Confirmatory Performance Test Plan

Norlite, LLC
628 S. Saratoga Street
Cohoes, NY 12047

Sources to be Tested: Two Lightweight Aggregate Kilns (LWAKs)
Proposed Test Dates: August 8-10, 2023

Project No. AST-2023-2721

Prepared By
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Regulatory Information

Regulatory Citation	40 CFR 63, Subpart EEE – National Emission Standards for Hazardous Waste Incinerators, Cement Kilns, and Lightweight Aggregate Kilns

Source Information

Source Name	*Source ID*	*Target Parameter*
Lightweight Aggregate Kilns (LWAK)	Kiln #1, EP 00001 Kiln #2, EP 00002	Dioxin/Furan

Contact Information

Test Location	*Test Company*	*Analytical Laboratory*
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1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by Norlite to conduct Confirmatory Performance Testing (CfPT) at the Cohoes, New York facility. The purpose of testing is to satisfy the performance testing requirements of 40 CFR Part 63.1207 (b)(2) Subpart EEE National Emission Standards for Hazardous Waste Incinerators, Cement Kilns, and Lightweight Aggregate Kilns. In general, emissions testing will be conducted to determine the concentration and emission rate of dioxins and furans (D/F) from the exhaust of two lightweight aggregate kilns (LWAK) under normal operating conditions.

As required in Subpart EEE concurrent with the performance of the CfPT, an audit of the Continuous Monitoring System (CMS) will be performed. The CMS Audit Plan is in Appendix D.

1.1 Facility Description

The Norlite LWAKs produce an expanded shale aggregate and in the process burn liquid low-grade fuel (LLGF) as an energy source. The process is monitored and controlled by a distributive control system (DCS) capable of continuously monitoring the process to assure operational parameters are within regulatory and permit limits while waste is being fed to the unit. In addition, both kilns are equipped with a continuous emissions monitoring system (CEMS) that continuously samples the exhaust gases for oxygen and carbon monoxide concentrations in the stack gas stream. This facility handles liquid wastes that are classified as hazardous and treats process vent streams from operations at the facility pursuant to compliance with 40 CFR Part 63, Subpart DD. Because these units burn RCRA hazardous waste, they are regulated by 40 CFR Part 63, Subpart EEE: National Emission Standards for Hazardous Air Pollutants (NESHAPs) from Hazardous Waste Combustors (HWCs).

There have not been any adjustments or significant maintenance performed on the control equipment during the six-month period prior to testing. There have not been any equipment modifications, failures, or malfunctions since the last performance test. There have not been any emissions-related engineering evaluations conducted on the system since the last performance test.

1.2 Project Team

Personnel planned to be involved in this project are identified in the following table.

Table 1-1 Project Team

Facility Personnel	Prince Knight
Alliance Personnel	Michael Kelley other field personnel assigned at time of testing event

1.3 Safety Requirements

Testing personnel will undergo site-specific safety training for all applicable areas upon arrival at the site. Alliance personnel will have current OSHA or MSHA safety training and be equipped with hard hats, safety glasses with side shields, steel-toed safety shoes, hearing protection, fire resistant clothing, and fall protection (including shock corded lanyards and full-body harnesses). Alliance personnel will conduct themselves in a manner consistent with Client and Alliance's safety policies.

A Job Safety Analysis (JSA) will be completed daily by the Alliance Field Team Leader.

2.0 Summary of Test Program

To satisfy the requirements of Norlite's NYSDEC permit and the NESHAP Subpart EEE, the facility will conduct a confirmatory performance test to document the continued compliance of each LWAK. Emissions testing will be performed on each kiln utilizing U.S. EPA Reference Test Methods 1, 2, 3A, 4 and SW 846-0023A while each kiln is operating at normal conditions. Table 2-3 presents an outline and tentative schedule for the emissions testing program.

2.1 Process/Control System Parameters

Table 2-1 provides normal carbon monoxide (CO) CEMS emissions levels for each Kiln. Testing will be performed within the range of the average value to the maximum value. The average value is defined as the sum of the hourly rolling average values recorded (each minute) over the previous 12 months, divided by the number of rolling averages recorded during that time. The average value does not include calibration data, startup data, shutdown data, malfunction data, and data obtained when not burning hazardous waste.

Table 2-1 Normal CO Concentrations

	Kiln 1		Kiln 2	
	Avg	Max	Avg	Max
CO ppm @ 15% O2	31.7	99.9	13.8	99.0

Each operating limit used to maintain compliance with the dioxin/furan emission standard will be held within the range of the average value over the previous 12 months and the maximum or minimum, as appropriate, that is allowed. Table 2-2 provides that normal operating range values for each operating parameter associated with D/F compliance.

Table 2-2 Normal Operating Parameter Values

Operating Parameter	Kiln 1			Kiln 2		
	Min	Avg	Max	Min	Avg	Max
Maximum Gas Conditioning Tower Exchanger Exit Temperature (°F)	339	357.1	393	286.1	360.9	393
Minimum Combustion Chamber Exit Temperature (°F)	918	958.5	1067	919	994.1	1200
Maximum Production Rate (TPH)	0.3	16.5	24.1	0.1	15.9	23.8
Maximum Total (and Pumpable) Hazardous Waste Feed Rate (GPH)	0.01	8.8	10.4	0.01	8.2	10.5

In addition, chlorine feed will be maintained at normal feed rates or greater. These values are 60.3 lbs/hr for Kiln 1 and Kiln 2

2.1 Proposed Test Schedule

Table 2-3 presents an outline and tentative schedule for the emissions testing program.

Table 2-3: Program Outline and Tentative Test Schedule

Testing Location	Parameter	US EPA Method	No. of Runs	Run Duration	Est. Onsite Time
DAY 1					
Equipment Setup & Pretest QA/QC Checks					6 hr
DAYS 2 - 3 (one day per kiln)					
Kiln Exhaust	VFR	1-2	3	180	12
	O_2/CO_2	3A			
	BWS	4			
	Dioxin/Furan	SW 846-0023A			
DAY 4					
Contingency Day (if needed)					

2.2 Emission Limits

Emission limits for each pollutant are below.

Table 2-2: Emission Limits

Emissions Parameter	Limit	Citation
PCDDs/PCDFs	$\leq$0.20 ng/dscm TEQ	40 CFR 63.1221(a)(1)(i)

2.3 Test Report

The final test report must be submitted within 60 days of the completion of the performance test and will include the following information.

- *Introduction* – Brief discussion of project scope of work and activities.
- *Results and Discussion* – A summary of test results and process/control system operational data with comparison to regulatory requirements or vendor guarantees along with a description of process conditions and/or testing deviations that may have affected the testing results.
- *Methodology* – A description of the sampling and analytical methodologies.
- *Sample Calculations* – Example calculations for each target parameter.
- *Field Data* – Copies of actual handwritten or electronic field data sheets.
- *Laboratory Data* – Copies of laboratory report(s) and chain of custody(s).
- *Quality Control Data* – Copies of all instrument calibration data and/or calibration gas certificates.
- *Process Operating/Control System Data* – Process operating and control system data (as provided by Norlite) to support the test results.

3.0 Testing Methodology

This section provides a description of the sampling and analytical procedures for each test method that will be employed during the test program. All equipment, procedures, and quality assurance measures necessary for the completion of the test program meet or exceed the specifications of each relevant test method. The emission testing program will be conducted in accordance with the test methods listed in Table 3-1.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Volumetric / Gravimetric Analysis
Dioxin/Furans	0023A	Isokinetic Sampling

All stack diameters, depths, widths, upstream and downstream disturbance distances, and nipple lengths will be measured on site with a verification measurement provided by the Field Team Leader.

3.1 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide

The oxygen (O_2) and carbon dioxide (CO_2) testing will be conducted in accordance with U.S. EPA Reference Test Method 3A. Data will be collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line, gas conditioning system and the identified gas analyzers. The gas conditioning system will be a non-contact condenser used to remove moisture from the stack gas. The quality control measures are described in Section 3.4.

3.2 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content will be determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train will consist of a series of chilled impingers. Prior to testing, each impinger will be filled with a known quantity of water or silica gel. Each impinger will be analyzed gravimetrically before and after each test run on the same balance to determine the amount of moisture condensed.

3.3 SW-846 Test Method 0023A – Dioxin/Furan

The dioxin and furan testing were conducted in accordance with SW-846 Test Method 0023A. The sampling system consisted of a glass or quartz nozzle, heated glass or quartz-lined probe, glass filter holder with pre-cleaned glass-fiber filter, condenser coil, XAD sorbent module, gas conditioning train, pump, and calibrated dry gas meter. The gas conditioning system consisted of five (5) chilled impingers. The first impinger (shortened stem) was empty and used for moisture knockout. The next two (2) impingers each contained 100 mL of water. The fourth impinger was empty while the fifth impinger was charged with 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at a temperature of 120 ± 14°C (248 ±25°F), and the impinger temperature was maintained below at 20°C (68°F) or less throughout testing.

All glassware leading to the XAD adsorbing resin trap was cleaned and sealed before mobilizing to the site. The sampling train was assembled in the sample recovery area. The pre-cleaned quartz filter was placed in a glass filter holder with a Teflon filter support and connected to the condenser coil. All open ends of the sampling train were sealed with Teflon tape prior to complete assembly at the sampling location.

