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

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

Holcim (US) Inc.
Theodore Facility
3051 Hamilton Blvd
Theodore, AL 36582

AUTHOR: Scott Steinsberger, Ph.D.

TEST DATE: February 1, 2024

FIELD TEAM: Lee Harris, Michael Powell, Jeremy Rothenberg, and Scott Steinsberger

PREPARED FOR: Holcim (US) Inc.
Theodore Facility
3051 Hamilton Blvd
Theodore, AL 36582

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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 Theodore facility operates one dry cement kiln, equipped with a preheater and a 4-stage inline precalciner. It is equipped with two, inline dryers. The kiln is fed a variety of fuels including, but not limited to, coal, pet coke, natural gas, tire-derived fuel (TDF), wood waste, non-hazardous waste solids, fuel oil and non-hazardous waste liquids. It is capable of producing up to 250 tons of clinker per hour (TPH), when operating both dryers.

The Holcim Theodore kiln uses two reverse air baghouses for air pollution control. Each reverse air baghouse has sixteen compartments with an air-to-cloth ratio of 1.35. They are rated for 800,000 actual cubic feet per minute (acfm). A selective non-catalytic reduction (SNCR) post combustion emissions control technology reduces NO_x by injecting ammonia into the process at a properly determined location. Raw materials fed to the dryers, in conjunction with a water spray system, protects the baghouses from high temperature preheater tower exhaust.

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., THEODORE, AL FACILITY; MAIN KILN STACK; FEBRUARY 1, 2024

Test Parameters	Main Stack
Hydrogen Cyanide (FTIR)	
parts-per-million, dry basis corrected to 7% O_2	2.3
pounds-per-hour	1.58
pounds-per-ton of clinker	0.010
Hydrogen Fluoride (FTIR)	
parts-per-million, dry basis corrected to 7% O_2	<0.11
pounds-per-hour	<0.059
pounds-per-ton of clinker	<0.0004
Hydrogen Fluoride (Method 26A)	
parts-per-million, dry basis corrected to 7% O_2	<0.56
pounds-per-hour	<0.291
pounds-per-ton of clinker	<0.0018
Diatomic Chlorine (Method 26A)	
parts-per-million, dry basis corrected to 7% O_2	<0.14
pounds-per-hour	<0.257
pounds-per-ton of clinker	<0.0016

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 Main Stack under one condition on February 1, 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 Lee Harris, Michael Powell, Jeremy Rothenberg, 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., THEODORE, AL FACILITY

Location and Frequency	Test Parameter	Sampling Method	Sampling Procedure	Analysis Method	Analysis Procedure
Kiln 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 Theodore AL 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 Main Stack under one condition and the results are summarized in Table 2.1.

TABLE 2.1 HOLCIM INC., THEODORE, AL FACILITY; KILN MAIN STACK HYDROGEN CYANIDE, HYDROGEN FLUORIDE, AND DIATOMIC CHLORINE EMISSIONS; FEBRUARY 1, 2024

Test Parameter	Kiln Main Stack Run 1	Kiln Main Stack Run 2	Kiln Main Stack Run 3	Kiln Main Stack Average
Time	10:26-11:35	11:56-13:05	13:18-14:27	February 1, 2024
Flow Rate (dscfm)	539,100	539,200	536,700	538,300
Oxygen	16.6%	16.7%	16.4%	16.6%
Carbon Dioxide	7.3%	7.2%	7.4%	7.3%
Moisture	7.0%	6.4%	7.2%	6.8%
Hydrogen Cyanide (FTIR)				
ppm_{dry} at 7% O_2	2.0	2.7	2.1	2.3
pounds-per-hour	1.41	1.82	1.50	1.58
pounds-per-ton of clinker	0.009	0.011	0.009	0.010
Hydrogen Fluoride (FTIR)				
ppm_{dry} at 7% O_2	0.11	<0.11	<0.11	<0.11
pounds-per-hour	0.061	<0.057	<0.058	<0.059
pounds-per-ton of clinker	0.0004	<0.0004	<0.0004	<0.0004
Hydrogen Fluoride (Method 26A)				
ppm_{dry} at 7% O_2	<0.58	<0.58	<0.52	<0.30
pounds-per-hour	<0.297	<0.292	<0.279	<0.291
pounds-per-ton of clinker	<0.0019	<0.0018	<0.0017	<0.0018
Diatomic Chlorine (Method 26A)				
ppm_{dry} at 7% O_2	0.16	<0.13	0.13	<0.14
pounds-per-hour	0.299	<0.233	0.239	<0.257
pounds-per-ton of clinker	0.0018	<0.0014	<0.0015	<0.0016

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 Main Stack at Holcim's Theodore, AL 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 Main Stack is a vertically-oriented circular stack with an inside diameter of 204". The stack gas sampling ports are located 1680 inches (8.2 duct diameters) above the duct breaching and 1380 inches (6.8 duct diameters) below the stack outlet.

This sampling location meets the minimum specifications for selection of a measurement site as outlined in EPA Method 1. The number and location of the sampling or traverse points were determined according to the procedures outlined in EPA Method 1. All points were at least 1.0 inches from the stack wall, per Method 1. A twelve (12) point sampling traverse was made using three (3) point traverses in each of 4 sampling ports on two perpendicular directions. Each traverse was made at each sampling location using a type-S pitot tube in accordance with EPA Methods 2 procedures. Gas temperatures were measured using calibrated Type K thermocouples and digital readout devices. All measurements were performed in accordance with the procedures in EPA Methods 2, and 26A.

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

A schematic of the Kiln Main Stack is provided in Figure 3.1.

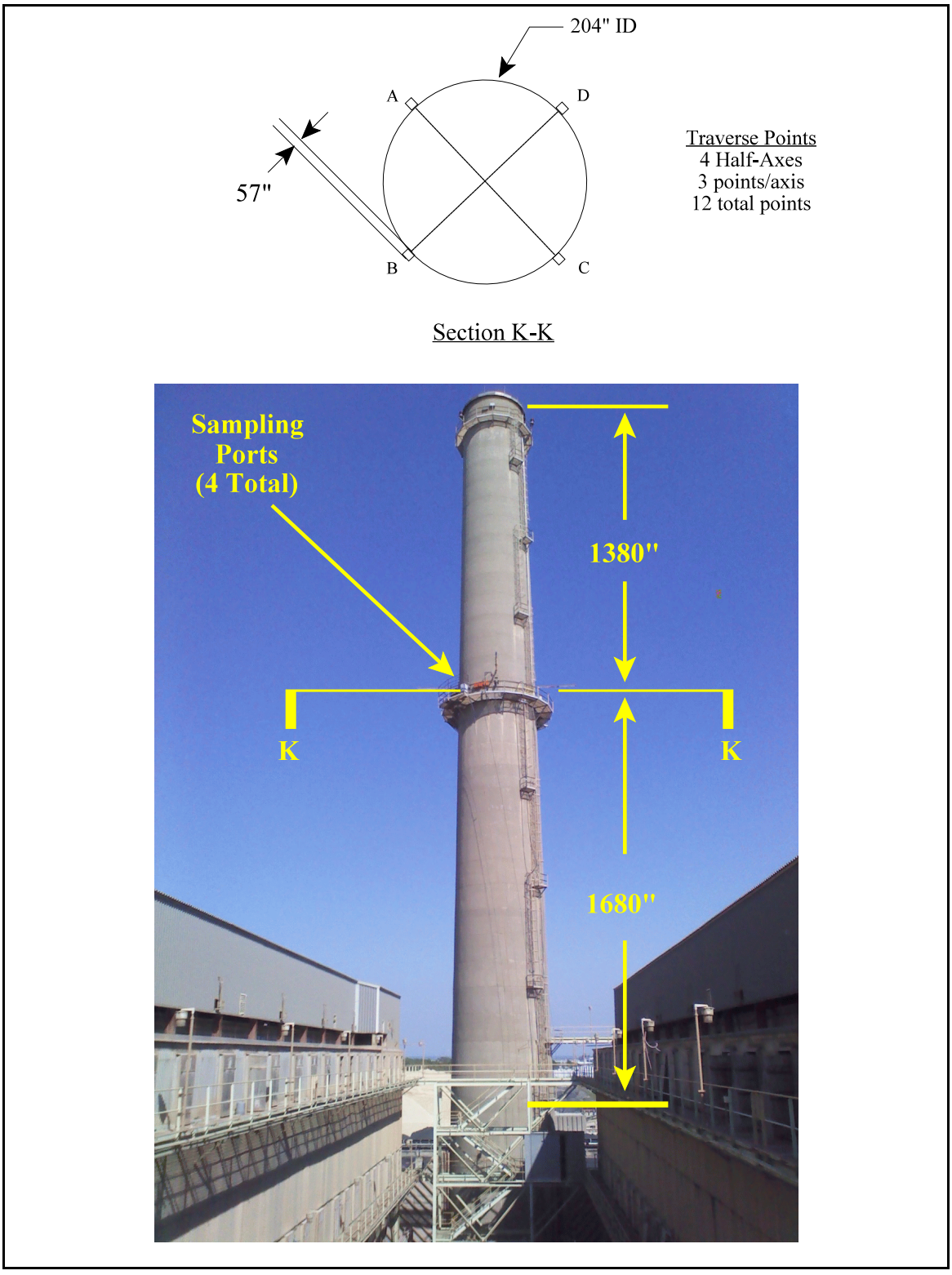


Figure 3.1 Schematic of the Kiln Main Stack Sampling Location

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 MAIN STACK; FEBRUARY 1, 2024

Run	Time	Train A Diatomic Chlorine Concentration (ppm,dry)	Train B Diatomic Chlorine Concentration (ppm,dry)	Absolute Difference (ppm,dry)
Run 1	10:26-11:35	0.053	0.047	0.006
Run 2	11:56-13:05	0.040	<0.038	0.002
Run 3	13:18-14:27	0.040	0.040	0.000

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__156801.LAB	48.27	4.78			
SPC__156802.LAB	48.30	4.77			
SPC__156803.LAB	48.32	4.78			
SPC__156804.LAB	48.18	4.78			
Averages	48.27	4.78			
Residuals for Post HCN analyte spike native scans					
SPC_156855.LAB					
Concentration	0.56		0.16		
MDC3	0.01		0.24		
MDC3%	NA		NA		
SPC_156856.LAB					
Concentration	0.55		0.16		
MDC3	0.01		0.22		
MDC3%	NA		NA		
Final SNR @ 2500 cm^{-1} and single beam intensity @ 2500 cm^{-1}					
SPC__157191.LAB				4867.1	1.05

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 MAIN STACK; FEBRUARY 1, 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	08:02-08:19	0.56	4.26	98.6%	-3.6%
Post Run 1	11:28-11:46	0.62	4.19	115.9%	
Post Run 2	12:59-13:18	0.75	3.68	100.3%	
Post Run 3	14:21-14:46	0.54	3.46	99.6%	-4.3%

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; Theodore AL
Source: Kiln Main Stack
Job ID: 24-3328
Train Type: M26A

	1A 02/01/24 1026-1135	1B 02/01/24 1026-1135	2A 02/01/24 1156-1305	2B 02/01/24 1156-1305	3A 02/01/24 1318-1427	3B 02/01/24 1318-1427	Average
Initial Meter Volume, ft^3	88.401	586.761	144.525	642.926	203.358	703.655	
Final Meter Volume, ft^3	144.292	642.771	203.135	703.016	264.935	763.405	
Intra-Port Leak Check Volume, ft^3	0.000	0.000	0.000	0.000	0.000	0.000	
Total Sample Volume, cf	**55.891**	**56.010**	**58.610**	**60.090**	**61.577**	**59.750**	**58.655**
DGM Calibration Factor	0.967	1.014	0.967	1.014	0.967	1.014	0.991
Average DGM Temp, F	57.4	69.1	69.0	78.5	67.8	82.7	70.8
Average DGM delta H, "H2O	2.97	2.83	3.39	2.88	3.63	3.23	3.16
Barometric Pressure, "Hg	29.86	29.86	29.86	29.86	29.86	29.86	29.86
Corrected Sample Vol,dscf	**55.424**	**56.934**	**56.904**	**60.022**	**59.955**	**59.271**	**58.085**
Corrected Sample Vol,dscm	**1.569**	**1.612**	**1.611**	**1.700**	**1.698**	**1.678**	**1.645**
Oxygen, %	16.6	16.6	16.7	16.7	16.4	16.4	16.6
Carbon Dioxide, %	7.3	7.3	7.2	7.2	7.4	7.4	7.3
Nitrogen, %	76.1	76.1	76.1	76.1	76.2	76.2	76.1
Stack Gas Excess Air, %	475.6	475.6	492.6	492.6	441.2	441.2	469.8
Total Moisture Catch Weight, grams	85.2	95.9	81.6	87.5	97.0	97.2	93.9
Stack Gas Moisture, %	**6.7**	**7.3**	**6.3**	**6.4**	**7.1**	**7.2**	**6.8**
Stack Gas Dry Molecular Weight, lb/lbmole	29.83	29.83	29.82	29.82	29.84	29.84	29.83
Stack Gas Wet Molecular Weight, lb/lbmole	29.04	28.97	29.08	29.06	29.00	28.99	29.02
Average Stack Temp, F	235.2	236.0	263.0	262.8	258.5	261.6	252.9
Stack Static (Gauge) Pressure, "H2O	-0.80	-0.80	-0.80	-0.80	-0.80	-0.80	-0.80
Stack Gas Actual Pressure, "Hg	29.80	29.80	29.80	29.80	29.80	29.80	29.80
Average Sqrt delta P	0.868	0.880	0.878	0.894	0.881	0.892	0.882
Pitot Tube Coefficient	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Stack Gas Velocity, ft/second	**55.87**	**56.74**	**57.59**	**58.65**	**57.69**	**58.54**	**57.51**
Nozzle Inside Diameter, inches	0.278	0.278	0.278	0.278	0.278	0.278	
Total Sample Time, min	60	60	60	60	60	60	60
Isokinetic Rate, %	**92.7**	**94.5**	**95.6**	**99.1**	**100.8**	**98.7**	**96.9**
Stack Dimensions	204 in. ID	204 in. ID	204 in. ID	204 in. ID	204 in. ID	204 in. ID	
Stack Area, sq ft	226.98	226.98	226.98	226.98	226.98	226.98	226.98
Stack Gas Flow Rate, acfm	**760,900**	**772,700**	**784,300**	**798,700**	**785,700**	**797,200**	**783,250**
Stack Gas Flow Rate, acmm	21,546	21,881	22,209	22,617	22,249	22,574	22,179
Stack Gas Flow Rate, dscfm	**537,000**	**541,200**	**534,500**	**543,900**	**534,200**	**539,200**	**538,333**
Stack Gas Flow Rate, dscmm	15,206	15,325	15,135	15,402	15,127	15,269	15,244

Company: Holcim; Theodore AL
Source: Kiln Main Stack
Job ID: 24-3328
Train Type: M26A

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

		1A 02/01/24 1026-1135	1B 02/01/24 1026-1135	2A 02/01/24 1156-1305	2B 02/01/24 1156-1305	3A 02/01/24 1318-1427	3B 02/01/24 1318-1427	Average
Hydrogen Fluoride	Catch Wt, mg	ND(0.232)	ND(0.245)	ND(0.236)	ND(0.243)	ND(0.225)	ND(0.243)	ND(0.237)
	Conc., mg/dscm	ND(0.148)	ND(0.152)	ND(0.146)	ND(0.143)	ND(0.133)	ND(0.145)	ND(0.144)
	Conc., mg/dscm @7% O2	ND(0.478)	ND(0.491)	ND(0.485)	ND(0.473)	ND(0.409)	ND(0.447)	ND(0.464)
	Conc., mg/dscm @12% CO2	ND(0.243)	ND(0.250)	ND(0.244)	ND(0.238)	ND(0.215)	ND(0.235)	ND(0.238)
	Conc., ppmvd	ND(0.178)	ND(0.183)	ND(0.176)	ND(0.172)	ND(0.159)	ND(0.174)	ND(0.174)
	Conc., ppmvd @7% O2	ND(0.575)	ND(0.591)	ND(0.583)	ND(0.569)	ND(0.492)	ND(0.538)	ND(0.558)
	Conc., ppmvd @12% CO2	ND(0.292)	ND(0.300)	ND(0.294)	ND(0.286)	ND(0.258)	ND(0.282)	ND(0.286)
	Emission Rate, lb/hr	ND(0.297)	ND(0.308)	ND(0.293)	ND(0.291)	ND(0.265)	ND(0.292)	ND(0.291)
	Clinker Rates (mtph and lbs/ton)	147.75	ND(0.0019)	147.71	ND(0.0018)	147.93	ND(0.0017)	ND(0.0018)
Chlorine	Catch Wt, mg	0.246	0.225	0.191	ND(0.19)	0.201	0.2	ND(0.209)
	Conc., mg/dscm	0.157	0.140	0.119	ND(0.112)	0.118	0.119	ND(0.127)
	Conc., mg/dscm @7% O2	0.507	0.451	0.392	ND(0.370)	0.366	0.368	ND(0.409)
	Conc., mg/dscm @12% CO2	0.258	0.229	0.198	ND(0.186)	0.192	0.193	ND(0.209)
	Conc., ppmvd	0.053	0.047	0.040	ND(0.038)	0.040	0.040	ND(0.043)
	Absolute Difference, ppmvd (<0.2 required)		0.006		0.002		0.000	
	Conc., ppmvd @7% O2	0.172	0.153	0.133	ND(0.125)	0.124	0.125	ND(0.139)
	Conc., ppmvd @12% CO2	0.087	0.078	0.067	ND(0.063)	0.065	0.066	ND(0.071)
	Emission Rate, lb/hr	0.315	0.283	0.237	ND(0.228)	0.237	0.241	ND(0.257)
	Clinker Rates (tph and lbs/ton)	147.75	0.0018	147.71	< 0.0014	147.93	0.0015	< 0.0016

Holcim; Theodore AL
Kiln Main Stack; Dryers On
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__156976.LAB	02/01/24	10:26:51.555	0.630	0.015	0.006	0.692	7.724	6.657
SPC__156977.LAB	02/01/24	10:27:55.213	0.599	-0.001	0.006	0.757	7.677	6.300
SPC__156978.LAB	02/01/24	10:28:59.348	0.576	0.076	0.005	0.692	7.739	6.337
SPC__156979.LAB	02/01/24	10:30:02.944	0.613	0.025	0.006	0.822	7.656	6.312
SPC__156980.LAB	02/01/24	10:31:06.802	0.722	0.030	0.006	0.611	7.600	6.544
SPC__156981.LAB	02/01/24	10:32:10.705	0.548	0.082	0.004	0.736	7.713	7.493
SPC__156982.LAB	02/01/24	10:33:14.593	0.711	-0.005	0.000	0.754	7.693	7.965
SPC__156983.LAB	02/01/24	10:34:18.824	0.653	0.085	-0.000	0.984	7.727	8.289
SPC__156984.LAB	02/01/24	10:35:22.394	0.657	0.000	0.003	0.727	7.496	7.714
SPC__156985.LAB	02/01/24	10:36:26.283	0.587	-0.009	0.002	0.691	7.188	6.878
SPC__156986.LAB	02/01/24	10:37:30.512	0.638	0.007	0.004	0.586	7.135	6.819
SPC__156987.LAB	02/01/24	10:38:34.082	0.629	0.028	0.005	0.655	7.068	6.758
SPC__156988.LAB	02/01/24	10:39:37.972	0.659	0.037	0.003	0.701	7.089	7.220
SPC__156989.LAB	02/01/24	10:40:41.868	0.691	0.004	0.001	0.613	7.219	7.992
SPC__156990.LAB	02/01/24	10:41:45.772	0.667	0.006	0.004	0.734	7.270	8.117
SPC__156991.LAB	02/01/24	10:42:49.666	0.667	0.026	-0.000	0.680	7.287	7.917
SPC__156992.LAB	02/01/24	10:43:53.559	0.596	0.015	0.002	0.603	7.316	7.740
SPC__156993.LAB	02/01/24	10:44:57.464	0.531	0.006	0.004	0.538	7.131	6.970
SPC__156994.LAB	02/01/24	10:46:01.692	0.636	-0.011	0.001	0.623	6.918	6.226
SPC__156995.LAB	02/01/24	10:47:05.288	0.616	0.001	0.004	0.617	6.913	6.407
SPC__156996.LAB	02/01/24	10:48:09.190	0.649	0.031	0.006	0.581	6.881	6.718
SPC__156997.LAB	02/01/24	10:49:13.411	0.651	0.015	0.003	0.722	6.932	7.137
SPC__156998.LAB	02/01/24	10:50:16.978	0.757	0.012	0.001	0.776	7.238	8.077
SPC__156999.LAB	02/01/24	10:51:20.943	0.714	0.007	-0.000	0.928	7.502	8.335
SPC__157000.LAB	02/01/24	10:52:24.771	0.831	-0.011	0.001	1.103	7.688	8.199
SPC__157001.LAB	02/01/24	10:53:28.959	0.604	-0.014	-0.001	0.693	7.586	7.357
SPC__157002.LAB	02/01/24	10:54:32.631	0.611	0.007	0.001	0.670	7.302	6.221
SPC__157003.LAB	02/01/24	10:55:36.546	0.701	0.032	0.005	0.852	7.269	5.776
SPC__157004.LAB	02/01/24	10:56:40.316	0.652	0.052	0.004	0.734	7.239	5.904
SPC__157005.LAB	02/01/24	10:57:44.220	0.629	0.020	0.005	0.699	7.187	6.172
SPC__157006.LAB	02/01/24	10:58:48.110	0.619	0.011	0.004	0.619	7.357	7.004
SPC__157007.LAB	02/01/24	10:59:52.008	0.601	0.012	0.004	0.671	7.383	7.148
SPC__157008.LAB	02/01/24	11:00:55.913	0.658	0.026	0.005	0.716	7.515	7.508
SPC__157009.LAB	02/01/24	11:01:59.804	0.658	0.086	0.002	0.695	7.758	8.247
SPC__157010.LAB	02/01/24	11:03:03.739	0.576	0.082	0.002	0.779	7.819	8.169
SPC__157011.LAB	02/01/24	11:04:07.639	0.608	0.054	0.002	0.760	7.976	8.169
SPC__157012.LAB	02/01/24	11:05:11.599	0.682	0.073	0.002	0.694	8.061	7.909
SPC__157013.LAB	02/01/24	11:06:15.389	0.578	0.081	0.002	0.735	8.040	7.383
SPC__157014.LAB	02/01/24	11:07:19.293	0.679	0.102	0.001	0.662	8.101	6.888
SPC__157015.LAB	02/01/24	11:08:23.187	0.604	0.095	0.003	0.710	8.180	7.258
SPC__157016.LAB	02/01/24	11:09:27.080	0.642	0.109	-0.000	0.751	8.145	7.634
SPC__157017.LAB	02/01/24	11:10:30.986	0.597	0.079	0.001	0.714	7.892	7.583
SPC__157018.LAB	02/01/24	11:11:34.913	0.550	0.036	0.002	0.616	7.733	7.966
SPC__157019.LAB	02/01/24	11:12:38.811	0.595	-0.002	0.000	0.675	7.514	7.890
SPC__157020.LAB	02/01/24	11:13:42.712	0.560	0.012	0.002	0.585	7.468	7.815
SPC__157021.LAB	02/01/24	11:14:46.566	0.573	-0.001	0.001	0.695	7.362	7.221
SPC__157022.LAB	02/01/24	11:15:50.567	0.534	-0.003	0.003	0.578	7.464	6.821
SPC__157023.LAB	02/01/24	11:16:54.367	0.520	0.001	0.004	0.646	7.647	6.668
SPC__157024.LAB	02/01/24	11:17:58.591	0.508	0.080	0.006	0.761	7.734	6.045
SPC__157025.LAB	02/01/24	11:19:02.225	0.562	0.056	0.001	0.687	8.034	7.027
SPC__157026.LAB	02/01/24	11:20:06.389	0.592	0.068	0.002	0.612	8.294	7.215
SPC__157027.LAB	02/01/24	11:21:09.984	0.614	0.059	0.003	0.697	8.323	7.046
SPC__157028.LAB	02/01/24	11:22:13.880	0.544	0.101	0.001	0.645	8.422	7.594
SPC__157029.LAB	02/01/24	11:23:17.781	0.542	0.099	0.003	0.691	8.437	7.752
SPC__157030.LAB	02/01/24	11:24:21.768	0.619	0.064	0.003	0.662	8.221	7.708
SPC__157031.LAB	02/01/24	11:25:25.570	0.559	-0.003	0.002	0.673	7.682	7.498
SPC__157032.LAB	02/01/24	11:26:29.436	0.631	-0.005	0.001	0.584	7.032	6.875
Dryers On Run 1	**Averages**	**(actual)**	**0.622**	**0.034**	**0.003**	**0.700**	**7.579**	**7.238**
Oxygen	**16.6%**	**(ppm,dry @7% O2)**	**2.009**	**0.110**	**0.009**	**2.262**	**7.0**	**M26A Moisture**
DSCFM	**539,100**	**(lbs/hr)**	**1.410**	**0.061**	**0.033**	**1.648**		
Clinker (mtons/hr)	**147.8**	**(lbs/ton clinker)**	**0.009**	**0.0004**				

