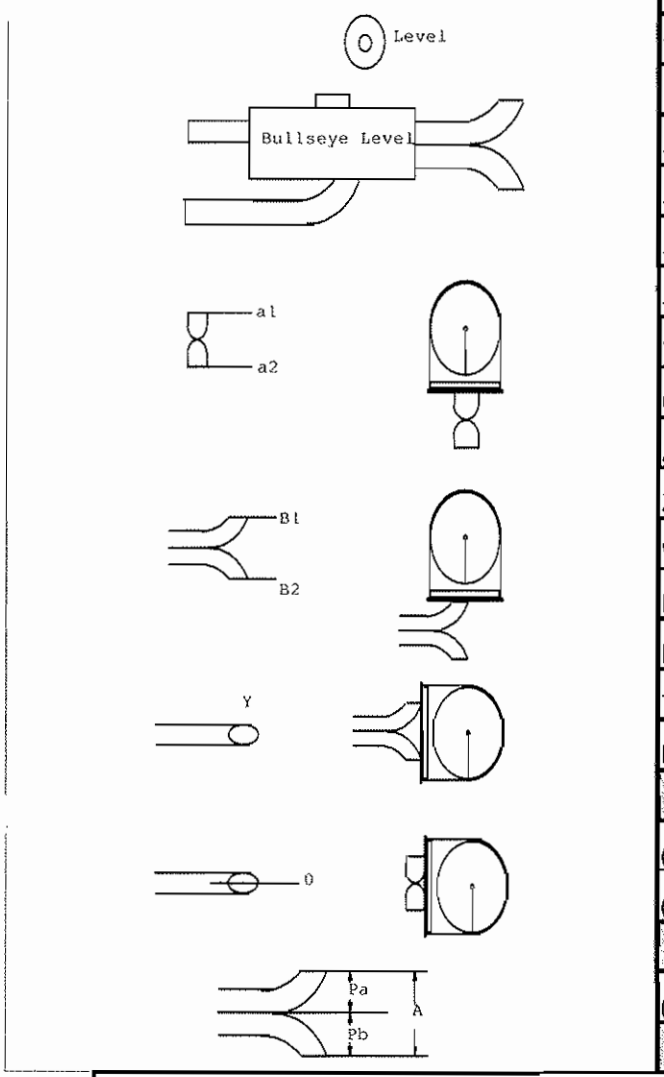
Date/Time	CLINKER_PROD_RAW (MTHR) Raw Value
01/24/2024 16:28	48.3
01/24/2024 17:07	48.5
01/24/2024 17:08	48.7
01/24/2024 17:09	48.6
01/24/2024 17:10	47.6
01/24/2024 17:11	48.3
01/24/2024 17:12	48.6
01/24/2024 17:13	48.8
01/24/2024 17:14	49.2
01/24/2024 17:15	48.6
01/24/2024 17:16	48.9
01/24/2024 17:17	49.0
01/24/2024 17:18	49.1
01/24/2024 17:19	49.5
01/24/2024 17:20	48.7
01/24/2024 17:21	48.6
01/24/2024 17:22	49.2
01/24/2024 17:23	48.6
01/24/2024 17:24	48.3
01/24/2024 17:25	48.5
01/24/2024 17:26	48.2
01/24/2024 17:27	48.6
01/24/2024 17:28	48.2
01/24/2024 17:29	47.4
01/24/2024 17:30	47.3
01/24/2024 17:31	47.1
01/24/2024 17:32	47.0
01/24/2024 17:33	47.2
01/24/2024 17:34	47.5
Average	**48.6**

Appendix E

Calibration Documents

Probe or Pitot No:	5A

Pitot Tube Inspection Sheet



Date	01/03/23
Tube Assembly Level?	Yes
Ports Damaged?	No
-10 deg < a1 < +10 deg	2
-10 deg < a2 < +10 deg	1
-5 deg < B1 < +5 deg	1
-5 deg < B2 < +5 deg	1
Y (gamma)	1
0 (theta)	1
A (alpha)	0.951
Z = A (sin y) < 0.125"?	yes
W = A (sin 0) < 0.031"?	yes
Pa =	0.475
Pb =	0.476
Tube Diameter (Dt) =	0.376
Pa = Pb +- 0.063"?	yes
(1.05 x Dt)?	0.3948
(1.50 x Dt)?	0.564
(1.05 x Dt)< P < (1.50 x Dt)?	yes
Eligible for Default Pitot Calibration Factor (Cp = 0.84)?	**Yes**

Thermocouple Calibration

Type of Reference Thermometer?	Mercury	Date	01/03/23
Barometeric Pressure?	29.52	Ambient Temperature?	68

Source	Reference Temp, F	Thermocouple Temp, F	Absolute Temp Difference
cold air	37	38	-0.20%
medium air	215	215	0.00%
hot air	325	325	0.00%

Windtunnel Calibration

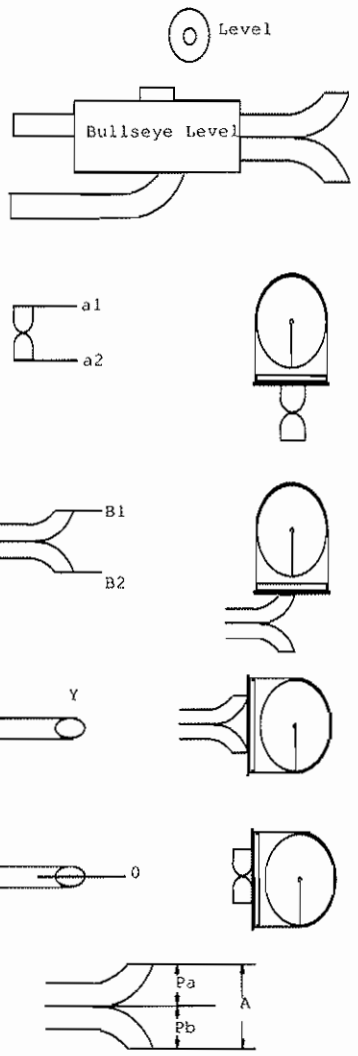
Pitot Reading	Reference (0.99)	5A S-Type Pitot	Cp
ΔP_1	0.31	0.44	0.84
ΔP_2	0.31	0.43	0.85
ΔP_3	0.31	0.43	0.85
		Average Pitot Tube Calibration Factor--->	**0.85**

Thermocouple Calibration Check (EPA ALT-011 Procedure), performed on 1/3/23

Source	Ref. Temp. F	Thermocouple Temp. F	± 2 deg F?
Ambient	68	66.9	Yes

Probe or Pitot No: **5B**

Pitot Tube Inspection Sheet



Date	01/03/23
Tube Assembly Level?	Yes
Ports Damaged?	No
-10 deg < a1 < +10 deg	1
-10 deg < a2 < +10 deg	2
-5 deg < B1 < +5 deg	1
-5 deg < B2 < +5 deg	2
Y (gamma)	1
0 (theta)	1
A (alpha)	0.94
Z = A (sin y) < 0.125"?	yes
W = A (sin 0) < 0.031"?	yes
Pa =	0.47
Pb =	0.47
Tube Diameter (Dt) =	0.376
Pa = Pb +- 0.063"?	yes
(1.05 x Dt)?	0.3948
(1.50 x Dt)?	0.564
(1.05 x Dt)< P < (1.50 x Dt)?	yes
Eligible for Default Pitot Calibration Factor (Cp = 0.84)?	**Yes**

Thermocouple Calibration

Type of Reference Thermometer?	Mercury	Date	01/03/23
Barometeric Pressure?	29.52	Ambient Temperature?	69.9

Source	Reference Temp, F	Thermocouple Temp, F	Absolute Temp Difference
cold air	37	38	-0.20%
medium air	215	215	0.00%
hot air	325	324	0.13%

Windtunnel Calibration

Pitot Reading	Reference (0.99)	5B S-Type Pitot	Cp
ΔP_1	0.31	0.44	0.84
ΔP_2	0.31	0.43	0.85
ΔP_3	0.31	0.44	0.84
		Average Pitot Tube Calibration Factor--->	**0.84**

Thermocouple Calibration Check (EPA ALT-011 Procedure), performed on 1/3/23

Source	Ref. Temp. F	Thermocouple Temp. F	± 2 deg F?
Ambient	69.9	69.4	Yes

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

Quality - Service - Reliability

ENVIRONMENTAL SUPPLY COMPANY

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: 12/23/23 | METER SERIAL #: M5-18 | BAROMETRIC PRESSURE (in Hg): INITIAL 30.15, FINAL 30.18, AVG (P_{bar}) 30.165

METER PART #: M5-18 | CRITICAL ORIFICE SET SERIAL #: 14315

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 (%)	$\Delta H_@$
12	1	0.3283				0.000						0							
	2					0.000						0							
	3					0.000						0							
																AVG =			
15	1	0.4094	18	361.456	367.017	5.561	69	59	67	58	61	61.25	10.00	0.81	5.6915	5.3709	0.944		1.62
	2	0.4094	18	367.017	372.464	5.447	69	64	71	61	64	65	10.00	0.81	5.5349	5.3709	0.970		1.60
	3					0.000						0							
																AVG =	0.957	-1.65	
19	1	0.5047	18	372.917	379.625	6.708	69	71	76	65	68	70	10.00	1.3	6.7600	6.6212	0.979		1.68
	2	0.5047	18	379.625	386.363	6.738	69	73	77	68	70	72	10.00	1.3	6.7647	6.6212	0.979		1.67
	3					0.000						0							
																AVG =	0.979	0.62	
23	1	0.6426	18	387.121	395.674	8.553	69	75	81	70	73	74.75	10.00	2.1	8.5593	8.4303	0.985		1.66
	2	0.6426	18	395.674	404.294	8.620	68	79	80	73	74	76.5	10.00	2.1	8.5982	8.4383	0.981		1.65
	3					0.000						0							
																AVG =	0.983	1.03	
32	1	0.8587				0.000						0							
	2					0.000						0							
	3					0.000						0							
																AVG =			

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, Vm (std), and the critical orifice, Vcr (std), and the DGM calibration factor, Y. These equations are automatically calculated in the

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **0.973**

AVERAGE $\Delta H_@$ = **1.65**

Potentiometer Check, °F (per manufacturer procedure): 0 @ 0 F; 496 @ 500 F; 1000 @ 1000 F

Avg Absolute Difference = **0.1%**

(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

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

ENVIRONMENTAL SUPPLY COMPANY — 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: 08/04/23 | METER SERIAL #: m5-22 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.46, FINAL 29.43, AVG (P_{bar}) 29.445

METER PART #: m5-22 | CRITICAL ORIFICE SET SERIAL #: 1431S

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 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 (%)	$\Delta H_@$
12	1	0.3283				0.000						0							
	2					0.000						0							
	3					0.000						0							
																AVG =			
15	1	0.4094	18	122.826	128.142	5.316	83	83	84	83	83	83.25	10.00	0.82	5.0960	5.1747	1.015		1.65
	2	0.4094	18	128.142	133.460	5.318	83	83	85	83	84	83.75	10.00	0.82	5.0933	5.1747	1.016		1.65
	3					0.000						0							
																AVG =	1.016	0.19	
19	1	0.5047	18	133.864	140.425	6.561	83	85	87	84	85	85.25	10.00	1.3	6.2739	6.3792	1.017		1.72
	2	0.5047	18	140.425	147.019	6.594	83	86	88	85	85	86	10.00	1.3	6.2968	6.3792	1.013		1.72
	3	0.5047				0.000						0							
																AVG =	1.015	0.11	
23	1	0.6426	18	147.234	155.627	8.393	83	86	88	84	85	85.75	10.00	2.2	8.0364	8.1223	1.011		1.80
	2	0.6426	18	155.627	164.026	8.399	83	87	88	85	85	86.25	10.00	2.2	8.0347	8.1223	1.011		1.79
	3					0.000						0							
																AVG =	1.011	-0.30	
32	1	0.8587				0.000						0							
	2					0.000						0							
	3					0.000						0							
																AVG =			

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, Vm (std), and the critical orifice, Vcr (std), and the DGM calibration factor, Y. These equations are automatically calculated in the

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.014

AVERAGE $\Delta H_@$ = 1.72

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

= 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

Potentiometer Check, °F (per manufacturer procedure): 0 @ 0 F; 500 @ 500 F; 1004 @ 1000 F

Avg Absolute Difference = 0.1%

Company: Holcim Whitehall PA
Source: Kiln 2 Main Stack
Job ID: 24-3326
Train Type: M26A

Alt-009 Alternate Post Test Calibration Data	M5-22 1A 01/24/24 1231-1337	M5-18 1B 01/24/24 1231-1337	M5-22 2A 01/24/24 1412-1518	M5-18 2B 01/24/24 1412-1518	M5-22 3A 01/24/24 1528-1634	M5-18 3B 01/24/24 1528-1634	M5-22 Average	M5-18 Average
Vm	46.795	48.244	47.233	48.108	46.861	48.073		
Tm	514.3	518.1	518.6	520.3	516.7	520		
Pb	30	30	30	30	30	30		
Havg	2.03	1.96	2.04	1.96	2.03	1.96		
H@	1.72	1.65	1.72	1.65	1.72	1.65		
Md	31.288	31.288	31.624	31.624	31.528	31.528		
(Havg)^0.5	1.42113892	1.39457773	1.42380193	1.39457773	1.42113892	1.39457773		
Run Time, Min	60	60	60	60	60	60		
Meter Gamma	1.014	0.973	1.014	0.973	1.014	0.973		
Calculated Gamma (Yqa)	0.987	0.963	0.978	0.962	0.984	0.964	0.983	0.963
% difference from Actual Y	2.69%	1.07%	3.53%	1.11%	2.97%	0.92%	3.1%	1.0%

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
630 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI77E15A3796	Reference Number:	122-402248430-1
Cylinder Number:	EB0070787	Cylinder Volume:	151.1 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22021	Valve Outlet:	590
Gas Code:	CO,CO2,O2,BALN	Certification Date:	Oct 13, 2021

Expiration Date: Oct 13, 2029

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	65.00 PPM	64.01 PPM	G1	+/- 0.7% NIST Traceable	10/13/2021
CARBON DIOXIDE	10.00 %	10.19 %	G1	+/- 0.6% NIST Traceable	10/12/2021
OXYGEN	12.00 %	11.97 %	G1	+/- 0.4% NIST Traceable	10/12/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010213	KAL004779	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024
NTRM	19060402	6162642Y	11.105 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Dec 04, 2025
NTRM	10010616	K014963	9.967 % OXYGEN/NITROGEN	+/- 0.3%	Apr 19, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VA-5001 CO2 BF89GV17	Nondispersive Infrared (NDIR)	Sep 15, 2021
Horiba VIA510 CO 1G46EA07	Nondispersive Infrared (NDIR)	Sep 22, 2021
Siemens Oxymat 61 M3299 O2	Paramagnetic	Sep 14, 2021