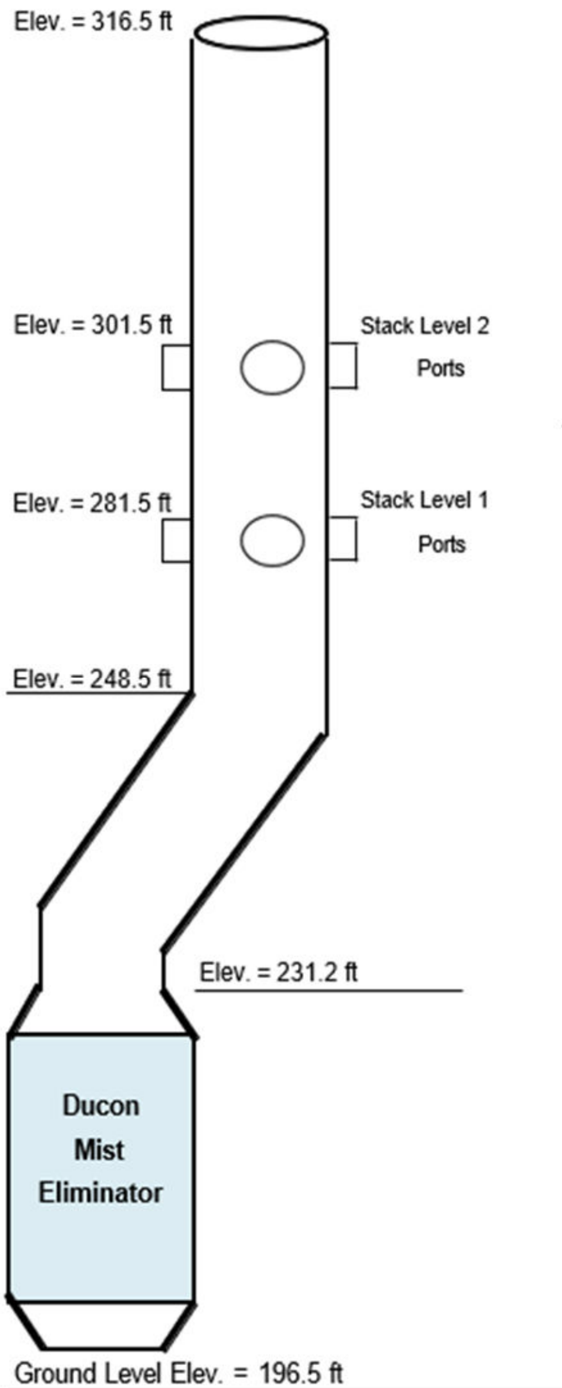
Following the completion of each test run, the sampling train was leak checked at vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. The contents of the impingers were measured for moisture gain, then discarded. The XAD sorbent module was sealed on both ends and placed on ice. The filter was removed from the filter holder and placed in container 1. The nozzle, probe liner and front half of the filter holder were triple-rinsed and brushed with acetone and methylene chloride, and these rinses were recovered in container 2. All glassware cleaned for container 2 was also triple rinsed with toluene and recovered into container 2. The back half of the filter holder and coil condenser glassware were triple rinsed with acetone and methylene chloride and recovered in container 3. All glassware cleaned for container 3 were also triple rinsed with toluene and recovered into container 3. All samples were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

3.4 Sampling Locations

Exhaust gas samples will be collected in the outlet stacks, which is 125 ft. above grade, has an inside diameter of 48 inches and is equipped with two sampling platforms. The samples will be collected from test ports that meet the minimum criteria specified in EPA Method 1. Level 1 ports are approximately 85 ft. above ground and Level 2 ports are about 105 ft. above ground. Consistent with prior testing, Level 1 test ports will be used during this test program.

Figure 3-1 provides a schematic of the stack showing the location of the sampling ports and the upstream/downstream distances from flow disturbances. This schematic drawing also provides a schematic of the traverse point locations applicable to the isokinetic sampling trains as well as key stack parameters needed to select the appropriate size sampling nozzle.

Figure 3-1 Stack Sampling Traverse Point Locations



KEY STACK PARAMETERS		
Parameter	**Units**	**Value**
Temp.	°F	130
Moisture	% v/v	13.0
O_2	% v/v	14.9
CO_2	% v/v	4.6
Flowrate	dscfm	30,250
Vel. Press.	in. w.c.	0.70
Static P.	in. w.c.	1.00

From Disturbances:

Level 1: 8.25 diam. downstream & 8.75 diam. upstream

Level 2: 13.25 diam. downstream & 3.75 diam. upstream

TRAVERSE POINT DATA		
Pt. No.	**% of Diam.**	**Dist. Incl. Port (in.)**
1	4.4%	8.1
2	14.6%	13.0
3	29.6%	20.2
4	70.4%	39.8
5	85.4%	47.0
6	95.6%	51.9

Stack ID = **48** inches
Port + Wall = **6.0** inches

Kiln # 1 or # 2
Norlite LLC - Cohoes, NY

4.0 Quality Assurance Program

Alliance follows the procedures outlined in the Quality Assurance/Quality Control Management Plan 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. Adherence to prescribed procedures is quite often the most applicable QC check.

4.1 Equipment

Field test equipment is assigned a unique, permanent identification number. Prior to mobilizing for the test program, equipment is inspected before being packed to detect equipment problems prior to arriving on site. 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. Therefore, replacements for critical equipment or components are brought to the job site. Equipment returning from the field is inspected before it is returned to storage. During these inspections, items are cleaned, repaired, reconditioned, and recalibrated where necessary.

Calibrations are conducted in a manner, and at a frequency, which meets or exceeds U.S. EPA specifications. The calibration procedures outlined in the U.S. EPA Methods, and those recommended within the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III (EPA-600/R-94/038c, September 1994) are utilized. When these methods are inapplicable, methods such as those prescribed by the American Society for Testing and Materials (ASTM) or other nationally recognized agency may be used. Data obtained during calibrations is checked for completeness and accuracy. Copies of calibration forms are included in the report.

The following sections elaborate on the calibration procedures followed by Alliance for these items of equipment.

- Dry Gas Meter and Orifice. A full meter calibration using critical orifices as the calibration standard is conducted at least semi-annually, more frequently if required. The meter calibration procedure determines the meter correction factor (Y) and the meter's orifice pressure differential (ΔH@). Alliance uses approved Alternative Method 009 as a post-test calibration check to ensure that the correction factor has not changed more than 5% since the last full meter calibration. This check is performed after each test series.
- Pitot Tubes and Manometers. Type-S pitot tubes that meet the geometric criteria required by U.S. EPA Reference Test Method 2 are assigned a coefficient of 0.84 unless a specific coefficient has been determined from a wind tunnel calibration. If a specific coefficient from a wind tunnel calibration has been obtained that coefficient will be used in lieu of 0.84. Standard pitot tubes that meet the geometric criteria required by U.S. EPA Reference Test Method 2 are assigned a coefficient of 0.99. Any pitot tubes not meeting the appropriate geometric criteria are discarded and replaced. Manometers are verified to be level and zeroed prior to each test run and do not require further calibration.
- Temperature Measuring Devices. All thermocouple sensors mounted in Dry Gas Meter Consoles are calibrated semi-annually with a NIST-traceable thermocouple calibrator (temperature simulator) and verified during field use using a second NIST-traceable meter. NIST-traceable thermocouple calibrators are calibrated annually by an outside laboratory.
- Nozzles. Nozzles are measured three (3) times prior to initiating sampling with a caliper. The maximum difference between any two (2) dimensions is 0.004 in.
- Digital Calipers. Calipers are calibrated annually by Alliance by using gage blocks that are calibrated annually by an outside laboratory.

- Barometer. The barometric pressure is obtained from a nationally recognized agency or a calibrated barometer. Calibrated barometers are checked prior to each field trip against a mercury barometer. The barometer is acceptable if the values agree within ± 2 percent absolute. Barometers not meeting this requirement are adjusted or taken out of service.
- Balances and Weights. Balances are calibrated annually by an outside laboratory. A functional check is conducted on the balance each day it is use in the field using a calibration weight. Weights are re-certified every two (2) years by an outside laboratory or internally. If conducted internally, they are weighed on a NIST traceable balance. If the weight does not meet the expected criteria, they are replaced.
- Other Equipment. A mass flow controller calibration is conducted on each Environics system annually following the procedures in the Manufacturer's Operation manual. A methane/ethane penetration factor check is conducted on the total hydrocarbon analyzers equipped with non-methane cutters every six (6) months following the procedures in 40 CFR 60, Subpart JJJJ. Other equipment such as probes, umbilical lines, cold boxes, etc. are routinely maintained and inspected to ensure that they are in good working order. They are repaired or replaced as needed.

4.2 Field Sampling

Field sampling will be done in accordance with the Standard Operating Procedures (SOP) for the applicable test method(s). General QC measures for the test program include:

- Cleaned glassware and sample train components will be sealed until assembly.
- Sample trains will be leak checked before and after each test run.
- Appropriate probe, filter and impinger temperatures will be maintained.
- The sampling port will be sealed to prevent air from leaking from the port.
- Dry gas meter, ΔP, ΔH, temperature and pump vacuum data will be recorded during each sample point.
- An isokinetic sampling rate of 90-110% will be maintained, as applicable.
- All raw data will be maintained in organized manner.
- All raw data will be reviewed daily for completeness and acceptability.

4.3 Analytical Laboratory

Analytical laboratory selection for sample analyses is based on the capabilities, certifications, and accreditations that the laboratory possesses. An approved analytical laboratory subcontractor list is maintained with a copy of the certificate and analyte list as evidence of compliance. Alliance assumes responsibility to the client for the subcontractor's work. Alliance maintains a verifiable copy of the results with chain of custody documentation.