Holcim; Theodore AL
Kiln Main Stack; Dryers On
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__157060.LAB	02/01/24	11:56:44.521	0.351		0.003	0.003	0.733	7.175	8.142
SPC__157061.LAB	02/01/24	11:57:48.378	0.567		-0.006	0.003	0.659	7.322	8.143
SPC__157062.LAB	02/01/24	11:58:52.319	0.514		0.003	0.001	0.632	7.198	7.517
SPC__157063.LAB	02/01/24	11:59:56.275	0.571		-0.012	0.003	0.664	7.154	7.158
SPC__157064.LAB	02/01/24	12:01:00.127	0.519		-0.010	0.002	0.591	7.163	6.618
SPC__157065.LAB	02/01/24	12:02:03.971	0.709		0.022	0.006	0.614	7.190	6.375
SPC__157066.LAB	02/01/24	12:03:07.989	0.442		0.025	-0.000	0.596	7.435	7.130
SPC__157067.LAB	02/01/24	12:04:11.757	0.384		0.004	0.003	0.634	7.315	7.549
SPC__157068.LAB	02/01/24	12:05:15.660	1.043		-0.004	-0.002	0.558	6.719	7.988
SPC__157069.LAB	02/01/24	12:06:19.556	0.769		-0.001	0.002	0.595	6.334	7.624
SPC__157070.LAB	02/01/24	12:07:23.782	0.613		-0.024	-0.001	0.528	5.541	6.971
SPC__157071.LAB	02/01/24	12:08:27.587	0.950		-0.032	0.000	0.528	5.050	6.046
SPC__157072.LAB	02/01/24	12:09:31.239	1.039		0.047	0.001	0.643	5.546	5.854
SPC__157073.LAB	02/01/24	12:10:35.166	0.924		0.036	0.003	0.605	5.350	6.203
SPC__157074.LAB	02/01/24	12:11:39.374	0.819		0.030	0.002	0.629	5.355	6.940
SPC__157075.LAB	02/01/24	12:12:42.968	0.885		-0.026	-0.002	0.671	5.534	8.122
SPC__157076.LAB	02/01/24	12:13:47.162	0.759		-0.025	-0.001	0.606	5.687	8.115
SPC__157077.LAB	02/01/24	12:14:50.727	0.992		-0.029	0.001	0.609	5.878	7.602
SPC__157078.LAB	02/01/24	12:15:54.621	1.222		-0.026	0.002	0.549	6.005	6.996
SPC__157079.LAB	02/01/24	12:16:58.514	0.947		-0.024	0.002	0.578	5.921	6.358
SPC__157080.LAB	02/01/24	12:18:02.418	0.667		0.029	0.004	0.626	5.771	5.645
SPC__157081.LAB	02/01/24	12:19:06.312	0.670		0.020	0.003	0.703	5.756	5.856
SPC__157082.LAB	02/01/24	12:20:10.265	0.641		0.023	0.002	0.589	5.758	6.370
SPC__157083.LAB	02/01/24	12:21:14.109	0.615		0.030	0.003	0.634	5.815	6.811
SPC__157084.LAB	02/01/24	12:22:18.092	0.685		-0.040	-0.001	0.920	6.085	8.140
SPC__157085.LAB	02/01/24	12:23:21.897	0.944		-0.001	-0.000	0.646	6.080	8.243
SPC__157086.LAB	02/01/24	12:24:25.804	0.770		-0.003	-0.001	0.635	6.190	8.278
SPC__157087.LAB	02/01/24	12:25:29.728	0.976		-0.023	0.000	0.687	6.128	7.929
SPC__157088.LAB	02/01/24	12:26:33.586	0.898		-0.021	-0.003	0.601	5.887	6.987
SPC__157089.LAB	02/01/24	12:27:37.489	0.999		-0.010	0.002	0.572	5.859	6.524
SPC__157090.LAB	02/01/24	12:28:41.489	0.709		0.034	-0.001	0.638	5.869	6.301
SPC__157091.LAB	02/01/24	12:29:45.277	1.089		0.026	-0.001	0.676	5.983	6.615
SPC__157092.LAB	02/01/24	12:30:49.180	0.742		-0.012	0.002	0.773	6.109	7.646
SPC__157093.LAB	02/01/24	12:31:53.403	0.948		-0.026	-0.002	0.659	6.197	8.430
SPC__157094.LAB	02/01/24	12:32:56.967	1.073		-0.032	-0.003	0.738	6.341	8.642
SPC__157095.LAB	02/01/24	12:34:00.869	0.668		-0.027	-0.003	0.614	6.411	8.417
SPC__157096.LAB	02/01/24	12:35:04.759	0.424		-0.028	-0.001	0.591	6.125	7.211
SPC__157097.LAB	02/01/24	12:36:08.658	0.722		-0.011	0.001	0.606	6.077	6.671
SPC__157098.LAB	02/01/24	12:37:12.561	0.612		0.059	0.004	0.599	6.158	6.186
SPC__157099.LAB	02/01/24	12:38:16.490	0.932		-0.002	0.002	0.638	6.144	5.905
SPC__157100.LAB	02/01/24	12:39:20.387	0.919		-0.017	0.005	0.745	6.277	6.077
SPC__157101.LAB	02/01/24	12:40:24.248	0.736		-0.016	0.004	0.808	6.484	6.461
SPC__157102.LAB	02/01/24	12:41:28.247	0.906		0.041	-0.001	0.652	6.499	7.500
SPC__157103.LAB	02/01/24	12:42:32.036	0.824		-0.034	-0.000	0.700	6.517	7.659
SPC__157104.LAB	02/01/24	12:43:36.041	0.759		-0.018	0.000	0.701	6.628	8.018
SPC__157105.LAB	02/01/24	12:44:39.929	0.783		-0.028	-0.003	0.641	6.639	8.000
SPC__157106.LAB	02/01/24	12:45:44.063	0.647		-0.019	-0.000	0.711	6.680	7.808
SPC__157107.LAB	02/01/24	12:46:47.965	0.676		-0.015	0.004	0.724	6.677	7.636
SPC__157108.LAB	02/01/24	12:47:51.564	0.414		-0.015	0.001	0.588	6.645	7.760
SPC__157109.LAB	02/01/24	12:48:55.462	0.582		-0.025	0.000	0.643	6.777	8.044
SPC__157110.LAB	02/01/24	12:49:59.401	0.440		-0.019	0.000	0.726	6.877	8.201
SPC__157111.LAB	02/01/24	12:51:03.553	0.837		0.033	-0.001	0.619	6.878	8.158
SPC__157112.LAB	02/01/24	12:52:07.115	0.857		-0.013	-0.003	0.667	6.989	8.186
SPC__157113.LAB	02/01/24	12:53:11.097	0.499		-0.018	0.002	0.662	6.693	6.981
SPC__157114.LAB	02/01/24	12:54:14.949	0.649		-0.037	0.005	0.722	6.540	6.003
SPC__157115.LAB	02/01/24	12:55:18.845	0.920		-0.036	0.003	0.744	6.534	6.184
SPC__157116.LAB	02/01/24	12:56:22.747	0.505		-0.010	0.003	0.714	6.512	6.220
Dryers On Run 2	**Averages**	**(actual)**	**0.750**	**<**	**0.032**	**0.001**	**0.651**	**6.324**	**7.213**
Oxygen	**16.7%**	**(ppm,dry @7% O2)**	**2.651**	**<**	**0.113**	**0.003**	**2.302**	**6.4**	**M26A Moisture**
DSCFM	**539,200**	**(lbs/hr)**	**1.817**	**<**	**0.057**	**0.012**	**1.638**		
Clinker (mtons/hr)	**147.7**	**(lbs/ton clinker)**	**0.011**	**<**	**0.0004**				

Holcim; Theodore AL
Kiln Main Stack; Dryers On
Run 3

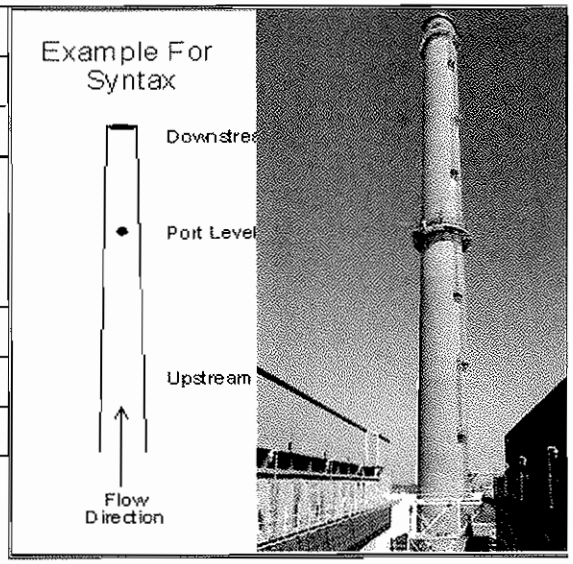
Spectrum	Date	Time	HCN (200) PCA 191C 191c		HF ppm (10) 191C	SF6 (10) 191C	Ethylene (100,3000) 191C	H2O% (40) 191C	CO2% (40) 191C span
SPC__157136.LAB	02/01/24	13:19:02.022	0.680		0.044	-0.001	0.686	6.662	6.926
SPC__157137.LAB	02/01/24	13:20:06.238	0.757		0.004	0.000	0.632	6.824	7.565
SPC__157138.LAB	02/01/24	13:21:09.776	0.610		0.003	-0.002	0.692	6.888	8.006
SPC__157139.LAB	02/01/24	13:22:13.759	0.342		-0.038	-0.003	0.721	6.898	8.438
SPC__157140.LAB	02/01/24	13:23:17.899	1.095		-0.033	-0.007	1.495	7.019	9.084
SPC__157141.LAB	02/01/24	13:24:21.569	0.934		0.014	-0.003	1.541	6.967	8.930
SPC__157142.LAB	02/01/24	13:25:25.362	1.016		-0.036	0.000	0.680	6.673	7.521
SPC__157143.LAB	02/01/24	13:26:29.367	1.045		-0.004	-0.002	0.666	6.547	6.466
SPC__157144.LAB	02/01/24	13:27:33.337	0.784		-0.022	0.002	0.537	6.593	6.361
SPC__157145.LAB	02/01/24	13:28:37.053	0.542		-0.043	0.002	0.642	6.644	6.501
SPC__157146.LAB	02/01/24	13:29:40.952	0.411		-0.027	0.000	0.637	6.693	7.075
SPC__157147.LAB	02/01/24	13:30:44.844	0.695		-0.004	0.003	0.643	6.712	7.355
SPC__157148.LAB	02/01/24	13:31:48.740	0.668		0.006	0.001	0.648	6.766	7.608
SPC__157149.LAB	02/01/24	13:32:52.743	0.665		0.002	-0.004	0.606	6.860	8.157
SPC__157150.LAB	02/01/24	13:33:56.532	0.480		-0.034	-0.002	0.620	6.988	8.351
SPC__157151.LAB	02/01/24	13:35:00.612	0.642		0.017	-0.000	0.683	7.030	8.128
SPC__157152.LAB	02/01/24	13:36:04.360	0.825		-0.057	0.001	0.553	6.925	7.564
SPC__157153.LAB	02/01/24	13:37:08.262	0.533		-0.003	-0.000	0.599	6.800	6.413
SPC__157154.LAB	02/01/24	13:38:12.158	0.235		-0.037	0.003	0.640	6.820	6.293
SPC__157155.LAB	02/01/24	13:39:16.375	0.714		-0.015	0.004	0.575	6.800	6.401
SPC__157156.LAB	02/01/24	13:40:20.274	0.439		0.039	0.001	0.694	6.985	7.174
SPC__157157.LAB	02/01/24	13:41:23.895	0.382		-0.045	-0.000	0.571	7.052	7.261
SPC__157158.LAB	02/01/24	13:42:27.888	0.485		-0.011	0.002	0.605	7.030	7.309
SPC__157159.LAB	02/01/24	13:43:31.596	0.506		0.021	0.002	0.607	7.108	7.748
SPC__157160.LAB	02/01/24	13:44:35.489	0.393		-0.012	0.001	0.672	7.130	7.857
SPC__157161.LAB	02/01/24	13:45:39.390	0.819		-0.016	-0.000	0.671	7.094	7.797
SPC__157162.LAB	02/01/24	13:46:43.283	0.416		-0.016	0.000	0.618	7.174	7.645
SPC__157163.LAB	02/01/24	13:47:47.181	0.671		-0.015	-0.001	0.614	7.164	7.463
SPC__157164.LAB	02/01/24	13:48:51.264	0.515		-0.034	0.001	0.605	7.054	6.956
SPC__157165.LAB	02/01/24	13:49:55.155	0.290		0.004	0.003	0.648	7.032	6.837
SPC__157166.LAB	02/01/24	13:50:58.975	0.424		-0.033	0.000	0.642	6.999	7.228
SPC__157167.LAB	02/01/24	13:52:02.768	0.862		-0.047	0.001	0.616	6.909	7.597
SPC__157168.LAB	02/01/24	13:53:06.968	0.413		-0.017	-0.002	0.726	6.877	7.677
SPC__157169.LAB	02/01/24	13:54:10.663	0.651		0.010	0.001	0.684	6.836	7.895
SPC__157170.LAB	02/01/24	13:55:14.457	0.802		-0.007	-0.001	0.820	6.922	8.141
SPC__157171.LAB	02/01/24	13:56:18.349	0.610		-0.049	-0.000	0.686	6.981	7.880
SPC__157172.LAB	02/01/24	13:57:22.244	0.565		-0.026	0.001	0.544	6.808	7.034
SPC__157173.LAB	02/01/24	13:58:26.146	0.660		0.007	0.004	0.711	6.711	6.325
SPC__157174.LAB	02/01/24	13:59:30.289	0.446		-0.018	0.002	0.644	6.826	6.859
SPC__157175.LAB	02/01/24	14:00:33.935	0.350		-0.055	-0.003	0.675	6.840	6.925
SPC__157176.LAB	02/01/24	14:01:37.836	0.539		-0.027	0.000	0.655	6.926	7.202
SPC__157177.LAB	02/01/24	14:02:41.727	0.891		-0.021	0.001	0.597	7.071	7.581
SPC__157178.LAB	02/01/24	14:03:45.663	0.797		-0.027	-0.000	0.661	7.225	7.937
SPC__157179.LAB	02/01/24	14:04:49.555	0.955		-0.039	0.001	0.794	7.319	8.160
SPC__157180.LAB	02/01/24	14:05:53.456	0.554		-0.035	-0.001	0.834	7.313	8.246
SPC__157181.LAB	02/01/24	14:06:57.396	0.689		-0.029	0.001	0.659	7.099	6.987
SPC__157182.LAB	02/01/24	14:08:01.242	0.689		-0.022	0.001	0.644	7.075	6.444
SPC__157183.LAB	02/01/24	14:09:05.103	0.562		-0.009	0.006	0.671	7.089	6.343
SPC__157184.LAB	02/01/24	14:10:08.999	0.619		-0.024	0.004	0.881	7.226	6.515
SPC__157185.LAB	02/01/24	14:11:12.901	0.826		-0.016	0.002	0.607	7.318	7.155
SPC__157186.LAB	02/01/24	14:12:17.124	0.643		-0.014	0.001	0.667	7.403	7.569
SPC__157187.LAB	02/01/24	14:13:20.797	0.585		-0.037	0.002	0.689	7.494	7.783
SPC__157188.LAB	02/01/24	14:14:24.585	0.368		-0.026	0.001	0.637	7.436	7.448
SPC__157189.LAB	02/01/24	14:15:28.475	0.495		-0.024	-0.002	0.736	7.330	7.050
SPC__157190.LAB	02/01/24	14:16:32.372	0.846		-0.055	-0.001	0.614	7.403	7.337
SPC__157191.LAB	02/01/24	14:17:36.275	0.204		-0.072	0.004	0.672	7.422	7.107
Dryers On Run 3	**Averages**	**(actual)**	**0.619**	**<**	**0.032**	**0.000**	**0.689**	**6.996**	**7.386**
Oxygen	**16.4%**	**(ppm,dry @7% O2)**	**2.058**	**<**	**0.106**	**0.001**	**2.291**	**7.2**	**M26A Moisture**
DSCFM	**536,700**	**(lbs/hr)**	**1.504**	**<**	**0.058**	**0.006**	**1.739**		
Clinker (mtons/hr)	**147.9**	**(lbs/ton clinker)**	**0.009**	**<**	**0.0004**				

Appendix B

Field Data
and
CEM/FTIR Data

EPA Method 1
Traverse Point Location for Circular Ducts

Plant	Holcim (US) Theodore
City	Theodore
State	Alabama
Location	Main Kiln
Stack ID (inches)	204
Nipple Length	57
Nearest Upstream Disturbance (Bend, ID FAN, etc)	
Distance (inches)	1680
Type of Disturbance	Duct Breaching
Nearest Downstream Disturbance (Bend, or Stack Outlet)	
Distance (inches)	1380
Type of Disturbance	Stack Outlet
Sampler	ENA
Date	07/22/02



Stack Schematic (Draw by hand after printing)

(Mark with an "x")

Particulate Traverse? [x] Yes [ ] No

Number of Traverse Points Required: 6

Traverse Point Number	Fraction of Stack Internal Diam.	Stack ID (Inches)	Diameter Frac. x Stack ID	Nipple Length (Inches)	Traverse Point Distance from outside Nipple
1	0.044	204	8.98	57	66 in.
2	0.146	204	29.78	57	86 3/4 in.
3	0.296	204	60.38	57	117 3/8 in.
4	0.704	204	143.62	57	200 5/8 in.
5	0.854	204	174.22	57	231 1/4 in.
6	0.956	204	195.02	57	252 in.

