Test Plan

Facility: Johnson Controls

Source: Furnace No. 3

Permit #: 1040-0129

ID #: NA

Plan Submittal Date: May 15, 2013

Type of Testing: PM, Metals, NOx, etc

Location: Florence, SC

May 17, 2013

Mr. Timothy Lafond
Johnson Controls Battery Group, Inc.
1800 Paper Mill Road
Florence, SC 29501

RE: Furnace No. 3 Initial MACT and Permit Test Plan – Revision 2 Dated May 17, 2013

Dear Mr. Lafond:

The referenced site-specific test plan is approved by the Department. Any deviations from the plan, without prior approval from the Department, may be cause for rejecting the test results.

If I can be of further assistance in this matter, please call me at (803) 898-3897 or e-mail me at **frcklj@dhec.sc.gov**.

Sincerely,

L. Jake Frick
Compliance Management Division
Bureau of Air Quality

ec: Michael Shroup, BAQ
Quentin Best, CEC

cc: Compliance File: 1040-0129

MEMO

To: Source Evaluation Files

From: Jake Frick

Date: May 17, 2013

This plan revises the initial plan that was submitted November 21, 2012 and approved December 12, 2012. The revision applies to Furnace No. 3 testing only. The only revision is the test method used to determine Hg emissions.

The Method 29 Hg results from the recent tests on Furnaces 1&2 were DBL for most of the sample fractions. Since Method 29 requires analysis for several different fractions, the sample becomes diluted. CEC and JCI are requesting to use Method 101A for Hg as the final sample for analysis will only be one fraction which should increase the detection level for Hg. Method 101A detects particulate and vapor phase Hg so I am approving this method for Furnace No. 3

Frick, Jake <frickl j@dhec.sc.gov>

Re: Johnson Controls Florence Recycling Plant

1 message

Frick, Jake <frickl j@dhec.sc.gov> Mon, May 13, 2013 at 1:13 PM
To: "Best, Quentin" <qbest@cecinc.com>

Would not the measures suggested in 13.3.3 lower the DL for the front half also?

On Mon, May 13, 2013 at 1:06 PM, Best, Quentin <qbest@cecinc.com> wrote:

> Do look at the results in that only the mercury detected was in the vapor phase fractions 5b and 5c. There was non-detects for the other fractions of the Method 29 fractions for both Unit 1 and 2.
>
> **W. Quentin Best, QSTI** / Senior Project Manager
>
> Civil & Environmental Consultants, Inc.
>
> 2030 S. Tryon Street, Suite 3E · Charlotte, NC 28203
>
> Toll-Free: 855-859-9932 · Direct: 980-224-8104 · Fax: 980-224-8172
>
> Mobile: 704-309-7421 · Email: qbest@cecinc.com · http://www.cecinc.com
>
> Senior Leadership · Integrated Services · Personal Business Relationships
>
>
>
> **From:** Frick, Jake [mailto:frickl j@dhec.sc.gov]
> **Sent:** Monday, May 13, 2013 1:01 PM
> **To:** Best, Quentin
> **Subject:** Re: Johnson Controls Florence Recycling Plant
>
> I'm not real comfortable changing test methods in mid-stream. Two of the furnaces have already been tested using Method 29. The primary concern I have is that while Method 30B generally has lower DLs, it is only for vapor phase Hg. Method 29 (Section 13.3.3) includes things that can be done to improve the DL. I prefer that those be done first. I will have to check with our permitting staff to see if vapor phase Hg is the only Hg phase needed for demonstration of compliance with permitted Hg limits.
>
> On Mon, May 13, 2013 at 11:23 AM, Best, Quentin <qbest@cecinc.com> wrote:

JCI wants to get a lower detection limit. Mercury was only detected on two (5b and 5C) of the five fractions of the Method 29. This will allow for a lower detection limit.

W. Quentin Best, QSTI / Senior Project Manager

Civil & Environmental Consultants, Inc.

2030 S. Tryon Street, Suite 3E · Charlotte, NC 28203

Toll-Free: 855-859-9932 · Direct: 980-224-8104 · Fax: 980-224-8172

Mobile: 704-309-7421 · Email: qbest@cecinc.com · http://www.cecinc.com

Senior Leadership · Integrated Services · Personal Business Relationships

From: Frick, Jake [mailto:frickljj@dhec.sc.gov]
Sent: Monday, May 13, 2013 10:36 AM
To: Best, Quentin
Subject: Re: Johnson Controls Florence Recycling Plant

Why are you proposing to change the Hg test method?