Appendix A

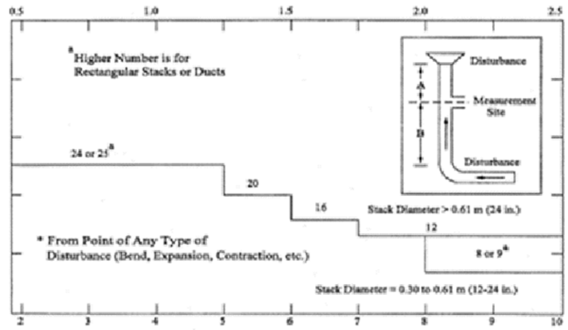
Alliance SOURCE TESTING

Method 1 Data

Location	0
Source	0
Project No.	0
Date:	

Stack Parameters

Duct Orientation:	Vertical	
Duct Design:	Circular	
Distance from Far Wall to Outside of Port:	25.00	in
Nipple Length:	5.00	in
Depth of Duct:	20.00	in
Width of Duct:	--	in
Cross Sectional Area of Duct:	2.18	ft^2
Equivalent Diameter:		in
No. of Test Ports:	2	
Distance A:	≥3.3	ft
Distance A Duct Diameters:	--	(must be > 0.5)
Distance B:	≥13.3	ft
Distance B Duct Diameters:	--	(must be > 2)
Minimum Number of Traverse Points:	0	
Actual Number of Traverse Points:	8	



CIRCULAR DUCT

LOCATION OF TRAVERSE POINTS

Number of traverse points on a diameter

	2	3	4	5	6	7	8	9	10	11	12
1	14.6	--	6.7	--	4.4	--	3.2	--	2.6	--	2.1
2	85.4	--	25.0	--	14.6	--	10.5	--	8.2	--	6.7
3	--	--	75.0	--	29.6	--	19.4	--	14.6	--	11.8
4	--	--	93.3	--	70.4	--	32.3	--	22.6	--	17.7
5	--	--	--	--	85.4	--	67.7	--	34.2	--	25.0
6	--	--	--	--	95.6	--	80.6	--	65.8	--	35.6
7	--	--	--	--	--	--	89.5	--	77.4	--	64.4
8	--	--	--	--	--	--	96.8	--	85.4	--	75.0
9	--	--	--	--	--	--	--	--	91.8	--	82.3
10	--	--	--	--	--	--	--	--	97.4	--	88.2
11	--	--	--	--	--	--	--	--	--	--	93.3
12	--	--	--	--	--	--	--	--	--	--	97.9

**Percent of stack diameter from inside wall to traverse point.*

Traverse Point	% of Diameter	Distance from inside wall	Distance from outside of port
1	6.7	1.34	6.34
2	25.0	5.00	10.00
3	75.0	15.00	20.00
4	93.3	18.66	23.66
5	--	--	--
6	--	--	--
7	--	--	--
8	--	--	--
9	--	--	--
10	--	--	--
11	--	--	--
12	--	--	--

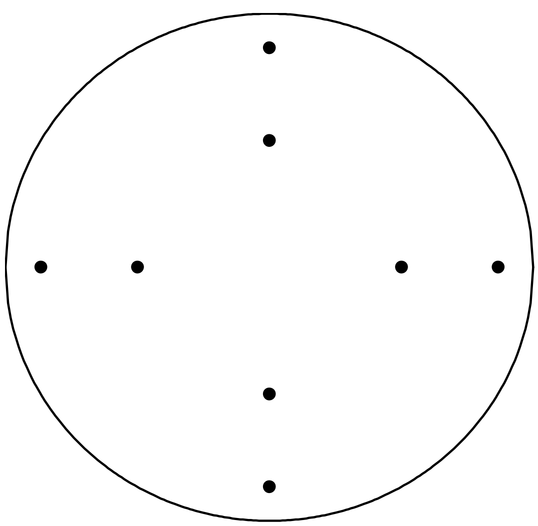
Stack Diagram

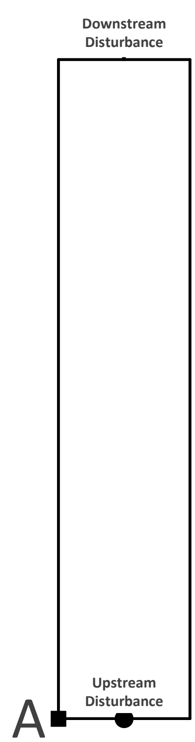
A = ≥3.3 ft.

B = ≥13.3 ft.

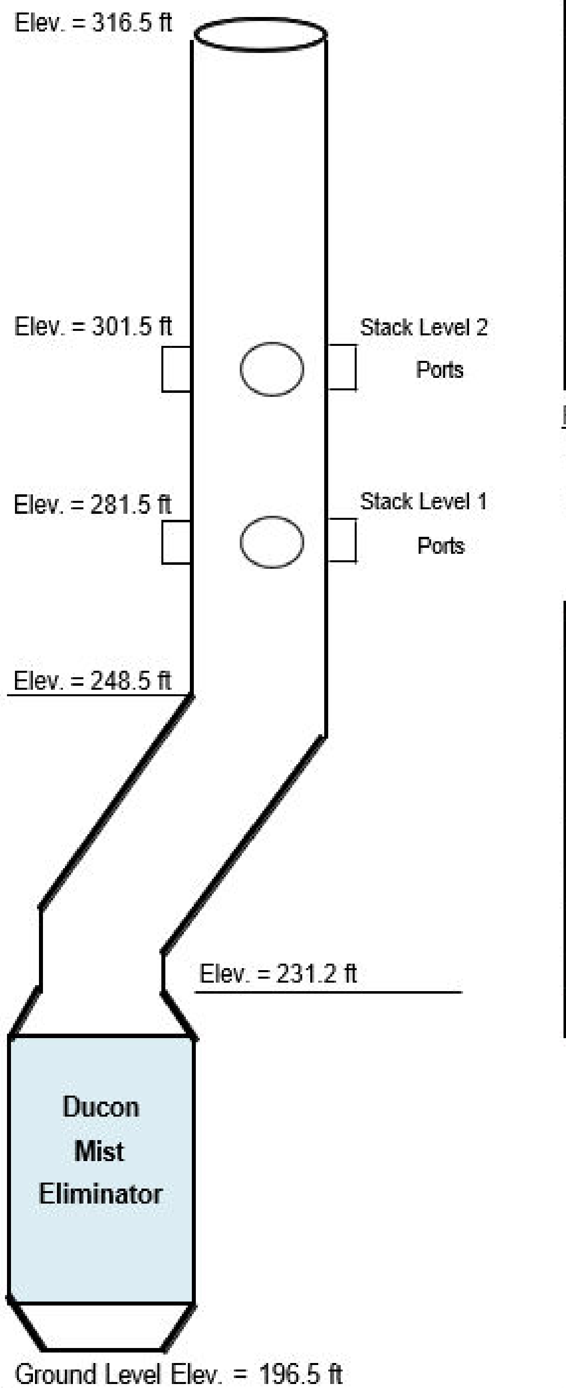
Depth of Duct = 20 in.

Cross Sectional Area





Stack Sampling Traverse Point Locations



KEY STACK PARAMETERS		
Parameter	**Units**	**Value**
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O_2	% v/v	14.9
CO_2	% v/v	4.6
Flowrate	dscfm	30,250
Vel. Press.	in. w.c.	0.70
Static P.	in. w.c.	1.00

From Disturbances:

Level 1: 8.25 diam. downstream & 8.75 diam. upstream

Level 2: 13.25 diam. downstream & 3.75 diam. upstream

TRAVERSE POINT DATA		
Pt. No.	**% of Diam.**	**Dist. Incl. Port (in.)**
1	4.4%	8.1
2	14.6%	13.0
3	29.6%	20.2
4	70.4%	39.8
5	85.4%	47.0
6	95.6%	51.9

Stack ID = **48** inches

Port + Wall = **6.0** inches

Kiln # 1 or # 2

Norlite LLC - Cohoes, NY

Appendix B

Alliance SOURCE TESTING

Location: --
Source: --
Project No.: --
Run No.: 1
Parameter: --

Meter Pressure (Pm), in. Hg

$$Pm = Pb + \frac{\Delta H}{13.6}$$

where,

Pb	--	= barometric pressure, in. Hg
ΔH	--	= pressure differential of orifice, in H_2O
Pm	--	= in. Hg

Absolute Stack Gas Pressure (Ps), in. Hg

$$Ps = Pb + \frac{Pg}{13.6}$$

where,

Pb	--	= barometric pressure, in. Hg
Pg	--	= static pressure, in. H_2O
Ps	--	= in. Hg

Standard Meter Volume (Vmstd), dscf

$$Vmstd = \frac{17.647 \times Y \times Vm \times Pm}{Tm}$$

where,

Y	--	= meter correction factor
Vm	0.000	= meter volume, cf
Pm	--	= absolute meter pressure, in. Hg
Tm	--	= absolute meter temperature, ^oR
Vmstd	--	= dscf

Standard Wet Volume (Vwstd), scf

$$Vwstd = 0.04707 \times Vlc$$

where,

Vlc	--	= volume of H_2O collected, ml
Vwstd	--	= scf

Moisture Fraction (BWSsat), dimensionless (theoretical at saturated conditions)

$$BWSsat = \frac{10^{6.37-\left(\frac{2,827}{Ts+365}\right)}}{Ps}$$

where,

Ts	--	= stack temperature, °F
Ps	--	= absolute stack gas pressure, in. Hg
BWSsat	--	= dimensionless