Cyclonic Flow Check Data Sheet

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim Theodore AL	2/1/24	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
MP/JR	29.56	-0.80	40	204	0.84	M515	NA	NA		1013

EPA Method 2 Data

Run Time (24 hr)	Traverse Port	Point ID	Pitot Delta P READING " H2O	STACK TEMP deg F	Absolute Angle at null (0) Delta P READING " H2O
	A	1	0.9	240	11
		2	0.8	230	8
		3	0.6	230	5
	B	1	0.9	232	9
		2	0.7	231	13
		3	0.6	231	2
	C	1	1.0	230	5
		2	0.8	230	4
		3	0.6	231	0
	D	1	1.0	232	13
		2	0.8	233	10
		3	0.6	237	6
Pitot Leak Check			leg		
Averages					

Average of Absolute Angle Readings must be < 20 degrees

METHOD 26A FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Theodore, AL	2/1/24	Theodore main stack	Method 26A	- ON OFF -M26A- 1 A

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESSURE (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
J. Rothenberg	29.86	-0.80	40	NA	2004	0.84	10' effective glass	.277 .278 .278	.278

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
7	15.25	1.95	0.967	10B	10B	CEM	.001 CU. FT @ 10 "Hg	.001 CU. FT @ 10 "Hg	16	7	~~4.0~~

PITOT LEAK CHECK ----> ☒ PASSED ☐ FAILED

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN)	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)	DGM IN / OUT TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	Sil Gel EXIT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	1026 0	1026	88.401	~~1.90~~	~~4.3~~ 3.6	254	~~219~~ 260	46	257	50	~~7~~ 6
2	5		93.54	.79	3.2	257	229	50	255	56	6
3	10		98.32	.55	2.2	256	232	53	255	57	6 5
	15	1041	102.420	End of Port							

INTRA-PORT LEAK CHECK? INITIAL ✓ LEAK RATE: ✓ CU.FT @ ✓ INCHES Hg
DGM VOLUME (CU. FT) FINAL ✓ ✓ CU.FT @ ✓ INCHES Hg

B-1	15	1044	102.420	.92	3.7	256	232	54	256	60	6
2	20		107.41	.73	2.9	256	231	54	256	61	6
3	25		111.93	.60	2.4	255	231	55	255	62	5
	30	1059	116.065	End of Port							

INTRA-PORT LEAK CHECK? INITIAL ✓ LEAK RATE: ✓ CU.FT @ ✓ INCHES Hg
DGM VOLUME (CU. FT) FINAL ✓ ✓ CU.FT @ ✓ INCHES Hg

C-1	30	1102	116.065	.95	3.8	247	230	~~60~~ 60	255	64	6
2	35		121.21	.77	3.1	253	231	~~61~~ 61	255	63	5
3	40		125.86	.56	2.2	253	233	~~62~~ 62	257	63	5
	45	1117	129.942	End of Port							

INTRA-PORT LEAK CHECK? INITIAL ✓ LEAK RATE: ✓ CU.FT @ ✓ INCHES Hg
DGM VOLUME (CU. FT) FINAL ✓ ✓ CU.FT @ ✓ INCHES Hg

D-1	45	1120	129.942	1.0	4.0	255	237	64	253	64	6
2	50		135.42	.77	3.1	254	238	65	250	64	6
3	55		140.73	.60	2.4	255	238	65	254	65	5
	60	1135	144.292	End of Port							

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
60 Min.					

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Theodore AL
Sample Location main stack
Run No. TD -M26A- 1A
Filter Number(s) Not Applicable

Sample Date 2/1/24
Recovery Date 2/1/24
Recovered by GCS

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight		763.6	786.2	687.1	765.8	778.7	975.3	g
Initial weight		747.6	756.5	670.9	757.3	776.4	962.8	g
Net weight		16.0	29.7	16.2	8.5	2.3	12.5	g

Description of impinger water Clear
20 % spent
B/W Sil gel color
Total moisture = 85.2 grams

RECOVERED SAMPLE

FV

H_2SO_4 Impingers and knockout contents and water rinse container no. TD -M26A-H2SO4- 1A
Liquid level marked/sealed V 440.3

NaOH Impingers contents and water rinse container no. TD -M26A-NaOH 1B
Liquid level marked/sealed V 353.0

Samples stored and locked
Remarks

METHOD 26A FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Theodore, AL	2/01/24	Main Stack	Method 26A	- ON OFF -M26A- 1B

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESSURE (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
M. Powell	29.86	-.80	40	NA	204	0.84	10' effective/S/q SS	.378 .378 .379	.378 in

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	Ø2 CONTENT %	CO2 CONTENT %	K FACTOR
7	M5-22	1.72	1.014	10E	10E	CEM	0.001 CU. FT @ 10 "Hg	0.00 CU. FT @ 5 "Hg	16	7	~~2.44~~ 3.6 MTP

PITOT LEAK CHECK ----> ☒ PASSED ☐ FAILED

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN)	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)	DGM IN / OUT TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	Sil Gel EXIT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	1026	586.781	.94	3.4	255	220	55	252	42	4
2	5		592.12	.85	3.1	252	240	62	255	44	4
3	10		597.29	.58	2.1	251	262	66	255	44	3
	15	1041	601.145	End of Port							

INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT) INITIAL ___/___ FINAL ___/___ LEAK RATE: ___/___ CU.FT @ ___/___ INCHES Hg MTD ___/___ CU.FT @ ___/___ INCHES Hg

B-1	15	1044	601.145	.89	3.4 3.2	253	237	65	254	43	4
2	20		606.06	.83	3.1	250	238	67	252	42	4
3	25		610.32	.61	2.2	251	238	69	251	41	3
	30	1054	614.881	End of Port							

INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT) INITIAL ___/___ FINAL ___/___ LEAK RATE ___/___ CU.FT @ ___/___ INCHES Hg ___/___ CU.FT @ ___/___ INCHES Hg

C-1	30	1102	614.881	.94	3.4	255	230	69	252	40	4
2	35		620.02	.83	3.0	256	231	73	253	40	4
3	40		624.71	.59	2.1	254	239	75	254	41	3
	45	1117	628.872	End of Port							

INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT) INITIAL ___/___ FINAL ___/___ LEAK RATE: ___/___ CU.FT @ ___/___ INCHES Hg ___/___ CU.FT @ ___/___ INCHES Hg

D-1	45	1120	628.872	.93	3.3	254	238	75	255	42	4
2	50		633.84	.84	3.0	252	237	76	251	44	4
3	55		638.77	.58	2.1	252	230	77	252	45	3
	60	1135	642.771	End of Port							

TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H		AVE. TEMP.	AVE. TEMP.
60 Min.							

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Theodore AL
Sample Location Main Stack
Run No. TD -M26A- 1B
Filter Number(s) Not Applicable

Sample Date 2/1/24
Recovery Date 2/1/24
Recovered by SC

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight		773.2	778.6	683.4	772.6	751.6	971.7	g
Initial weight		757.3	743.7	617.2	764.4	749.5	953.1	g
Net weight		15.9	34.9	16.2	8.2	2.1	18.6	g

Description of impinger water Clear
30 % spent
B/W Sil gel color
Total moisture = 95.9 grams

RECOVERED SAMPLE

H_2SO_4 Impingers and knockout contents and water rinse
container no. TD -M26A-H2SO4- 1B
Liquid level marked/sealed ✓ 465.3

NaOH Impingers contents and water rinse
container no. TD -M26A-NaOH 1B
Liquid level marked/sealed ✓ 367.2

Samples stored and locked
Remarks

METHOD 26A FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim;	2/1/24		Method 26A	- ON OFF -M26A- 2A

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESSURE (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
J. Rothenberg	29.86	-0.80	50	VF	20 4	0.84	10' glass	.277 .278 .278	.278

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
7	M5-25	1.95	0.967	10AB	10B	CEM	.001 CU. FT @ 10 "Hg	.001 CU. FT @ 10 "Hg	16	7	4.0 / 4.6

PITOT LEAK CHECK ----> [] PASSED [] FAILED

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN)	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)	DGM IN / OUT TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	Sil Gel EXIT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	1156	144.525	.95	3.8	254	260	66	258	64	6
2	5		149.59	.77	3.1	255	257	67	258	62	5
3	10		154.11	.53	2.1	254	256	67	259	61	5
	15	1211	159.050	End of Port							

INTRA-PORT LEAK CHECK?
DGM VOLUME (CU. FT) INITIAL _____ FINAL _____ LEAK RATE: _____ CU.FT @ _____ INCHES Hg _____ CU.FT @ _____ INCHES Hg

B-1	15	1214	159.050	.95	3.8	255	267	69	259	64	6
2	20		163.45	.81	3.2	255	271	70	256	63	5
3	25		168.03	.60	2.8	255	270	72	256	63	5
	30	1229	172.310	End of Port							

* change K factor to 4.6

INTRA-PORT LEAK CHECK?
DGM VOLUME (CU. FT) INITIAL _____ FINAL _____ LEAK RATE: _____ CU.FT @ _____ INCHES Hg _____ CU.FT @ _____ INCHES Hg

C-1	30	1232	172.310	1.0	4.6	257	262	70	253	64	8
2	35		178.30	.75	3.5	257	~~262~~ 263	69	253	62	6
3	40		183.25	.55	2.5	256	263	69	253	60	5
	45	1247	187.655	End of Port							

INTRA-PORT LEAK CHECK?
DGM VOLUME (CU. FT) INITIAL _____ FINAL _____ LEAK RATE: _____ CU.FT @ _____ INCHES Hg _____ CU.FT @ _____ INCHES Hg

D-1	45	1250	187.655	1.0	4.6	255	261	70	257	62	8
2	50		193.17	.82	3.8	256	263	70	257	60	6
3	55		198.72	.63	2.9	256	263	69	256	59	6
	60	1305	203.135	End of Port							

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
60 Min.					

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant Holcim Theodore AL
Sample Location Main Stack
Run No. TD -M26A- 2A
Filter Number(s) Not Applicable

Sample Date 2/1/24
Recovery Date 2/1/24
Recovered by SCS

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight		786.1	779.5	671.2	770.7	742.7	978.4	g
Initial weight		765.0	755.4	661.2	764.1	740.9	960.7	g
Net weight		21.1	24.4	10.0	6.6	1.8	17.7	g

Description of impinger water Clear

30 % spent
B/U Sil gel color

Total moisture = 81.6 grams

RECOVERED SAMPLE

H_2SO_4 Impingers and knockout contents and water rinse
container no. TD -M26A-H2SO4- 2A

Liquid level marked/sealed ✓

NaOH Impingers contents and water rinse
container no. TD -M26A-NaOH 2A

Liquid level marked/sealed ✓

Samples stored and locked _____
Remarks _____

METHOD 26A FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim; Theodore AL	2/21/24	Main Stack	Method 26A	- ON OFF -M26A- 2B

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESSURE (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
M. Powell	29.84	-0.80	50	NA	204	0.84	10' effective/glass	.278 .278 .279	.278

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
4	MS-22	1.72	1.014	10E	10E	CEM	0.001 CU. FT @ 10 "Hg	0.001 CU. FT @ 7 "Hg	16	7	3.6

PITOT LEAK CHECK ----> [X] PASSED [ ] FAILED

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN)	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)	DGM IN / OUT TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	Sil Gel EXIT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	1156	642.926	.96	3.5	252	254	75	250	48	6
2	5		647.88	.87	3.1	251	260	76	251	49	6
3	10		552.91	.59	2.1	255	262	77	252	50	4
	15	1211	656.987	End of Port							
INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT)			INITIAL / FINAL	LEAK RATE: / CU.FT @ / INCHES Hg / CU.FT @ / INCHES Hg							
B-1	15	1214	656.987	.95	3.4	252	264	76	253	50	6
2	20		662.02	.88	3.2	255	263	77	251	50	6
3	25		667.03	.58	2.0	254	270	78	250	47	4
	30	1229	671.642	End of Port							
INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT)			INITIAL / FINAL	LEAK RATE: / CU.FT @ / INCHES Hg / CU.FT @ / INCHES Hg							
C-1	30	1232	671.642	.95	3.4	254	266	78	252	46	6
2	35		677.33	.88	3.2	252	262	79	254	46	6
3	40		682.99	.59	2.1	250	263	80	251	46	4
	45	1247	687.492	End of Port							
INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT)			INITIAL / FINAL	LEAK RATE: / CU.FT @ / INCHES Hg / CU.FT @ / INCHES Hg							
D-1	45	1250	687.492	.94	3.4	248	260	81	250	47	6
2	50		693.36	.89	3.2	251	262	82	253	48	6
3	55		698.53	.60	2.0	251	263	83	250	50	4
	60	1305	703.016	End of Port							

TOTAL TIME		DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
60 Min.						

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant **Holcim; Theodore AL** Sample Date 2/1/24
Sample Location Main Stack Recovery Date 2/1/24
Run No. TD -M26A- 2B Recovered by SC
Filter Number(s) Not Applicable

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight		767.5	800.4	606.4	779.1	772.4	944.7	g
Initial weight		749.5	770.3	599.3	771.5	769.3	923.1	g
Net weight		18.0	30.1	7.1	7.6	3.1	21.6	g

Description of impinger water clear 30 % spent
BW Sil gel color
Total moisture = 87.5 grams

RECOVERED SAMPLE

H_2SO_4 Impingers and knockout contents and water rinse
container no. TD -M26A-H2SO4- 2B Liquid level marked/sealed ✓

NaOH Impingers contents and water rinse
container no. TD -M26A-NaOH- 2B Liquid level marked/sealed ✓

Samples stored and locked
Remarks

METHOD 26A FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim;	2 / 1 /24		Method 26A	- ON OFF -M26A-5 A

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESSURE (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
JSR	29.98	-0.26	50	10A	204	0.84	10' glass	.277 .278 .278	.278

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
1	MS25	1.95	0.967	10B	10B	CEM	.001 CU. FT @ 10 "Hg	.001 CU. FT @ 12 "Hg	16	7	4.6

PITOT LEAK CHECK ----> [X] PASSED [ ] FAILED

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN)	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)	DGM IN / OUT TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	Sil Gel EXIT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	1318	203.358	.97	4.5	255	260	67	258	63	10
2	5		208.88	.80	3.7	257	257	67	260	61	8
3	10		214.11	.62	3.0	256	259	68	259	60	7
	15	1333	218.828	End of Port							
INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT)		INITIAL / FINAL		LEAK RATE: / CU.FT @ / INCHES Hg / CU.FT @ / INCHES Hg							
B-1	15	1336	218.828	.93	4.3	256	263	67	257	65	10
2	20		224.13	.76	3.5	255	265	66	257	65	8
3	25		229.33	.55	2.5	256	265	66	256	63	7
	30	1351	233.656	End of Port							
INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT)		INITIAL / FINAL		LEAK RATE: / CU.FT @ / INCHES Hg / CU.FT @ / INCHES Hg							
C-1	30	1354	233.656	.97	4.5	255	259	68	257	64	10
2	35		239.41	.79	3.6	255	260	68	256	64	8
3	40		244.21	.65	3.0	254	260	69	256	63	8
	45	1409	248.979	End of Port							
INTRA-PORT LEAK CHECK? DGM VOLUME (CU. FT)		INITIAL / FINAL		LEAK RATE: / CU.FT @ / INCHES Hg / CU.FT @ / INCHES Hg							
D-1	45	1402	248.979	.96	4.4	255	249	69	256	64	10
2	50		254.42	.83	3.8	256	250	69	258	62	9
3	55		260.01	.61	2.8	256	255	69	257	62	8
	60	~~1427~~ 1427	264.935	End of Port							

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
60 Min.					

✓

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant **Holcim; Theodore AL** Sample Date 2/ 1 /24
Sample Location Main Stack Recovery Date 2/ 1 /24
Run No. TD -M26A- 3A Recovered by SG
Filter Number(s) Not Applicable

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight	X	795.4	804.1	616.4	766.5	746.2	921.7	g
Initial weight		761.0	775.8	611.8	757.1	742.9	904.7	g
Net weight		34.4	28.3	4.6	9.4	3.3	17.0	g

Description of impinger water Clear 90 % spent
B/W Sil gel color
Total moisture = 97.0 grams

RECOVERED SAMPLE

H_2SO_4 Impingers and knockout contents and water rinse
container no. **TD -M26A-H2SO4-** 3A
Liquid level marked/sealed ✓ 428.4

NaOH Impingers contents and water rinse
container no. **TD -M26A-NaOH-** 3A
Liquid level marked/sealed ✓ 373.2

Samples stored and locked
Remarks

METHOD 26A FIELD DATA SHEET

PLANT AND CITY	DATE	SAMPLING LOCATION	SAMPLE TYPE	RUN NUMBER
Holcim;	2 01 24	Main Stack	Method 26A	TO- ON OFF -M26A- 3 B

OPERATOR	AMBIENT PRESS (In. Hg)	STATIC PRESSURE (in. Water)	AMBIENT TEMP (deg. F)	FILTER NUMBERS	STACK ID (In.)	PITOT Cp	PROBE LENGTH AND LINER TYPE	NOZZLE NUMBER	NOZZLE DIAMETER
M. Powell	29.86	-0.50	50	N.A	20.4	0.84	10 effective/glass	.279 .275 .279	0.278

ASSUMED MOISTURE (%)	DGM BOX No.	DGM H@	DGM CAL FACTOR (Y)	STACK THERM NO.	STACK PITOT NO.	ORSAT NO.	LEAK CHECK (INITIAL)	LEAK CHECK (FINAL)	O2 CONTENT %	CO2 CONTENT %	K FACTOR
7	MF22	1.72	1.014	10E	10E	CEM	0.001 CU. FT @ 10 "Hg	0.001 CU. FT @ 6 "Hg	16	7	4.0

PITOT LEAK CHECK ----> ☐ PASSED ☐ FAILED

TRAVERSE PORT/ /POINT NO.	ELAPSED TEST TIME (MIN)	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)	DGM IN / OUT TEMP (deg. F)	FILTER OVEN TEMP (deg. F)	Sil Gel EXIT TEMP (deg. F)	SAMPLE TRAIN VAC (in. Hg)
A-1	0	1318	703.655	.93	3.7	250	259	79	250	47	5
2	5		708.92	.58	3.5	251	260	80	252	47	5
3	10		714.37	.59	2.4	252	259	81	253	48	3
	15	1333	718.941	End of Port							

INTRA-PORT LEAK CHECK?
DGM VOLUME (CU. FT) INITIAL ___/___ FINAL ___/___ LEAK RATE: ___/___ CU.FT @ ___/___ INCHES Hg ___/___ CU.FT @ ___/___ INCHES Hg

B-1	15	1336	718.441	.95	3.8	255	262	81	253	49	5
2	20		724.75	.87	3.5	253	266	82	255	50	5
3	25		729.45	.59	2.3	260	265	83	254	51	3
	30	1351	733.679	End of Port							

INTRA-PORT LEAK CHECK?
DGM VOLUME (CU. FT) INITIAL ___/___ FINAL ___/___ LEAK RATE: ___/___ CU.FT @ ___/___ INCHES Hg ___/___ CU.FT @ ___/___ INCHES Hg

C-1	30	1354	733.679	.94	3.8	256	263	83	251	51	5
2	35		739.12	.88	3.5	252	260	83	250	50	5
3	40		744.16	.59	2.4	254	263	84	252	48	3
	45	1409	748.575	End of Port							

INTRA-PORT LEAK CHECK?
DGM VOLUME (CU. FT) INITIAL ___/___ FINAL ___/___ LEAK RATE: ___/___ CU.FT @ ___/___ INCHES Hg ___/___ CU.FT @ ___/___ INCHES Hg

D-1	45	1412	748.575	.95	3.8	253	259	83	253	47	5
2	50		752.81	.89	3.6	255	261	86	253	46	5
3	55		758.31	.59	2.4	251	261	87	259	46	3
	60	1427	763.405	End of Port							

TOTAL TIME	DGM VOLUME	AVE SQRT delta P	AVE delta H	AVE. TEMP.	AVE. TEMP.
60 Min.					