On Mon, May 13, 2013 at 9:36 AM, Best, Quentin <qbest@cecinc.com> wrote:

JCI Florence Recycling plant is requesting to test Furnace No. 3 for the week of June 3, 2013. Sampling will begin on Tuesday, June 4, 2013. CEC will be forwarding an updated or revised protocol this week for Furnace No. 3. Currently CEC is proposing the following:

Table 1

Sampling Matrix

Johnson Controls Battery Group

Florence, South Carolina

Process	Stack ID. No.	Pollutants	EPA Methods Proposed and sample run times*

Natural Gas Fired Furnace 3*	ID 09	VE	Method 9 – 3 (1-hr)
		PM, Metals (Antimony, Arsenic, Beryllium, Cadmium, Chromium, Lead, Nickel, Selenium, Manganese)	Method 29 with PM – 3 (4-hrs)
		Mercury	Method 30B for Hg – 3 (4-hrs)
		SO2, NOx, & CO	Methods 3A, 6C, 7E & 10 – 3 (4-hrs)

The only change from the existing protocol is the mercury sampling. CEC is proposing 30B instead of Method 29 for the sampling of Mercury. An updated protocol will be forwarded to you later this week. Thanks for your time and efforts with this.

W. Quentin Best, QSTI / Senior Project Manager

Civil & Environmental Consultants, Inc.

2030 S. Tryon Street, Suite 3E · Charlotte, NC 28203

Toll-Free: 855-859-9932 · Direct: 980-224-8104 · Fax: 980-224-8172

Mobile: 704-309-7421 · Email: qbest@cecinc.com · http://www.cecinc.com

Senior Leadership · Integrated Services · Personal Business Relationships

--
Jake Frick

SC Dept. of Health & Environmental Control

Bureau of Air Quality

803.898.3897

> --
> Jake Frick
>
> SC Dept. of Health & Environmental Control
>
> Bureau of Air Quality
>
> 803.898.3897

--
Jake Frick
SC Dept. of Health & Environmental Control
Bureau of Air Quality
803.898.3897

Frick, Jake <fricklj@dhec.sc.gov>

Re: Revised Protocol For JCI Florence Battery Recycling Center

1 message

Frick, Jake <fricklj@dhec.sc.gov> Fri, May 17, 2013 at 2:21 PM
To: "Best, Quentin" <qbest@cecinc.com>
Cc: "Charles.Emanuelli@jci.com" <Charles.Emanuelli@jci.com>, "timothy.j.lafond@jci.com" <timothy.j.lafond@jci.com>, "Jenkins, Paul" <pjenkins@cecinc.com>, Ted Ambrose <ambrosts@dhec.sc.gov>

See attached copy of the approval letter. The June 4th sampling start date is okay too.

On Fri, May 17, 2013 at 10:30 AM, Best, Quentin <qbest@cecinc.com> wrote:

> Please find attached the revised sampling protocol for Johnson Control Battery Group Battery Florence Battery Recycling Center. As discussed CEC is modifying the protocol to change the sampling of mercury from USEPA Method 29 to US EPA Method 101A. Sampling is schedule to start June 4, 2013 pending your approval.

--
Jake Frick
SC Dept. of Health & Environmental Control
Bureau of Air Quality
803.898.3897

JCI Furnace 3 Plan Approval.doc
26K

SITE-SPECIFIC TEST PLAN

FOR

JOHNSON CONTROLS BATTERY GROUP, INC.

FLORENCE, SOUTH CAROLINA

Initial Stack Testing
For the Lead Acid Battery Recycling Facility

Furnace No. 3 Stack ID No. 9

Revision 2

Proposed Test Date: June 4, 5, and 6, 2013

Prepared by:

Civil & Environmental Consultants, Inc.
Charlotte, North Carolina

May 17, 2013

Civil & Environmental Consultants, Inc.