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
630 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E04NI59E15A38X3	Reference Number:	122-402389885-1A
Cylinder Number:	ALM-056015	Cylinder Volume:	143.7 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	2016 PSIG
PGVP Number:	B22022	Valve Outlet:	590
Gas Code:	CO,CO2,O2,BALN	Certification Date:	Mar 28, 2022

Expiration Date: Mar 28, 2030

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	120.0 PPM	116.5 PPM	G1	+/- 0.3% NIST Traceable	03/28/2022
CARBON DIOXIDE	18.00 %	18.17 %	G1	+/- 0.7% NIST Traceable	03/28/2022
OXYGEN	22.00 %	21.90 %	G1	+/- 0.5% NIST Traceable	03/28/2022
NITROGEN	Balance				

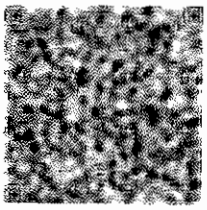
CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13010207	KAL003102	246.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.2%	Oct 16, 2024
NTRM	12061508	CC354696	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024
NTRM	08010220	K013155	23.20 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VA-5001 CO2 BF89GV17	Nondispersive Infrared (NDIR)	Mar 01, 2022
Horiba VIA510 CO RS2EGL6K	Nondispersive Infrared (NDIR)	Mar 01, 2022
Siemens Oxymat 61 M3299 O2	Paramagnetic	Mar 01, 2022

Triad Data Available Upon Request



Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA, LLC
630 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI65E15A6270	Reference Number:	122-401213509-1
Cylinder Number:	CC714737	Cylinder Volume:	142.3 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	1690 PSIG
PGVP Number:	B22018	Valve Outlet:	580
Gas Code:	CO2,BALN	Certification Date:	May 31, 2018

Expiration Date: May 31, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	35.00 %	35.10 %	G2	+/- 0.6% NIST Traceable	05/31/2018
NITROGEN	Balance				

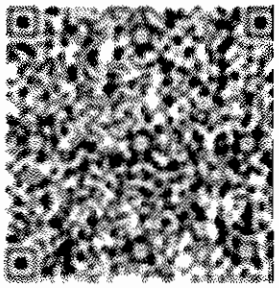
CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060810	CC415934	24.04 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 16, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA510 CO2 2L6YXWY0	Nondispersive Infrared (NDIR)	May 10, 2018

Triad Data Available Upon Request



Approved for Release

Airgas
Air Liquide company

CERTIFICATE OF ACCURACY: *GMACS-c Calibration Standard*

AY LABORATORY

CUSTOMER INFORMATION

AIRGAS SPECIALTY GASES
Exploratory Products Group
6141 Easton Road
Plumsteadville, PA 18949

Work Order #: 160-402845897-1
Sales Order #: 1123601913
PO #: 7100179560

Customer: DEECO Inc.
Address 1: 3404 Lake Woodard Road
Address 2:
City / State / Zip: Raleigh, NC 27604

PRODUCT INFORMATION

COMPOSITION	CONCENTRATION	UNCERTAINTY (Abs)	UNCERTAINTY (Rel)
Hydrogen Cyanide	49.9 PPM	2.3 PPM	4.6 %
Sulfur Hexafluoride	5.0 PPM	0.07 PPM	1.3 %
Nitrogen	Balance		

CYLINDER #:	**CC768222**	AIRGAS PART #:	**X03NI99C15AC0W8**
CYLINDER TYPE:	**150A Aluminum**	CERTIFICATION DATE:	**7-Sep-2023**
CGA:	**350 SS**	EXPIRATION DATE:	**7-Mar-2024**
CYLINDER PRESSURE:	**2000 psig**	MIXTURE DEW POINT:	**N/A**

CERTIFICATION DATA

BLENDING PROCESS: **GravStat™ Gravimetry**

COMPONENT	CONCENTRATION	UNCERTAINTY (Abs)	UNCERTAINTY (Rel)
ırogen Cyanide	50.02 PPM	0.9 PPM	1.8 %
Sulfur Hexafluoride	5.02 PPM	0.07 PPM	1.3 %

CONFIRMING ANALYSIS: **FTIR Spectroscopy**
INSTRUMENT / MODEL: **CAI Model 700 FTIR**

COMPONENT	CONCENTRATION	UNCERTAINTY (Abs)	UNCERTAINTY (Rel)
Hydrogen Cyanide	49.8 PPM	2.1 PPM	4.2 %

REFERENCE STANDARD: **GMPS-c 50 PPM Hydrogen Cyanide**
CYLINDER NUMBER: **CC768196**
EXPIRATION DATE: **2/29/2024**

COMPONENT	CONCENTRATION	UNCERTAINTY (Abs)	UNCERTAINTY (Rel)
Hydrogen Cyanide	48.9 PPM	1.7 PPM	3.4 %

CALIBRATION CURVE DATA	Curve Order	Correlation	Slope (X2)	Slope (X)	Intercept
Point-to-Point Matching Std	Linear / Direct Ratio	N/A	N/A	N/A	N/A

INTERLOCK STATISTICS

	CONCENTRATION	UNCERTAINTY (Abs)	UNCERTAINTY (Rel)
BLEND RESULT:	50.02 PPM	0.9 PPM	1.8 %
ANALYSIS RESULT:	49.8 PPM	2.1 PPM	4.2 %
INTERLOCK RESULT:	49.9 PPM	2.3 PPM	4.6 %

OMMENTS / SPECIAL INSTRUCTIONS

1. A GMACS-c ("Candidate GMACS") is made and certified according to the EPA GMACS Procedure (Alt-114) found at: https://cfpub.epa.gov
2. Do not use this standard if pressure is less than 200 psig.
3. Do not use or store this product at or below the stated dew point.

APPROVED BY: _____ BOB GRASMEDER

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
630 United Drive
Durham, NC 27713
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X02Ni99C15A54F5	Reference Number:	122-402705571-1
Cylinder Number:	CC426155	Cylinder Volume:	144.0 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSIG
Analysis Date:	Mar 28, 2023	Valve Outlet:	350
Lot Number:	122-402705571-1		

Expiration Date: Mar 28, 2031

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
ETHYLENE	75.00 PPM	75.47 PPM	+/- 2%
NITROGEN	Balance		

Approved for Release

Client: Holcim Whitehall PA
Test Location: Kiln 2 Main Stack
Date: Jan 24 24 Start Time: 12:31:07
Run number Stratification Check
One Minute Averages

	Reference O2 %,dry	Plant O2 %,dry
12:32:05 PM	10.8	12.4
12:33:05 PM	10.3	12.2
12:34:05 PM	9.6	10.9
12:35:05 PM	9.4	10.1
12:36:05 PM	10.6	10.1
Point A	10.1	11.1
12:37:05 PM	10.9	11.0
12:38:05 PM	10.3	11.1
12:39:05 PM	10.0	10.8
12:40:05 PM	10.0	10.5
12:41:05 PM	9.3	10.4
Point B	10.1	10.8
12:42:05 PM	10.2	9.3
12:43:05 PM	10.1	10.5
12:44:05 PM	10.3	10.7
12:45:05 PM	10.2	10.8
12:46:05 PM	10.9	10.9
Point C	10.4	10.4

Holcim
Whitehall PA
Kiln 2; Run 1

Date/Time	K2: O2_DRY (PCT) Expression Value
01/24/2024 13:31	12.39
01/24/2024 13:32	12.15
01/24/2024 13:33	10.88
01/24/2024 13:34	10.06
01/24/2024 13:35	10.05
01/24/2024 13:36	11.02
01/24/2024 13:37	11.11
01/24/2024 13:38	10.82
01/24/2024 13:39	10.54
01/24/2024 13:40	10.39
01/24/2024 13:41	9.25
01/24/2024 13:42	10.47
01/24/2024 13:43	10.73
01/24/2024 13:44	10.80
01/24/2024 13:45	10.88

Analysis Validation Report

Sample Filename: F:\Whitehall RTR\Whitehall January 2024\January 24\SPC__156520.LAB

Filename for noise: F:\Midlothian on Rental\November 14\SPC__000837.LAB
Interferences Filenames: C:\Midlothian on Rental\November 15\SPC__001463.LAB
C:\Midlothian on Rental\November 15\SPC__001464.LAB
C:\Midlothian on Rental\November 15\SPC__001465.LAB
C:\Midlothian on Rental\November 15\SPC__001466.LAB
C:\Midlothian on Rental\November 15\SPC__001467.LAB
C:\Midlothian on Rental\November 15\SPC__001468.LAB
C:\Midlothian on Rental\November 15\SPC__001469.LAB
C:\Midlothian on Rental\November 15\SPC__001470.LAB

Recipe path: C:\OLT\recipes\Cement Testing R3.MGRCP

Gas calibration Name	Conc	MDC3	MDC2	MDC1	MAU	FMU*R	OCU	~ DL	~ CL	~ Bias	Sigma	Range	Span	Comment
SG1 HCN (200) PCA 191C 191C	1.58	0.17	-	0.24	0.3	0.21	0.3	-	0.09	-	-	0-200	-	Good
HF PPM (10) 191C	-0.15	0.27	0.05	0.04	0.07	0.48	0.48	0.07	0.23	0.02	0.02	0-10	-	Close to DL
SF6 (10) 191C	-0.01	0.02	-	0	0	0.02	0.02	-	0.02	-	-	0-10	-	Check it!
ETHYLENE (100,3000) 191C	0.6	2.01	0.33	0.17	0.29	3.5	3.5	1.08	1.84	0.75	0.11	0-3000	-	Close to DL
H2O% (40) 191C	12.3	0.15	-	0.01	0.02	0.29	0.29	-	0.25	-	-	0-40	-	Good
CO2% (40) 191C	16	0.21	-	0.01	0.02	0.29	0.29	-	0.32	-	-	0-40	-	Good
HCL PPM (100) 191C	-0.12	0.56	0.05	0.15	0.28	1.03	1.03	0.06	0.43	0.01	0.02	0-100	-	Close to DL
SO2 (1000) 191C	11.03	1.1	0.37	0.14	0.27	2.12	2.12	0.79	0.82	0.42	0.12	0-1000	-	Good
NO (350,3000) 191C	180.4	4.65	0.22	0.26	0.35	6.36	6.36	0.45	3.64	0.23	0.07	0-3000	-	Good
NH3 (300) 191C (1OF2)	24.21	1.56	0.03	0.12	0.2	2.68	2.68	0.15	0.87	0.11	0.01	0-300	-	Good
CO (500) 191C (1OF2)	257.52	7.09	-	0.2	0.43	14.19	14.19	-	5.15	-	-	0-500	-	Good
CO% (1) 191C (2OF2)	0.03	0	0	0	0	0	0	0	0	0	0	0-1	-	Good
FORMALDEHYDE (70) 191C	0.99	1.13	0.28	0.2	0.24	1.36	1.36	0.33	0.91	0.04	0.09	0-70	-	Close to DL
ACETALDEHYDE (1000) 191C	0.52	2.47	0.23	0.35	0.38	2.69	2.69	0.59	2.11	0.35	0.08	0-1000	-	Close to DL
CH4 (250) 191C (1OF2)	3.38	1.05	0.05	0.26	0.7	2.78	2.78	0.06	0.7	0.01	0.02	0-250	-	Check it!
PROPANE (100) 191C	0.03	0.53	0.42	0.12	0.14	0.63	0.63	0.72	0.72	0.3	0.14	0-100	-	Close to DL
HBR (100) 180C	-0.51	5.41	0.17	0.68	1.39	10.99	10.99	0.19	4.74	0.02	0.06	0-100	-	Close to DL
NO2 (150) 191C (1OF2)	-0.18	0.38	0.04	0.02	0.03	0.4	0.4	0.05	0.35	0.01	0.01	0-150	-	Close to DL
NO2 (2000) 191C (2OF2)	-0.47	4.43	2.03	0.88	1.12	5.64	5.64	3.81	3.81	1.78	0.68	0-2000	-	Close to DL
N2O (100,200,300) 191C	3.03	0.21	0.05	0.04	0.05	0.25	0.25	0.07	0.1	0.02	0.02	0-300	-	Good
NH3 (3000) 191C (2OF2)	25.56	5.63	0.35	1.19	2.25	10.61	10.61	0.44	3.92	0.09	0.12	0-3000	-	Good
CH4 (3000) 191C (2OF2)	3.27	7.31	0.34	1.1	1.81	12.04	12.04	0.61	6.16	0.27	0.11	0-3000	-	Close to DL
ACETYLENE (1000) 191C	0.35	1.58	0.15	0.31	0.37	1.91	1.91	0.21	1.28	0.06	0.05	0-1000	-	Close to DL
PROPYLENE (200,1000) 191C	0.73	5.02	0.19	0.43	0.5	5.88	5.88	0.49	4.58	0.3	0.06	0-1000	-	Close to DL
COS (100) 150C	0.15	0.19	0.02	0.02	0.02	0.26	0.26	0.02	0.17	0	0.01	0-100	-	Close to DL
ETHANE (500) 191C	0.68	0.9	0.32	0.2	0.22	1	1	0.54	0.69	0.22	0.11	0-500	-	Close to DL
H2SO4 (50) 150C	-0.05	0.17	0.04	0.05	0.05	0.18	0.18	0.29	0.29	0.25	0.01	0-50	-	Close to DL
MEOH (10) 191C	0.21	0.66	0.14	0.14	0.16	0.76	0.76	0.17	0.53	0.03	0.05	0-10	-	Close to DL
SO3 (150) 191C	-3.61	0.37	0.7	0.03	0.04	0.4	0.4	1.14	1.14	0.44	0.23	0-150	-	Close to DL

Analysis Validation Report

Sample Filename: F:\Whitehall RTR\Whitehall January 2024\January 24\SPC__156521.LAB

Filename for noise: F:\Midlothian on Rental\November 14\SPC__000837.LAB
Interferences Filenames: C:\Midlothian on Rental\November 15\SPC__001463.LAB
C:\Midlothian on Rental\November 15\SPC__001464.LAB
C:\Midlothian on Rental\November 15\SPC__001465.LAB
C:\Midlothian on Rental\November 15\SPC__001466.LAB
C:\Midlothian on Rental\November 15\SPC__001467.LAB
C:\Midlothian on Rental\November 15\SPC__001468.LAB
C:\Midlothian on Rental\November 15\SPC__001469.LAB
C:\Midlothian on Rental\November 15\SPC__001470.LAB