V

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant **Holcim; Theodore AL** Sample Date 2/ 1 /24
Sample Location Main Stack Recovery Date 2/ 1 /24
Run No. TD -M26A- 3B Recovered by SC
Filter Number(s) Not Applicable

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight		778.2	798.3	661.4	761.7	777.9	1022.6	g
Initial weight		755.9	766.3	648.2	755.4	775.8	1001.5	g
Net weight		22.3	32.0	13.2	6.3	2.1	21.1	g

Description of impinger water clear 35 % spent
15/40 Sil gel color
Total moisture = 97.2 grams

RECOVERED SAMPLE

H_2SO_4 Impingers and knockout contents and water rinse
container no. **TD -M26A-H2SO4-** 3B
Liquid level marked/sealed ✓ 462.3

NaOH Impingers contents and water rinse
container no. **TD -M26A-NaOH-** 3B
Liquid level marked/sealed ✓ 386.8

Samples stored and locked
Remarks

EPA METHOD 26A RECOVERY AND INTEGRITY DATA SHEET

Plant **Holcim; Theodore AL** Sample Date 12 / /24
Sample Location Main Stack Recovery Date 12 / /24
Run No. TD **-M26A-**Field Blank Recovered by SCS
Filter Number(s) Not Applicable

MOISTURE

Impingers	1 50 ml 0.1N H_2SO_4 (knockout)	2 100 ml 0.1N H_2SO_4 (tipped)	3 100 ml 0.1N H_2SO_4 (tipped)	4 Optional Knockout (untipped)	5 100 ml 0.1N NaOH (untipped)	6 100 ml 0.1N NaOH (untipped)	Silica gel (untipped)	
Final weight		736.4	745.8	666.1	744.1	755.8	975.4	g
Initial weight		736.4	749.9	666.2	744.2	755.7	975.2	g
Net weight								g

Description of impinger water clear 15 % spent
B/U Sil gel color
Total moisture = _____ grams

RECOVERED SAMPLE

H_2SO_4 Impingers and knockout contents and water rinse
container no. **TD** **-M26A-H2SO4-** FB
Liquid level marked/sealed ✓

NaOH Impingers contents and water rinse
container no. **TD** **-M26A-NaOH-** FB
Liquid level marked/sealed ✓

Samples stored and locked _____
Remarks From Train 1A

Client: Holcim Theodore AL
Test Location: Kiln Main Stack
Date: Feb 01 24 Start Time: 10:26:30
Run number 1
One Minute Averages

	O2 %,dry	CO2 %,dry
10:27:28 AM	17.0	6.6
10:28:28 AM	17.1	6.3
10:29:28 AM	17.0	6.4
10:30:28 AM	17.1	6.3
10:31:28 AM	17.1	6.5
10:32:28 AM	16.7	7.4
10:33:28 AM	16.5	7.7
10:34:28 AM	16.0	8.4
10:35:28 AM	16.1	8.1
10:36:28 AM	16.6	7.3
10:37:28 AM	17.0	6.8
10:38:28 AM	17.0	6.6
10:39:28 AM	16.8	6.9
10:40:28 AM	16.6	7.3
10:41:28 AM	16.2	8.1
10:42:28 AM	16.1	8.1
10:43:28 AM	16.2	7.9
10:44:28 AM	16.3	7.7
10:45:28 AM	16.7	7.0
10:46:28 AM	17.2	6.2
10:47:28 AM	17.1	6.3
10:48:28 AM	17.0	6.6
10:49:28 AM	16.8	6.9
10:50:28 AM	16.4	7.8
10:51:28 AM	16.1	8.2
10:52:28 AM	15.9	8.5
10:53:28 AM	16.2	7.9
10:54:28 AM	16.8	6.9
10:55:28 AM	17.3	6.0
10:56:28 AM	17.3	5.8
10:57:28 AM	17.3	6.0
10:58:28 AM	17.1	6.3
10:59:28 AM	16.8	7.0
11:00:28 AM	16.8	7.1
11:01:28 AM	16.7	7.5
11:02:28 AM	16.2	8.3
11:03:28 AM	16.3	8.2
11:04:28 AM	16.2	8.4
11:05:28 AM	16.4	8.1
11:06:28 AM	16.5	7.7
11:07:28 AM	16.7	7.1
11:08:28 AM	16.7	7.0
11:09:28 AM	16.4	7.6
11:10:28 AM	16.4	7.7
11:11:28 AM	16.5	7.7
11:12:28 AM	16.2	8.1
11:13:28 AM	16.3	7.9
11:14:28 AM	16.3	7.8
11:15:28 AM	16.6	7.1
11:16:28 AM	16.9	6.8
11:17:28 AM	16.9	6.7
11:18:28 AM	17.3	6.1
11:19:28 AM	16.8	6.9
11:20:28 AM	16.6	7.4
11:21:28 AM	16.9	7.0
11:22:28 AM	16.5	7.6
11:23:28 AM	16.4	7.8
11:24:28 AM	16.3	7.9
11:25:28 AM	16.3	7.7
11:26:28 AM	16.6	7.1
Run Avgs	16.6	7.3
Cal Gas	12.1	10.1
Initial Zero	0.3	0.1
Final Zero	0.5	0.2
Initial cal.	12.1	9.9
Final Cal.	12.3	10.0
Corrected Average	16.6	7.3

Client: Holcim Theodore AL
Test Location: Kiln Main Stack
Date: Feb 01 24 Start Time: 11:56:04
Run number 2
One Minute Averages

	O2 %,dry	CO2 %,dry
11:57:02 AM	16.3	8.1
11:58:02 AM	16.2	8.1
11:59:02 AM	16.4	7.8
12:00:02 PM	16.8	7.3
12:01:02 PM	17.1	6.9
12:02:02 PM	17.3	6.3
12:03:02 PM	17.1	6.6
12:04:02 PM	16.8	7.3
12:05:02 PM	16.6	7.6
12:06:02 PM	16.3	7.9
12:07:02 PM	16.6	7.5
12:08:02 PM	17.0	6.7
12:09:02 PM	17.5	5.9
12:10:02 PM	17.5	5.7
12:11:02 PM	17.4	6.0
12:12:02 PM	17.1	6.5
12:13:02 PM	16.5	7.7
12:14:02 PM	16.3	8.0
12:15:02 PM	16.5	7.7
12:16:02 PM	16.8	7.2
12:17:02 PM	17.3	6.3
12:18:02 PM	17.4	6.0
12:19:02 PM	17.6	5.5
12:20:02 PM	17.4	5.9
12:21:02 PM	17.3	6.2
12:22:02 PM	17.0	6.8
12:23:02 PM	16.3	8.2
12:24:02 PM	16.3	8.1
12:25:02 PM	16.3	8.2
12:26:02 PM	16.4	7.9
12:27:02 PM	17.1	6.9
12:28:02 PM	17.3	6.5
12:29:02 PM	17.4	6.2
12:30:02 PM	17.2	6.3
12:31:02 PM	16.7	7.3
12:32:02 PM	16.5	7.9
12:33:02 PM	16.0	8.7
12:34:02 PM	16.0	8.5
12:35:02 PM	16.4	7.9
12:36:02 PM	17.1	6.8
12:37:02 PM	17.3	6.5
12:38:02 PM	17.4	6.0
12:39:02 PM	17.5	5.9
12:40:02 PM	17.3	6.0
12:41:02 PM	17.1	6.5
12:42:02 PM	16.7	7.4
12:43:02 PM	16.6	7.6
12:44:02 PM	16.5	7.9
12:45:02 PM	16.4	8.0
12:46:02 PM	16.5	7.9
12:47:02 PM	16.7	7.6
12:48:02 PM	16.7	7.8
12:49:02 PM	16.6	7.9
12:50:02 PM	16.5	8.0
12:51:02 PM	16.1	8.4
12:52:02 PM	16.2	8.3
12:53:02 PM	16.4	7.8
12:54:02 PM	17.1	6.6
12:55:02 PM	17.3	6.0
12:56:02 PM	17.3	6.2
Run Avgs	16.8	7.2
Cal Gas	12.1	10.1
Initial Zero	0.5	0.2
Final Zero	0.6	0.2
Initial cal.	12.3	10.0
Final Cal.	12.4	10.0
Corrected Average	16.7	7.2

Client: Holcim Theodore AL
Test Location: Kiln Main Stack
Date: Feb 01 24 Start Time: 13:18:04
Run number 3
One Minute Averages

	O2 %,dry	CO2 %,dry
1:19:02 PM	16.8	6.4
1:20:02 PM	16.5	7.0
1:21:02 PM	16.3	7.5
1:22:02 PM	16.0	8.0
1:23:02 PM	15.9	8.4
1:24:02 PM	15.5	9.1
1:25:02 PM	15.6	8.8
1:26:02 PM	16.4	7.3
1:27:02 PM	16.9	6.3
1:28:02 PM	16.9	6.2
1:29:02 PM	16.8	6.3
1:30:02 PM	16.6	6.8
1:31:02 PM	16.4	7.2
1:32:02 PM	16.4	7.3
1:33:02 PM	16.2	7.8
1:34:02 PM	15.9	8.2
1:35:02 PM	15.9	8.1
1:36:02 PM	16.0	7.8
1:37:02 PM	16.3	7.1
1:38:02 PM	16.8	6.1
1:39:02 PM	16.8	6.1
1:40:02 PM	16.7	6.4
1:41:02 PM	16.4	7.0
1:42:02 PM	16.4	7.1
1:43:02 PM	16.4	7.1
1:44:02 PM	16.2	7.6
1:45:02 PM	16.1	7.7
1:46:02 PM	16.1	7.6
1:47:02 PM	16.0	7.6
1:48:02 PM	16.1	7.4
1:49:02 PM	16.3	7.1
1:50:02 PM	16.6	6.6
1:51:02 PM	16.5	6.8
1:52:02 PM	16.2	7.4
1:53:02 PM	16.2	7.3
1:54:02 PM	16.1	7.7
1:55:02 PM	16.0	7.8
1:56:02 PM	15.8	8.0
1:57:02 PM	16.0	7.6
1:58:02 PM	16.5	6.8
1:59:02 PM	16.8	6.2
2:00:02 PM	16.6	6.6
2:01:02 PM	16.6	6.7
2:02:02 PM	16.5	7.0
2:03:02 PM	16.3	7.3
2:04:02 PM	16.0	7.8
2:05:02 PM	15.9	7.9
2:06:02 PM	15.7	8.1
2:07:02 PM	16.1	7.6
2:08:02 PM	16.7	6.5
2:09:02 PM	16.9	6.2
2:10:02 PM	16.7	6.4
2:11:02 PM	16.7	6.4
2:12:02 PM	16.3	7.2
2:13:02 PM	16.1	7.5
2:14:02 PM	16.0	7.7
2:15:02 PM	16.2	7.3
2:16:02 PM	16.5	6.9
2:17:02 PM	16.4	7.2
2:18:02 PM	16.5	7.1
Run Avgs	16.3	7.2
Cal Gas	12.1	10.1
Initial Zero	0.3	0.1
Final Zero	0.3	0.1
Initial cal.	12.1	9.8
Final Cal.	12.1	9.9
Corrected Average	16.4	7.4

Holcim, Theodore AL | Kiln Main Stack | February 1, 2024 | Operator CCS

Cylinder ID	Gas Type	Value	Internal Response	Cal Error	Run No. 1 10:26-11:26 (CST) Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift	Run No. 2 11:56-12:56 Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift
	O2 Zero	Zero N2	0.0%	0.00%	0.3%	1.37%	0.5%	2.28%	0.91%	0.5%	2.28%	0.6%	2.74%	0.46%
EB0070764	O2 Mid	12.0%	12.1%	0.46%	12.1%	0.00%	12.3%	0.91%	0.91%	12.3%	0.91%	12.4%	1.37%	0.46%
ALM056015	O2 Span	21.9%	21.9%	0.00%										
	CO2 Zero	Zero N2	0.0%	0.00%	0.1%	0.55%	0.2%	1.10%	0.55%	0.2%	1.10%	0.2%	1.10%	0.00%
EB0070764	CO2 Mid	10.2%	10.1%	-0.55%	9.9%	-1.10%	10.0%	-0.55%	0.55%	10.0%	-0.55%	10.0%	-0.55%	0.00%
ALM056015	CO2 Span	18.2%	18.2%	0.17%										

Rezeroed O2/CO2 for Run 3

Holcim, Theodore AL Kiln Main Stack February 1, 2024 Operator SCS

Cylinder ID	Gas Type	Value	Internal Response	Cal Error	Run No. 3 13:18-14:18 Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift	Run No. Pre Run Bias	Percent Bias	Post Run Bias	Percent Bias	Percent Drift
	O2 Zero	Zero N2	0.0%	0.00%	0.3%	1.37%	0.3%	1.37%	0.00%					
EB0070764	O2 Mid	12.0%	12.0%	0.00%	12.1%	0.46%	12.1%	0.46%	0.00%					
ALM056015	O2 Span	21.9%	21.8%	-0.46%										
	CO2 Zero	Zero N2	0.1%	0.55%	0.1%	0.00%	0.1%	0.00%	0.00%					
EB0070764	CO2 Mid	10.2%	10.0%	-1.10%	9.8%	-1.10%	9.9%	-0.55%	0.55%					
ALM056015	CO2 Span	18.2%	18.1%	-0.39%										

Holcim
Theodore AL
Kiln Main Stack
HCN Analyte Spikes

	Date	**02/01/24**	**02/01/24**	**02/01/24**	**02/01/24**
	Time	**08:02-08:19**	**11:28--11:46**	**12:59-13:18**	**14:21-14:46**
		Pre Run 1	**Post Run 1**	**Post Run 2**	**Post Run 3**
	CC768222	**HCN**	**HCN**	**HCN**	**HCN**
Cs	Spike Direct, ppm	48.31	48.31	48.31	48.31
	SF6 Tracer Direct, ppm	4.78	4.78	4.78	4.78
SF6	Diluted SF6 Tracer, ppm	0.379	0.315	0.298	0.298
	Diluted SF6 Tracer, ppm	0.371	0.302	0.289	0.288
	Average Diluted SF6 Tracer, ppm	0.375	0.309	0.294	0.293
DF	Dilution Ratio	12.73	15.48	16.27	16.30
	Total, ppm	4.337	4.043	3.730	3.486
	Total, ppm	4.180	4.345	3.638	3.440
Ct	Average Total, ppm	4.259	4.194	3.684	3.463
	Pre Spike Native , ppm	0.569	0.603	0.956	0.631
	Pre Spike Native , ppm	0.565	0.631	0.867	0.663
	Post Spike Native , ppm	0.557	0.544	0.586	0.404
	Post Spike Native , ppm	0.554	0.689	0.596	0.479
Cn	Average Native , ppm	0.561	0.617	0.751	0.544
	Spike Recovery	**98.6%**	**115.9%**	**100.3%**	**99.6%**
	CTS Direct (CC426155)				
	Ethylene Expected (ppm)	75.47			75.48
	Ethylene Measured (ppm)	72.72			72.27
	CTS Error	**-3.6%**			**-4.3%**

Holcim; Theodore AL
Kiln Main Stack; Dryers On
Pre Run 1 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__156840.LAB	02/01/24	08:02:01.254	0.569	0.247	0.005
SPC__156841.LAB	02/01/24	08:03:05.387	0.565	0.265	0.006
SPC__156842.LAB	02/01/24	08:04:08.985	0.173	0.249	0.007
SPC__156843.LAB	02/01/24	08:05:12.888	0.467	0.282	-0.001
SPC__156844.LAB	02/01/24	08:06:16.780	0.589	0.227	0.002
SPC__156845.LAB	02/01/24	08:07:20.641	3.961	0.243	0.218
SPC__156846.LAB	02/01/24	08:08:24.549	4.337	0.212	0.379
SPC__156847.LAB	02/01/24	08:09:28.489	4.180	0.207	0.371
SPC__156848.LAB	02/01/24	08:10:32.648	6.974	0.193	0.556
SPC__156849.LAB	02/01/24	08:11:36.226	0.363	0.014	0.006
SPC__156850.LAB	02/01/24	08:12:40.117	0.155	0.025	-0.000
SPC__156851.LAB	02/01/24	08:13:44.031	-0.042	0.095	0.001
SPC__156852.LAB	02/01/24	08:14:47.935	0.326	0.225	0.004
SPC__156853.LAB	02/01/24	08:15:51.827	0.377	0.216	0.003
SPC__156854.LAB	02/01/24	08:16:55.797	0.349	0.200	0.005
SPC__156855.LAB	02/01/24	08:17:59.633	0.557	0.205	0.005
SPC__156856.LAB	02/01/24	08:19:03.525	0.554	0.202	0.004

Holcim; Theodore AL
Kiln Main Stack; Dryers On
Post Run 1 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__157031.LAB	02/01/24	11:25:25.570	0.603	-0.005	0.001
SPC__157032.LAB	02/01/24	11:26:29.436	0.631	-0.005	0.001
SPC__157033.LAB	02/01/24	11:27:33.361	0.836	-0.010	0.005
SPC__157034.LAB	02/01/24	11:28:37.300	3.307	-0.006	0.130
SPC__157035.LAB	02/01/24	11:29:41.120	4.043	0.010	0.315
SPC__157036.LAB	02/01/24	11:30:45.348	4.345	0.003	0.302
SPC__157037.LAB	02/01/24	11:31:49.196	6.433	-0.022	0.496
SPC__157038.LAB	02/01/24	11:32:53.138	1.012	-0.032	0.002
SPC__157039.LAB	02/01/24	11:33:56.811	0.687	-0.001	0.005
SPC__157040.LAB	02/01/24	11:35:00.762	-0.205	-0.004	0.001
SPC__157041.LAB	02/01/24	11:36:04.581	0.148	-0.007	0.001
SPC__157042.LAB	02/01/24	11:37:08.382	0.133	-0.026	-0.010
SPC__157043.LAB	02/01/24	11:38:12.279	-0.187	-0.032	-0.006
SPC__157044.LAB	02/01/24	11:39:16.246	-0.198	-0.025	-0.009
SPC__157045.LAB	02/01/24	11:40:20.419	0.138	-0.034	-0.006
SPC__157046.LAB	02/01/24	11:41:24.015	1.159	-0.003	0.002
SPC__157047.LAB	02/01/24	11:42:28.212	0.671	0.058	0.002
SPC__157048.LAB	02/01/24	11:43:31.808	0.824	0.034	0.005
SPC__157049.LAB	02/01/24	11:44:36.037	0.544	0.014	0.005
SPC__157050.LAB	02/01/24	11:45:39.666	0.689	0.025	0.002

Holcim; Theodore AL
Kiln Main Stack; Dryers On
Post Run 2 HCN Analyte Spike

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C
SPC__157118.LAB	02/01/24	12:58:30.496	0.956	0.018	-0.001
SPC__157119.LAB	02/01/24	12:59:34.675	0.867	-0.007	-0.003
SPC__157120.LAB	02/01/24	13:00:38.287	0.973	0.037	0.002
SPC__157121.LAB	02/01/24	13:01:42.182	2.458	0.026	0.076
SPC__157122.LAB	02/01/24	13:02:46.086	4.012	0.023	0.307
SPC__157123.LAB	02/01/24	13:03:49.976	3.730	-0.013	0.298
SPC__157124.LAB	02/01/24	13:04:54.011	3.638	-0.008	0.289
SPC__157125.LAB	02/01/24	13:05:57.777	2.016	-0.024	0.119
SPC__157126.LAB	02/01/24	13:07:01.694	3.190	0.006	0.278
SPC__157127.LAB	02/01/24	13:08:05.581	0.156	0.003	0.003
SPC__157128.LAB	02/01/24	13:09:09.483	0.009	-0.051	-0.007
SPC__157129.LAB	02/01/24	13:10:13.344	0.049	-0.002	-0.005
SPC__157130.LAB	02/01/24	13:11:17.333	1.100	-0.045	0.001
SPC__157131.LAB	02/01/24	13:12:21.479	0.821	0.024	0.003
SPC__157132.LAB	02/01/24	13:13:25.040	0.586	0.019	0.003
SPC__157135.LAB	02/01/24	13:17:58.181	0.596	0.044	0.044

Holcim; Theodore AL
Kiln Main Stack; Dryers On
Post Run 3 HCN Analyte Spike and CTS

Spectrum	Date	Time	HCN (200) PCA 191C 191c	HF ppm (10) 191C	SF6 (10) 191C	Ethylene (100,3000) 191C
SPC__157194.LAB	02/01/24	14:20:48.143	0.631	0.011	0.002	0.704
SPC__157195.LAB	02/01/24	14:21:51.852	0.663	-0.005	0.002	0.780
SPC__157196.LAB	02/01/24	14:22:55.748	0.347	-0.028	-0.004	0.790
SPC__157197.LAB	02/01/24	14:23:59.650	0.084	-0.030	0.001	0.769
SPC__157198.LAB	02/01/24	14:25:03.933	0.537	-0.020	-0.003	0.727
SPC__157199.LAB	02/01/24	14:26:07.436	2.944	-0.046	0.215	0.695
SPC__157200.LAB	02/01/24	14:27:11.338	3.486	-0.032	0.298	0.530
SPC__157201.LAB	02/01/24	14:28:15.228	3.440	-0.054	0.288	0.620
SPC__157202.LAB	02/01/24	14:29:19.292	6.269	-0.033	0.509	0.566
SPC__157203.LAB	02/01/24	14:30:23.014	0.253	0.023	0.003	0.052
SPC__157204.LAB	02/01/24	14:31:26.904	-0.017	0.012	0.004	0.041
SPC__157205.LAB	02/01/24	14:32:30.806	-0.091	-0.018	-0.009	0.097
SPC__157206.LAB	02/01/24	14:33:34.706	-0.139	-0.054	-0.008	0.142
SPC__157207.LAB	02/01/24	14:34:38.603	0.676	-0.039	0.001	0.553
SPC__157208.LAB	02/01/24	14:35:42.500	0.336	-0.028	0.001	0.723
SPC__157209.LAB	02/01/24	14:36:46.399	0.419	-0.044	-0.000	0.690
SPC__157210.LAB	02/01/24	14:37:50.324	0.404	-0.010	-0.000	0.346
SPC__157211.LAB	02/01/24	14:38:54.173	0.479	0.024	0.000	0.027
SPC__157212.LAB	02/01/24	14:39:58.073	0.096	-0.002	0.002	0.081
SPC__157213.LAB	02/01/24	14:41:01.963	0.026	0.005	-0.007	10.259
SPC__157214.LAB	02/01/24	14:42:05.983	0.005	-0.003	-0.011	72.358
SPC__157215.LAB	02/01/24	14:43:09.760	-0.025	0.004	-0.014	72.908
SPC__157216.LAB	02/01/24	14:44:13.652	-0.018	0.013	-0.010	72.281
SPC__157217.LAB	02/01/24	14:45:17.547	-0.233	-0.006	-0.009	72.379
SPC__157218.LAB	02/01/24	14:46:21.447	-0.168	0.001	-0.011	72.162

Holcim; Theodore AL
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__156787BKG.LAB	02/01/24	07:54:33.196	0.000	0.000	0.000	0.000
SPC__156788BKG.LAB	02/01/24	06:57:42.676	0.000	0.000	0.000	0.000
SPC__156789.LAB	02/01/24	06:58:52.684	0.006	-0.005	0.001	-0.043
SPC__156790BKG.LAB	02/01/24	07:01:34.489	0.000	0.000	0.000	0.000
SPC__156791.LAB	02/01/24	07:02:44.197	0.008	0.010	0.001	0.071
SPC__156792.LAB	02/01/24	07:03:48.203	0.082	0.008	-0.019	29.421
SPC__156793.LAB	02/01/24	07:04:51.998	-0.013	-0.008	-0.012	72.612
SPC__156794.LAB	02/01/24	07:05:55.897	-0.034	0.001	-0.010	72.328
SPC__156795.LAB	02/01/24	07:06:59.801	-0.003	-0.002	-0.011	72.701
SPC__156796.LAB	02/01/24	07:08:03.697	-0.080	0.001	-0.013	72.730
Ethylene CTS (CC426155)						**72.716**
SPC__156797.LAB	02/01/24	07:09:07.595	20.579	0.017	2.026	33.972
SPC__156798.LAB	02/01/24	07:10:11.505	47.032	0.000	4.770	-0.557
SPC__156799.LAB	02/01/24	07:11:15.434	47.503	0.001	4.759	-0.492
SPC__156800.LAB	02/01/24	07:12:19.332	47.771	0.007	4.766	-0.477
SPC__156801.LAB	02/01/24	07:13:23.202	48.271	0.005	4.776	-0.543
SPC__156802.LAB	02/01/24	07:14:27.121	48.304	0.004	4.769	-0.443
SPC__156803.LAB	02/01/24	07:15:31.029	48.324	0.000	4.781	-0.529
SPC__156804.LAB	02/01/24	07:16:34.933	48.175	-0.008	4.780	-0.534
HCN Analyte Spike (CC768222)			**48.268**		**4.776**	

Appendix C

Ion Chromatography Analytical Report Data

Deeco, Inc.