Moisture Fraction (BWS), dimensionless (measured)

$$BWS = \frac{Vwstd}{(Vwstd + Vmstd)}$$

where,

Vwstd	--	= standard wet volume, scf
Vmstd	--	= standard meter volume, dscf
BWS	--	= dimensionless

Moisture Fraction (BWS), dimensionless

$$BWS = BWSmsd \text{ unless } BWSsat < BWSmsd$$

where,

BWSsat	--	= moisture fraction (theoretical at saturated conditions)
BWSmsd	--	= moisture fraction (measured)
BWS	--	

Location: --
Source: --
Project No.: --
Run No.: 1
Parameter: --

Molecular Weight (DRY) (Md), lb/lb-mole

$$Md = (0.44 \times \% CO_2) + (0.32 \times \% O2) + (0.28\,(100 - \% CO_2 - \% O2))$$

where,

CO_2	--	= carbon dioxide concentration, %
O_2	--	= oxygen concentration, %
Md	--	= lb/lb mol

Molecular Weight (WET) (Ms), lb/lb-mole

$$Ms = Md\,(1 - BWS) + 18\,(BWS)$$

where,

Md	--	= molecular weight (DRY), lb/lb mol
BWS	--	= moisture fraction, dimensionless
Ms	--	= lb/lb mol

Average Velocity (Vs), ft/sec

$$Vs = 85.49 \times Cp \times (\Delta P^{1/2})\ avg \times \sqrt{\frac{Ts}{Ps \times Ms}}$$

where,

Cp	--	= pitot tube coefficient
$\Delta P^{1/2}$	--	= velocity head of stack gas, (in. H_2O)$^{1/2}$
Ts	--	= absolute stack temperature, °R
Ps	--	= absolute stack gas pressure, in. Hg
Ms	--	= molecular weight of stack gas, lb/lb mol
Vs	--	= ft/sec

Average Stack Gas Flow at Stack Conditions (Qa), acfm

$$Qa = 60 \times Vs \times As$$

where,

Vs	--	= stack gas velocity, ft/sec
As	--	= cross-sectional area of stack, ft^2
Qa	--	= acfm

Average Stack Gas Flow at Standard Conditions (Qs), dscfm

$$Qs = 17.647 \times Qa \times (1 - BWS) \times \frac{Ps}{Ts}$$

where,

Qa	--	= average stack gas flow at stack conditions, acfm
BWS	--	= moisture fraction, dimensionless
Ps	--	= absolute stack gas pressure, in. Hg
Ts	--	= absolute stack temperature, °R
Qs	--	= dscfm

Dry Gas Meter Calibration Check (Yqa), dimensionless

$$Yqa = \frac{Y - \left(\frac{\Theta}{Vm}\sqrt{\frac{0.0319 \times Tm \times 29}{\Delta H@ \times \left(Pb + \frac{\Delta Havg.}{13.6}\right) \times Md}}\sqrt{\Delta H}\ avg.\right)}{Y} \times 100$$

where,

Y	--	= meter correction factor, dimensionless
Θ	240	= run time, min.
Vm	0	= total meter volume, dcf
Tm	--	= absolute meter temperature, °R
ΔH@	--	= orifice meter calibration coefficient, in. H_2O
Pb	--	= barometric pressure, in. Hg
ΔH avg	--	= average pressure differential of orifice, in H_2O
Md	--	= molecular weight (DRY), lb/lb mol
$(\Delta H)^{1/2}$	--	= average squareroot pressure differential of orifice, (in. H2O)$^{1/2}$
Yqa	--	= dimensionless

Location: --
Source: --
Project No.: --
Run No.: 1
Parameter: --

Volume of Nozzle (Vn), ft^3

$$\mathrm{Vn} = \frac{Ts}{Ps}\left(0.002669 \times Vlc + \frac{\mathrm{Vm} \times Pm \times Y}{Tm}\right)$$

where,

Ts	--	= absolute stack temperature, °R
Ps	--	= absolute stack gas pressure, in. Hg
Vlc	--	= volume of H_2O collected, ml
Vm	0.000	= meter volume, cf
Pm	--	= absolute meter pressure, in. Hg
Y	--	= meter correction factor, unitless
Tm	--	= absolute meter temperature, °R
Vn	--	= volume of nozzle, ft^3

Isokinetic Sampling Rate (I), %

$$\mathrm{I} = \left(\frac{\mathrm{Vn}}{\theta \times 60 \times \mathrm{An} \times Vs}\right) \times 100$$

where,

Vn	--	= nozzle volume, ft^3
θ	240.0	= run time, minutes
An	--	= area of nozzle, ft^2
Vs	--	= average velocity, ft/sec
I	--	= %

D/F TEQ Concentration ($C_{D/F}$), ng TEQ/dscm

$$C_{D/F} = \frac{M_{D/F} \times 35.313}{Vmstd \times \ 1.0E+03}$$

where,

$M_{D/F}$	--	= D/F TEQ mass, pg
Vmstd	--	= standard meter volume, dscf
$C_{D/F}$	--	= ng TEQ/dscm

Alliance SOURCE TESTING

Emission Calculations

Location --
Source --
Project No. --
Parameter --

Run Number			Run 1	Run 2	Run 3	Average
Date			--	--	--	--
Start Time			--	--	--	--
Stop Time			--	--	--	--
Run Time, min	(θ)		240.0	240.0	240.0	240.0
INPUT DATA						
Barometric Pressure, in. Hg	(Pb)		--	--	--	--
Meter Correction Factor	(Y)		--	--	--	--
Orifice Calibration Value	(ΔH @)		--	--	--	--
Meter Volume, ft^3	(Vm)		0.000	0.000	0.000	0.000
Meter Temperature, °F	(Tm)		--	--	--	--
Meter Temperature, °R	(Tm)		--	--	--	--
Meter Orifice Pressure, in. WC	(ΔH)		--	--	--	--
Volume H_2O Collected, mL	(Vlc)		--	--	--	--
Nozzle Diameter, in	(Dn)		--	--	--	--
Area of Nozzle, ft^2	(An)		--	--	--	--
D/F TEQ TEQ Mass, pg	($M_{D/F}$)	**(TEF)**	--	--	--	--
2,3,7,8-TCDD TEQ Mass, pg		**1**	--	--	--	--
1,2,3,7,8 PeCDD TEQ Mass, pg		**0.5**	--	--	--	--
1,2,3,4,7,8 HxCDD TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,6,7,8 HxCDD TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,7,8,9 HxCDD TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,4,6,7,8 HpCDD TEQ Mass, pg		**0.01**	--	--	--	--
OCDD TEQ Mass, pg		**0.001**	--	--	--	--
2,3,7,8-TCDF TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,7,8 PeCDF TEQ Mass, pg		**0.05**	--	--	--	--
2,3,4,7,8 PeCDF TEQ Mass, pg		**0.5**	--	--	--	--
1,2,3,4,7,8 HxCDF TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,6,7,8 HxCDF TEQ Mass, pg		**0.1**	--	--	--	--
2,3,4,6,7,8 HxCDF TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,7,8,9 HxCDF TEQ Mass, pg		**0.1**	--	--	--	--
1,2,3,4,6,7,8 HpCDF TEQ Mass, pg		**0.01**	--	--	--	--
1,2,3,4,7,8,9 HpCDF TEQ Mass, pg		**0.01**	--	--	--	--
OCDF TEQ Mass, pg		**0.001**	--	--	--	--
ISOKINETIC DATA						
Standard Meter Volume, ft^3	(Vmstd)		--	--	--	--
Standard Water Volume, ft^3	(Vwstd)		--	--	--	--
Moisture Fraction Measured	(BWSmsd)		--	--	--	--
Moisture Fraction @ Saturation	(BWSsat)		--	--	--	--
Moisture Fraction	(BWS)		--	--	--	--
Meter Pressure, in Hg	(Pm)		--	--	--	--
Volume at Nozzle, ft^3	(Vn)		--	--	--	--
Isokinetic Sampling Rate, (%)	(I)		--	--	--	--
DGM Calibration Check Value, (+/- 5%)	(Y_{qa})		--	--	--	--
EMISSION CALCULATIONS						
D/F TEQ Concentration, grain/dscf	(C_{DF})		--	--	--	--
D/F TEQ Concentration, ng/ft3	($C_{D/F}$)		--	--	--	--
D/F TEQ Concentration, ng/dscm	($C_{D/F}$)		--	--	--	--

Volumetric Flow Rate Data

Location --
Source --
Project No. --
Parameter --

Run Number		Run 1	Run 2	Run 3	Average
Date		--	--	--	--
Start Time		--	--	--	--
Stop Time		--	--	--	--
Run Time, min		240.0	240.0	240.0	240.0
VELOCITY HEAD, in. WC					
Point 1		--	--	--	--
Point 2		--	--	--	--
Point 3		--	--	--	--
Point 4		--	--	--	--
Point 5		--	--	--	--
Point 6		--	--	--	--
Point 7		--	--	--	--
Point 8		--	--	--	--
Point 9		--	--	--	--
Point 10		--	--	--	--
Point 11		--	--	--	--
Point 12		--	--	--	--
Point 13		--	--	--	--
Point 14		--	--	--	--
Point 15		--	--	--	--
Point 16		--	--	--	--
Point 17		--	--	--	--
Point 18		--	--	--	--
Point 19		--	--	--	--
Point 20		--	--	--	--
Point 21		--	--	--	--
Point 22		--	--	--	--
Point 23		--	--	--	--
Point 24		--	--	--	--
CALCULATED DATA					
Square Root of ΔP, (in. WC)$^{1/2}$	(ΔP)	--	--	--	--
Pitot Tube Coefficient	(Cp)	--	--	--	--
Barometric Pressure, in. Hg	(Pb)	--	--	--	--
Static Pressure, in. WC	(Pg)	--	--	--	--
Stack Pressure, in. Hg	(Ps)	--	--	--	--
Stack Cross-sectional Area, ft^2	(As)	--	--	--	--
Temperature, °F	(Ts)	--	--	--	--
Temperature, °R	(Ts)	--	--	--	--
Moisture Fraction Measured	(BWSmsd)	--	--	--	--
Moisture Fraction @ Saturation	(BWSsat)	--	--	--	--
Moisture Fraction	(BWS)	--	--	--	--
O_2 Concentration, %	(O_2)	--	--	--	--
CO_2 Concentration, %	(CO_2)	--	--	--	--
Molecular Weight, lb/lb-mole (dry)	(Md)	--	--	--	--
Molecular Weight, lb/lb-mole (wet)	(Ms)	--	--	--	--
Velocity, ft/sec	(Vs)	--	--	--	--
VOLUMETRIC FLOW RATE					
At Stack Conditions, acfm	(Qa)	--	--	--	--
At Standard Conditions, dscfm	(Qs)	--	--	--	--