Recipe path: C:\OLT\recipes\Cement Testing R3.MGRCP

Gas calibration Name	Conc	MDC3	MDC2	MDC1	MAU	FMU*R	OCU	~ DL	~ CL	~ Bias	Sigma	Range	Span	Comment
SG1 HCN (200) PCA 191C 191C	1.45	0.21	-	0.24	0.3	0.26	0.3	-	0.13	-	-	0-200	-	Good
HF PPM (10) 191C	-0.18	0.29	0.05	0.04	0.07	0.51	0.51	0.07	0.25	0.02	0.02	0-10	-	Close to DL
SF6 (10) 191C	-0.01	0.02	-	0	0	0.03	0.03	-	0.02	-	-	0-10	-	Close to DL
ETHYLENE (100,3000) 191C	0.64	1.98	0.33	0.17	0.29	3.45	3.45	1.08	1.81	0.75	0.11	0-3000	-	Close to DL
H2O% (40) 191C	12.18	0.15	-	0.01	0.02	0.29	0.29	-	0.24	-	-	0-40	-	Good
CO2% (40) 191C	15.54	0.2	-	0.01	0.02	0.27	0.27	-	0.31	-	-	0-40	-	Good
HCL PPM (100) 191C	-0.1	0.57	0.05	0.15	0.28	1.03	1.03	0.06	0.44	0.01	0.02	0-100	-	Close to DL
SO2 (1000) 191C	10.01	1.09	0.37	0.14	0.27	2.1	2.1	0.79	0.81	0.42	0.12	0-1000	-	Good
NO (350,3000) 191C	176.29	4.53	0.22	0.26	0.35	6.2	6.2	0.45	3.55	0.23	0.07	0-3000	-	Good
NH3 (300) 191C (1OF2)	24.62	1.55	0.03	0.12	0.2	2.67	2.67	0.15	0.85	0.11	0.01	0-300	-	Good
CO (500) 191C (1OF2)	199.51	5.52	-	0.2	0.43	11.2	11.2	-	3.99	-	-	0-500	-	Good
CO% (1) 191C (2OF2)	0.02	0	0	0	0	0	0	0	0	0	0	0-1	-	Good
FORMALDEHYDE (70) 191C	1.01	1.18	0.28	0.2	0.24	1.42	1.42	0.33	0.96	0.04	0.09	0-70	-	Close to DL
ACETALDEHYDE (1000) 191C	0.65	2.48	0.23	0.35	0.38	2.7	2.7	0.59	2.12	0.35	0.08	0-1000	-	Close to DL
CH4 (250) 191C (1OF2)	3.26	1.06	0.05	0.26	0.7	2.8	2.8	0.06	0.71	0.01	0.02	0-250	-	Check it!
PROPANE (100) 191C	-0.03	0.54	0.42	0.12	0.14	0.64	0.64	0.72	0.72	0.3	0.14	0-100	-	Close to DL
HBR (100) 180C	-0.38	5.45	0.17	0.68	1.39	11.07	11.07	0.19	4.78	0.02	0.06	0-100	-	Close to DL
NO2 (150) 191C (1OF2)	-0.13	0.36	0.04	0.02	0.03	0.38	0.38	0.05	0.34	0.01	0.01	0-150	-	Close to DL
NO2 (2000) 191C (2OF2)	-0.22	4.52	2.03	0.88	1.12	5.76	5.76	3.81	3.81	1.78	0.68	0-2000	-	Close to DL
N2O (100,200,300) 191C	3.12	0.22	0.05	0.04	0.05	0.25	0.25	0.07	0.11	0.02	0.02	0-300	-	Good
NH3 (3000) 191C (2OF2)	26.14	5.61	0.35	1.19	2.25	10.58	10.58	0.44	3.89	0.09	0.12	0-3000	-	Good
CH4 (3000) 191C (2OF2)	2.43	7.63	0.34	1.1	1.81	12.57	12.57	0.61	6.51	0.27	0.11	0-3000	-	Close to DL
ACETYLENE (1000) 191C	0.39	1.65	0.15	0.31	0.37	2	2	0.21	1.35	0.06	0.05	0-1000	-	Close to DL
PROPYLENE (200,1000) 191C	0.57	4.99	0.19	0.43	0.5	5.85	5.85	0.49	4.57	0.3	0.06	0-1000	-	Close to DL
COS (100) 150C	0.14	0.18	0.02	0.02	0.02	0.25	0.25	0.02	0.16	0	0.01	0-100	-	Close to DL
ETHANE (500) 191C	0.62	0.91	0.32	0.2	0.22	1.02	1.02	0.54	0.71	0.22	0.11	0-500	-	Close to DL
H2SO4 (50) 150C	-0.05	0.17	0.04	0.05	0.05	0.18	0.18	0.29	0.29	0.25	0.01	0-50	-	Close to DL
MEOH (10) 191C	0.15	0.63	0.14	0.14	0.16	0.73	0.73	0.17	0.5	0.03	0.05	0-10	-	Close to DL
SO3 (150) 191C	-3.65	0.38	0.7	0.03	0.04	0.41	0.41	1.14	1.14	0.44	0.23	0-150	-	Close to DL

Holcim Whitehall PA
Kiln 2 Main Stack
Run 3

Spectrum	Date	Time	SNR 2500	sBeam @ 2500
SPC__156761.LAB	01/24/24	16:28:03.329	**4074.36**	**1.14**

Calibration Generated: 01/15/2024 54 PM

Gas ID: SG1 HCN (200) PCA 191C 191c

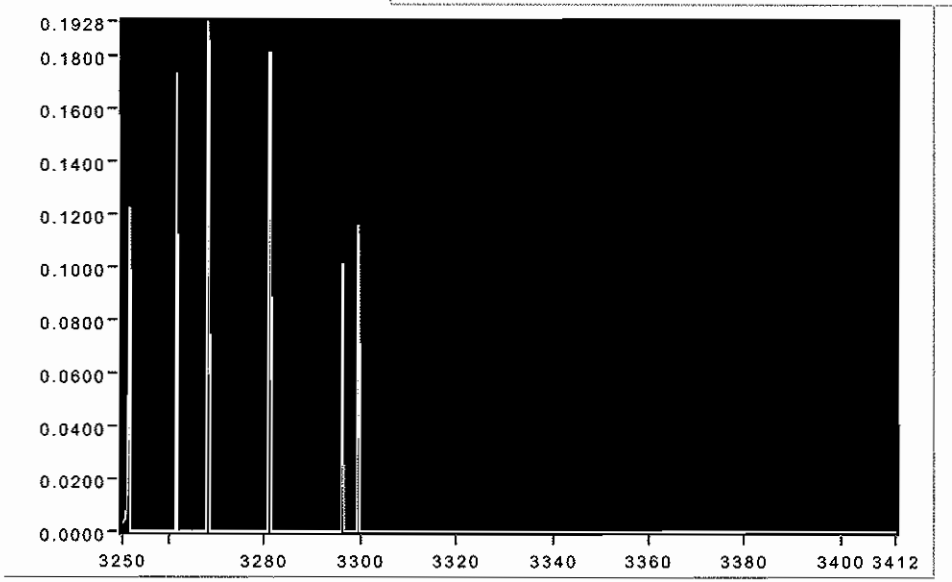
LRF Path: C:\OLT\Methods R3\Cement-coal-EGU method 191C\SG1 HCN (200) PCA 191C 191c_18.lrf

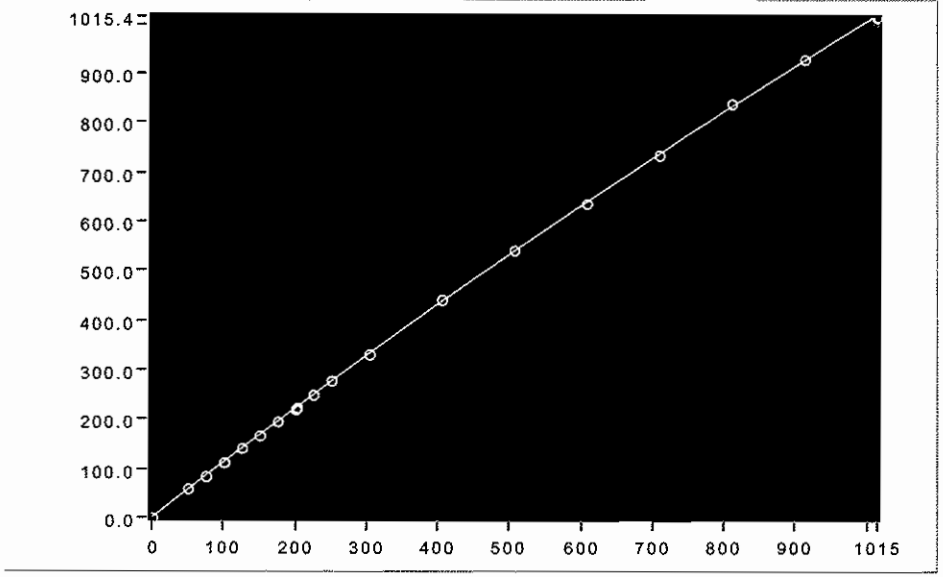
Lo Alarm: NaN

Hi Alarm: NaN

Span: Offset: 0000

Mutations: FALSE





Cal Spectra	Temp (C)	Pres (atm)	Conc (ppm-m)	Actual	Calc'd
HCN (200) PCA 191C (9.86ppm, 5.11r	191.209	0.977	50.385	50.338	58.783
HCN (200) PCA 191C (14.79ppm, 5.11	191.194	0.977	75.577	75.505	83.841
HCN (200) PCA 191C (19.72ppm, 5.11	191.202	0.977	100.769	100.670	111.887
HCN (200) PCA 191C (19.87ppm, 5.11	191.196	0.978	101.536	101.566	112.063
HCN (200) PCA 191C (24.65ppm, 5.11	191.204	0.977	125.962	125.832	141.005
HCN (200) PCA 191C (29.58ppm, 5.11	191.209	0.977	151.154	150.999	166.591
HCN (200) PCA 191C (34.51ppm, 5.11	191.225	0.977	176.346	176.168	195.479
HCN (200) PCA 191C (39.44ppm, 5.11	191.217	0.977	201.538	201.349	219.828
HCN (200) PCA 191C (39.74ppm, 5.11	191.194	0.978	203.071	203.055	223.703
HCN (200) PCA 191C (44.37ppm, 5.11	191.203	0.977	226.731	226.500	249.690
HCN (200) PCA 191C (49.30ppm, 5.11	191.199	0.977	251.923	251.691	277.964
HCN (200) PCA 191C (59.61ppm, 5.11	191.221	0.978	304.607	304.577	330.988
HCN (200) PCA 191C (79.48ppm, 5.11	191.195	0.977	406.143	405.954	440.831
HCN (200) PCA 191C (99.35ppm, 5.11	191.258	0.977	507.679	507.181	541.777
HCN (200) PCA 191C (119.22ppm, 5.11	191.209	0.977	609.214	608.643	637.005
HCN (200) PCA 191C (139.09ppm, 5.11	191.246	0.977	710.750	709.953	735.231
HCN (200) PCA 191C (158.96ppm, 5.11	191.263	0.977	812.286	811.364	839.113
HCN (200) PCA 191C (178.83ppm, 5.11	191.221	0.977	913.821	913.339	929.366
HCN (200) PCA 191C (198.70ppm, 5.11	191.202	0.978	1015.357	1015.357	1015.357

Interpolation: Quadratic

Force Through Zero: ☒

Min % Residuals: ☐ Excl. Zero: ☐ Quant w/ Highest: ☐

Spectral Regions
Region 00 - 3250.25 to 3411.52 cm-1
Region 01 - 593.01 to 840.34 cm-1
Region 02 - 1295.95 to 1518.21 cm-1
Region 03 - 2496.93 to 2901.43 cm-1
Region 04 - 3172.38 to 3250.01 cm-1
Region 05 - 3881.35 to 4113.97 cm-1

Calibration Generated: [illegible]:50 AM 11/30/2012

Gas ID: Ethylene (100,3000) 191C

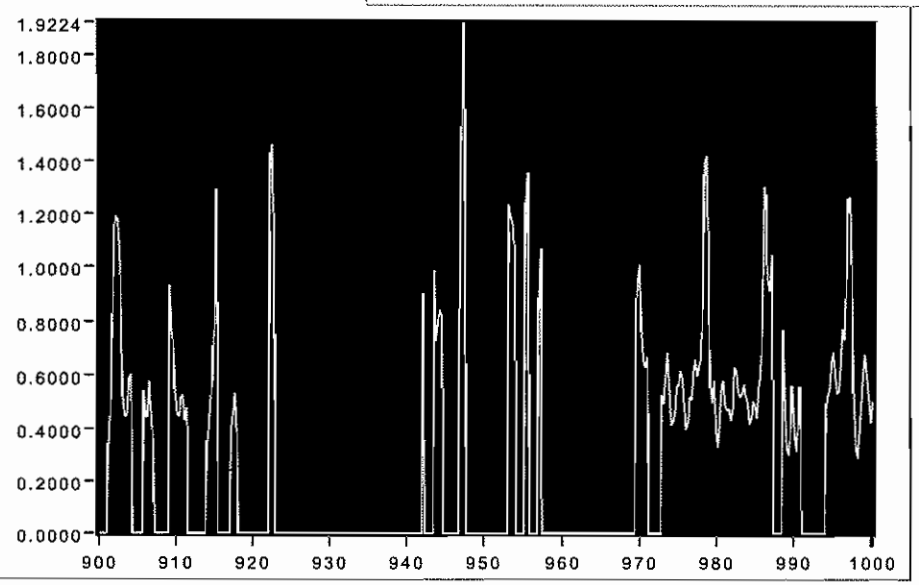
LRF Path: C:\OLT\Methods R3\Cement-coal-EGU method 191C\Ethylene (100,3000) 191C_19.lrf