3404 Lake Woodard Drive
Raleigh, NC 27604

Project ID: 24-3328
Holcim Theodore

Hydrogen Fluoride & Chlorine

EPA Method 26A Analysis

Analytical Report
41983

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 41983
has been reviewed for completeness, accuracy,
adherence to method protocol,
and compliance with quality assurance guidelines.

Review by:

Linda Ann Webb

Linda Ann Webb, M.S. Analytical Chemist
February 14, 2024

Report Reviewed and Finalized by:

Ken Smith, Laboratory Director
February 14, 2024

SUMMARY OF RESULTS

Summary of Analysis

Summary of Method 26A Analysis

Element	TD-M26A-R1A e41983-1 Total mg	TD-M26A-R2A e41983-2 Total mg	TD-M26A-R3A e41983-3 Total mg
HF	< 0.232	< 0.236	< 0.225
Cl_2	0.246	0.191	0.201

Element	TD-M26A-R1B e41983-4 Total mg	TD-M26A-R2B e41983-5 Total mg	TD-M26A-R3B e41983-6 Total mg
HF	< 0.245	< 0.243	< 0.243
Cl_2	0.225	< 0.190	0.200

Element	TD-M26A-FB e41983-7 Total mg
HF	< 0.201
Cl_2	< 0.171

ANALYTICAL NARRATIVE

Element One Analytical Narrative

Client:	Deeco, Inc.	Element One #:	41983
Client ID:	24-3328 Holcim Theodore, AL	Analyst:	LAW, MNB
Method:	M26A	Dates Received:	02.05.24
Analytes:	HF, Cl_2	Dates Analyzed:	02.08-12.24

Summary of Analysis

The samples were prepared and analyzed according to Method 26A protocol. The samples were analyzed for fluoride and chloride on Metrohm 861/778 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. 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	TD-M26A-R1A RPD	TD-M26A-R2A RPD	TD-M26A-R3A RPD
HF	NA	NA	NA
Cl_2	0.7%	0.9%	0.9%

Element	TD-M26A-R1B RPD	TD-M26A-R2B RPD	TD-M26A-R3B RPD
HF	NA	NA	NA
Cl_2	0.8%	NA	1.0%

Element	TD-M26A-FB RPD
HF	NA
Cl_2	NA

Summary of Method 26A Spike Recoveries

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

Element	TD-M26A-R3A Recovery	TD-M26A-R3B Recovery
HF	106%	108%
Cl_2	102%	105%

Second Source Calibration Verification

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

Element	DL 0.1mg/L Recovery	*QC 5.0mg/L Recovery
HF	109%	99%
Cl_2	106%	103%

SAMPLE CUSTODY

41983

DEECO, Inc

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

Date:	02/5/24
Lab:	Element One
Train:	EPA Method 26A

Plant Name: Holcim | Plant Location: Theodore, AL | Project Name: 24-3328

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
[signature]	2/5/24	[signature]	2.5.24	
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
TD-1A-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 440.3 mL	Element One
TD-1A-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 353.0 mL **Sodium thiosulfate not added**	Element One
TD-1B-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 465.3 mL	Element One
TD-1B-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 367.2 mL **Sodium thiosulfate not added**	Element One
TD-2A-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 449.0 mL	Element One
TD-2A-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 352.4 mL **Sodium thiosulfate not added**	Element One

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

DEECO, Inc

41983

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

Date:	02/5/24
Lab:	Element One
Train:	EPA Method 26A

Plant Name: Holcim | Plant Location: Theodore, AL | Project Name: 24-3328

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
		Lucy Bruton	2.5.24	
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
TD-2B-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 461.1 mL	Element One
TD-2B-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 379.5 mL **Sodium thiosulfate not added**	Element One
TD-3A-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 428.4 mL	Element One
TD-3A-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 373.0 mL **Sodium thiosulfate not added**	Element One
TD-3B-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 462.3 mL	Element One
TD-3B-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 386.1 mL **Sodium thiosulfate not added**	Element One

41983

DEECO, Inc

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

Date:	02/5/24
Lab:	Element One
Train:	EPA Method 26A

Plant Name: Holcim | Plant Location: Theodore, AL | Project Name: 24-3328

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Comments
	2/5/24		2.5.24	
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
TD-FB-H_2SO_4	02/01/24	Comp.	Fluoride ion as Hydrogen Fluoride	EPA Method 26A	0.1N H_2SO_4 and DI Rinses	Final Volume 382.3 mL	Element One
TD-FB-NaOH	02/01/24	Comp.	Chloride ion as Diatomic Chlorine	EPA Method 26A	0.1N NaOH and DI Rinses	Final Volume 341.5 mL **Sodium thiosulfate not added**	Element One

ANALYTICAL DATA

Analytical Calculations

HF -

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

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 41983**

Analysis Due Date 02.13.24
QA/QC/Report Due Date 02.15.24

Client:	Deeco, Inc.
Project No	24-3328

Date Rec	02.05.24
Time Rec	1100

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

Sample Identification TD LAW 021424

1	TD-M26A-R1A	4	TD-M26A-R1B	7	~~WH~~-M26A-FB
2	TD-M26A-R2A	5	TD-M26A-R2B		
3	TD-M26A-R3A	6	TD-M26A-R3B		
	TD-M26A-R3A Spike		TD-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	440.3						353.0			
2	449.0						352.4			
3.S	428.4						373.0			
4	463.3						367.2			
5	461.1						379.5			
6.S	462.3						386.1			
7	382.3						341.5			

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---02.05.24 LLB

SS Page 1 of 1
SS by KKB
2/5/2024 3:38:22 PM

Imp 1, 2, &3 Prep By / Date 02.07.24 MNB
Imp 4 & 5 Prep By / Date 02.09.24 LAW
Labeled By/Date LAW 02.05.24
ID Verification By/Date PDR 2.6.24

Metrohm 861/788 Ion Chromatograph System

elementOne **M26A-HF IC Data Sheet** **Lab ID #: 41983**

Client: Deeco
Date: 02.13.24
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.
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	0.025	1	10	< 0.001			_2024-02-08_	2/8/2024 14:31
LRB	0.025	1	10	< 0.001		NA	_2024-02-08_	2/8/2024 14:51
LRB SPK	5.039	1	10	0.053	5.00	100%	_2024-02-08_	2/8/2024 15:12
LRB SPK	5.102	1	10	0.054	5.00	102%	_2024-02-08_	2/8/2024 15:33
41983-1	0.025	5	440.3	< 0.232			_2024-02-08_	2/8/2024 15:54
41983-1 DUP	0.022	5	440.3	< 0.232		NA	_2024-02-08_	2/8/2024 16:14
41983-2	0.028	5	449.0	< 0.236			_2024-02-08_	2/8/2024 16:35
41983-2 DUP	0.034	5	449.0	< 0.236		NA	_2024-02-08_	2/8/2024 16:56
41983-3	0.000	5	428.4	< 0.225			_2024-02-08_	2/8/2024 19:21
41983-3 DUP	0.020	5	428.4	< 0.225		NA	_2024-02-08_	2/8/2024 19:42
41983-3 SPK	5.253	5	428.4	11.8	5.00	105%	_2024-02-08_	2/8/2024 20:02
41983-3 SPK DUP	5.350	5	428.4	12.1	5.00	107%	_2024-02-08_	2/8/2024 20:23
41983-4	0.022	5	465.3	< 0.245			_2024-02-08_	2/8/2024 17:17
41983-4 DUP	0.021	5	465.3	< 0.245		NA	_2024-02-08_	2/8/2024 17:37
41983-5	0.030	5	461.1	< 0.243			_2024-02-08_	2/8/2024 20:44
41983-5 DUP	0.025	5	461.1	< 0.243		NA	_2024-02-08_	2/8/2024 21:05
41983-6	0.024	5	462.3	< 0.243			_2024-02-08_	2/8/2024 21:25
41983-6 DUP	0.021	5	462.3	< 0.243		NA	_2024-02-08_	2/8/2024 21:46
41983-6 SPK	5.360	5	462.3	13.0	5.00	107%	_2024-02-08_	2/8/2024 22:07
41983-6 SPK DUP	5.410	5	462.3	13.2	5.00	108%	_2024-02-08_	2/8/2024 22:28
41983-7 FB	0.000	5	382.3	< 0.201			_2024-02-12_	2/12/2024 19:34
41983-7 FB DUP	0.000	5	382.3	< 0.201		NA	_2024-02-12_	2/12/2024 19:55

Metrohm 861/788 Ion Chromatograph System

elementOne **M26A-HF IC Data Sheet** **Lab ID #: 41983**

Client: Deeco
Date: 02.13.24
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.
F^- to HF factor: 1.053

Standards	F^- µg/ml	Dilution	QC, µg/ml	% Relative Error	% Recovery	File Name	Date Time
0	0.000					_2024-02-07_	2/7/2024 15:26
0.1	0.103			3.0%	103%	_2024-02-07_	2/7/2024 15:47
1	0.952			-4.8%	95%	_2024-02-07_	2/7/2024 16:08
3	3.023			0.8%	101%	_2024-02-07_	2/7/2024 16:28
5	5.051			1.0%	101%	_2024-02-07_	2/7/2024 16:49
10	9.971			-0.3%	100%	_2024-02-07_	2/7/2024 17:10
0.1	0.109			9.0%	109%	_2024-02-12_	2/12/2024 21:59
1	1.042			4.2%	104%	_2024-02-12_	2/12/2024 22:20
3	3.102			3.4%	103%	_2024-02-12_	2/12/2024 22:41
5	5.236			4.7%	105%	_2024-02-12_	2/12/2024 23:02
10	10.399			4.0%	104%	_2024-02-12_	2/12/2024 23:22
Correlation-	0.9999						
QC	4.934		5.00		99%	_2024-02-08_	2/8/2024 12:26
QC	5.066		5.00		101%	_2024-02-08_	2/8/2024 12:47
QC	4.958		5.00		99%	_2024-02-08_	2/8/2024 17:58
QC	5.006		5.00		100%	_2024-02-08_	2/8/2024 18:19
QC	5.187		5.00		104%	_2024-02-08_	2/8/2024 22:48
QC	5.191		5.00		104%	_2024-02-08_	2/8/2024 23:09
QC	5.009		5.00		100%	_2024-02-12_	2/12/2024 18:53
QC	5.059		5.00		101%	_2024-02-12_	2/12/2024 20:57
QC	5.313		5.00		106%	_2024-02-12_	2/12/2024 23:43
DL	0.109		0.10		109%	_2024-02-08_	2/8/2024 13:49
DL	0.104		0.10		104%	_2024-02-08_	2/8/2024 14:10
DL	0.109		0.10		109%	_2024-02-12_	2/12/2024 21:18
DL	0.120		0.10		120%	_2024-02-13_	2/13/2024 0:04
40034-6 QC	6.820	10	71.7		100%	_2024-02-12_	2/12/2024 20:16
40034-6 QC	6.884	10	71.7		101%	_2024-02-12_	2/12/2024 20:36
BLK	0.000					_2024-02-08_	2/8/2024 13:08
BLK	0.000					_2024-02-08_	2/8/2024 13:28
BLK	0.170					_2024-02-08_	2/8/2024 18:39
BLK	0.031					_2024-02-08_	2/8/2024 19:00
BLK	0.036					_2024-02-08_	2/8/2024 23:30
BLK	0.033					_2024-02-08_	2/8/2024 23:50
BLK	0.033					_2024-02-08_	2/8/2024 23:50
BLK	0.000					_2024-02-12_	2/12/2024 19:13
BLK	0.000					_2024-02-12_	2/12/2024 21:38
BLK	0.000					_2024-02-13_	2/13/2024 0:24

HF Data 2 of 2

elementOne
e 41983-HF

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41983

Date: 820724 Column: ~~Metrosep A Supp 19~~ IonPac AS14A Instrument: 821/788
Analyst: MNB/LAW Conc. Eluent: 8.0 mM Na_2CO_3/ ~~0.25~~ 1.0 mM $NaHCO_3$ Lot# IC11-102-1
Batch name: 020724-41983 10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Regenerant: ~~500~~ 100 mM H_2SO_4 Lot # IC11-124-4
Flow Rate: ~~0.7 mL/min.~~ 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	mant	R2	
2	0.1		F	BBCJ0577	sigma	0.9999	
3	1.0				aldrich	0.9999	
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	41983-1	deeco	HF		—	SX	
18	-1d	↓	↓		—	↓	
19	-2				—		
20	-2d				—		
21	-4				—		
22	-4d	↓	↓		—	↓	
23	QC						
24	QC						
25	BLK						

Manual integra
Curve IC Lot # IC11-177-4 Comments: pg1 OA3
Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: IC ME Solution 1903029-250 IC NO2 Solution 2305042-250
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: 8.13.24 Time: 1111 By: MNB QC Review- Date: 8/ Time: _____ By: _____

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41983

Date: 2.7.24
Analyst: mnbl LAW
Batch name: 020724-~~41989~~ 41983

Column: ~~Metrosep A Supp 19~~ IonPac AS14A
Conc. Eluent: 8.0 mM Na_2CO_3/ ~~0.25~~ 1.0 mM $NaHCO_3$
10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Regenerant: ~~500~~ 100 mM H_2SO_4
Flow Rate: ~~0.7 mL/min~~. 1.0 mL/min

Instrument: 881/788
Lot# IC11-1026-1
Lot # IC11-1244
Method: 300/26A

AS LOC.	Sample ID	Client	Analyte	Results (ug/mL)	Results (ug/mL)	Dilution	Wt (g) / FV (mL)
26	BLK bad blue	~~dup~~					
27	41983-3	deeco	HF		—	5X	
28	-3d				—		
29	-3t				5.253		
30	-3+d				5.350		
31	-5				—		
32	-5d				—		
33	-6				—		
34	-6d				—		
35	-6t				5.310		
36	-6+d	↓	↓		5.417	↓	
37	QC						
38	QC						
39	BLK						
40	BLK						
41	41983-7 fB	deeco	HF	flow -vev		5X	
42	-7d fB	↓	↓	issues		↓	
43	41983-6 QC					10X	TV=71.7
44	-6d QC					↓	↓
45	QC						
46	DL						
47	BLK						
48	0.1						
49	1.0						
50	3.0						

Manual integra
Curve IC Lot #_____ Comments: Rep 2.07.3
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 #:** 41983

Date: 2.7.24 Column: IonPac AS14A Instrument: Red/788
Analyst: MMB/AW Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# 1C11.1C12.1
Batch name: 020724-41983 10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Regenerant: 100 mM H_3PO_4 Lot # 1C11.124.4
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	S.0						
S2	10.0						
S3	QC						
S4	DL						
S5	BLK						
S6	LPB } invert						
S7	LPB } seq						
1	41983-7FB	Deeco	HF		—	5X	
2	-7FB d	↓	↓		—	↓	
3	40034-6 QC					10X	TV=71.7
4	-6d QC					↓	↓
5	QC						
6	DL						
7	BLK						
8	0.1						
9	1.0						
10	3.0						
11	5.0						
12	10.0						
13	QC						
14	DL						
15	BLK						
16	QC }						
17	~~QC~~ BLK } incr						
18	~~BLK~~ } seq						

19 ~~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 listed 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 #: 41983

Client: Deeco
Date: 02.13.24
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	0.000	1	10	< 0.001			-17de6efb:18d8a3def01:-7538	2/9/2024 16:50
LRB	0.000	1	10	< 0.001		NA	-17de6efb:18d8a3def01:-7536	2/9/2024 17:13
LRB SPK	5.175	1	10	0.052	5.00	104%	-17de6efb:18d8a3def01:-7534	2/9/2024 17:37
LRB SPK	5.182	1	10	0.052	5.00	104%	-17de6efb:18d8a3def01:-7532	2/9/2024 18:00
41983-1	0.140	5	353.0	0.247			-17de6efb:18d8a3def01:-7530	2/9/2024 18:24
41983-1 DUP	0.139	5	353.0	0.245		0.7%	-17de6efb:18d8a3def01:-752e	2/9/2024 18:47
41983-2	0.109	5	352.4	0.192			-17de6efb:18d8a3def01:-751c	2/9/2024 22:19
41983-2 DUP	0.108	5	352.4	0.190		0.9%	-17de6efb:18d8a3def01:-751a	2/9/2024 22:42
41983-3	0.107	5	373.0	0.200			-17de6efb:18d8a3def01:-752c	2/9/2024 19:11
41983-3 DUP	0.108	5	373.0	0.201		0.9%	-17de6efb:18d8a3def01:-752a	2/9/2024 19:34
41983-3 SPK	5.189	5	373.0	9.68	5.00	102%	-17de6efb:18d8a3def01:-7528	2/9/2024 19:58
41983-3 SPK DUP	5.222	5	373.0	9.74	5.00	102%	-17de6efb:18d8a3def01:-7526	2/9/2024 20:21
41983-4	0.123	5	367.2	0.226			-17de6efb:18d8a3def01:-7518	2/9/2024 23:06
41983-4 DUP	0.122	5	367.2	0.224		0.8%	-17de6efb:18d8a3def01:-7516	2/9/2024 23:29
41983-5	0.088	5	379.5	< 0.19			-17de6efb:18d8a3def01:-7514	2/9/2024 23:53
41983-5 DUP	0.089	5	379.5	< 0.19		NA	-17de6efb:18d8a3def01:-7512	2/10/2024 0:16
41983-6	0.104	5	386.1	0.201			-17de6efb:18d8a3def01:-7510	2/10/2024 0:40
41983-6 DUP	0.103	5	386.1	0.199		1.0%	-17de6efb:18d8a3def01:-750e	2/10/2024 1:03
41983-6 SPK	5.338	5	386.1	10.3	5.00	105%	-17de6efb:18d8a3def01:-750c	2/10/2024 1:27
41983-6 SPK DUP	5.331	5	386.1	10.3	5.00	105%	-17de6efb:18d8a3def01:-750a	2/10/2024 1:50
41983-7 FB	0.037	5	341.5	< 0.171			-17de6efb:18d8a3def01:-7500	2/10/2024 3:48
41983-7 FB DUP	0.027	5	341.5	< 0.171		NA	-17de6efb:18d8a3def01:-74fe	2/10/2024 4:11

Metrohm 881/858 Ion Chromatograph System

elementOne

M26A-Cl_2 IC Data Sheet

Lab ID #: 41983

Client: Deeco
Date: 02.13.24
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	0.000					-17de6efb:18d8a3def01:-7550	2/9/2024 12:08
0.1	0.102			2.0%	102%	-17de6efb:18d8a3def01:-754e	2/9/2024 12:31
1	0.969			-3.1%	97%	-17de6efb:18d8a3def01:-754c	2/9/2024 12:55
3	3.001			0.0%	100%	-17de6efb:18d8a3def01:-754a	2/9/2024 13:18
5	5.046			0.9%	101%	-17de6efb:18d8a3def01:-7548	2/9/2024 13:42
10	9.981			-0.2%	100%	-17de6efb:18d8a3def01:-7546	2/9/2024 14:05
0.1	0.103			3.0%	103%	-17de6efb:18d8a3def01:-74da	2/10/2024 11:14
1	1.022			2.2%	102%	-17de6efb:18d8a3def01:-74d8	2/10/2024 11:37
3	3.093			3.1%	103%	-17de6efb:18d8a3def01:-74d6	2/10/2024 12:01
5	5.239			4.8%	105%	-17de6efb:18d8a3def01:-74d4	2/10/2024 12:24
10	10.456			4.6%	105%	-17de6efb:18d8a3def01:-74d2	2/10/2024 12:48
Correlation-	0.999911						
QC	5.162		5.00		103%	-17de6efb:18d8a3def01:-7544	2/9/2024 14:29
QC	5.137		5.00		103%	-17de6efb:18d8a3def01:-7542	2/9/2024 14:52
QC	5.259		5.00		105%	-17de6efb:18d8a3def01:-7524	2/9/2024 20:45
QC	5.243		5.00		105%	-17de6efb:18d8a3def01:-7522	2/9/2024 21:08
QC	5.236		5.00		105%	-17de6efb:18d8a3def01:-7508	2/10/2024 2:14
QC	5.314		5.00		106%	-17de6efb:18d8a3def01:-7506	2/10/2024 2:37
QC	5.222		5.00		104%	-17de6efb:18d8a3def01:-74ec	2/10/2024 7:43
QC	5.246		5.00		105%	-17de6efb:18d8a3def01:-74ea	2/10/2024 8:06
QC	5.385		5.00		108%	-17de6efb:18d8a3def01:-74d0	2/10/2024 13:11
DL	0.106		0.10		106%	-17de6efb:18d8a3def01:-753c	2/9/2024 16:03
DL	0.098		0.10		98%	-17de6efb:18d8a3def01:-753a	2/9/2024 16:26
DL	0.104		0.10		104%	-17de6efb:18d8a3def01:-74de	2/10/24 10:27
DL	0.096		0.10		96%	-17de6efb:18d8a3def01:-74ce	2/10/2024 13:35
40034-7 QC	3.919	20	78.00		100%	-17de6efb:18d8a3def01:-74fc	2/10/2024 4:35
40034-7 QC DUP	3.886	20	78.00		100%	-17de6efb:18d8a3def01:-74fa	2/10/2024 4:58
BLK	0.000					-17de6efb:18d8a3def01:-7540	2/9/2024 15:16
BLK	0.000					-17de6efb:18d8a3def01:-753e	2/9/2024 15:39
BLK	0.000					-17de6efb:18d8a3def01:-7520	2/9/2024 21:32
BLK	0.000					-17de6efb:18d8a3def01:-751e	2/9/2024 21:55
BLK	0.000					-17de6efb:18d8a3def01:-7504	2/10/2024 3:01
BLK	0.000					-17de6efb:18d8a3def01:-7502	2/10/2024 3:24
BLK	0.000					-17de6efb:18d8a3def01:-74e8	2/10/2024 8:30
BLK	0.000					-17de6efb:18d8a3def01:-74e6	2/10/2024 8:53
BLK	0.000					-17de6efb:18d8a3def01:-74dc	2/10/2024 10:51
BLK	0.000					-17de6efb:18d8a3def01:-74cc	2/10/2024 13:58