Alliance SOURCE TESTING

Method 2 Data

Location --
Source --
Project No. --
Date

Saturation Moisture Content Check	Traverse Point	Δ P (in. WC)	Ts (°F)
Temperature: ____ °F Moisture Fraction @ Sat.: --			
Stack Parameters			
Pitot Tube ID#: ____ Pitot Tube Coefficient (Cp): ____ Barometric Pressure (Pb): ____ in. Hg Static Pressure(Pg): ____ in. WC Stack Pressure (Ps): ____ in. Hg			

Square Root of ΔP, (in. W.C.) $^{1/2}$	--
Average ΔP, (in. W.C.)	--
Average Temperature (Ts), °F	--
Average Temperature (Ts), °R	--
Moisture (BWS), %	54.2
O_2 Concentration, %	5.7
CO_2 Concentration, %	10.5
Molecular Weight (Md), lb/lb-mole (dry)	29.91
Molecular Weight (Ms), lb/lb-mole (wet)	23.45
Velocity (Vs), ft/sec	--
VFR at stack conditions (Qa), acfm	--
VFR at standard conditions (Qs), dscfm	--

Alliance SOURCE TESTING

Cyclonic Flow Check

Location --
Source --
Project No. --
Date

Sample Point	Angle (ΔP=0)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Average	--

Alliance SOURCE TESTING

Method 4 Data

Location --
Source --
Project No. --
Parameter --
Analysis --

Run 1	**Date:**	--					
Impinger No.	**1***	**2**	**3**	**4**	**5**	**6***	**Total**
Contents	XAD Trap	Empty	H2O	H2O	Empty	Silica	**--**
Initial Volume, mL							--
Final Volume, mL							--
Gain	--	--	--	--	--	--	--
Run 2	**Date:**	--					
Impinger No.	**1***	**2**	**3**	**4**	**5**	**6***	**Total**
Contents	XAD Trap	Empty	H2O	H2O	Empty	Silica	**--**
Initial Volume, mL							--
Final Volume, mL							--
Gain	--	--	--	--	--	--	--
Run 3	**Date:**	--					
Impinger No.	**1***	**2**	**3**	**4**	**5**	**6***	**Total**
Contents	XAD Trap	Empty	H2O	H2O	Empty	Silica	**--**
Initial Volume, mL							--
Final Volume, mL							--
Gain	--	--	--	--	--	--	--

* This impinger will be analyzed gravimetrically

Alliance
SOURCE TESTING

Isokinetic Field Data

Location: --		**Start Time:** --		**Source:** --	
Date: --	**Run 1** VALID	**End Time:** --		**Project No.:** --	**Parameter:** --

STACK DATA (EST)			EQUIPMENT			STACK DATA (EST)			FILTER NO.	STACK DATA (FINAL)			MOIST. DATA
Moisture:		% est.	**Meter Box ID:**	--		**Est. Tm:**		°F		**Pb:**	--	in. Hg	**Vlc (ml)**
Barometric:	--	in. Hg	**Y:**	--		**Est. Ts:**	--	°F		**Pg:**	--	in. WC	--
Static Press:	--	in. WC	**ΔH @ (in.WC):**	--		**Est. ΔP:**	--	in. WC		**O_2:**	--	%	**K-FACTOR**
Stack Press:	--	in. Hg	**Probe ID:**	--		**Est. Dn:**	--	in.		**CO_2:**	--	%	--
CO_2:	10.5	%	**Liner Material:**	--		**Target Rate:**	--	scfm					
O_2:	5.7	%	**Pitot ID:**	--									
N_2/CO:	83.8	%	**Pitot Cp/Type:**	--	--								
Md:	29.91	lb/lb-mole	**Nozzle ID:**	--	--								
Ms:	29.91	lb/lb-mole	**Nozzle Dn (in.):**	--									

LEAK CHECKS	Pre	Mid 1	Mid 2	Mid 3	Post
Leak Rate (cfm):		--	--	--	
Vacuum (in Hg):		--	--	--	
Pitot Tube:		--	--	--	

Check Pt.	Initial	Final	Corr.
Mid 1 (cf)			--
Mid 2 (cf)			--
Mid 3 (cf)			--
Mid-Point Leak Check Vol (cf):			--

Sample Pt.	Sample Time (minutes) Begin	Sample Time (minutes) End	Dry Gas Meter Reading (ft^3)	Pitot Tube ΔP (in WC)	Gas Temperatures (°F) DGM Average (Amb.)	Gas Temperatures (°F) Stack (Amb.)	Orifice Press. ΔH (in. WC) Ideal	Orifice Press. ΔH (in. WC) Actual	Pump Vac (in. Hg)	Gas Temperatures (°F) Probe (Amb.)	Filter (Amb.)	Imp Exit (Amb.)	Aux (Amb.)	% ISO	Vs (fps)
													-		
A-1	0.00	10.00											-		--
1b	10.00	20.00											-		--
2	20.00	30.00											-		--
2b	30.00	40.00											-		--
3	40.00	50.00											-		--
3b	50.00	60.00											-		--
B-1	60.00	70.00											-		--
1b	70.00	80.00											-		--
2	80.00	90.00											-		--
2b	90.00	100.00											-		--
3	100.00	110.00											-		--
3b	110.00	120.00											-		--
C-1	120.00	130.00											-		--
1b	130.00	140.00											-		--
2	140.00	150.00											-		--
2b	150.00	160.00											-		--
3	160.00	170.00											-		--
3b	170.00	180.00											-		--
D-1	180.00	190.00											-		--
1b	190.00	200.00											-		--
2	200.00	210.00											-		--
2b	210.00	220.00											-		--
3	220.00	230.00											-		--
3b	230.00	240.00											-		--
	Final DGM:	--													

RESULTS	Run Time	Vm	ΔP	Tm	Ts	Max Vac	ΔH	%ISO	BWS	Y_{qa}
	240.0 min	0.000 ft^3	-- in. WC	-- °F	-- °F	--	-- in. WC	--	--	--

QA/QC Data

Location --
Source --
Project No. --
Parameter --

Date	Nozzle ID	Nozzle Diameter (in.) #1	#2	#3	Dn (Average)	Difference	Criteria	Material
					--	--	≤ 0.004 in.	--

Date	Pitot ID	Evidence of damage?	Evidence of mis-alignment?	Calibration or Repair required?

Date	Probe ID	Reference Temp. (°F)	Indicated Temp. (°F)	Difference	Criteria	Probe Length
	--			--	± 1.5 % (absolute)	--

Field Balance Check						
Date						
Balance ID:						
Test Weight ID:						
Certified Weight (g):						
Measured Weight (g):						
Weight Difference (g):	--	--	--	--	--	--

Date	Barometric Pressure	Evidence of damage?	Reading Verified	Calibration or Repair required?	Barometer ID

Date	Meter Box ID	Positive Pressure Leak Check
		Pass

Reagent	Lot#	Field Prep performed	Field Lot	Date	By

Posttest Purge					
Run 1		**Run 2**		**Run 3**	
Flow Rate (lpm):		Flow Rate (lpm):		Flow Rate (lpm):	
Clock Time	Temperature	Clock Time	Temperature	Clock Time	Temperature
-	--	--	--	--	--
-	--	--	--	--	--
-	--	--	--	--	--
-	--	--	--	--	--
-	--	--	--	--	--

Balance Check must be conducted each day

Acceptable Balance Tolerance is measurement within +/- 0.5g of certified weight

QA Data

Location -
Source --
Project No. --

Parameter	O_2 - Outlet	CO_2 - Outlet
Make	--	--
Model	--	--
S/N	--	--
Operating Range	--	--
Cylinder ID		
Zero	NA	NA
Low	NA	NA
Mid	--	--
High	--	--
Cylinder Certifed Values		
Low	NA	NA
Mid	--	--
High	--	--
Cylinder Expiration Date		
Zero	NA	NA
Low	NA	NA
Mid	--	--
High	--	--

Alliance SOURCE TESTING

Calibration Data

Location: -
Source: --
Project No.: --
Date: --

Parameter	O_2 - Outlet	CO_2 - Outlet
Expected Average Concentration	--	--
Span Between		
Low	--	--
High	--	--
Desired Span	--	--
Low Range Gas		
Low	NA	NA
High	NA	NA
Mid Range Gas		
Low	--	--
High	--	--
High Range Gas		
Low	NA	NA
High	NA	NA
Actual Concentration (% or ppm)		
Zero	0.0	0.0
Low	NA	NA
Mid	--	--
High	--	--
Response Time (seconds)	--	--
Upscale Calibration Gas (C_{MA})		
Instrument Response (% or ppm)		
Zero	--	--
Low	NA	NA
Mid	--	--
High	--	--
Performance (% of Span or Cal. Gas Conc.)		
Zero	--	--
Low	NA	NA
Mid	--	--
High	--	--
Status		
Zero	--	--
Low	NA	NA
Mid	--	--
High	--	--