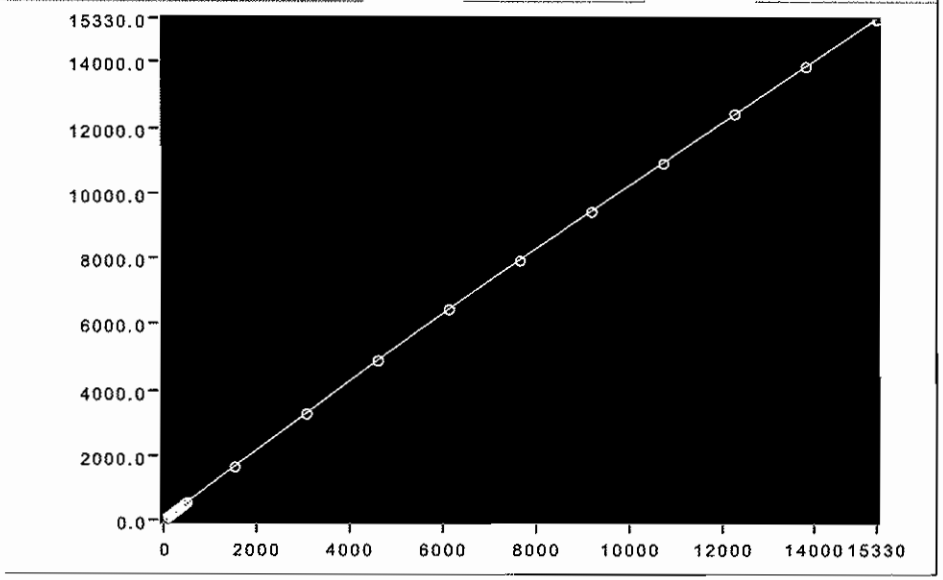
Lo Alarm: NaN

Hi Alarm: NaN

Span: Offset. J0000

Mutations: FALSE





Cal Spectra	Temp (C)	Pres (atm)	Conc (ppm-m)	Actual	Calc'd
Ethylene (9.74ppm, 5.11m, 190C).lab	190.014	0.994	49.792	49.542	54.522
Ethylene (19.49ppm, 5.11m, 190C).lab	189.989	0.994	99.594	99.135	107.070
Ethylene (29.23ppm, 5.11m, 190C).lab	189.985	0.994	149.365	148.729	162.298
Ethylene (38.98ppm, 5.11m, 190C).lab	189.998	0.995	199.188	198.392	217.388
Ethylene (48.72ppm, 5.11m, 190C).lab	189.971	0.995	248.959	247.990	272.190
Ethylene (58.46ppm, 5.11m, 190C).lab	189.964	0.995	298.731	297.587	327.537
Ethylene (68.21ppm, 5.11m, 190C).lab	189.977	0.995	348.553	347.251	383.508
Ethylene (77.95ppm, 5.11m, 190C).lab	189.933	0.995	398.325	396.868	439.409
Ethylene (87.70ppm, 5.11m, 190C).lab	189.964	0.995	448.127	446.506	495.696
Ethylene (97.44ppm, 5.11m, 190C).lab	189.934	0.995	497.918	496.089	551.021
Ethylene (300.00ppm, 5.11m, 190C).la	189.942	0.997	1533.000	1531.357	1654.977
Ethylene (600.00ppm, 5.11m, 190C).la	189.991	0.998	3066.000	3063.066	3290.420
Ethylene (900.00ppm, 5.11m, 190C).la	189.934	0.998	4599.000	4597.015	4885.213
Ethylene (1200.00ppm, 5.11m, 190C).la	189.933	0.998	6132.000	6130.754	6446.341
Ethylene (1500.00ppm, 5.11m, 190C).la	189.960	0.998	7664.999	7658.046	7940.995
Ethylene (1800.00ppm, 5.11m, 190C).la	189.922	0.998	9197.999	9195.039	9445.204
Ethylene (2100.00ppm, 5.11m, 190C).la	189.971	0.998	10730.999	10728.462	10942.161
Ethylene (2400.00ppm, 5.11m, 190C).la	189.936	0.998	12263.999	12262.913	12444.229
Ethylene (2700.00ppm, 5.11m, 190C).la	189.914	0.998	13796.999	13797.629	13888.468

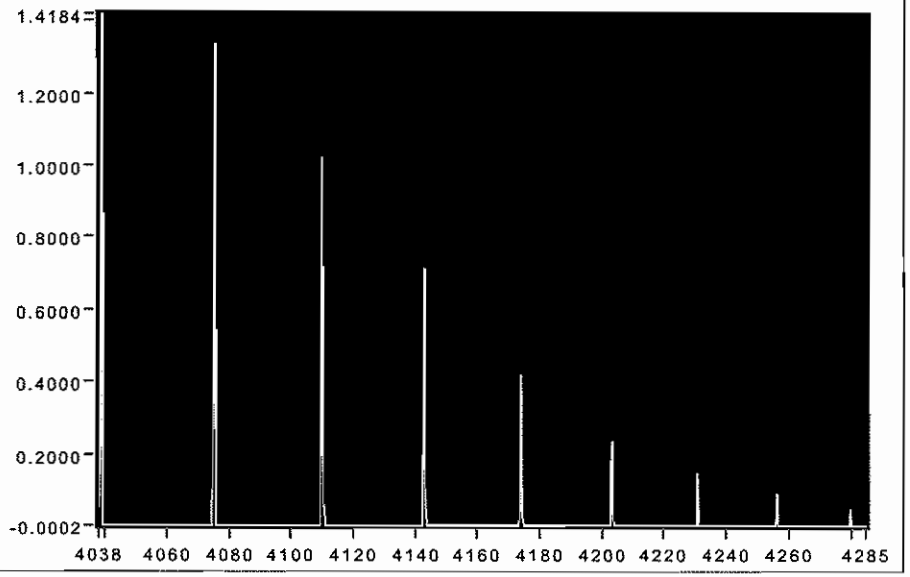
Interpolation: Quartic

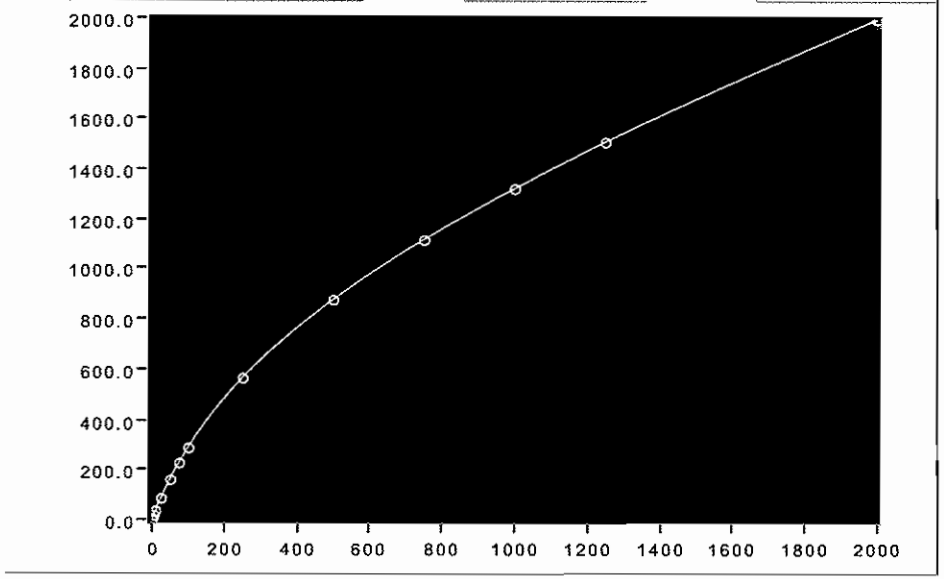
Force Through Zero: ☒

Min % Residuals: ☒ Excl. Zero: ☐ Quant w/ Highest: ☐

Spectral Regions
Region 00 - 900.12 to 1000.16 cm-1
Region 01 - 615.91 to 899.88 cm-1
Region 02 - 1000.40 to 1211.33 cm-1
Region 03 - 1341.75 to 2117.96 cm-1
Region 04 - 2901.41 to 3286.87 cm-1

Calibration Generated	[illegible].22 AM 06/26/2012	Gas ID	HF ppm (10) 191C	Lo Alarm	NaN	Span	Offset. [illegible]0000
		LRF Path	C:\OLT\Methods R3\Cement-coal-EGU method 191C\HF ppm (10) 191C_12.lrf	Hi Alarm	NaN	Mutations	FALSE





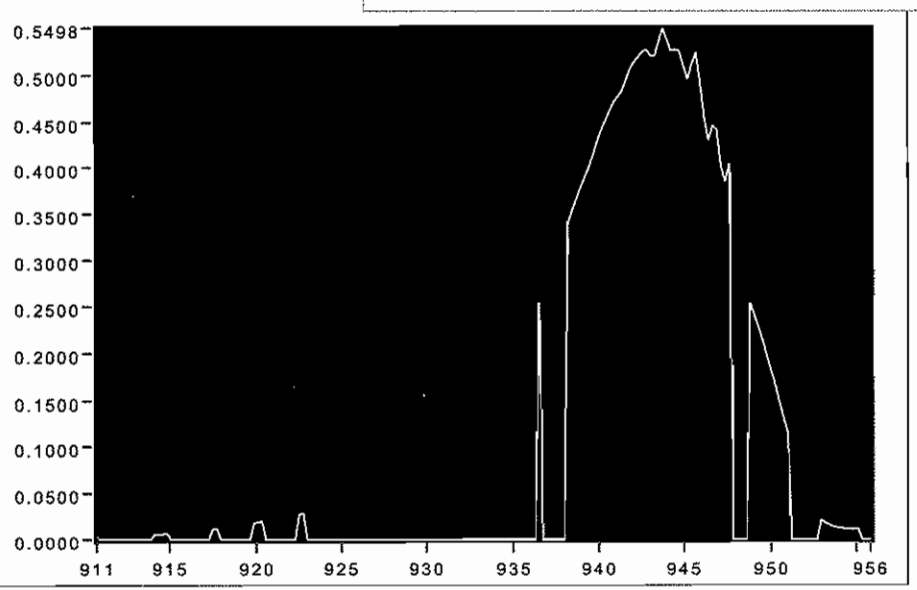
Cal Spectra	Temp (C)	Pres (atm)	Conc (ppm-m)	Actual	Calc'd
HF 96 MNB-fz 1ppm-m (1ppm, 1.000m, 1	191.000	1.000	1.000	1.000	3.620
HF 96 MNB-fz 5ppm-m (5ppm, 1.000m,	191.000	1.000	5.000	5.000	17.914
HF 96 MNB-fz 10ppm-m (10ppm, 1.000m	191.000	1.000	10.000	10.000	35.375
HF 96 MNB-fz 25ppm-m (25ppm, 1.000r	191.000	1.000	25.000	25.000	85.208
HF 96 MNB-fz 50ppm-m (50ppm, 1.000r	191.000	1.000	50.000	50.000	160.659
HF 96 MNB-fz 75ppm-m (75ppm, 1.000r	191.000	1.000	75.000	75.000	228.048
HF 96 MNB-fz 100ppm-m (100ppm, 1.00	191.000	1.000	100.000	100.000	288.789
HF 96 MNB-fz 250ppm-m (250ppm, 1.00	191.000	1.000	250.000	250.000	565.147
HF 96 MNB-fz 500ppm-m (500ppm, 1.00	191.000	1.000	500.000	500.000	875.753
HF 96 MNB-fz 750ppm-m (750ppm, 1.00	191.000	1.000	750.000	750.000	1115.993
HF 96 MNB-fz 1000ppm-m (1000ppm, 1.	191.000	1.000	1000.000	1000.000	1322.828
HF 96 MNB-fz 1250ppm-m (1250ppm, 1	191.000	1.000	1250.000	1250.000	1509.378
HF 96 MNB-fz 2000ppm-m (2000ppm, 1	191.000	1.000	2000.000	2000.000	2000.000

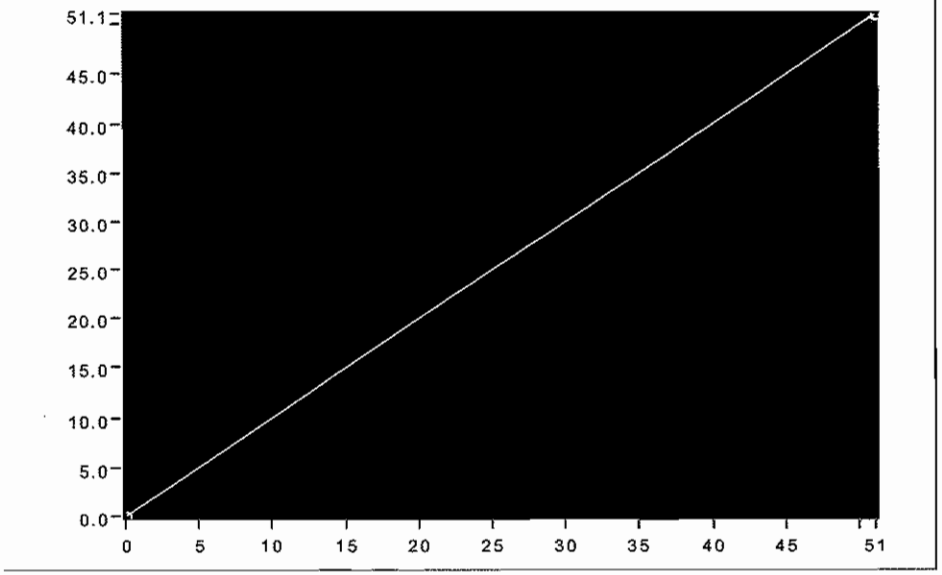
Interpolation: Spline — Force Through Zero: ☒

Min % Residuals: ☐ Excl. Zero: ☐ Quant w/ Highest: ☐

Spectral Regions
Region 00 - 4037.90 to 4284.87 cm-1
Region 01 - 3405.41 to 4037.84 cm-1
Region 02 - 4284.93 to 4363.63 cm-1

Calibration Generated	[illegible]:34 PM 07/09/2012	Gas ID	SF6 (10) 191C	Lo Alarm	NaN	Span	Offset. [illegible]0000
		LRF Path	C:\OLT\Methods R3\Cement-coal-EGU method 191C\SF6 (10) 191C_0.lrf	Hi Alarm	NaN	Mutations	FALSE





Cal Spectra	Temp (C)	Pres (atm)	Conc (ppm-m)	Actual	Calc'd
SF6 (10ppm, 5.11m, 191C) #1.LAB	191.504	1.008	51.100	51.100	51.100

Interpolation: Linear — Force Through Zero: ☒

Min % Residuals: ☒ — Excl. Zero: ☐ — Quant w/ Highest: ☐

Spectral Regions
Region 00 - 910.73 to 955.81 cm-1
Region 01 - 902.05 to 910.49 cm-1
Region 02 - 956.05 to 1004.99 cm-1

Appendix F

Test Participants

Scott Steinsberger	Project Manager and FTIR Operator
Dustin Carpenter	Sampling Technician
Lee Harris	Sampling Technician
Lori Steele	Holcim Plant Contact

Appendix G

RTR Sampling and Analytical Protocol

DEECO Inc.
3404 Lake Woodard Road
Raleigh, NC 27604
(919) 250-0285 (ph); (919) 250-1835 (Fax) www.deeco.com

PROTOCOL TO PERFORM A SAMPLING AND ANALYTICAL TESTING PROGRAM AS PART OF THE US EPA RISK AND TECHNOLOGY REVIEW

at

Holcim (US) Inc.
Whitehall Facility
5160 Main Street
Whitehall, Pennsylvania 18052

Submitted By:
DEECO, INC.
3404 Lake Woodard Road
Raleigh, NC 27604

September 29, 2023

Copy # 1

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The United States Environmental Protection Agency (US EPA) has directed the portland cement industry (SIC 3241) to conduct emissions testing as part of the US EPA Risk and Technology Review (RTR). This document provides the overall test program approach and specifies minimum sample collection procedures, data quality objectives, and quality assurance/quality control measures to be used by the source testing firms selected by the cement companies performing tests. The test program is designed to be a comprehensive and robust test of each facility. The quality assurance and quality control (QA/QC) measures are designed to produce standardized data having known precision and accuracy. Collection of accurate, representative, and standardized data for facilities with low emissions is necessary especially in view of MACT standard setting procedures.