42006

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41983

Date: 02.09.24 Column: IonPac AS14A Instrument: 881 IC 858
Analyst: CMO 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: 020924-41983 Regenerant: 100mM H_3PO_4 Lot # 1C1(-124-4
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			GC	MANF	R2	
2	0.1		Cl-	4308554	RICCA	.09991	
3	1.0						
4	3.0						
5	5.0						
6	10.0						
7	GC						
8	GC						
9	BLK						
10	BLK						
11	DL						
12	DL						
13	LCS						
14	LCS						
15	LCSL						
16	LCS+						
17	41983-1		Cl2		0.140	5X	
18	-1D				0.139		
19	-3				0.107		
20	-3D				0.108		
21	-3+				5.189		
22	-3+				5.222		
23	GC						
24	GC						
25	BLK						

Manual integra
Curve IC Lot # 1C11-129-1 Sodium Thiosulfate Lot # 191-124-3 Comments: pg 1 of 3
Spike 50 uL from 1000 ug/mL Std. to 10mL sample Lot #'s: IC ME Solution 2303089-250145
QC: Spike 50 uL from 1000 ug/mL Br Std. to 10mL sample; lot #'s listied above.
Submitted for QC- Date: 02.10.24 Time: 8:30 By: CMO QC Review- Date: ✓ Time: _____ By: _____

42006

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41983

Date: 020924 Column: IonPac AS14A Instrument: 881 / 858
Analyst: MW Conc. Eluent: 8.0 mM Na_2CO_3/ 1.0mM $NaHCO_3$ Lot# IC11-106-1
10mL Conc. Eluent Diluted to FV=1L with filtered UPDI
Batch name: 020924-41983 Regenerant: 100mM H_3PO_4 Lot # IC11-124-4
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)
26	BLK						
27	41983-2		Cl_2		0.109	5X	
28	-2D				0.108	↓	
29	-4				0.123	5X	
30	-4D				0.122		
31	-5				—		
32	-5D				—		
33	-6				0.104		
34	-6D				0.103		
35	-6+				5.338		
36	-6+	↓	↓		5331	↓	
37	QC						
38	QC						
39	BLK						
40	BLK						
41	41983-7FB		Cl_2		—	5X	
42	-7FB.D	↓			—	↓	
43	40034-1 QC				3.919	20X	TV= 78.0
44	-7 QC				3.886	↓	
45	MW 020924 QC / 42006-1				—	5X	
46	DI -1D				—		
47	BLK -2				—		
48	0.1 -2D				—		
49	1.0 -2+				5.070		
50	30 -2+D		↓		5.277	↓	

Manual integrations noted by M
Curve IC Lot #_____ Sodium Thiosulfate Lot #_____ Comments: RS 20P3
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:_____

elementOne **IC Sample Sheet/Digestion Worksheet** **Lab ID #:** 41983 42006

Date: 02.09.24 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: 020924-41983 Regenerant: 100mM H_3PO_4 Lot # 1C11-124-4
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 LMO CCV						
52	10.0 CCV						
53	CCB						
54	DL BLK						
55	BLK 42006-3BLK		Cl2		—	5X	
56	-3BLKD		1		—	1	
57	CCV						
58	DL						
59	BLK						
60	0.1						
61	1.0						
62	3.0						
63	5.0						
64	10.0						
65	CCV						
66	DL						
67	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 listied above.
Submitted for QC- Date:_____ Time:_____ By:_____ QC Review- Date:_____ Time:_____ By:_____

Appendix D

Plant Process Data

Holcim
Theodore AL
Main Stack

Date/Time	CEMS: CLINKER_METRIC (TNHR) Raw Value
Run 1	
02/01/2024 10:26	147.6
02/01/2024 10:27	148.0
02/01/2024 10:28	148.6
02/01/2024 10:29	148.4
02/01/2024 10:30	147.8
02/01/2024 10:31	147.6
02/01/2024 10:32	148.5
02/01/2024 10:33	149.8
02/01/2024 10:34	150.5
02/01/2024 10:35	149.4
02/01/2024 10:36	149.4
02/01/2024 10:37	149.9
02/01/2024 10:38	148.6
02/01/2024 10:39	149.1
02/01/2024 10:40	148.6
02/01/2024 10:41	148.6
02/01/2024 10:42	146.2
02/01/2024 10:43	147.0
02/01/2024 10:44	146.7
02/01/2024 10:45	145.1
02/01/2024 10:46	144.8
02/01/2024 10:47	147.1
02/01/2024 10:48	147.4
02/01/2024 10:49	147.2
02/01/2024 10:50	146.4
02/01/2024 10:51	145.8
02/01/2024 10:52	145.8
02/01/2024 10:53	147.1
02/01/2024 10:54	147.1
02/01/2024 10:55	146.4
02/01/2024 10:56	147.5
02/01/2024 10:57	148.3
02/01/2024 10:58	148.8
02/01/2024 10:59	148.4
02/01/2024 11:00	148.2
02/01/2024 11:01	149.0
02/01/2024 11:02	150.1
02/01/2024 11:03	149.4

Holcim
Theodore AL
Main Stack

Date/Time	CEMS: CLINKER_METRIC (TNHR) Raw Value
02/01/2024 11:04	149.2
02/01/2024 11:05	149.0
02/01/2024 11:06	148.8
02/01/2024 11:07	150.2
02/01/2024 11:08	149.7
02/01/2024 11:09	148.8
02/01/2024 11:10	148.8
02/01/2024 11:11	149.2
02/01/2024 11:12	148.5
02/01/2024 11:13	147.5
02/01/2024 11:14	147.0
02/01/2024 11:15	146.7
02/01/2024 11:16	149.1
02/01/2024 11:17	147.5
02/01/2024 11:18	146.5
02/01/2024 11:19	146.8
02/01/2024 11:20	146.6
02/01/2024 11:21	146.8
02/01/2024 11:22	147.5
02/01/2024 11:23	146.2
02/01/2024 11:24	146.9
02/01/2024 11:25	146.9
02/01/2024 11:26	145.4
02/01/2024 11:27	146.0
02/01/2024 11:28	146.7
02/01/2024 11:29	146.3
02/01/2024 11:30	147.1
02/01/2024 11:31	147.2
02/01/2024 11:32	147.3
02/01/2024 11:33	146.8
02/01/2024 11:34	147.8
02/01/2024 11:35	147.5
Sum	10342.50
Average	147.75
Max	150.50
Min	144.80
Count	70

Holcim
Theodore AL
Main Stack

Date/Time	CEMS: CLINKER_METRIC (TNHR) Raw Value
Run 2	
02/01/2024 11:56	148.4
02/01/2024 11:57	148.3
02/01/2024 11:58	147.3
02/01/2024 11:59	146.8
02/01/2024 12:00	146.1
02/01/2024 12:01	146.0
02/01/2024 12:02	146.4
02/01/2024 12:03	146.6
02/01/2024 12:04	148.2
02/01/2024 12:05	146.7
02/01/2024 12:06	146.9
02/01/2024 12:07	146.3
02/01/2024 12:08	147.3
02/01/2024 12:09	147.8
02/01/2024 12:10	147.4
02/01/2024 12:11	147.4
02/01/2024 12:12	147.8
02/01/2024 12:13	148.7
02/01/2024 12:14	149.6
02/01/2024 12:15	149.0
02/01/2024 12:16	150.7
02/01/2024 12:17	149.4
02/01/2024 12:18	148.4
02/01/2024 12:19	148.6
02/01/2024 12:20	149.2
02/01/2024 12:21	147.6
02/01/2024 12:22	146.8
02/01/2024 12:23	147.5
02/01/2024 12:24	148.5
02/01/2024 12:25	147.9
02/01/2024 12:26	146.4
02/01/2024 12:27	146.4
02/01/2024 12:28	148.2
02/01/2024 12:29	147.7
02/01/2024 12:30	147.1
02/01/2024 12:31	145.7
02/01/2024 12:32	145.9
02/01/2024 12:33	145.9

Holcim
Theodore AL
Main Stack

Date/Time	CEMS: CLINKER_METRIC (TNHR) Raw Value
02/01/2024 12:34	146.2
02/01/2024 12:35	146.3
02/01/2024 12:36	146.8
02/01/2024 12:37	146.7
02/01/2024 12:38	145.9
02/01/2024 12:39	146.7
02/01/2024 12:40	147.2
02/01/2024 12:41	148.3
02/01/2024 12:42	149.3
02/01/2024 12:43	149.8
02/01/2024 12:44	149.7
02/01/2024 12:45	149.0
02/01/2024 12:46	149.0
02/01/2024 12:47	149.5
02/01/2024 12:48	149.8
02/01/2024 12:49	149.2
02/01/2024 12:50	149.1
02/01/2024 12:51	148.6
02/01/2024 12:52	148.8
02/01/2024 12:53	148.9
02/01/2024 12:54	148.1
02/01/2024 12:55	147.2
02/01/2024 12:56	148.1
02/01/2024 12:57	147.2
02/01/2024 12:58	146.7
02/01/2024 12:59	147.0
02/01/2024 13:00	146.0
02/01/2024 13:01	146.3
02/01/2024 13:02	145.9
02/01/2024 13:03	148.6
02/01/2024 13:04	148.8
02/01/2024 13:05	148.2
Sum	10339.80
Average	147.71
Max	150.70
Min	145.70
Count	70

Holcim
Theodore AL
Main Stack

Date/Time	CEMS: CLINKER_METRIC (TNHR) Raw Value
Run 3	
02/01/2024 13:18	148.9
02/01/2024 13:19	148.8
02/01/2024 13:20	149.2
02/01/2024 13:21	148.6
02/01/2024 13:22	149.2
02/01/2024 13:23	149.3
02/01/2024 13:24	147.9
02/01/2024 13:25	146.8
02/01/2024 13:26	147.1
02/01/2024 13:27	146.7
02/01/2024 13:28	146.1
02/01/2024 13:29	147.4
02/01/2024 13:30	149.0
02/01/2024 13:31	147.2
02/01/2024 13:32	146.5
02/01/2024 13:33	146.0
02/01/2024 13:34	146.4
02/01/2024 13:35	146.3
02/01/2024 13:36	146.4
02/01/2024 13:37	145.8
02/01/2024 13:38	146.2
02/01/2024 13:39	146.9
02/01/2024 13:40	147.3
02/01/2024 13:41	148.2
02/01/2024 13:42	148.6
02/01/2024 13:43	149.3
02/01/2024 13:44	148.8
02/01/2024 13:45	148.7
02/01/2024 13:46	148.6
02/01/2024 13:47	149.6
02/01/2024 13:48	149.8
02/01/2024 13:49	149.3
02/01/2024 13:50	150.0
02/01/2024 13:51	149.1
02/01/2024 13:52	148.5
02/01/2024 13:53	148.4
02/01/2024 13:54	148.5
02/01/2024 13:55	149.3

Holcim
Theodore AL
Main Stack

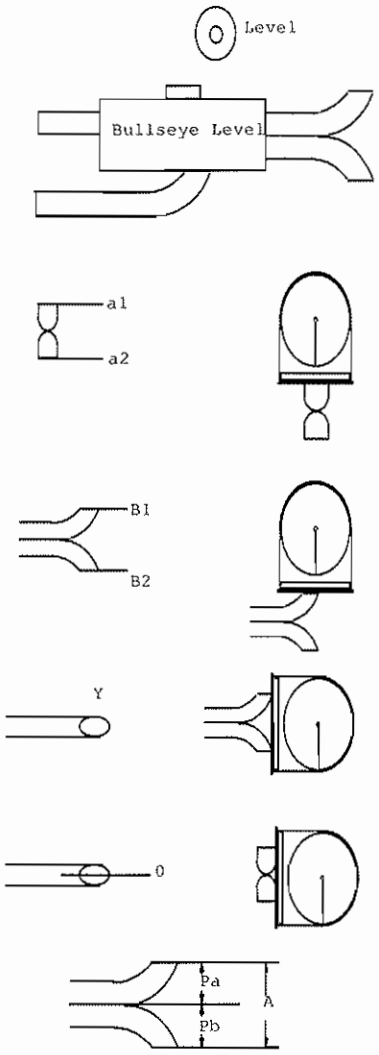
Date/Time	CEMS: CLINKER_METRIC (TNHR) Raw Value
02/01/2024 13:56	148.5
02/01/2024 13:57	147.3
02/01/2024 13:58	146.9
02/01/2024 13:59	148.7
02/01/2024 14:00	147.8
02/01/2024 14:01	145.4
02/01/2024 14:02	146.6
02/01/2024 14:03	146.6
02/01/2024 14:04	145.8
02/01/2024 14:05	146.2
02/01/2024 14:06	146.6
02/01/2024 14:07	146.8
02/01/2024 14:08	145.7
02/01/2024 14:09	146.0
02/01/2024 14:10	148.7
02/01/2024 14:11	147.8
02/01/2024 14:12	146.7
02/01/2024 14:13	148.0
02/01/2024 14:14	148.8
02/01/2024 14:15	148.9
02/01/2024 14:16	149.6
02/01/2024 14:17	149.3
02/01/2024 14:18	149.7
02/01/2024 14:19	149.8
02/01/2024 14:20	149.5
02/01/2024 14:21	149.0
02/01/2024 14:22	149.0
02/01/2024 14:23	148.3
02/01/2024 14:24	148.6
02/01/2024 14:25	148.0
02/01/2024 14:26	148.2
02/01/2024 14:27	147.9
Sum	10355.40
Average	147.93
Max	150.00
Min	145.40
Count	70

Appendix E

Calibration Documents

Probe or Pitot No:	10B

Pitot Tube Inspection Sheet



Date	01/02/24
Tube Assembly Level?	Yes
Ports Damaged?	No
-10 deg < a1 < +10 deg	1
-10 deg < a2 < +10 deg	1
-5 deg < B1 < +5 deg	2
-5 deg < B2 < +5 deg	1
Y (gamma)	1
0 (theta)	1
A (alpha)	0.939
Z = A (sin y) < 0.125"?	yes
W = A (sin 0) < 0.031"?	yes
Pa =	0.469
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	01/02/24
Barometeric Pressure?	29.91	Ambient Temperature?	56

Source	Reference Temp, F	Thermocouple Temp, F	Absolute Temp Difference
cold air	38	38	0.00%
medium air	215	213	0.30%
hot air	325	325	0.00%

Windtunnel Calibration

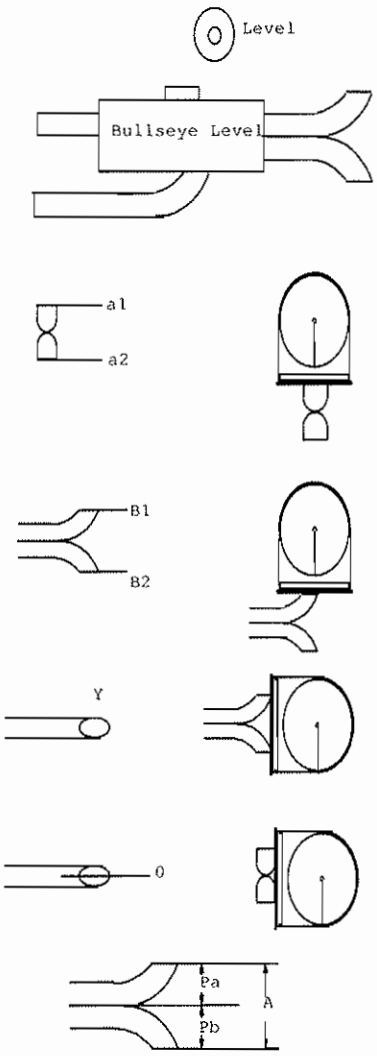
Pitot Reading	Reference (0.99)	10B S-Type Pitot	Cp
ΔP_1	0.31	0.44	0.84
ΔP_2	0.32	0.45	0.84
ΔP_3	0.31	0.45	0.83
	Average Pitot Tube Calibration Factor--->		**0.84**

Thermocouple Calibration Check (EPA ALT-011 Procedure), performed on 1/2/24

Source	Ref. Temp. F	Thermocouple Temp. F	± 2 deg F?
Ambient	59	59	Yes

Probe or Pitot No:	10E

Pitot Tube Inspection Sheet



Date	01/02/24
Tube Assembly Level?	Yes
Ports Damaged?	No
-10 deg < a1 < +10 deg	1
-10 deg < a2 < +10 deg	1
-5 deg < B1 < +5 deg	1
-5 deg < B2 < +5 deg	2
Y (gamma)	1
0 (theta)	1
A (alpha)	0.941
Z = A (sin y) < 0.125"?	yes
W = A (sin 0) < 0.031"?	yes
Pa =	0.468
Pb =	0.473
Tube Diameter (Dt) =	0.376
Pa = Pb +- 0.063"?	yes
(1.05 x Dt)?	0.397
(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	01/02/24
Barometeric Pressure?	29.91	Ambient Temperature?	56

Source	Reference Temp, F	Thermocouple Temp, F	Absolute Temp Difference
cold air	36	36	0.00%
medium air	215	216	-0.15%
hot air	325	324	0.13%

Windtunnel Calibration

Pitot Reading	Reference (0.99)	10E S-Type Pitot	Cp
ΔP_1	0.31	0.44	0.84
ΔP_2	0.32	0.44	0.85
ΔP_3	0.31	0.45	0.83
		Average Pitot Tube Calibration Factor--->	**0.84**

Thermocouple Calibration Check (EPA ALT-011 Procedure), performed on 1/2/24

Source	Ref. Temp. F	Thermocouple Temp. F	± 2 deg F?
Ambient	64	65	Yes

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

ES 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:	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 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	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

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 1.014

AVERAGE $\Delta H_@$ = 1.72

(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

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

Avg Absolute Difference = 0.1%

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.

					INITIAL	FINAL	AVG (P_{bar})
DATE:	12/21/23	METER SERIAL #:	m5-25	BAROMETRIC PRESSURE (in Hg):	30.18	30.15	30.165
METER PART #:	m5-25	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	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 (%)	ΔH@
12	1	0.3283				0.000						0							
	2					0.000						0							
	3					0.000						0							
																AVG =			
15	1	0.4094	18	576.201	581.661	5.460	55	53	55	53	54	53.75	10.00	0.97	5.6719	5.4435	0.960		1.91
	2	0.4094	18	581.661	587.119	5.458	55	55	58	54	55	55.5	10.00	0.97	5.6506	5.4435	0.963		1.91
	3					0.000						0							
																AVG =	0.962	-0.59	
19	1	0.5047	18	587.424	594.121	6.697	55	57	61	55	56	57.25	10.00	1.5	6.9187	6.7106	0.970		1.94
	2	0.5047	18	594.121	600.831	6.710	57	59	63	56	57	58.75	10.00	1.5	6.9121	6.6976	0.969		1.94
	3					0.000						0							
																AVG =	0.969	0.22	
23	1	0.6426	18	601.129	609.648	8.519	57	62	65	58	59	61	10.00	2.5	8.7589	8.5276	0.974		1.99
	2	0.6426	18	609.648	618.182	8.534	58	63	62	58	55	59.5	10.00	2.5	8.7997	8.5194	0.968		2.00
	3					0.000						0							
																AVG =	0.971	0.37	
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 = 0.967

AVERAGE ΔH@ = 1.95

Potentiometer Check, °F (per manufacturer procedure)

0	@ 0 F
498	@ 500 F
1004	@ 1000 F

Avg Absolute Difference = 0.0%

(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

Company: Holcim; Theodore AL
Source: Kiln Main Stack
Job ID: 24-3328
Train Type: M26A

Alt-009 Alternate Post Test Calibration Data	M5-25 1A 02/01/24 1026-1135	M5-22 1B 02/01/24 1026-1135	M5-25 2A 02/01/24 1156-1305	M5-22 2B 02/01/24 1156-1305	M5-25 3A 02/01/24 1318-1427	M5-22 3B 02/01/24 1318-1427	M5-25 Average	M5-22 Average
Vm	55.891	56.01	58.61	60.09	61.577	59.75		
Tm	517.4	529.1	529	538.5	527.8	542.7		
Pb	29.86	29.86	29.86	29.86	29.86	29.86		
Havg	2.97	2.83	3.39	2.88	3.63	3.23		
H@	1.95	1.72	1.95	1.72	1.95	1.72		
Md	29.832	29.832	29.82	29.82	29.84	29.84		
(Havg)^0.5	1.71361427	1.67578167	1.83037489	1.68804189	1.8977963	1.78713523		
Run Time, Min	60	60	60	60	60	60		
Meter Gamma	0.967	1.014	0.967	1.014	0.967	1.014		
Calculated Gamma (Yqa)	0.962	1.011	0.991	0.958	0.976	1.023	0.976	0.997
% difference from Actual Y	0.50%	0.28%	2.45%	5.53%	0.92%	0.90%	1.3%	2.2%

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				

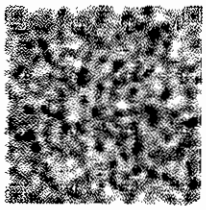
CALIBRATION STANDARDS

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
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)
rogen 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 %