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: -
Source: --
Project No.: --

Parameter	O_2 - Outlet	CO_2 - Outlet
Run 1 Date --		
Span Value	-	-
Instrument Zero Cal Response	-	-
Instrument Mid Cal Response	-	-
Pretest System Zero Response	-	-
Posttest System Zero Response	-	-
Pretest System Mid Response	-	-
Posttest System Mid Response	-	-
Bias (%)		
Pretest Zero	-	-
Posttest Zero	-	-
Pretest Span	-	-
Posttest Span	-	-
Drift (%)		
Zero	-	-
Mid	-	-
Run 2 Date --		
Span Value	-	-
Instrument Zero Cal Response	-	-
Instrument Mid Cal Response	-	-
Pretest System Zero Response	-	-
Posttest System Zero Response	-	-
Pretest System Mid Response	-	-
Posttest System Mid Response	-	-
Bias (%)		
Pretest Zero	-	-
Posttest Zero	-	-
Pretest Span	-	-
Posttest Span	-	-
Drift (%)		
Zero	-	-
Mid	-	-
Run 3 Date --		
Span Value	-	-
Instrument Zero Cal Response	-	-
Instrument Mid Cal Response	-	-
Pretest System Zero Response	-	-
Posttest System Zero Response	-	-
Pretest System Mid Response	-	-
Posttest System Mid Response	-	-
Bias (%)		
Pretest Zero	-	-
Posttest Zero	-	-
Pretest Span	-	-
Posttest Span	-	-
Drift (%)		
Zero	-	-
Mid	-	-

Location -
Source --
Project No. --

Run Number		Run 1	Run 2	Run 3	Average
Date		--	--	--	--
Start Time		--	--	--	--
Stop Time		--	--	--	--
Calculated Data - Outlet					
O_2 Concentration, % dry	C_{O_2}	-	-	-	--
CO_2 Concentration, % dry	C_{CO_2}	-	-	-	--

Alliance SOURCE TESTING

Location: -
Source: --
Project No.: --
Date: -

Time	O_2 - Outlet	CO_2 - Outlet
Unit	% dry	% dry
Status	Valid	Valid
-		
-		
-		
-		
-		
-		
-		
-		
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-		

Parameter	O_2 - Outlet	CO_2 - Outlet
Uncorrected Run Average (C_{obs})	-	-
Cal Gas Concentration (C_{MA})	#N/A	#N/A
Pretest System Zero Response		
Posttest System Zero Response		
Average Zero Response (Co)	-	-
Pretest System Cal Response		
Posttest System Cal Response		
Average Cal Response (C_M)	-	-
Corrected Run Average (Corr)	-	-

Alliance SOURCE TESTING

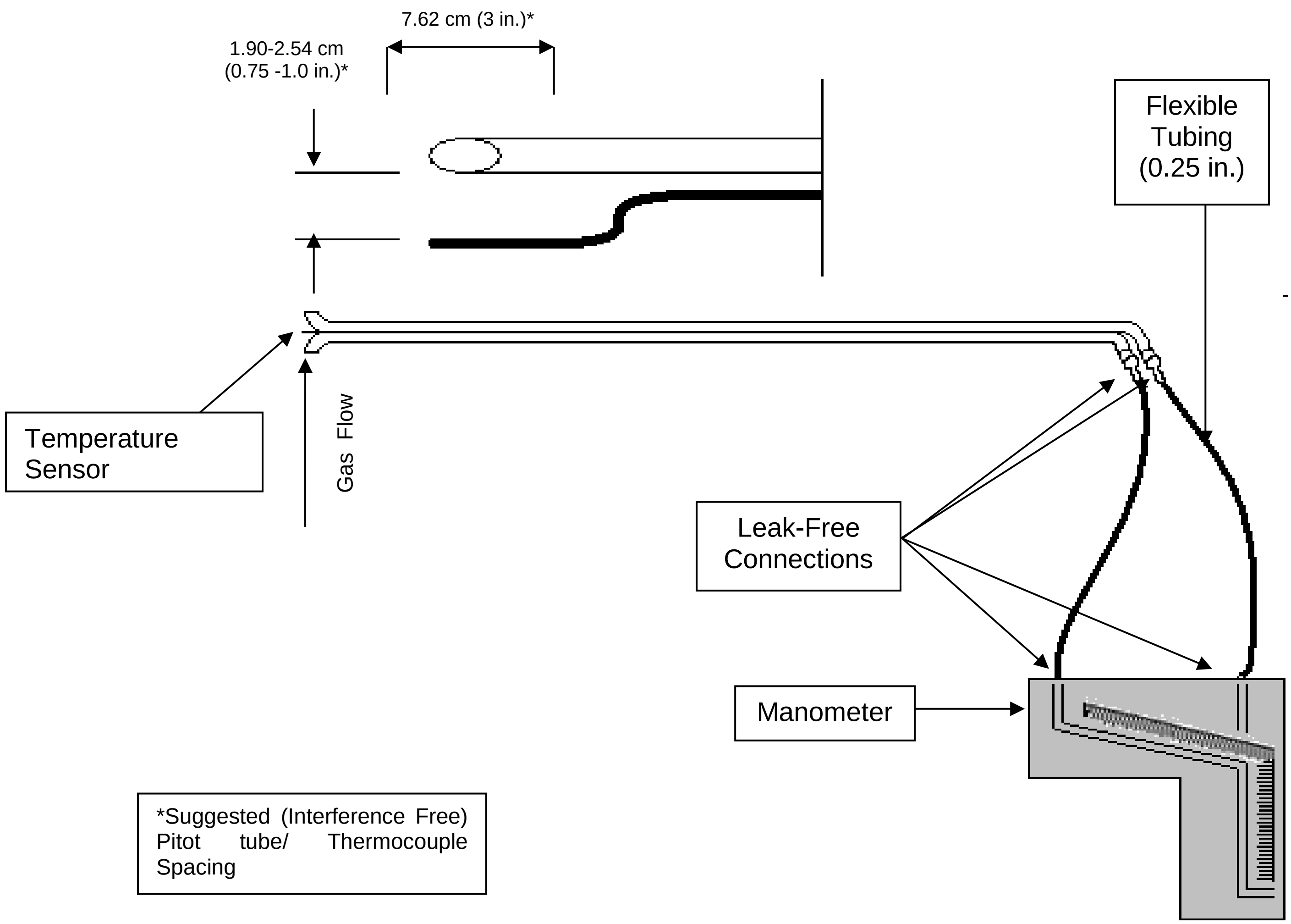
QA Data
Stratification Check

Location: 0
Source: 0
Project No.: 0
Date:

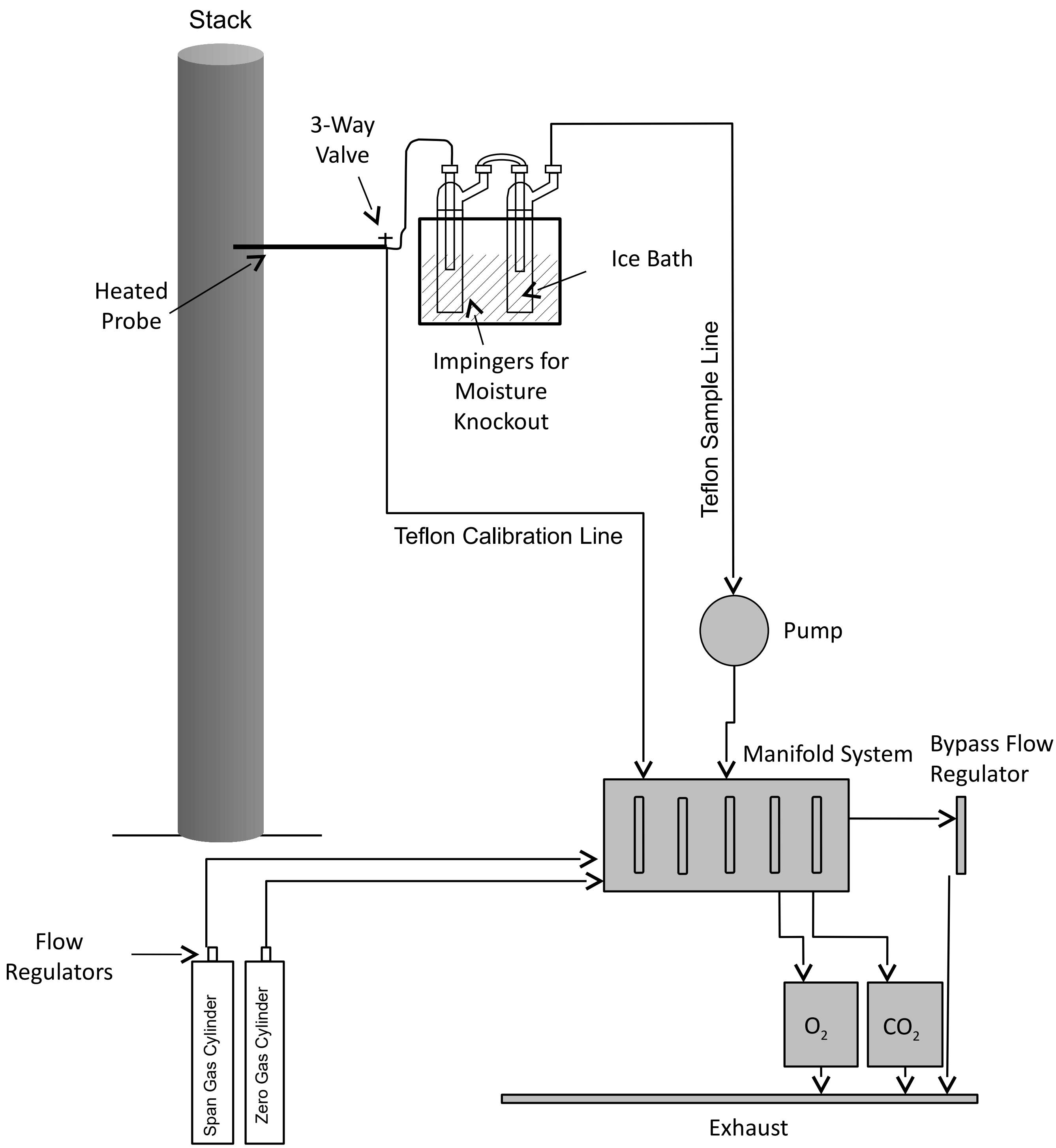
Traverse Point	Time	O_2 (%)	CO_2 (%)
A-1			
2	0:00		
3	0:00		
4	0:00		
5	0:00		
6	0:00		
B-1	0:00		
2	0:00		
3	0:00		
4	0:00		
5	0:00		
6	0:00		
Average		--	--
Criteria Met		Single Point	Single Point