Cement kiln pyro-processing systems located throughout the US will be included in this request. Individual facilities have a wide range of kiln system configurations and air pollution control (APC) trains. Site-specific considerations will be required to capture emissions profiles for the target analytes that represent the extent of control or possible emissions increases from these controls.

1.2 PLANT NAME, ADDRESS, AND CONTACT

Holcim (US) Inc. - Whitehall Facility
5160 Main Street
Whitehall, Pennsylvania 18052

Ms. Laurel Steele
TEL (610) 483-5218
E-Mail laurel.steele@holcim.com

1.3 PROCESS OF INTEREST

The process to be tested at the Whitehall facility is a pyro-processing system equipped with a preheater, designated as Kiln 2. Kiln 2 (Process 282005) is a Fuller Company Model 84200 that is 195 feet long and 13.5 feet in diameter with a nominal clinker capacity of 59 tons per hour. Other kilns located at the facility are idled.

1.4 AIR POLLUTION CONTROL EQUIPMENT

The Holcim Whitehall facility operates a number of air pollution control devices which help control and lower stack emissions. The kiln is equipped with a selective non-catalytic reduction (SNCR) system and dry absorbent addition (DAA) system for oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) control, respectively. Particulate matter is captured in an Allen Shennan Hoftman baghouse (ID: C01) and returned to the kiln feed system. A water spray system between the preheater and the induced draft fan protects the baghouse from high temperatures.

1.5 EMISSION POINTS AND SAMPLING LOCATIONS

The emissions from Kiln 2 are exhausted through an individual horizontal duct, before entering a common shell stack. Emissions will be measured in the duct.

1.6 POLLUTANTS TO BE MEASURED

Emission testing will be conducted for hydrogen cyanide (HCN), hydrogen fluoride (HF), and diatomic chlorine (Cl_2). Concurrent measurements to determine volumetric flow rate will be made. The sampling and analytical procedures to be followed are discussed in detail in Section 4.

1.7 EXPECTED TEST DATES

Test dates are to be determined.

1.8 TEST PROGRAM ORGANIZATION

The test program organizational chart is presented in Figure 1.1.

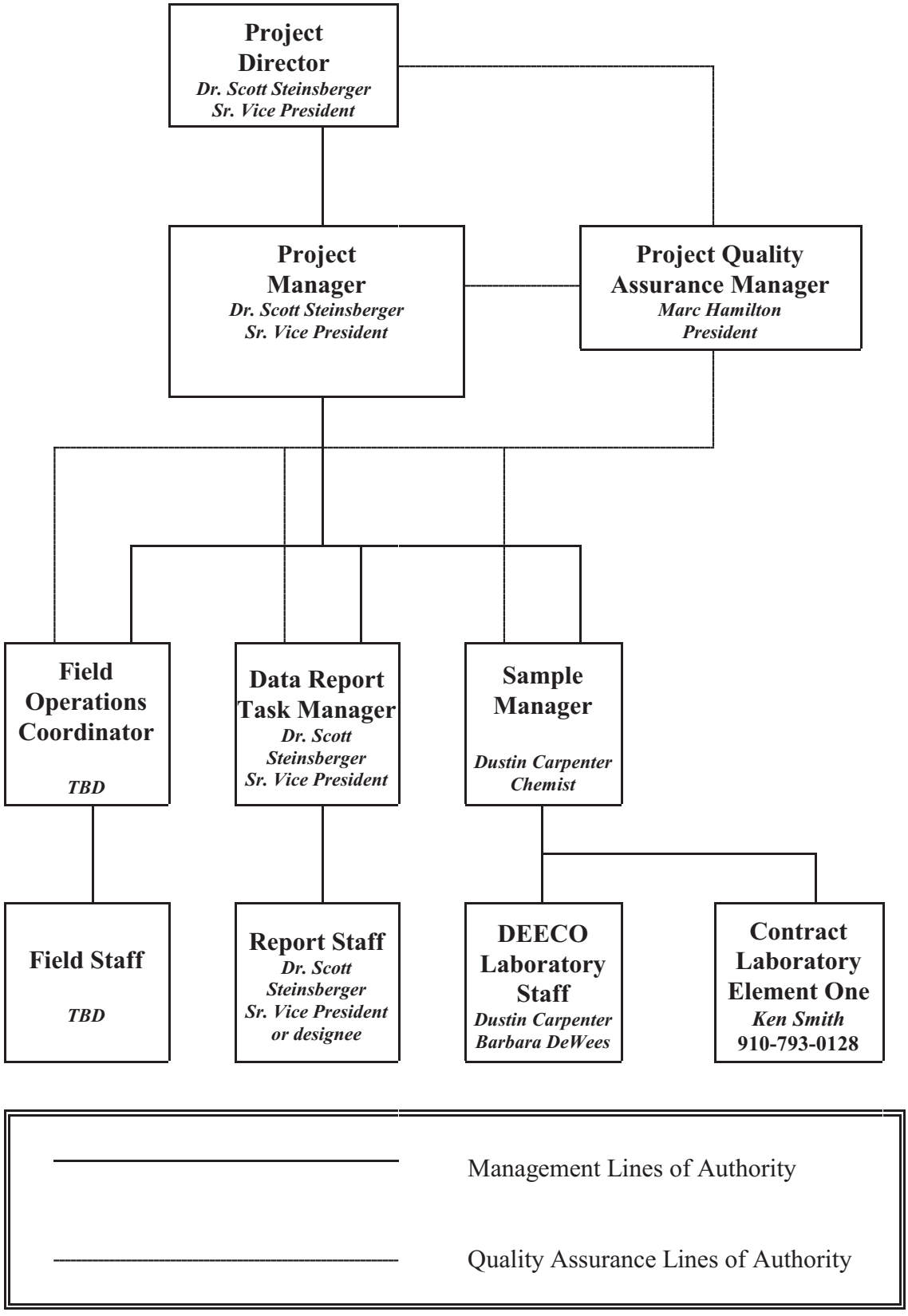


Figure 1.1 Organizational Chart

2.0 SOURCE DESCRIPTION

2.1 PROCESS DESCRIPTION

The Kiln 2 process uses pulverized limestone and other raw materials are fed into the preheater, and pulverized bituminous coal, coke and plastics-derived fuels are introduced as fuel in the combustion end of the kiln. Tire-derived fuels are used as supplemental fuel in the preheater. The raw material is heated to 2,600 to 3,000°F., with preheat temperatures exceeding 1,400°F. Combustion gases pass through the rotating kiln counter to the flow of raw materials. As a result, some of the materials are entrained as particulate matter.

2.2 CONTROL EQUIPMENT DESCRIPTION

The Holcim Whitehall facility operates a number of air pollution control devices which help control and lower stack emissions. The kiln is equipped with a selective non-catalytic reduction (SNCR) system and dry absorbent addition (DAA) system for oxides of nitrogen (NO_x) and sulfur dioxide (SO_2) control, respectively. Particulate matter is captured in an Allen Shennan Hoftman baghouse (ID: C01) and returned to the kiln feed system. A water spray system between the preheater and the induced draft fan protects the baghouse from high temperatures.

A schematic of the Whitehall process, including control equipment is shown below in Figure 2.1.

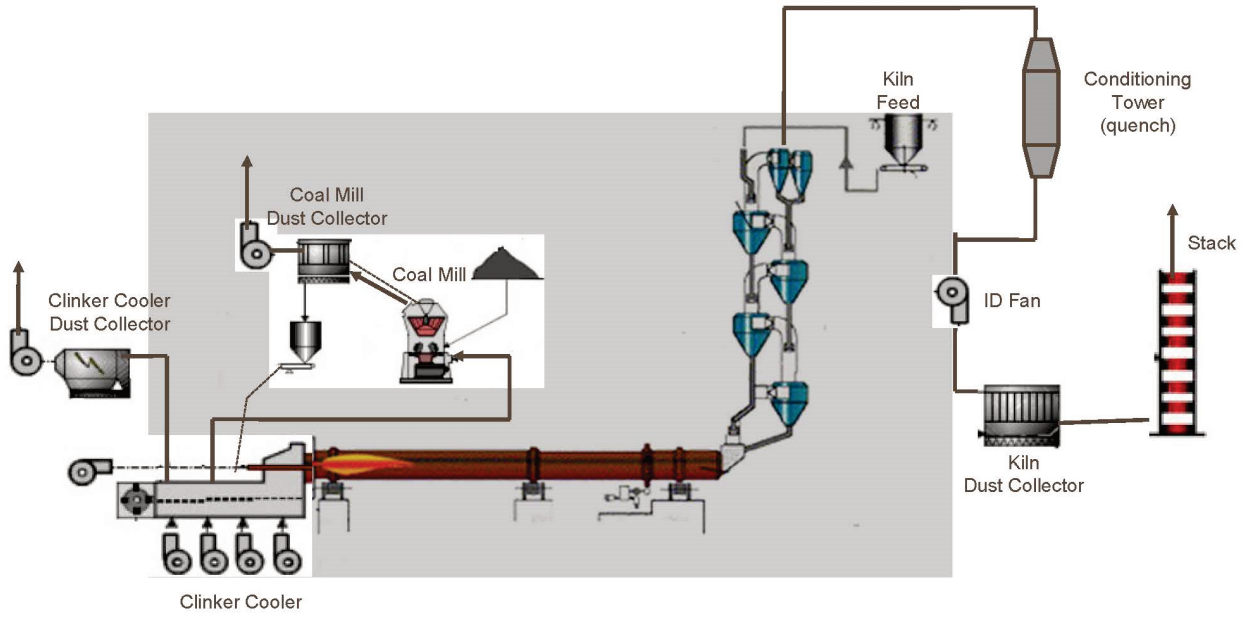


Figure 2.1 Whitehall Detailed Process Schematic

3.0 TEST PROGRAM

3.1 OBJECTIVES

An air emissions sampling and analytical program will be conducted on the Kiln 2 exhaust duct at the Whitehall cement facility located in Whitehall, Pennsylvania. All testing will be performed following accepted EPA methodology. The test program is to provide a standardized data set to the EPA and the cement industry so that reliable facility inter-comparisons of emissions can be made.

All testing will be performed in strict accordance with "DRAFT GENERAL TEST PLAN Testing To Determine HCN, HF, and Cl_2 Emissions From Cement Kilns" dated March 2, 2023" and the specifications stipulated in 40 CFR 60, Appendix A for flow rate following EPA Method 1, 2, 3A, and 4) and hydrogen fluoride (HF) and diatomic chlorine (Cl_2) following EPA Method 26A and in 40 CFR 63, Appendix A for hydrogen cyanide (HCN) and (HF) following EPA Method 320. All sampling runs will be one hour long.

The source emission test will be performed on a date to be determined. Testing will be conducted under representative process and control system operating conditions. For facilities with inline raw mills, testing will be performed while operating in the "Mill On" and "Mill Off" conditions. Whitehall Kiln 2 has no inline raw mill, therefore only a single operating condition will be tested.

3.2 TEST MATRIX

Table 3-1 presents the sampling and analytical matrix and proposed test schedule.

TABLE 3-1 PROGRAM OUTLINE AND TENTATIVE TEST SCHEDULE

Sampling Location	No. of runs	Sample/Type Pollutant	Sampling Method	Sample Run Times (min)	Analytical Method	Analytical Laboratory
Day 1						
K2 Duct	Arrive on-site and set up test equipment on the Kiln 2 exhaust duct					
Day 2						
Kiln 2 Duct	3	O_2/CO_2	EPA Method 3A	60	Paramagnetic (O_2) NDIR (CO_2)	DEECO
	3	HF and Cl_2	EPA Method 26A[1]	60	Ion Chromatograph	Element One
	3	HCN and HF	EPA Method 320	60	FTIR (Method 320)	DEECO

[1] Stack gas flow rate and moisture measurement may be taken from concurrent Method 26A sampling trains.

3.3 TEST COORDINATION

Ms. Laurel Steele, the Whitehall facility contact, will serve as the test coordinator and will be responsible for:

1. Scheduling the start of all testing
2. Principal contact with the agency officials concerning the tests
3. Principal contact with DEECO concerning the tests
4. Recording the process data during the testing
5. Providing copies of any field test data to the agency

If there is a temporary equipment malfunction in the middle of a test, radio contact will be made with the test crew in order to delay the test. When problems have been corrected, the test will continue from the point where it was delayed. If the malfunction or upset condition results in an extended test delay, then the affected test run(s) may be aborted and a new run(s) conducted when the malfunction has been corrected or process upset cleared. Any samples or field data from aborted runs may be discarded.

4.0 SAMPLING LOCATION DESCRIPTIONS

4.1 SAMPLING LOCATION DESCRIPTION

The Kiln 2 exhaust duct is a horizontally-oriented 8 feet by 4 feet rectangular stack. The stack gas sampling ports (4 total) are located approximately 1.5 diameters from the upstream disturbance and 3.76 diameters from the downstream disturbance. The location does not meet the minimum specifications for a measurement site under EPA Method 1.