COMMENTS / 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 Theodore AL
Test Location: Kiln Main Stack
Date: Feb 01 24 Start Time: 10:26:30
Run number Stratification Check
One Minute Averages

	Reference O2 %,dry	Plant O2 %,dry
10:27:28 AM	17.0	19.0
10:28:28 AM	17.1	19.2
10:29:28 AM	17.0	19.3
10:30:28 AM	17.1	19.2
10:31:28 AM	17.1	19.3
Point A	17.1	19.2
10:32:28 AM	16.7	19.2
10:33:28 AM	16.5	19.0
10:34:28 AM	16.0	18.9
10:35:28 AM	16.1	18.6
10:36:28 AM	16.6	18.7
Point B	16.4	18.9
10:37:28 AM	17.0	19.0
10:38:28 AM	17.0	19.2
10:39:28 AM	16.8	19.2
10:40:28 AM	16.6	19.1
10:41:28 AM	16.2	18.9
Point C	16.7	19.1

Holcim
Theodore AL
Main Stack

Date/Time	CEMS: ABB_O2_DRY (PCT) Expression Value
02/01/2024 10:26	19.02
02/01/2024 10:27	19.24
02/01/2024 10:28	19.27
02/01/2024 10:29	19.23
02/01/2024 10:30	19.27
02/01/2024 10:31	19.24
02/01/2024 10:32	19.01
02/01/2024 10:33	18.88
02/01/2024 10:34	18.60
02/01/2024 10:35	18.65
02/01/2024 10:36	19.02
02/01/2024 10:37	19.18
02/01/2024 10:38	19.18
02/01/2024 10:39	19.08
02/01/2024 10:40	18.91

Analysis Validation Report

Sample Filename: F:\Holcim Theodore October 2023\February 1\SPC__156855.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
TD HCN (200) PCA 191C 191C	0.56	0.01	-	0.29	0.34	0.02	0.34	-	0.01	-	-	0-200	-	Good
HF PPM (10) 191C	0.16	0.24	0.05	0.04	0.07	0.42	0.42	0.07	0.2	0.02	0.02	0-10	-	Close to DL
SF6 (10) 191C	0.01	0.01	-	0	0	0.02	0.02	-	0.01	-	-	0-10	-	Close to DL
ETHYLENE (100,3000) 191C	0.69	0.81	0.33	0.17	0.29	1.41	1.41	1.08	1.08	0.75	0.11	0-3000	-	Close to DL
H2O% (40) 191C	6.84	0.15	-	0.01	0.02	0.3	0.3	-	0.14	-	-	0-40	-	Good
CO2% (40) 191C	5.61	0.1	-	0.01	0.02	0.14	0.14	-	0.11	-	-	0-40	-	Good
HCL PPM (100) 191C	-0.12	0.73	0.05	0.15	0.28	1.32	1.32	0.06	0.6	0.01	0.02	0-100	-	Close to DL
SO2 (1000) 191C	0.35	1.34	0.37	0.14	0.27	2.58	2.58	0.79	1.21	0.42	0.12	0-1000	-	Close to DL
NO (350,3000) 191C	111.35	3.83	0.22	0.26	0.35	5.25	5.25	0.45	2.27	0.23	0.07	0-3000	-	Good
NH3 (300) 191C (1OF2)	1.47	0.65	0.03	0.12	0.2	1.09	1.09	0.15	0.49	0.11	0.01	0-300	-	Check it!
CO (500) 191C (1OF2)	122.59	3.88	-	0.2	0.43	8.01	8.01	-	2.45	-	-	0-500	-	Good
CO% (1) 191C (2OF2)	0.01	0	0	0	0	0	0	0	0	0	0	0-1	-	Good
FORMALDEHYDE (70) 191C	2.07	1.23	0.28	0.2	0.24	1.49	1.49	0.33	0.99	0.04	0.09	0-70	-	Close to DL
ACETALDEHYDE (1000) 191C	0.15	2.58	0.23	0.35	0.38	2.8	2.8	0.59	2.22	0.35	0.08	0-1000	-	Close to DL
CH4 (250) 191C (1OF2)	2.39	1.12	0.05	0.26	0.7	2.95	2.95	0.06	0.79	0.01	0.02	0-250	-	Check it!
PROPANE (100) 191C	-0.14	0.66	0.42	0.12	0.14	0.79	0.79	0.72	0.72	0.3	0.14	0-100	-	Close to DL
HBR (100) 180C	-0.42	4.43	0.17	0.68	1.39	9.01	9.01	0.19	3.77	0.02	0.06	0-100	-	Close to DL
NO2 (150) 191C (1OF2)	0.81	0.38	0.04	0.02	0.03	0.4	0.4	0.05	0.33	0.01	0.01	0-150	-	Check it!
NO2 (2000) 191C (2OF2)	-0.21	5.53	2.03	0.88	1.12	7.05	7.05	3.81	4.68	1.78	0.68	0-2000	-	Close to DL
N2O (100,200,300) 191C	0.45	0.17	0.05	0.04	0.05	0.19	0.19	0.07	0.12	0.02	0.02	0-300	-	Close to DL
NH3 (3000) 191C (2OF2)	2.8	5.74	0.35	1.19	2.25	10.82	10.82	0.44	4.68	0.09	0.12	0-3000	-	Close to DL
CH4 (3000) 191C (2OF2)	2.88	11.4	0.34	1.1	1.81	18.77	18.77	0.61	10.26	0.27	0.11	0-3000	-	Close to DL
ACETYLENE (1000) 191C	0.24	1.79	0.15	0.31	0.37	2.17	2.17	0.21	1.5	0.06	0.05	0-1000	-	Close to DL
PROPYLENE (200,1000) 191C	0.47	2.13	0.19	0.43	0.5	2.5	2.5	0.49	1.71	0.3	0.06	0-1000	-	Close to DL
COS (100) 150C	0.1	0.14	0.02	0.02	0.02	0.19	0.19	0.02	0.12	0	0.01	0-100	-	Close to DL
ETHANE (500) 191C	0.34	1.06	0.32	0.2	0.22	1.18	1.18	0.54	0.86	0.22	0.11	0-500	-	Close to DL
H2SO4 (50) 150C	-0.04	0.15	0.04	0.05	0.05	0.16	0.16	0.29	0.29	0.25	0.01	0-50	-	Close to DL
MEOH (10) 191C	-0.05	0.43	0.14	0.14	0.16	0.49	0.49	0.17	0.3	0.03	0.05	0-10	-	Close to DL
SO3 (150) 191C	-7.05	0.52	0.7	0.03	0.04	0.56	0.56	1.14	1.15	0.44	0.23	0-150	-	Check it!

Analysis Validation Report

Sample Filename: F:\Holcim Theodore October 2023\February 1\SPC__156856.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
TD HCN (200) PCA 191C 191C	0.55	0.01	-	0.29	0.34	0.01	0.34	-	0.01	-	-	0-200	-	Good
HF PPM (10) 191C	0.16	0.22	0.05	0.04	0.07	0.39	0.39	0.07	0.18	0.02	0.02	0-10	-	Close to DL
SF6 (10) 191C	0	0.01	-	0	0	0.02	0.02	-	0.01	-	-	0-10	-	Close to DL
ETHYLENE (100,3000) 191C	0.5	0.84	0.33	0.17	0.29	1.46	1.46	1.08	1.08	0.75	0.11	0-3000	-	Close to DL
H2O% (40) 191C	6.83	0.15	-	0.01	0.02	0.29	0.29	-	0.14	-	-	0-40	-	Good
CO2% (40) 191C	5.7	0.1	-	0.01	0.02	0.14	0.14	-	0.11	-	-	0-40	-	Good
HCL PPM (100) 191C	-0.12	0.69	0.05	0.15	0.28	1.26	1.26	0.06	0.56	0.01	0.02	0-100	-	Close to DL
SO2 (1000) 191C	0.43	1.32	0.37	0.14	0.27	2.53	2.53	0.79	1.18	0.42	0.12	0-1000	-	Close to DL
NO (350,3000) 191C	120.92	3.89	0.22	0.26	0.35	5.34	5.34	0.45	2.46	0.23	0.07	0-3000	-	Good
NH3 (300) 191C (1OF2)	1.45	0.66	0.03	0.12	0.2	1.12	1.12	0.15	0.51	0.11	0.01	0-300	-	Check it!
CO (500) 191C (1OF2)	119.35	3.2	-	0.2	0.43	6.62	6.62	-	2.39	-	-	0-500	-	Good
CO% (1) 191C (2OF2)	0.01	0	0	0	0	0	0	0	0	0	0	0-1	-	Good
FORMALDEHYDE (70) 191C	1.96	1.25	0.28	0.2	0.24	1.51	1.51	0.33	1.01	0.04	0.09	0-70	-	Close to DL
ACETALDEHYDE (1000) 191C	0.03	2.58	0.23	0.35	0.38	2.8	2.8	0.59	2.23	0.35	0.08	0-1000	-	Close to DL
CH4 (250) 191C (1OF2)	2.04	1.12	0.05	0.26	0.7	2.96	2.96	0.06	0.81	0.01	0.02	0-250	-	Check it!
PROPANE (100) 191C	-0.13	0.66	0.42	0.12	0.14	0.79	0.79	0.72	0.72	0.3	0.14	0-100	-	Close to DL
HBR (100) 180C	-0.37	4.47	0.17	0.68	1.39	9.08	9.08	0.19	3.8	0.02	0.06	0-100	-	Close to DL
NO2 (150) 191C (1OF2)	0.94	0.37	0.04	0.02	0.03	0.39	0.39	0.05	0.33	0.01	0.01	0-150	-	Check it!
NO2 (2000) 191C (2OF2)	-0.06	5.41	2.03	0.88	1.12	6.89	6.89	3.81	4.56	1.78	0.68	0-2000	-	Close to DL
N2O (100,200,300) 191C	0.51	0.17	0.05	0.04	0.05	0.2	0.2	0.07	0.12	0.02	0.02	0-300	-	Close to DL
NH3 (3000) 191C (2OF2)	2.86	5.87	0.35	1.19	2.25	11.08	11.08	0.44	4.82	0.09	0.12	0-3000	-	Close to DL
CH4 (3000) 191C (2OF2)	2.44	11.14	0.34	1.1	1.81	18.36	18.36	0.61	10.02	0.27	0.11	0-3000	-	Close to DL
ACETYLENE (1000) 191C	0.14	1.78	0.15	0.31	0.37	2.16	2.16	0.21	1.49	0.06	0.05	0-1000	-	Close to DL
PROPYLENE (200,1000) 191C	0.74	2.19	0.19	0.43	0.5	2.57	2.57	0.49	1.76	0.3	0.06	0-1000	-	Close to DL
COS (100) 150C	0.11	0.14	0.02	0.02	0.02	0.19	0.19	0.02	0.12	0	0.01	0-100	-	Close to DL
ETHANE (500) 191C	0.32	1.05	0.32	0.2	0.22	1.18	1.18	0.54	0.86	0.22	0.11	0-500	-	Close to DL
H2SO4 (50) 150C	-0.05	0.14	0.04	0.05	0.05	0.15	0.15	0.29	0.29	0.25	0.01	0-50	-	Close to DL
MEOH (10) 191C	0.01	0.41	0.14	0.14	0.16	0.47	0.47	0.17	0.28	0.03	0.05	0-10	-	Close to DL
SO3 (150) 191C	-6.98	0.51	0.7	0.03	0.04	0.56	0.56	1.14	1.15	0.44	0.23	0-150	-	Close to DL

Holcim; Theodore AL
Kiln Main Stack; Dryers On
Run 3

Spectrum	Date	Time	SNR 2500	sBeam @ 2500
SPC__157191.LAB	02/01/24	14:17:36.275	**4867.05**	**1.05**

Calibration Generated: 1[illegible].35 PM 02/20/2024

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

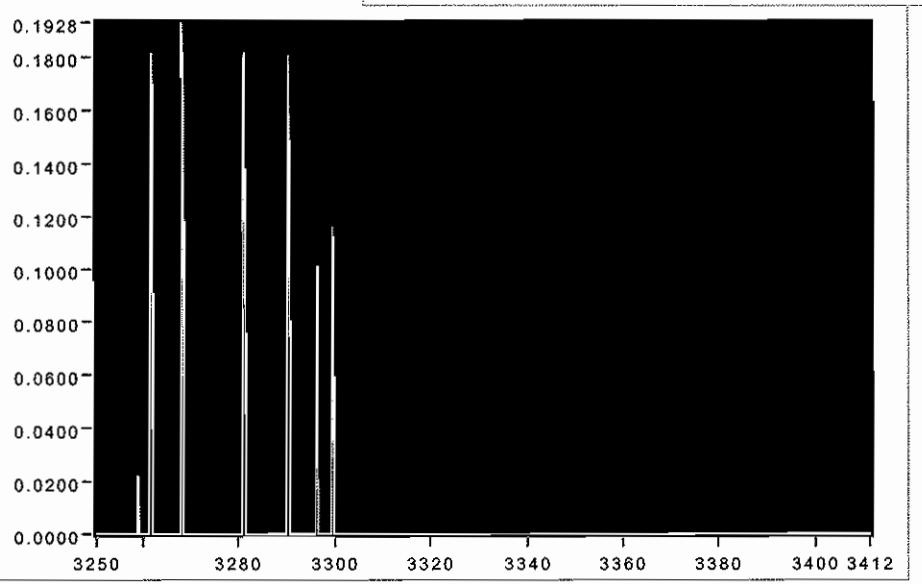
LRF Path: C:\OLT\Methods R3\Cement-coal-EGU method 191C\TD HCN (200) PCA 191C 191c_18.lrf

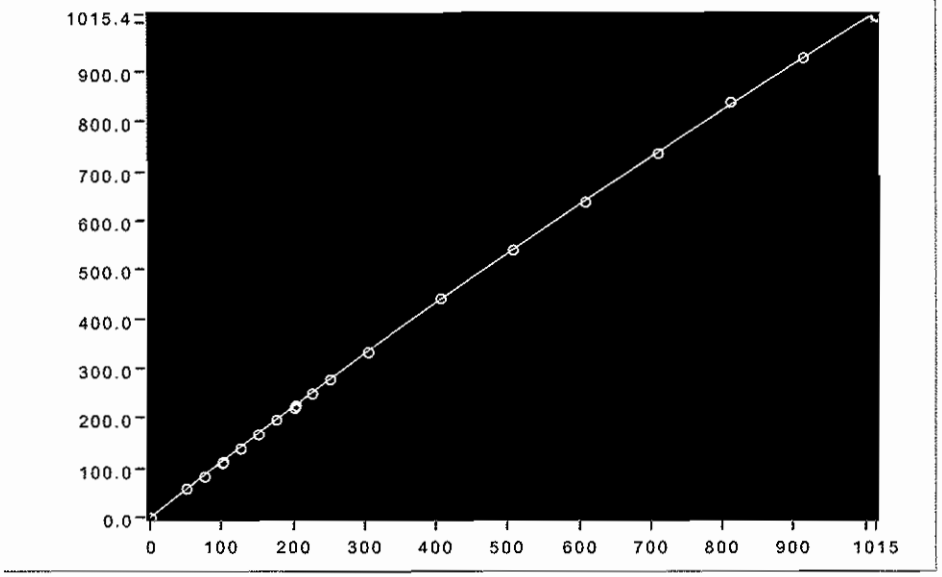
Lo Alarm: NaN

Hi Alarm: NaN

Span: Offset. [illegible]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	59.055
HCN (200) PCA 191C (14.79ppm, 5.11	191.194	0.977	75.577	75.505	83.590
HCN (200) PCA 191C (19.72ppm, 5.11	191.202	0.977	100.769	100.670	111.066
HCN (200) PCA 191C (19.87ppm, 5.11	191.196	0.978	101.536	101.566	112.904
HCN (200) PCA 191C (24.65ppm, 5.11	191.204	0.977	125.962	125.832	140.114
HCN (200) PCA 191C (29.58ppm, 5.11	191.209	0.977	151.154	150.999	168.265
HCN (200) PCA 191C (34.51ppm, 5.11	191.225	0.977	176.346	176.168	197.179
HCN (200) PCA 191C (39.44ppm, 5.11	191.217	0.977	201.538	201.349	221.482
HCN (200) PCA 191C (39.74ppm, 5.11	191.194	0.978	203.071	203.055	225.817
HCN (200) PCA 191C (44.37ppm, 5.11	191.203	0.977	226.731	226.500	249.947
HCN (200) PCA 191C (49.30ppm, 5.11	191.199	0.977	251.923	251.691	278.232
HCN (200) PCA 191C (59.61ppm, 5.11	191.221	0.978	304.607	304.577	332.797
HCN (200) PCA 191C (79.48ppm, 5.11	191.195	0.977	406.143	405.954	442.717
HCN (200) PCA 191C (99.35ppm, 5.11	191.258	0.977	507.679	507.181	542.937
HCN (200) PCA 191C (119.22ppm, 5.11	191.209	0.977	609.214	608.643	639.922
HCN (200) PCA 191C (139.09ppm, 5.11	191.246	0.977	710.750	709.953	738.363
HCN (200) PCA 191C (158.96ppm, 5.11	191.263	0.977	812.286	811.364	841.793
HCN (200) PCA 191C (178.83ppm, 5.11	191.221	0.977	913.821	913.339	930.554
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].22 AM 06/26/2012

Gas ID: HF ppm (10) 191C

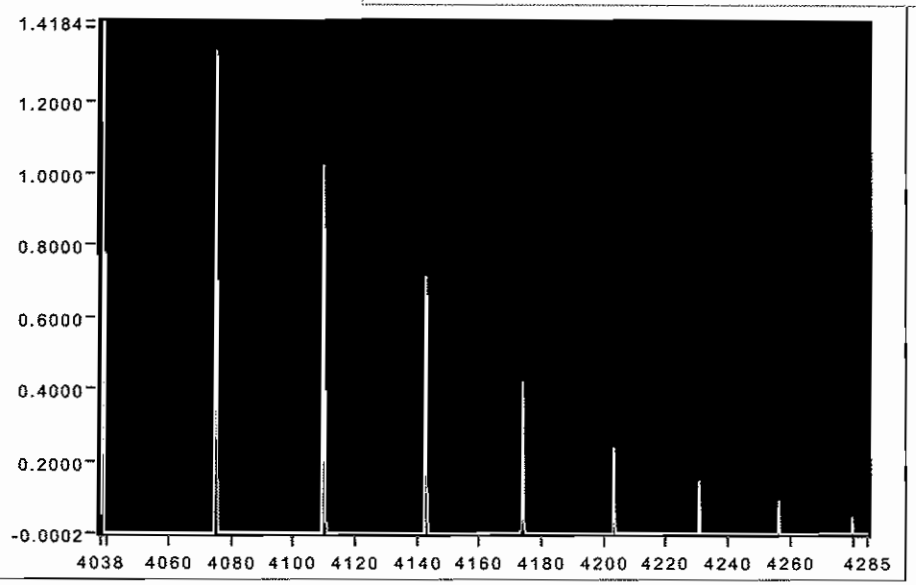
LRF Path: C:\OLT\Methods R3\Cement-coal-EGU method 191C\HF ppm (10) 191C_12.lrf

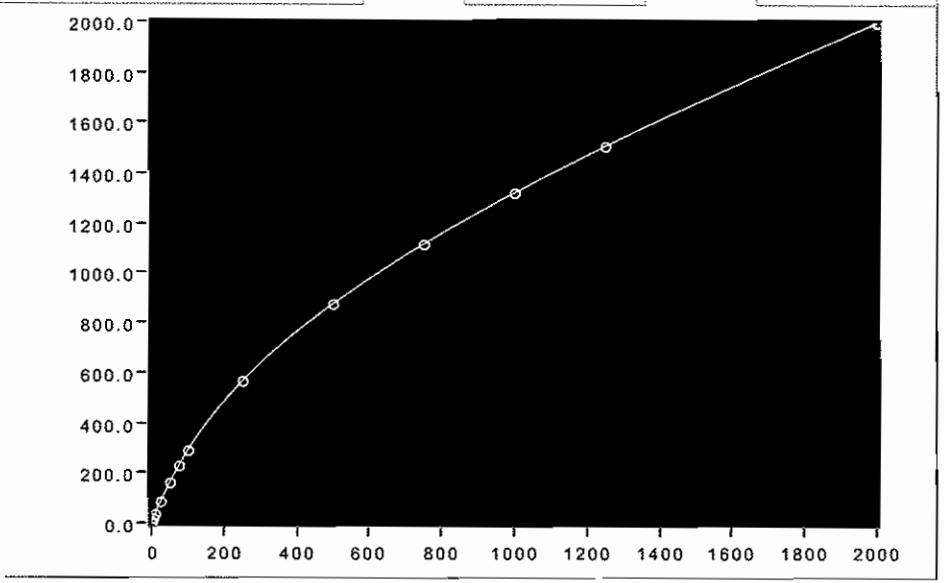
Lo Alarm: NaN

Hi Alarm: NaN

Span: Offset. [illegible]0000

Mutations: FALSE





Cal Spectra	Temp (C)	Pres (atm)	Conc (ppm-m)	Actual	Calc'd
HF 96 MNB-fz 1ppm-m (1ppm, 1.000m,	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, 1.0(	191.000	1.000	250.000	250.000	565.147
HF 96 MNB-fz 500ppm-m (500ppm, 1.0(	191.000	1.000	500.000	500.000	875.753
HF 96 MNB-fz 750ppm-m (750ppm, 1.0(	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