Appendix C

U.S. EPA Method 2- Type S Pitot Tube Manometer Assembly



Reference Method Monitors Sampling System
(EPA Method 3A)



Appendix D

Appendix D

Continuous Monitoring System (CMS) Performance Evaluation Test (PET) Plan for Confirmatory Performance Test (CfPT)

Norlite, LLC
A Division of Tradebe Environmental Services, LLC
Cohoes, New York

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June 2023

ALLIANCE TECHNICAL GROUP

TABLE OF CONTENTS

1.1. OBJECTIVE

The Hazardous Waste Combustor (HWC) Maximum Achievable Control Technology (MACT) regulations require continuous monitoring to determine compliance with applicable emission standards and operating parameter limits. Thus, facilities are required to conduct performance evaluations on continuous monitoring systems (CMS) used to demonstrate compliance with HWC MACT standards.

In accordance with 40 CFR 63.1207(e)(1)(ii), a CMS Performance Evaluation Test (PET) Plan must be submitted with the Confirmatory Performance Test (CfPT) Plan. Norlite, LLC, a division of Tradebe Environmental Services, LLC (Norlite) has prepared this CMS PET Plan to meet this requirement.

The contents of this CMS PET Plan ensure that:

- Each kiln (Kiln No. 1 and Kiln No. 2) is properly controlled; and
- The CMS used to determine compliance with each applicable HWC MACT standard is operating properly and providing accurate data.

This CMS PET Plan provides an overview of the pertinent CMS, the procedures and documentation practices that will be used to verify the operability and accuracy of the CMS, and the associated quality assurance and quality control (QA/QC) procedures associated with the CMS PET.

Please refer to Norlite's CMS QC Program for a more in-depth discussion of the overall CMS QA/QC program.

1.2. OVERVIEW

1.2.1. General Process Overview

The Norlite facility produces an expanded shale lightweight aggregate in two dry process rotary kilns (Kiln No. 1 and Kiln No. 2). Raw materials are quarried on-site and transported to the kiln via a conveyor system. The basic material (shale) is proportioned and stored in a silo. The raw product is introduced to the kiln at the feed (back) end from the silo, while fuels are fed from the opposite end. Calcination of the product occurs at a product temperature of 1,700 degrees Fahrenheit (°F) to 2,000°F. The shale is then heated to the point of incipient fusion where it is in a semi-plastic state to expand internal gases, thereby creating voids. The cooled vitreous clinker is then discharged and stockpiled.

1.2.2. Rotary Kilns Descriptions

Kiln No. 1, manufactured by Traylor, is 175 feet long, and Kiln No. 2, manufactured by Allis-Chalmers, is 180 feet long. Both kilns have an outside diameter of 11 feet and consist of a steel shell lined with 6-inches of refractory brick, for an effective inside diameter of 10 feet. The rated capacity of each kiln is approximately 25 tons per hour (tph) clinker.

Heat is supplied to each kiln by firing fossil fuel, used oil, or liquid low grade fuel (LLGF). All fuel is fed to the kiln through burners at the front end of the kiln. The burn zone extends approximately 30 feet from the front end of the kiln. The burn zone gas temperature is maintained at 2,200°F to 3,000°F. Each kiln has thermocouples mounted at the kiln gas exit and at the fabric filter inlet for monitoring process temperatures.

1.2.3. Air Pollution Control Equipment Description

Both kilns have identical emission control systems. Both systems utilize semi-dry technology devices for the collection and removal of particulate matter, hydrogen chloride (HCl), metals and other gaseous emission products. The principal collection mechanisms are sedimentation, condensation, impaction, filtration and interception for particulate matter and metals and absorption for HCl and other gaseous species. The overall air pollution control system (APCS) also includes forced draft fans, an induced draft fan and exhaust stack, each of which is described below. It is also noted that neither kiln is equipped with any type of emergency safety vent.

Cyclone - Kiln emissions first pass through a mechanical collector to remove large particulate matter. The cyclone has an internal diameter of 114 inches and is refractory lined for wear and thermal protection. The cyclone is provided to remove coarse particulate matter. Dust collected in the cyclone is air conveyed to a hopper where it combines with the baghouse fines, which are added to the lightweight aggregate becoming part of the block mix product used in building materials.

Gas Conditioning Tower (GCT) - The kiln flue gas then passes through a gas conditioning tower. The conditioning tower uses water injection with air atomization to cool the gases. Gases enter the 118-inch diameter vessel and passes through two gas distribution screens to ensure appropriate flow through the vessel. The cooling process takes place through evaporation of the injected water. The gas enters at approximately 870°F to 1082°F and exits at 320°F to 400°F. A damper provides cooling air to control temperature if the inlet temperature to the baghouse is higher than desired. The damper is under negative pressure since it is upstream of the induced draft fan.

Gas Suspension Absorber (GSA) - The reactor system is comprised of an inlet bend, a venture and a riser section. The inlet bend is to ensure proper distribution of the flue gas into the venturi. In the venturi the cross section of the duct is narrowed to increase the linear flue gas velocity. The increased velocity ensures that solid material can be transported by the flue gas to create a fluidized bed in the riser section. Water and hydrated lime, which is stored in two 60 cubic meter (m^3) silos, are injected in the venturi and passed into the riser section. The main part of the flue gas treatment takes place in the riser section due to the intimate contact between the lime and flue gas. In this section the lime reacts with the acid constituents in the flue gases, thus capturing and neutralizing them. The large reaction surface formed by the fluidized bed increases the contact between the lime and the pollutants in the flue gas results in increased removal efficiency. Efficiency greater than 91.5% can be achieved for HCl and SO_2 within the reactor. Lime feed varies from near zero to 1200 pounds per hour, depending upon the fuel type and feed rate.

In the riser section the flue gas velocity is relatively high, and some of the solid particles are transported by the flue gas to the top of the riser section and into a second process cyclone. In the cyclone the main part of the particles is separated from the flue gas. Approximately 99% are captured, and only the smallest particles are transported by the flue gas to the Baghouse. The captured particles are returned to the reactor via a re-circulation box.

The purpose of the recirculation box is to have a buffer of reaction products with excess lime to maintain the absorption capacity and for peak temperature control purposes. The re-circulation box consists of a box with two screw conveyors. One screw conveyor at the bottom of the box for transport of solid material back into the riser section, and one screw conveyor at the top that bleeds out the spent lime and dust to a bin.

Fabric Filter (Baghouse) - Following the GSA is an FLS DuoClean filter (fabric filter or baghouse) with four modules and 14,467 square feet of filter area. The unit is rated for 40,792 actual cubic feet per minute (acfm). The air cloth ratio is 2.82:1 with all four modules operating and 3.77:1 with one module offline for maintenance. 560 woven glass with polytetrafluoroethylene (PTFE) membrane bags with a filtration guarantee of 10 milligrams per normal cubic meters (mg/Nm^3) are used as the filter media. The filter media is continuously pulsed one row at a time, controlled by a timer. Hydrated lime [Ca(OH)2], may be injected immediately prior to the baghouse in addition to the GSA.

Fines collected in the baghouse are discharged via a rotary air lock. The fines are combined with the cyclone fines and conveyed to one of two storage silos. Fines from both silos are added to the lightweight aggregate, becoming part of the product. The baghouse is also equipped with a bag leak detection system as required by 40 CFR 63.1206(c)(8)(ii). This system is fully certified to comply with EPA bag leak detection system guidelines of responding to mass emissions at concentrations of 1.0 mg/m^3.

Induced and Forced Draft Fans - The baghouse is followed by a 400 horsepower (HP) system fan which induces draft through the kiln, cyclone, gas conditioning tower, gas suspension absorber and baghouse. The ID fan is rated at 46,827 acfm. Secondary combustion air is supplied by forced draft clinker cooler fans rated at a total of 34,495 acfm.

Exhaust Stack - The treated kiln exhaust passes to the atmosphere via a 46.5-inch diameter steel stack with a reducer to 35.5 inches at the exit point 125 feet above grade. Two access platforms are provided for stack sampling.