Cyclonic flow checks, as described in EPA Method 1 Section 2.4, using the Type-S pitot null procedure and angle measurements will be conducted at the Kiln 2 stack test location.

The expected number of sampling traverse points will be 28, as has been used historically and calculated using EPA Method 1. Each traverse will be made at each sampling location using a type-S pitot tube in accordance with EPA Methods 2 procedures. Gas temperatures are to be measured using calibrated Type K thermocouples and digital readout devices. All measurements are to be performed in accordance with the procedures in EPA Methods 2, and 26A.

A schematic of the Kiln 2 exhaust duct is provided in Figure 4.1.

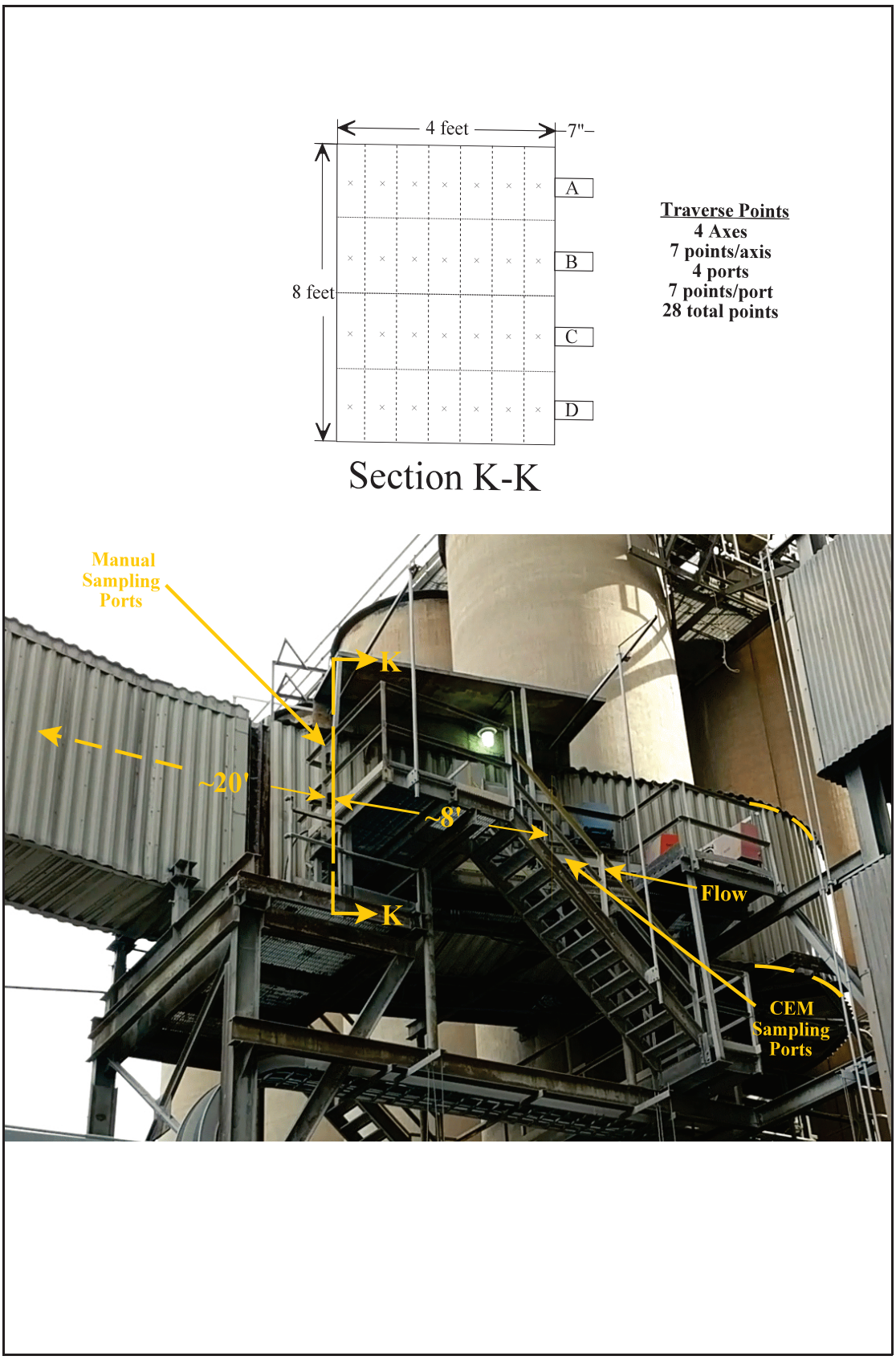


Figure 4.1 Schematic of Stack Sampling Location

5.0 SAMPLING AND ANALYTICAL PROCEDURES

This section contains a brief description of the sampling and analytical procedures for each method that will be employed during the test program. All equipment, procedures, and quality assurance measures necessary for completion of the test program will meet or exceed the specifications of the appropriate methods Any deviations from the methods to ensure quality representativeness of the results are also discussed.

5.1 TEST METHODS

The methods for the test program are described below, and apply to all process operating conditions (e.g. where there is an inline raw mill, testing will be performed while operating in the "Mill On" and "Mill Off" conditions). Table 3-1 outlines expected operating conditions for this test.

5.1.1 SAMPLING POINT DETERMINATION - EPA METHOD 1

The number and location of the sampling or traverse points will be determined according to the procedures outlined in EPA Method 1. The sample location will be inspected to insure EPA Method 1 criteria is met. All points will be at least 1.0 inches from the stack wall, per Method 1.

5.1.2 FLUE GAS VELOCITY AND VOLUMETRIC FLOW RATE - EPA METHOD 2

The flue gas velocity and volumetric flow rate will be determined according to the procedures outlined in EPA Method 2. Velocity measurements will be made using type S pitot tubes conforming to the calibration specifications outlined in EPA Method 2, Section 10.1. Each Type-S pitot tube, calibrated according to these standards, will have an assigned coefficient. Differential pressures will be measured with Magnehelic gauges of appropriate range or with fluid manometers. Effluent gas temperatures will be measured with chromel-alumel thermocouples equipped with digital readouts.

5.1.3 OUTLET FLUE GAS COMPOSITION - EPA METHOD 3A

Outlet flue gas analysis for oxygen (O_2) and carbon dioxide (CO_2) concentrations, and the calculation of percent excess air and flue gas dry molecular weight will be performed in accordance with EPA Method 3A.

To evaluate the sampling location and points for FTIR and O_2 sampling, a three-point O_2 concentration stratification test on a line passing through the centroidal area at 16.7, 50.0 and 83.3 percent of the measurement line (or for stacks is greater than 2.4 meters (7.8 ft) at 0.4, 1.2 and 2.0 meters from the stack or duct wall). The procedures in Section 8.1.2 of Method 7E will be followed, but oxygen will be used as parameter as allowed by fourth sentence in Section 8.1.2. The plant O_2 CEMS as a control. A criteria of <5% variation from combined mean for each point will be used as indication of non-stratification and allowing single point sampling at the point closest to the mean. Otherwise, sampling for equal periods at the three test points during test run will be conducted.

Per EPA Method 3A for determining molecular weight, integrated sampling will be obtain using the Method 320 sampling system described in Section 5.1.6.

A portion of the hot , wet gas sample will be sent through a condensing system to remove the stack moisture, A portion of the moisture-free gas sample will be snt to a CAI Model 200 O_2 (or

equivalent) analyzer measures using the paramagnetic technique. An oxygen molecule, because of its sp3 electron orbital distribution, has an unpaired electron and hence displays a magnetic orientation. Since other elements that display this magnetic phenomenon are not common gasses at normal temperatures, the paramagnetic measurement technique is virtually specific for oxygen. The sample gas flows through a detection cell located in a very strong magnetic field. The concentration of O_2 gas present induces a pressure differential in the detector cell. The amount of differential pressure is proportional to the concentration of O_2 gas present.

Calibration procedures will be performed in accordance with EPA methodology. Analyzers will be calibrated before and after each test and a calibration check between each test run.

The pretest calibrations will consist of the following steps:

- Internal (direct) calibration of each analyzer to adjust calibration and check linearity.
- External (through the entire sampling system) calibration to check the system bias on zero and span gases.

The post test calibration will consist of an external system bias calibration check.

The analyzer will be as calibrated using a certified zero and span (mid or high range) gas. Zero and span gases were directed to each analyzer through the appropriate plumbing, the calibration gas flow rates will be adjusted to the correct flow rate and the analyzer will be adjusted with the appropriate span pot.

After the analyzer is properly adjusted the linearity will be checked using a low and high range calibration gas. The maximum allowable limit for linearity is 2% of the analyzer range. All analyzers will be shown to be linear within these limits before proceding..

The external calibration bias check will be performed by placing the CEM system in sampling mode and injecting a zero and span gas into the sample line at the probe exit. This check shows if there is any sampling system related bias, and also checks the integrity of the sample line.

5.1.3.1 Calibration Gases-DEECO will use EPA Protocol and/or ±2% NIST Traceable gases for calibration as required by the various reference methods employed in this test program. Calibration gases will be selected from previous experience with similar sources and/or from information obtained from the facility engineer prior to sampling. In some cases if the gases that are selected are out of the optimum range of operation then no significant impact of data quality is expected due to the linear nature of the analyzers that were used.

Audit gases, if available from a federal or a state agency, will be analyzed.

5.1.3.2 Sampling Procedures-At the completion of the pretest calibration routine, the CEM system will be ready for operation. No further adjustments of sample flow rates, analyzer zero or span adjustments, or other critical CEM operating parameters will be made until testing and post test calibration were complete.

Each sampling run will be one hour. At the completion for each test run, calibration gases will be used to check between test runs. A zero and the upscale calibration gas closest to the actual emission concentrations will be used for the pretest and post test calibrations.

5.1.4 FLUE GAS MOISTURE CONTENT - EPA METHOD 4

The flue gas moisture content will be determined in conjunction with the EPA Method 26A trains according to the sampling and analytical procedures outlined in EPA Method 4. (**NOTE:** In order to maintain isokinetic sampling, the sampling rate used may be required to temporarily exceed the EPA Method 4-specified maximum sampling rate of 0.75 CFM, based on observed stack gas pitot readings.) The impingers will be connected in series and will contain reagents as described below. The impingers will be contained in an ice bath in order to assure condensation of the moisture in the flue gas stream. Any moisture that is not condensed in the impingers is captured in the silica gel, therefore all moisture can be weighed and entered into moisture content calculations.

5.1.5 HYDROGEN FLUORIDE AND DIATOMIC CHLORINE - EPA METHOD 26A

Sampling and analytical procedures will be similar to those outlined in EPA Method 26A to determine primarily diatomic chlorine (Cl_2) emissions and hydrogen fluoride (HF) emissions at main stack outlet sampling locations. Duplicate simultaneous trains (a.k.a "paired trains") for each test run will be used to determine precision.

Sample is collected through a heated glass probe, followed by a heated quartz fiber filter, where stack gas HF and Cl_2 are collected in a series of chilled impingers. The sampling train impingers will contain 50 ml of 0.1N sulfuric acid in the first impinger (optional should high moisture warrant a modified short stem), 100 ml of 0.1N sulfuric acid in the second and third, an empty fourth impinger, 100 ml of 0.1N NaOH in the fifth and sixth and 200 grams of silica gel in the last impinger. (**NOTE**: For plants with scrubbers, the optional cyclone may be used since the gas stream may be saturated with moisture.)

Sampling will be conducted isokinetically (±10%) with readings of flue gas parameters recorded at traverse points selected according to EPA Method 1. Leak-checks on the Method 26A sampling train will be are performed before and after each sampling run and optionally for any port change. In the event that any portion of the train needed to be disassembled and reassembled (i.e., due to filter or resin changes), leak-checks are performed. The sampling train leak-checks and leakage rate (where applicable) are documented on the field test data sheet for each respective run. All leak checks will be acceptable.

The glass button hook nozzle and probe liner will be constructed of borosilicate glass or quartz. The filter holder will be constructed of borosilicate glass with a Teflon frit filter support and a sealing gasket. A heated quartz fiber filter, for sources above 210°C, or PTFE-bonded glass fiber filter will be used. The probe and filter housing will heated to above 248°F and not exceed an upper boundary of 273°F. Probe liners and filter holders will be cleaned thoroughly prior to testing.

The Method 26A trains will be operated isokinetically for a minimum of 60 minutes and collect a minimum of 1 dry, standard cubic meter (DSCM). Pretest preparations, preliminary determinations, and leak check procedures will be those outlined in EPA Method 5.

After completion of sampling the train will be leak checked and transferred to the sample recovery trailer. All leak checks will be acceptable. The impingers will be weighed to determine moisture gain in accordance with EPA Method 4.

Sample recovery will involve quantitative recovery of the sulfuric acid impinger contents and the NaOH impinger contents into separate tare-weighed, precleaned polyethylene sample containers.

The nozzle, probe, filter and filter housing will not be recovered.

The contents of sulfuric acid impingers, including the contents if any of the empty (2nd knockout or fourth) impinger will be quantitatively transferred to the tare-weighed, precleaned polyethylene sample container, followed by three rinses with deionized (DI) water of the impingers and all connecting glassware (including the connecting glassware to the first impinger) placed in the same H_2SO_4 container. The container will be labeled and weighed to determine the final sample volume. The liquid level will be marked on the sample container.

The contents NaOH impingers will be quantitatively transferred to a second tare-weighed, precleaned polyethylene sample container, followed by three rinses with DI water of the impingers and all connecting glassware placed in the same NaOH container. The container will be labeled and weighed to determine the final sample volume. The liquid level will be marked on the sample container

Sample recovery from each train will include:

1. Container No. 1 - Contents 1st knockout, H_2SO_4 impingers, and 2nd knockout and, and DI rinse of impingers and connecting glassware; and
2. Container No. 2 - Contents NaOH impingers, and DI rinse of impingers and connecting glassware.

Additional quality control consists of collecting and analyzing a field blank train for every three test runs. The blank train is to be assembled from a used train, leak checked and sit for a period equal to the sampling time (i.e, 1-hr). The blank train data will be used to determine the method detection limit for the test program target analytes (ie. The lowest number that could be detected), and compared to stack emissions.

Reagent blanks of 0.1 N H_2SO_4, 0.1N NaOH, and DI water will be collected and archived for later analysis should there be any issues with the field blank train samples

The H_2SO_4 impinger solutions will be analyzed using ion chromatography techniques for fluoride ions (F^-) (EPA SW-9057). Duplicate analyses will be performed on the samples and a reagent blank. Precision will be demonstrated by duplicate injection of each sample, the results of each individual analysis must be within 5% of their mean to be acceptable. If the precision criteria is not met, analysis of the sample is repeated until consecutive injections meet the criteria.