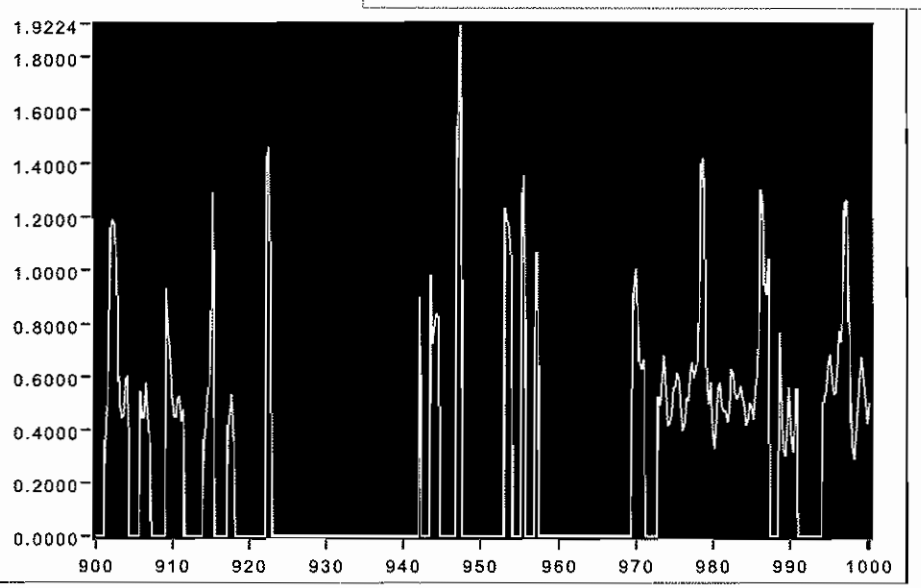
Interpolation: Spline

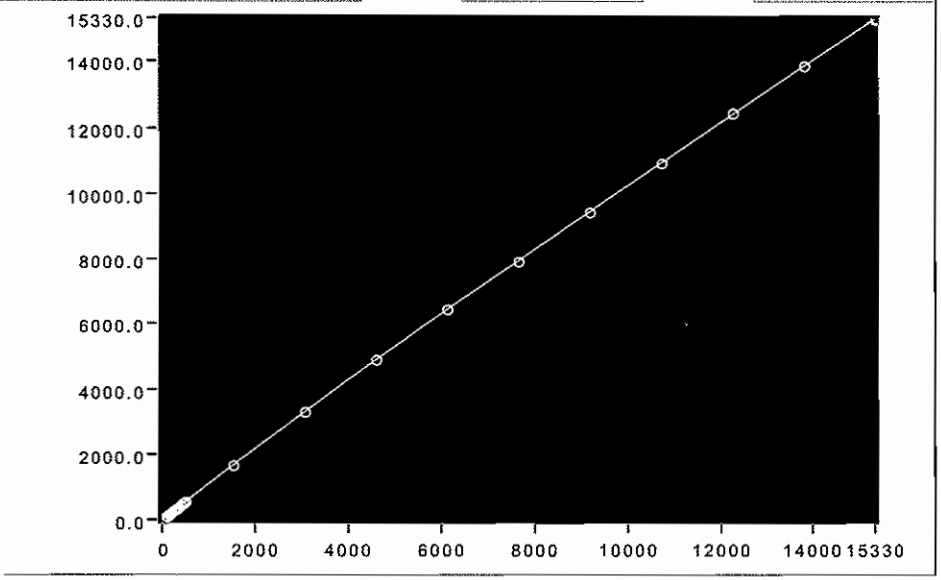
Force Through Zero: ☒

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].:50 AM 11/30/2012	Gas ID	Ethylene (100,3000) 191C	Lo Alarm	NaN	Span	Offset. .00000
		LRF Path	C:\OLT\Methods R3\Cement-coal-EGU method 191C\Ethylene (100,3000) 191C_19.lrf	Hi Alarm	NaN	Mutations	FALSE





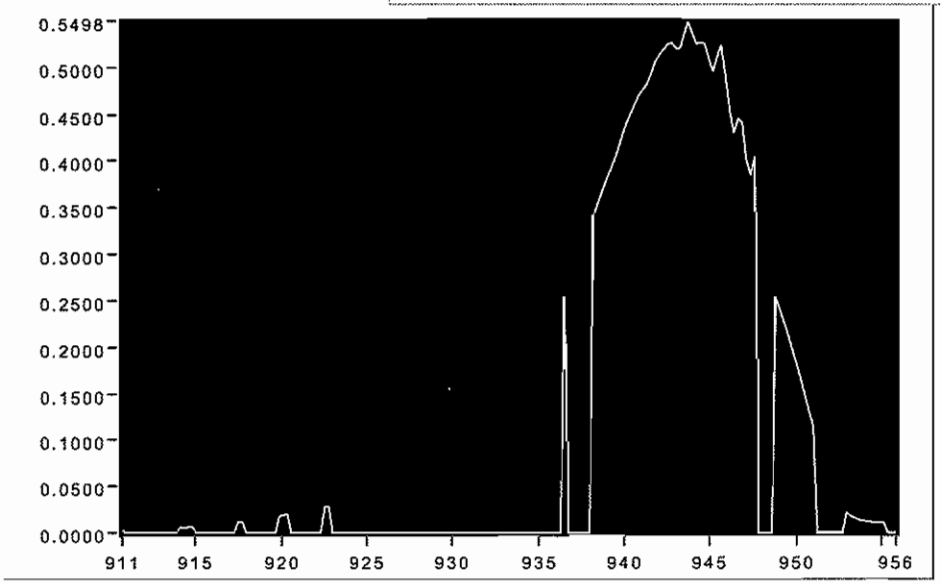
Cal Spectra	Temp (C)	Pres (atm)	Conc (ppm-m)	Actual	Calc'd
Ethylene (9.74ppm, 5.11m, 190C).lab	190.014	0.994	49.792	49.542	54.522
Ethylene (19.49ppm, 5.11m, 190C).lab	189.989	0.994	99.594	99.135	107.070
Ethylene (29.23ppm, 5.11m, 190C).lab	189.985	0.994	149.365	148.729	162.298
Ethylene (38.98ppm, 5.11m, 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

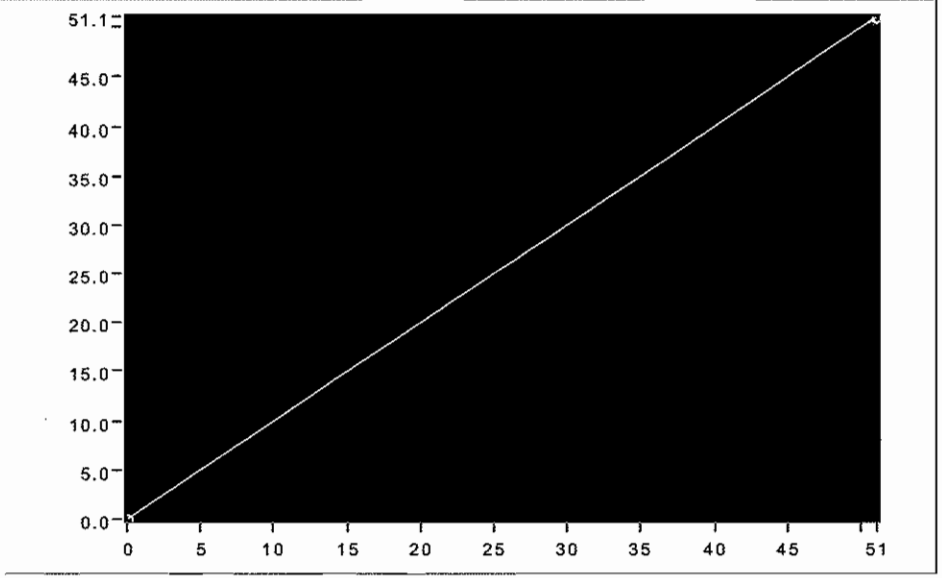
Interpolation: Quartic — Force Through Zero: ☒

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]: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
Lee Harris	Sampling Technician
Michael Powell	Sampling Technician
Jeremy Rothenberg	Sampling Technician
Duane Cannon	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.
Theodore Facility
3051 Hamilton Blvd
Theodore, AL 36582

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

September 29, 2023

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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. - Theodore Facility
3051 Hamilton Blvd
Theodore, AL 36582

Mr. Duane Cannon
Tel: (251) 443-1202
Fax: (251) 443-5127
E-Mail duane.cannon@holcim.com

1.3 PROCESS OF INTEREST

The process to be tested at the Theodore facility operates one dry cement kiln, equipped with a preheater and a 4-stage inline precalciner. It is equipped with two, inline dryers. The kiln is fed a variety of fuels including, but not limited to, coal, pet coke, natural gas, tire-derived fuel (TDF), wood waste, non-hazardous waste solids, fuel oil and non-hazardous waste liquids. It is capable of producing up to 250 tons of clinker per hour (TPH), when operating both dryers.

1.4 AIR POLLUTION CONTROL EQUIPMENT

The Holcim Theodore kiln uses two reverse air baghouses for air pollution control. Each reverse air baghouse has sixteen compartments with an air-to-cloth ratio of 1.35. They are rated for 800,000 actual cubic feet per minute (acfm). A selective non-catalytic reduction (SNCR) post combustion emissions control technology reduces NO_x by injecting ammonia into the process at a properly determined location. Raw materials fed to the dryers, in conjunction with a water spray system, protects the baghouses from high temperature preheater tower exhaust.

1.5 EMISSION POINTS AND SAMPLING LOCATIONS

The emissions from the clinker cooler and kiln are fed into two parallel dryers, before commingling in a common stack. Emissions will be measure at the common stack.

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.

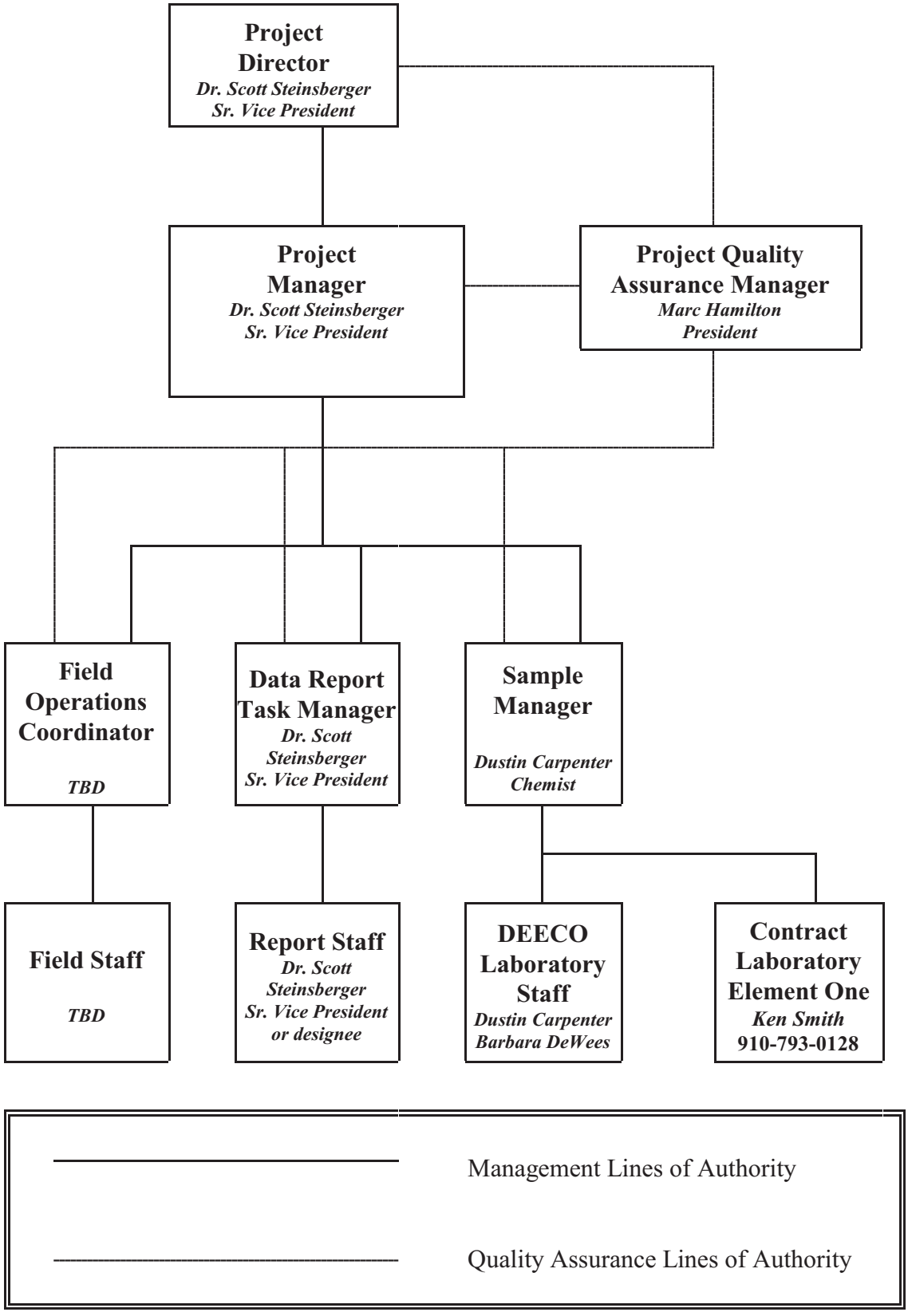


Figure 1.1 Organizational Chart

2.0 SOURCE DESCRIPTION

2.1 PROCESS DESCRIPTION

The Holcim facility operates one dry cement kiln at the Theodore, AL facility. It is equipped with two, inline dryers. The kiln is fueled by a variety of fuels including, but not limited to, coal, pet coke, natural gas, tire-derived fuel(TDF), wood waste, non-hazardous waste solids, fuel oil and non-hazardous waste liquids. The Kiln is capable of producing about 250 TPH of clinker, when operating both dryers.

A portion of kiln gases are diverted to the coal mill system, which are then exhausted through a separate stack.

2.2 CONTROL EQUIPMENT DESCRIPTION

The Holcim Theodore kiln uses two reverse air baghouses for air pollution control. Each reverse air baghouse has sixteen compartments with an air-to-cloth ratio of 1.35. They are rated for 800,000 actual cubic feet per minute (acfm). A selective non-catalytic reduction (SNCR) post combustion emissions control technology reduces NO_x by injecting ammonia into the process at a properly determined location. Raw materials fed to the dryers, in conjunction with a water spray system, protects the baghouses from high temperature preheater tower exhaust.

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

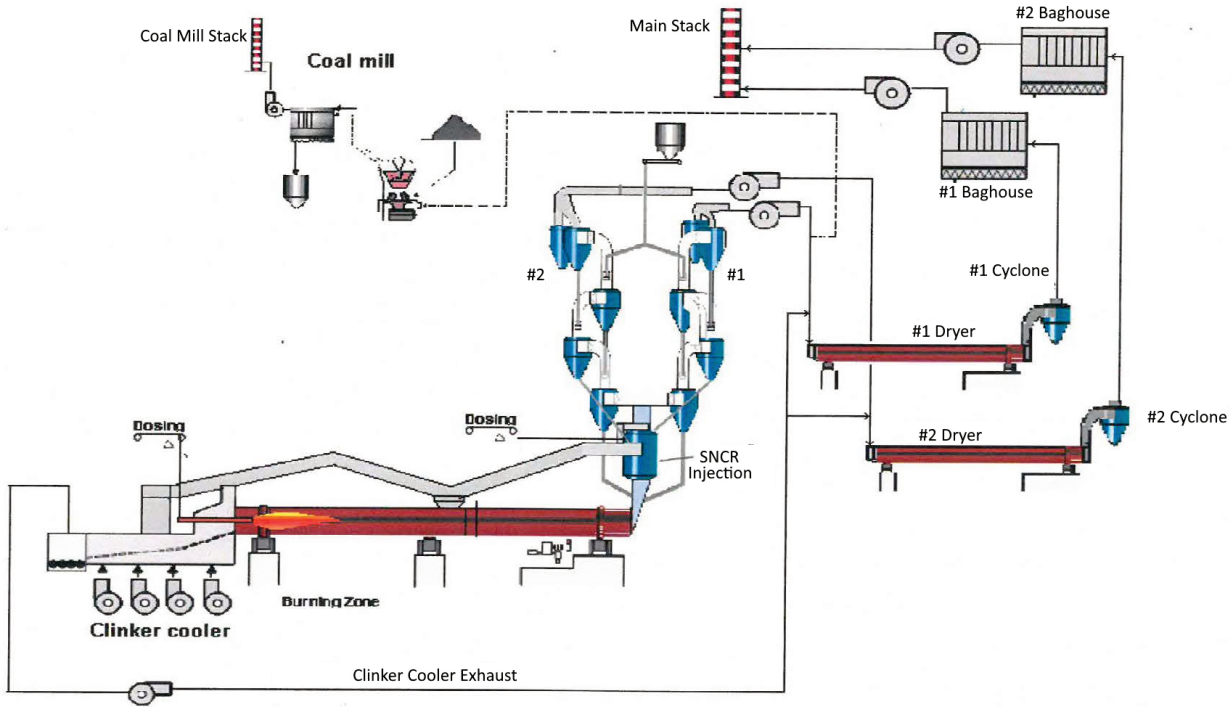


Figure 2.1 Theodore Detailed Process Schematic

3.0 TEST PROGRAM

3.1 OBJECTIVES

An air emissions sampling and analytical program will be conducted on the main stack at the Theodore cement facility located in Theodore, Alabama. 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. The Theodore kiln has no inline raw mill, however the inline dryers are treated similar; therefore both "Dryers On" and "Dryers Off" operating conditions are anticipated to be tested; unless market or process conditions dictate a single dryer (a.k.a. "single string") operation.

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						
Stack	Arrive on-site and set up test equipment on the common stack					
Day 2						
Stack; Both Dryers On	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
Day 3						
Stack; Both Dryers Off	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

Mr. Duane Cannon, the Theodore 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

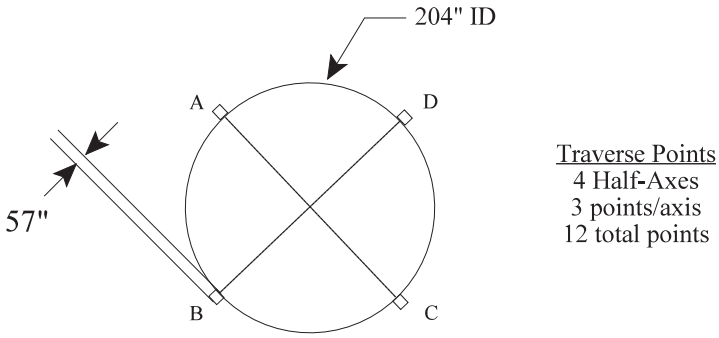
4.1 SAMPLING LOCATION DESCRIPTION

The common stack is a vertically-oriented circular stack with an inside diameter of 204". The stack gas sampling ports are located 1680 inches (8.2 duct diameters) above the duct breaching and 1380 inches (6.8 duct diameters) below the stack outlet.

This sampling location meets the minimum specifications for selection of a measurement site as outlined in 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 common stack test location.

A twelve (12) point sampling traverse will be made using six (6) point traverses in each of two perpendicular directions (or 3 points in each of 4 sampling ports) at the common stack. 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 common stack is provided in Figure 4.1.



Section K-K

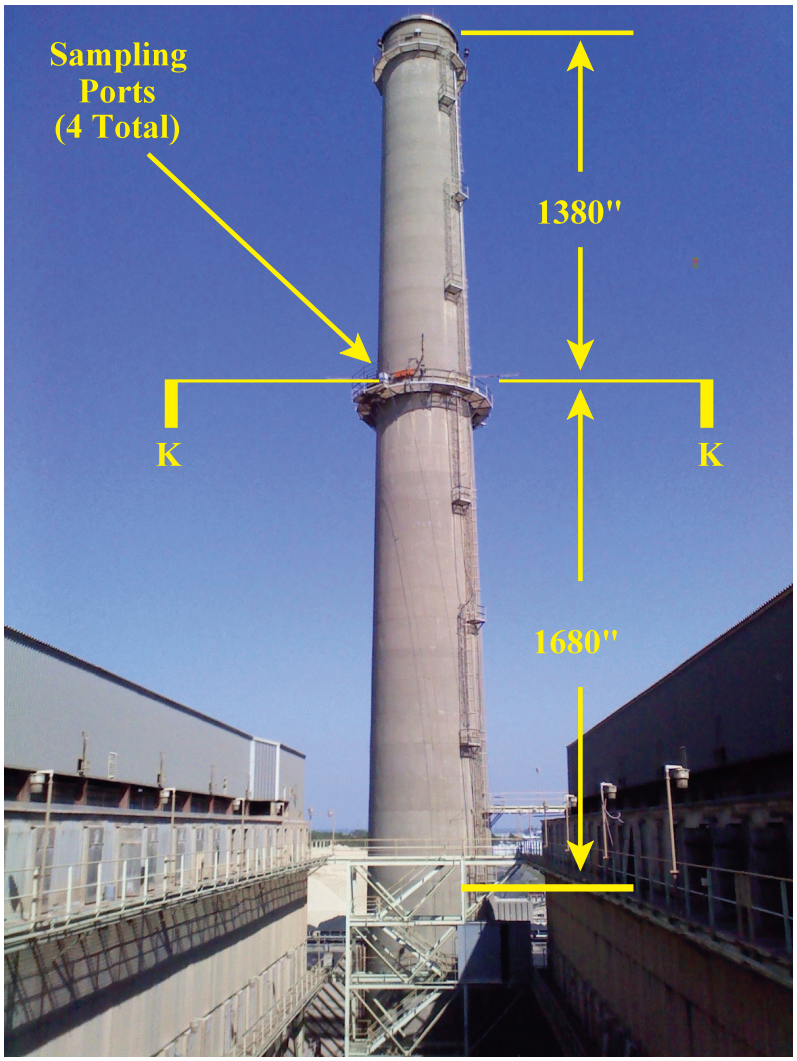


Figure 4.1 Schematic of Stack Sampling Location

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 results will be presented in a format which meets the requirements of the TCEQ reporting requirements. 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