2.1. OVERVIEW

EPA defines CMS in 40 CFR 63.2:

> *Continuous Monitoring System (CMS)* is a comprehensive term that may include, but is not limited to, continuous emission monitoring systems, continuous opacity monitoring systems, continuous parameter monitoring systems, or other manual or automatic monitoring that is used for demonstrating compliance with an applicable regulation on a continuous basis as defined by the regulation.

Based on this definition, the main components of the CMS for the Norlite kilns include the following:

- Process instruments that monitor or control key process parameters, including each continuous emission monitoring system (CEMS);
- The distributive control system (DCS), which uses a programmable logic controller (PLC) and data acquisition system (or DAS); and
- The automatic waste feed cutoff (AWFCO) system.

2.2. FIELD INSTRUMENTATION

Table 2-1, located at the end of this section, provides information pertaining to field instruments and/or parameters to be monitored that are part of the overall CMS. These instruments monitor and control certain process operations to assure the unit is operating safely and in compliance with applicable environmental requirements. These instruments meet the definition of "Continuous Monitor" provided in 40 CFR 63.1201 and stated below:

> *Continuous Monitor* means a device which continuously samples the regulated parameter specified in 40 CFR 63.1209 without interruption, evaluates the detector response at least once every 15 seconds, and computes and records the average value at least every 60 seconds […].

Prior to initial installation and use, instrument audit and calibration procedures are identified and/or developed. These procedures specify the frequency of auditing the instrument's function and accuracy and the actual procedure for verification. These procedures specify both the specific steps and the acceptable accuracy requirements that the instrument must meet to "pass". Troubleshooting procedures are typically included to help pertinent personnel correct any problems.

2.3. CONTINUOUS EMISSION MONITORING SYSTEM

In addition to the field instrumentation discussed in Section 2.2, each kiln is also equipped with CEMS to monitor stack emissions concentrations. The information pertaining to each CEMS is provided in Table 2-1, located at the end of this section.

2.4. PROCESS CONTROL

The process control systems for Norlite's kilns: detect signals from process instruments; perform calculations according to the programmable logic; adjust control equipment; and notify operators when key process parameters deviate outside acceptable limits.

In addition to notifying operating personnel when key process parameters deviate outside acceptable limits, the AWFCO system will automatically shut down the waste feeds and the overall process itself in the event of deviations outside acceptable operating limits.

2.5. CMS OPERATION

All the components of the CMS must be operational for the kilns to burn waste. The DCS and overall process control system are designed in such a manner as to continually verify CMS operability while the units are running. Field instrumentation (both sensing and control) are connected to the DCS in "control loops" with common wiring, electrical signal transmitters, input/output devices and related programmable logic. All components of each control loop related to the feeding of waste must be operating for each kiln to be enabled to burn waste.

The programmable logic is designed in such a way that it can sense and verify that various components of the process and the process itself are operating as required.

2.6. MANAGEMENT OF CHANGE

A Management of Change (MOC) procedure is implemented at Norlite to ensure that adequate levels of communication exist between all departments when changes are made which affect the process. A change made in one part of the process may have unintended effects on other parts of the process because the stationary sources are an integrated system. These proposed changes are therefore appropriately scrutinized before they are made to ensure the changes do not compromise the safety and integrity of the process and avoid adverse effects or worker and public safety and the environment.

The MOC evaluation procedure includes changes which impact:

- Process chemicals;
- Technology;
- Equipment;
- Procedures; and
- Employees.

Each type of change requires the appropriate authorization to proceed with the change. Personnel (e.g., engineering, operations, and safety) assess the potential impact of the change on safety and health. The MOC procedure allows for documentation of changes, employee training and education, and an assessment of regulatory requirements for the changes.

The MOC procedure does not apply to "replacement in kind" which is defined as replacements that satisfy the current design specifications.

Table 2-1. CMS Instrumentation

Monitored Parameter	Kiln	Instrument Description (Make/Model)	Span and Units of Measurement
Kiln Combustion Chamber Pressure	Kiln 1 Kiln 2	Rosemount 1151 DP	-2.0 to + 1.0 in. w.c.
Pumpable (and Total) Hazardous Waste Feed Rate	Kiln 1 Kiln 2	Micromotion	0-14 gpm
LLGF Lance Atomizing Pressure	Kiln 1 Kiln 2	Rosemount 1151 DP	0-100 psi
Kiln Back end Pressure	Kiln 1 Kiln 2	Rosemount 2051CD	-4.00 to +2.00 in/wc
Kiln Back-End (Exit) Temperature (aka cyclone inlet)	Kiln 1 Kiln 2	Pyco 09-0028	32 to 1292 °F
Gas Conditioning Tower Exit Temperature #1	Kiln 1 Kiln 2	BJI B28.0500.00	32 to 1200 °F
Gas Conditioning Tower Exit Temperature #2	Kiln 1 Kiln 2	BJI B28.0500.00	32 to 1200 °F
Baghouse Inlet Temperature	Kiln 1 Kiln 2	Pyro 22-4018	32 to 572 °F
Dry Sorbent (Lime) Carrier Fluid Flow Rate: Baghouse	Kiln 1 Kiln 2	Yokogawa Model YewFlo	0 to 706 SCFM
Dry Sorbent (Lime) Carrier Fluid Flow Rate: GSA	Kiln 1 Kiln 2	Yokogawa Model YewFlo	0 to 706 SCFM
Kiln Production Rate (Shale Feed Rate)	Kiln 1 Kiln 2	Pfister	0-30 st/hr
Flue Gas Velocity	Kiln 1 Kiln 2	OSI OFS-2000	0.33-131 ft/s
Stack Oxygen (O_2)	Kiln 1 Kiln 2	Emerson / Rosemount	0-25%
Stack Low Carbon Monoxide (CO)	Kiln 1 Kiln 2	Emerson / Rosemount	0-200 ppm
Stack Gas CO Concentration Corrected to 7% O2	Kiln 1 Kiln 2	Emerson / Rosemount	0-3,000 ppm

3. PERFORMANCE EVALUATION TEST PLAN

As previously described, the CMS Performance Evaluation Test Plan relies on a combination of activities to determine whether the CMS is functioning properly. This will include the following:

- Auditing the instrument maintenance and calibration program;
- Auditing all calculations built into the operating parameter limit (OPL) tracking and recording process;
- Calibrating field instruments; and
- Auditing the AWFCO Testing Program.

Norlite personnel who are knowledgeable of facility operations, the process control systems, and relevant regulatory requirements, will perform these activities.

3.1. INSTRUMENT AUDIT AND CALIBRATION

As part of conducting the CMS Performance Evaluation, a two-step process will be used to assess the status of the various field instruments. First, audit/calibration records will be reviewed for these instruments to determine when the most recent audit/calibration occurred. From this review, any instruments that are approaching the end of its audit/calibration cycle will be scheduled for audit and/or calibration prior to performing the actual CfPT.

Because certain instruments cannot be audited or calibrated without taking the unit offline, these will be scheduled over a period prior to the test program to minimize process interruptions and shutdowns. All instruments requiring pre-test audits/calibrations will be evaluated prior to testing.

3.2. AWFCO SYSTEM PERFORMANCE EVALUATION

Another component of the CMS Performance Evaluation is auditing the AWFCO system and related DCS logic. This will be accomplished by reviewing the most recent previous year's AWFCO testing logs to assess whether there are any recurring problems with the AWFCO system. Any incidence of problems with the AWFCO system will be identified for follow-up and correction prior to testing.

This evaluation will also include examining the appropriate programmable logic statements to compare the AWFCO set points with the applicable operating parameter limits to assure that these are appropriate.

3.3. AUDITING THE CEMS

Each CEMS is installed, operated, and maintained to comply with the provisions of 40 CFR 63 Subpart EEE, Performance Specification 4B. In general, this means that the individual analyzers are calibrated daily (zero/span), quarterly (gas audits), and annually (relative accuracy test audits). Thus, the evaluation of the performance of this system will be done as part of meeting those requirements and a separate evaluation will not be conducted under this plan.

3.4. SCHEDULE

The Performance Evaluation Test will be conducted prior to the CfPT as required by the HWC MACT regulations. All evaluation activities will be completed, with all components meeting their respective accuracy requirements, prior to performing the CfPT.

3.5. REPORTING AND DOCUMENTATION

The results of the CMS Performance Evaluation will be included as part of the Final Notification of Compliance (NOC) as required by 40 CFR 63.9(h)(2). This will include the following information:

- Description of the CMS components;
- Description of the CMS Performance Evaluation Plan;
- Listing of all field instruments that are part of the CMS and their audit/calibration status;
- Listing of field instruments that have been specifically audited/calibrated as part of the CMS Performance Evaluation;
- Copies of the most recent audit/calibration results for CMS instruments;
- AWFCO system evaluation results;
- CEMS evaluation results; and
- Copies of relevant programmable logic statements showing where calculations and regulatory alarms and setpoints are used in the coding to assure compliance.

The quality assurance (QA) requirements for this Performance Evaluation Test are specified in Table 4-1, below.

Table 4-1 Quality Assurance for CMS Performance Evaluation

CMS Component	Basis for QA Requirement	QA Specification
Field Instruments	Manufacturer recommendations	Audit/calibration meets recommended specifications for all affected instruments
AWFCO System Evaluation	HWC MACT requirements	No failures of the AWFCO system
CEM System	40 CFR 60 Appendices A, B and F and Appendix to 40 CFR 63 Subpart EEE	Meets the specifications referenced in each listed document
Programmable Logic	HWC MACT requirements	All set points programmed correctly