The NaOH impinger solutions will be treated with sodium thiosulfate to ensure complete conversion of hypochlorous acid (HClO) to chloride ions (Cl^-). The resulting solution will be analyzed using ion chromatography techniques for chloride ions (EPA SW-9057). Duplicate analyses will be performed on the samples and a reagent blank. Precision will be demonstrated by duplicate injection of each sample, the results of each individual analysis must be within 5% of their mean to be acceptable. If the precision criteria is not met, analysis of the sample is repeated until consecutive injections meet the criteria.

All EPA Method 26A HF/Cl_2 samples will be analyzed by Element One of Wilmington NC. Refer to Section 1, Figure 1.1 for contact information.

The relative deviation (RD)will be calculated as described in EPA Method 30B between the Cl_2 concentrations measured with the paired trains.

5.1.6 HYDROGEN CYANIDE AND HYDROGEN FLUORIDE - EPA METHOD 320

EPA Method 320 will be performed to determine emissions of concentrations of HCN and HF. Three, 1-hour sampling runs will be conducted under representative process and control system operating conditions.

The gas sample will be extracted from the stack through a glass-lined probe and filter heated to 375° F. For external calibration checks and analyte spikes, the gases will be introduced in front of the heated filter. Any excess calibration gas will be diverted through the sample probes into the source. Outflow of gas from the heated filter enclosure was transported through a Teflon sample line heated to 375° F. For this source approximately 100' of sample line will be required. The heated sample line will be connected directly to the FTIR sample cell. Using heat-traced Teflon tubing the exit of the FTIR cell will be connected to a sample pump with a heated stainless steel pump head. The pump discharge will be directed to a proprietary chiller-type gas conditioner to remove moisture prior to delivery sample gas to the O_2/CO_2 monitors.

The distribution of the gas sample to the monitors will be accomplished using a panel equipped with valves and rotometers. The gas sample was then divided and directed to the analyzers.

FTIR sample cell will be maintained at 191°C and connected to a MKS Instruments Multigas 2030 Fourier Transform Infrared Spectrometer and Detector.

The FTIR spectrometer will measure vapor phase organic or inorganic compounds which absorb energy in the mid-infrared spectral region, about 400 to 4000 cm^{-1} (25 to 2.5 μm). Continuous measurement will be made by matching sample absorbance bands with bands in reference spectra, and comparing sample band intensities with reference band intensities.

The principle limitation to FTIR spectroscopy are the presence of interfering compounds that also absorb energy in the mid-infrared spectral region. In a cement kiln stack gas matrix, water vapor (H_2O) and carbon dioxide (CO_2) are the primary interferents that must be incorporated into the identification and quantitation method.

The FTIR software performs the computation for a single compound by subtracting all the other compounds (interferants and target) from the absorbance spectra and quantifies the single compound based on the remain absorbance. The FTIR software provides a Standard Error Calculation (SEC) value that is an indication of how well the identification and quantitation has been performed. A high SEC indicates that other interferants have not been accounted for in the analysis method, and a low SEC is indicative of greater confidence measurement.

The instrument is operated with a resolution of 0.5 cm^{-1} with 4x zero filling. Beer-Norton Medium apodization is used with amplitude phase correction.

For this RTR test program, following specific QA/QC activities for EPA Method 320 will be performed and criterium met.

5.1.6.1 Laboratory QA/QC Activities Before Field Test Program- Before field testing occurs, the following QA/QC activities will be conducted;

1) Seven consecutive samples of dry nitrogen through the sampling system will be acquired and used to calculate the standard deviation for each of the test program target analytes multiplied

by a factor of 3. These data will be considered representative of detection limits for this test program and are to be compared to the 0.5 ppm required DL;

2) From these seven dry nitrogen samples, the results for the Signal-to-Noise Ratio (SNR) @ 2500 cm^{-1} should be >2500, at 64 scans and the results for single beam intensity @ 2500 cm^{-1} should be >0.9; and

3 Upon receipt of HCN calibration gases a direct analysis will be performed to verify FTIR response agrees with tag value within 5%. Analysis results will be reported to PCA to assess need for modified reference spectra and/or change to direct analysis criterion:

5.1.6.2 QA/QCActivities During Field Test Program- During the field test program, following QA/QC activities will be performed and criterium met;

1) On each test day prior to any testing , an instrument background will be collected using dry nitrogen directed to the gas cell. The background will be collected with at least 128 scans;
2) The probe, filter, sample line and all sample system components in contact with effluent will be maintained at or above 375ºF or 191ºC (consistent with FTIR calibration temperature) to avoid any possible "cold spots;"
3) Heated sample lines will be ≤100 feet wherever possible, and not longer than 200 feet, without prior approval for unusual test circumstances;
4) A system zero with all sampling system components at operating temperature will be performed by injecting nitrogen at the sample probe and through sample filter and entire measurement system. After zero equilibration has been achieved, all measurement components will be quantified for at least 128 scans;
5) Ambient air will be sampled until equilibration of the measurement system has been achieved and all measurement components will be quantify for at least 128 scans;
6) The sample probe will be position at effluent measurement point and sampling will continue until equilibration of the measurement system has been achieved. At this point, the effluent concentrations will be quantified with two consecutive 64-scan samples as the initial native concentration for the dynamic spike;
7) Analyte spiking will be conducted for HCN before the first test run, and after each successive test run for a minimum of 4 spikes per test condition. (Additional spikes would be required before and after corrective action for the sampling or analysis system and/or before and after removing the sampling system from the stack.) These results will determine accuracy;
8) The spike gas injections will be maintained at 10% or less of total sample volume. The spike gas concentration and flow rate will be selected to approximately double the native effluent concentration, or the spike will be conducted to add 3-4 ppm to native concentration, whichever results in greater spiked concentration. Spike recovery results will be within ±20% of the expected value or ±0.5 ppm, whichever is least restrictive. (Specific HCN gases will be manufactured for this test program in the range of 50-100 ppm to provide spikes in the 5-10 ppm range, or lower. An SF_6 or appropriate tracer will be used to calculate the exact spike gas dilution ratio of 10% or less;)
9) After the dynamic spike, nitrogen will be sent through the sampling system until all traces of spike gas are removed and lines are proven below DL for target analytes;
10) The nitrogen purge will be discontinued and the sampling system will be allowed to equilibrate with stack gas before starting a test run. The first two consecutive 64-scan samples of a sample run will be used for the final native concentration. Residual results for HCN and HF will be verified to be less than 0.2-0.3 ppm for data acceptance, or less than 5% of the measured value, whichever is least restrictive. Calculate the standard deviation for

each of the test program target analytes for seven consecutive sample spectra from Run 1, multiplied by a factor of 3. These data will be compared to the pre-test system nitrogen standard deviation results and also included in the facility test report;

11) The SNR @ 2500 cm^{-1}, at 64 scans, and the results for single beam intensity @ 2500 cm^{-1} will be verified to met the >2500 and >0.9 criterium; respectively. The analyte spiking for HCN and subsequent system nitrogen injection will be conducted after each test run. Continue sequence until at least three valid runs per test condition are completed.

6.0 QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

6.1 QA/QC PROCEDURES

The QA/QC procedures for this RTR test program are summarized in Table 6-1.

TABLE 6-1 QA/QC PROCEDURES AND REQUIREMENTS

Target Analyte	Test Method	Detection Limit	QA/QC
HCN	EPA Method 320	0.5 ppm	Increase scans if needed to achieve detection limits. Increasing to 400 from relative 64 (gives a 2.5 S/N advantage). HCN spiking before and after each run by adding 10% or less spike to approximately double the native effluent concentration, or conduct spike to add 3-4 ppm to native concentration, whichever results in greater spiked concentration. Spike recovery results shall be within ±20% of the expected value or ±0.5 ppm, whichever is least restrictive 5% pre-to-post run calibration transfer standard (CTS) requirement
HF		0.2-0.3 ppm	Rely on CTS (5%), HCN and tracer gas responses to validate HF FTIR data
Cl_2	EPA Method 26A	~ 0.07 mg/m^3 (~0.2 ppm)	Duplicate Simultaneous Trains; Collect minimum of 1 dscm for each sample train. Acceptance criteria for paired samples: 10% Relative Deviation or 0.2 ppm absolute difference, whichever is least restrictive. Insert dry impinger between acid and base impingers
Effluent Flow Rate	EPA Methods 1-4	Not Applicable	As per M26A isokinetic testing or separately by Methods 1-3. FTIR measurements for H_2O. **Wind Tunnel calibrated pitot tube having a Cp of 0.84 or less is required for all flow measurements**. Compare preliminary velocity traverse measurements and sample run flow rate measurements to installed certified flow rate monitor. Investigate and resolve differences greater than 10% of average flow rate.
O_2	EPA Method 3A	Not Applicable	Analyte concentrations corrected @ 7% O_2 Span is 10%, 15%, or 20% (for co-mingled stacks only) Acceptance criteria are 0.2% O_2 difference for analyzer calibration error, and 0.3% O_2 for system bias checks, and zero and upscale drift checks.

6.2 SAMPLE IDENTIFICATION AND CUSTODY

Sample custody procedures for this program are based on EPA recommended procedures. Since samples will be analyzed by one or more laboratories as well as in the field, the custody procedures emphasize careful documentation of sample collection and field analytical data and the use of chain of custody records for samples being transported. The procedures which will be used are discussed below.

The project manager will be responsible for ensuring that proper custody and documentation procedures are followed for the field sampling and field analytical efforts. He will be assisted in this effort by key sampling personnel involved in sampling recovery.

Samples will be collected, transported, and stored in clean containers which are constructed of materials inert to the analytical matrix such as glass jars. Only containers which allow air tight seals will be used. Amber glass jars will be employed when containers are needed to inhibit photochemical reactions.

All sampling data, including information regarding sampling times, locations, and any specific considerations associated with sample acquisition will be recorded on preformatted data sheets. All samples will be given unique, identifying alphanumeric sample codes which will serve to track samples from the field to the laboratory.

Samples will be stored for transport from the lab to the field to the lab in storage boxes constructed in a fashion which minimizes movement and thus prevents breakage of containers. For example, boxes used for transporting glass containers will have foam inserts with form-fitting cutouts. Sample transport boxes will be locked except when in use. Vans containing equipment and samples will be locked whenever they are left unattended.

A daily activity log will be maintained by the project supervisor. This will be an informal log used to record various types of information, such as minor problems which arise, sketches of sampling locations, names and phone numbers of plant contacts. daily activity summaries, etc.

This section provides information regarding the organization of the sampling and analytical program. The following details the key positions and their responsibilities. Once personnel have been assigned to these positions, their qualifications will be provided as an addendum.

The organization of the project team, including QA functions, is shown in the project organization chart (see Figure 1.1).

7.0 SAMPLE CUSTODY

Sample custody procedures for this program are based on EPA recommended procedures. Since samples will be analyzed by one or more laboratories as well as in the field, the custody procedures emphasize careful documentation of sample collection and field analytical data and the use of chain of custody records for samples being transported. The procedures which will be used are discussed below.

7.1 FIELD SAMPLING OPERATIONS

The project manager will be responsible for ensuring that proper custody and documentation procedures are followed for the field sampling and field analytical efforts. He will be assisted in this effort by key sampling personnel involved in sampling recovery.

Samples will be collected, transported, and stored in clean containers which are constructed of materials inert to the analytical matrix such as glass jars. Only containers which allow air tight seals will be used. Amber glass jars will be employed when containers are needed to inhibit photochemical reactions.

All sampling data, including information regarding sampling times, locations, and any specific considerations associated with sample acquisition will be recorded on preformatted data sheets. All samples will be given unique, identifying alphanumeric sample codes which will serve to track samples from the field to the laboratory.

Samples will be stored for transport from the lab to the field to the lab in storage boxes constructed in a fashion which minimizes movement and thus prevents breakage of containers. For example, boxes used for transporting glass containers will have foam inserts with form-fitting cutouts. Sample transport boxes will be locked except when in use. Vans containing equipment and samples will be locked whenever they are left unattended.

A daily activity log will be maintained by the project supervisor. This will be an informal log used to record various types of information, such as minor problems which arise, sketches of sampling locations, names and phone numbers of plant contacts. daily activity summaries, etc.

7.2 ANALYTICAL OPERATIONS

Analytical operations will be performed on-site in the laboratory as well as in the remote laboratories. Samples analyzed by outside laboratories are transported with a Change of Custody form. This form will list sample identifications, analytical parameters, sample matrices, anticipated date of results, and other relevant information necessary to ensure the appropriate analyses are performed and to document the progress of the samples.

8.0 INTERNAL QUALITY CONTROL CHECKS

Specific quality control (QC) procedures will be followed to ensure the continuous production of useful and valid data throughout the course of this test program. The QC checks and procedures described in this section represent an integral part of the overall sampling and analytical scheme. Strict adherence to prescribed procedures is quite often the most applicable QC check. A discussion of both the sampling and analytical QC checks that will be utilized during this program is presented below.

8.1 EQUIPMENT INSPECTION AND MAINTENANCE

Each item of field test equipment will be assigned a unique, permanent identification number. An effective preventative maintenance program is necessary to ensure data quality. Each item of equipment returning from the field will be inspected before it is returned to storage. During the course of these inspections, items are cleaned, repaired, reconditioned, and recalibrated where necessary.

Each item of equipment transported to the field for this test program will be inspected again before being packed to detect equipment problems which may originate during periods of storage. This minimizes lost time on the job site due to equipment failure.

Occasional equipment failure in the field is unavoidable despite the most rigorous inspection and maintenance procedures. For this reason, replacement equipment for all critical sampling train components will be transported to the job site.

8.2 EQUIPMENT CALIBRATION

New items for which calibration is required will be calibrated before initial field use. Equipment whose calibration status may change with use or time will be inspected in the field before testing begins and again upon return form each field use. When an item of equipment is found to be out of calibration, it will be repaired and recalibrated or retired from service. All equipment will be periodically recalibrated in full, regardless of the outcome of these regular inspections.

Calibrations will be conducted in a manner, and at a frequency, which meets or exceeds U.S. EPA specifications. The calibration procedures outlined in the EPA Methods will be followed. When these methods are inapplicable, methods such as those prescribed by the American Society for Testing Materials (ASTM) will be used.

Data obtained during calibrations will be recorded on standardized forms, which will be checked for completeness and accuracy by the quality assurance manager. Data reduction and subsequent calculations will be performed using computer facilities. Calculations will be checked at least twice for accuracy. Copies of calibration forms will be included in the test or projects reports.

Emissions sampling equipment requiring calibration includes pitot tubes, pressure gauges, thermometers, dry gas meters and barometers. The following sections elaborate on the calibration procedures to be followed for these items of equipment.

A: **Pitot Tubes.** All Type S pitot tubes used, whether separate or attached to a sampling probe, will be constructed in-house or by a third-party vendor. Each new pitot will

be calibrated in accordance with Section 10.1 of EPA Method 2. Each Type-S pitot tube, calibrated according to these standards, will have an assigned coefficient. This coefficient should not change as long as the pitot tube is not damaged.

Each pitot tube will be inspected visually upon return from the field. If a cursory inspection indicates damage or raises doubt that the pitot remains in accordance with the EPA geometry standards, the pitot tube will be refurbished as needed and recalibrated.

B: **Differential Pressure Gauge.** All meter consoles used are equipped with 10-inch water column (W.C.) inclined-vertical manometers. Fluid manometers do not require calibration other than leak checks. Manometers will be leak checked in the field prior to each test series, and again upon return from the field.

C: **Impinger Thermometer.** Prior to the start of testing, the thermometer used to monitor the temperature of the gas leaving the last impinger will be compared with a mercury-in-glass thermometer which meets ASTM E-1 No. 63F specifications. The impinger thermometer is adjusted if necessary until is agrees within 2°F of the reference thermometer. If the thermometer is not adjustable, it is labeled with a correction factor.

D: **Dry Gas Meter Thermometer.** The thermometer used to measure the temperature of the metered gas sample will be checked prior to each field trip against an ASTM mercury-in-glass thermometer. The dry gas meter thermometer is acceptable if the values agree within ± 5.4°F. Thermometers not meeting this requirements will be adjusted or labeled with a correction factor.

E: **Flue Gas Temperature Sensor.** All thermocouples employed for the measurement of flue gas temperature are calibrated upon receipt. Initial calibrations will be performed at three points (ice bath, boiling water, and hot oil). An ASTM mercury-in-glass thermometer will be used as a reference. The thermocouple is acceptable if the agreement is within 1.5 percent (absolute) at each of the three calibration points.

Before and after each field use, the reading from the flue gas thermocouple-potentiometer combination will be compared with an ASTM mercury-in-glass reference thermometer at ambient conditions. If the two agree within ± 1.5 percent (absolute), the thermocouple and potentiometer are considered to be in proper working order.

F: **Dry Gas Meter and Orifice.** Two procedures will be used to calibrate the dry gas meter and orifice simultaneously. The full calibration will be a complete laboratory procedure used to obtain the calibration factor of the dry gas meter. Full calibrations will be performed over a wide range of orifice settings. A simpler procedure, the post-test calibration, will be designed to check whether the calibration factor has changed.

A dry gas meter that is calibrated annually against a spirometer or a set of calibrated critical orifices will be used as a transfer standard. During the annual calibration, triplicate calibration runs will be performed at seven flow rates ranging from 0.25 to 1.40 cfm.

G: **Dry Gas Meter.** Each metering system receives a full calibration at the time of purchase and a post-test calibration after each field use. If the calibration factor, γ, deviates by less than five percent from the initial value, the test data are acceptable. If γ deviates by more than 5 percent, the meter is recalibrated and the meter coefficient (initial or recalibrated) that yields the lowest sample volume for the test runs is used.

EPA Method 5 requires another full calibration anytime the post-test calibration check indicates that γ changed by more than 5 percent. Standard practice is to adjust and recalibrate the dry gas meter anytime γ is found to be outside the range of 0.96 to 1.04. Post-test calibrations will be performed after each field test series per EPA Method 5, section 16.3 procedures.

H: **Orifice.** An orifice calibration factor will be calculated for each flow setting during a full calibration. If the range of values does not vary by more than 0.20 in H_2O over a range of 0.4 to 4.0 in H_2O, the arithmetic average of the values obtained during the calibration is used.

I: **Barometer.** Each field barometer will be adjusted before each test series to agree within ± 0.1 inches of a reference aneroid barometer. The reference barometer will be checked against the station pressure value (corrected for elevation difference) reported by the National Weather Service.

8.3 SAMPLING QUALITY CONTROL PROCEDURES

The following pretest QC checks will be conducted:

- All sampling equipment will be thoroughly checked to ensure clean and operable components.
- Equipment will be inspected for possible damage from shipment.
- The oil manometer or Magnehelic gauge used to measure pressure across the Type S pitot tube will be leveled and zeroed.
- The number and location of the sampling traverse points will be checked before taking measurements.
- The temperature measurement system will be visually checked for damage and operability by measuring the ambient temperature prior to each traverse.

In addition to the general QC procedures listed above, QC procedures specific to each sampling method will also be incorporated into the sampling scheme. These methods and specific procedures are discussed below.

A: Sampling Train QC checks. The following QC procedures will be emphasized:

Prior to Start of Tests

- Keep all cleaned glassware and sample train components sealed until train assembly.
- Assemble the sampling trains in an environment free from uncontrolled dust.
- Visually inspect each sampling train for proper assembly.
- Perform pretest calculations to determine the proper sampling nozzle size.

Prior to Each Test Run

- Visually inspect the sampling nozzle.
- Visually inspect the Type S pitot tube.
- Leak check each leg of the Type S pitot tube.
- Leak check the entire sampling train.

During Each Test Run

- Readings of temperature and differential pressure will be taken at each transverse point.
- All sampling data and calculations will be recorded on preformatted data sheets.
- All calibration data forms will be reviewed for completeness and accuracy.
- Any unusual occurrences will be noted during each run on the appropriate data form.
- The project supervisor will review sampling data sheets daily during testing.
- Properly maintain the roll and pitch axis of the Type S pitot tube and the sampling nozzle.
- Leak check the train before and after any move from one sampling port to another during a run (at DEECO's option) or if a filter change takes place.
- Conduct additional leak checks if the sampling time exceeds 4 hours.
- Maintain the probe, filter, and impingers at the proper temperatures.
- Maintain ice in the ice bath at all times.
- Make proper readings of the dry gas meter, delta P and delta H, temperature, and pump vacuum during sampling at each traverse point.
- Maintain isokinetic sampling within ± 10% of 100%.

After Each Test Run

- Visually inspect the sampling nozzle.
- Visually inspect the Type S pitot tube.
- Leak check each leg of the Type S pitot tube.
- Leak check the entire sampling train.

B: QC for Volumetric air flow rate determinations

Flue Gas Velocity. Data required to determine the flue gas velocity will be collected using the methodology specified in EPA Method 2. Quality control procedures are as follows.

- Visually inspect the Type S pitot tube before and after sampling.
- Leak check both legs of the pitot tube before and after sampling.
- Check the number and location of the sampling traverse points before taking measurements.

Flue Gas Molecular Weight. In the event that that integrated bag samples are to be used for determination of flue gas molecular weight, EPA Method 3 will be the sampling technique specified. Quality control will focus on the following procedures:

- The sampling train will be leak checked before and after each run.
- A constant sampling rate will be used in withdrawing a sample.
- The sampling train will be purged prior to sample collection.
- The sampling port will be properly sealed to prevent air in-leakage.

Moisture Content. The moisture content of the gas stream will be determined using the technique specified in EPA Method 4. The following QC checks will be performed:

- The sampling train will be leak checked before and after each run.
- Ice will be maintained in the ice bath throughout each run to insure an exit temperature (after the silica gel impinger) of $\leq 67^{\circ}F$.

8.4 ANALYTICAL QUALITY CONTROL PROCEDURES

All analyses for this program will be performed using accepted laboratory procedures in accordance with the specified analytical protocols. Adherence to prescribed QC procedures will ensure data of consistent and measurable quality. Analytical QC will focus upon the use of control standards to provide a measure of analytical precision and accuracy. Also, specific acceptance criteria are defined for various analytical operations including calibrations, control standard analyses, drift checks, blanks, etc. The following general QC procedures will be incorporated into the analytical effort:

- The on-site project manager will review all analytical data and QC data on a daily basis for completeness and acceptability.
- Analytical QC data will be tabulated using the appropriate charts and forms on a daily basis
- Copies of the QC data tabulation will be submitted to the quality assurance manager following the completion of the test program.
- All hard copy raw data (i.e., chromatograms, computer printouts, etc.) will be maintained in organized files.

Specific analytical QC procedures for the Orsat analyzer (if used) are listed below.

- The analyzer will be leveled and the fluid levels zeroed prior to use.
- The analyzer will be leak checked prior to use.
- The analyzer will be thoroughly purged with sample prior to use.
- The analyzer will be checked by analyzing an ambient air sample.

EPA Method 26A Sample Analysis QC Checks are listed below.

- Calibration curve consisting of 4 calibration levels that bracket the expected sample range. Dilute samples as necessary to reach the calibration range;
- Duplicate analysis of calibration standards, before and after sample analysis, with duplicate injections being within 5% of their mean;
- Duplicate analysis of reagent blanks, quality control samples and field samples with duplicate injections being within 5% of their mean;
- Matrix spike samples may be prepared and analyzed. Matrix spike recoveries should be 90-110%
- A field blank will be carried through the procedure and analyzed with the field samples.
- An audit sample will be analyzed for if available from two or more independent, Approved Audit Sample Providers no less than 60 days prior to the test effort.

9.0 REPORTING AND DATA REDUCTION REQUIREMENTS

9.1 DATA REPORTING

The reporting units for HCN, HF, and Cl_2 will be in parts-per-million by volume, wet basis ($ppm_{v,d}$), parts-per-million by volume, dry corrected to 7% oxygen ($ppm_{v,d}@7\%O_2$), pounds-per-hour (lbs/hr), and pounds-per-ton of clinker (lbs/ton). Additional supporting data for CO_2, O_2, and H_2O concentrations and volumetric flow rates (actual cubic feet-per-minute, wet,standard cubic feet-per-minute, and dry,standard cubic feet-per-minute) will be reported. The clinker production, in short tons-per-hour (TPH) will be reported.

Any data that is not acceptable because of technical difficulties will be indicated, and an explanation of the technical problem will be given. All related QC and calibration data will be in the final report.

9.2 REPORT CONTENTS

Copies of the test report will be submitted after the test series has been completed. Results reported will include, but not be limited to emission rates and concentrations of gaseous pollutants, and process sample determinations, any liquid stream constituents determinations, and any other type of data requested. This report will also include a list of all personnel present during testing, summary results, descriptions of test procedures used, a description of the source and its operation during testing, test locations drawings, example calculations, raw field data, and equipment calibrations.

9.3 DATA REDUCTION

Care will be exercised to ensure hand recorded data is written accurately and legibly. Additionally, the use of prepared data recording forms, conveniently formatted, is an important aid to verify that all necessary data items are recorded. The collected field and laboratory data will be reviewed by the analyst and the Project Manager.

The Project Manager will reduce and validate all of the sampling and analytical data that is collected. The sampling data will include flow measurements, calibrations, etc. Each laboratory will reduce all analytical results prior to their submission to the Project Manager. The analytical data will be used to determine concentrations and emission rates of the compounds of interest.

Data reduction follows guidelines published in EPA Reference Methods, where applicable, and by guideline documents where EPA Reference Methods are not available. Validated computer programs will be used to calculate all reported values.

9.4 DATA VALIDATION

A second technical review of the data will be performed and documented by a qualified scientist other than the one who performed the actual analyses. The second reviewer will include evidence (e.g., check marks, recalculations, etc.) that show which data points were checked. Finally, the second reviewer will sign and date the cover page of the data packet or the record that was reviewed.

In-situ measurements will be validated by demonstrated acceptable post-test leak checks and calibration verifications according to the referenced method used.

Analysis data may be validated according to defined criteria by a secondary reviewer or by the analyst. At a minimum and if applicable, analysis data will be validated according to the following criteria (additional method-specific criteria or project requirements may apply):

- Sampling records complete and traceable
- All appropriate QC samples included with the analytical batch and reported with the sample results
- Routine tuning, calibration and inspection of analytical instrumentation documented and performed prior to analyses
- Initial and continuing calibration criteria met
- Method/reagent blanks confirm no background contamination
- Surrogate recoveries within criteria
- Qualitative sample results (e.g., retention times, mass spectra, isotopic ratios) consistent with standard data
- Sample data within the calibrated range of the instrument
- Chromatograms or other raw data consistent with computer-generated quantitation reports
- Accuracy of intermediate data manipulations, transcribed numbers and/or final reported results verified
- Reference standards, instrumentation, sample identification, analysts, methodology, and sequence of processing clearly identified and traceable in the project records
- Lost data or corrective actions documented (e.g., loss of sample, reanalysis, redilutions, additional cleanup steps, alternative calculations etc.)
- Data that does not meet the validation requirements flagged accordingly
- Data reported in the correct units (e.g., "ppm" should not be used without specifying volume or mass units; "ug/g" are preferred units for data reporting)

10.0 PLANT ENTRY AND SAFETY

10.1 SAFETY RESPONSIBILITIES

The Project Manager is responsible for ensuring compliance with plant entry, health, and safety requirements. The Facility Contact (refer to Section 1.2) as the authority to impose or waive facility restrictions. The Project Manager has the authority to negotiate with facility person any deviations from the facility restrictions.

10.2 SAFETY PROGRAM

DEECO has a comprehensive health and safety program that satisfies Federal OSHA and MSHA requirements. The basic elements include: (1) written policies and procedures, (2) routine training of employees and supervisors, (3) medical monitoring, (4) use of personal protection equipment, (5) hazard communication, (6) pre-mobilization meetings with Holcim personnel and DEECO test team personnel, and (7) routine surveillance of the on-going test work.

10.3 SAFETY REQUIREMENTS

All test personnel will adhere to the following standard safety and precautionary measures as follows:

1) Confine activities to test area only;
2) Wear hard hats at all times on-site, except inside sample recovery trailers and mobile CEM laboratory;
3) Wear protective shoes or boots in test area:
4) Wear protective glasses or goggles at the outlet test sites, and other areas as designated;
5) Have readily available first aid equipment and fire extinguishers.

Before or on the first day on-site, the Project Manager will fill out the Emergency Response Procedure form and provide copies to be posted at each test site.

Appendix A

Sampling and Analytical Methods

The sampling and analytical methods for this sampling effort can be found at the following website:

Promulgated EPA test methods, 40 CFR 60 (Methods 1-4, 26A, and 320)

https://www.epa.gov/emc/emc-promulgated-test-methods