Charlotte
2030 S. Tryon Street | Suite 3E
Charlotte, North Carolina 28203
Ph: 980/224-8104 / Fx: 980/224-8172
Toll Free: 855/859-9932
charlotte@cecinc.com
www.cecinc.com

Austin	855/365-2324	**Columbus**	888/598-6808	**North Central PA**	877/321-2324
Boston	866/312-2024	**Detroit**	866/380-2324	**Phoenix**	877/231-2324
Chicago	877/963-6026	**Export**	800/899-3610	**Pittsburgh**	800/365/2324
Cincinnati	800/759-5674	**Indianapolis**	877/746-0749	**St. Louis**	866/250-3679
Cleveland	866/507-2324	**Nashville**	800/763-2326	**Toledo**	888/598-6808

TABLE OF CONTENTS

TABLES

Section 1.0 FACILITY INFORMATION

Section 1a Facility Address

Site-Specific Test Plan for:

Company Name:	Johnson Controls Battery Group, Inc.
Facility:	Florence Battery Recycling Facility
Address:	1800 Paper Mill Road
City, State, Zip:	Florence, South Carolina 29501
Phone Number:	414.870.0754
Facility Contact:	Mr. Tim Lafond, P.E.

Section 1b Permit & Source Identification

The Johnson Controls Battery Group (Johnson Controls) Florence facility has been issued Construction Permit No. 1040-0129-CA from the South Carolina Department of Health and Environmental Control (SC DHEC) for the start-up and operation of the new lead acid battery recycling plant.

Section 1c Source Testing Contractor

For purposes of performing source tests, Johnson Controls has contracted:

Civil & Environmental Consultants, Inc. (CEC)
2030 South Tryon Street, Suite 3E
Charlotte, North Carolina 28203
Phone Number: 704.224.8104
Bryan Starnes – Project Manager

Section 1d Subcontract Laboratory

Element One, Inc.
6319-D Carolina Beach Road
Wilmington, NC 28412
Phone Number: 910.793.0128
Ken Smith, President

Section 2.0 TEST OBJECTIVES

Section 2a Test Purpose

The purpose of this program is to determine compliance with the referenced construction permit issued on February 5, 2010. The following table (Table 1) lists the processes, stack identification numbers and the pollutants of interest for the upcoming emission testing. CEC is requesting to perform the testing on Furnace No. 03 (Stack ID: 09) commencing on June 4, 2013.

Table 1 - Sampling Matrix
Johnson Controls Battery Group
Florence, South Carolina

Process	Stack ID. No.	Pollutants	EPA Methods Proposed and sample run times*
Natural Gas Fired Furnace 3*	ID 09	VE	Method 9 – 3 (1-hr)
		PM, Metals (Antimony, Arsenic, Beryllium, Cadmium, Chromium, Lead, Nickel, Selenium, Manganese)	Method 29 with PM – 3 (4-hrs)
		Mercury	Method 101A for Hg – 3 (4-hrs)
		SO2, NOx, & CO	Methods 3A, 6C, 7E & 10 – 3 (4-hrs)

*The testing runs for the Furnace No. 3 will begin on the startup of the six hour cycle.

Section 2b Regulatory Requirements & Limitations

Measurements performed by the CEC Air Monitoring Group will be conducting using United States Environmental Protection Agency (US EPA) Reference Test Methods published in the *Code of Federal Regulations* Volume 40, Part 60. The location of sampling ports, the number of traverse points and presence or absence of cyclonic flow will be determined by Method 1. The determination of velocity and volumetric flow rates are to be determined by Method 2. Method 3A will be used for the determination of a dry molecular weight. The moisture content of each emission source will be determined by Method 4. Method 5 will be used to determine particulate matter concentrations and emission rates (or performed in conjunction with EPA Method 29 sampling procedures). Method 6C, 7E and 10 will be used for the determination of sulfur dioxide, oxide of nitrogen and carbon monoxide concentrations and emission rates. Visible opacity observations will be performed according to EPA Method 9 criteria. Method 29 will be used for determining multiple metal excluding mercury emission rates. Method 101A will be used for the determination of total mercury emission rates. Specific application of these methods is described in Section 5.0, Sampling Methods.

Section 3.0 PROCESS DESCRIPTION

This section contains a brief description of the process, a typical process air flow schematic and the process conditions and controls to be in force during the emissions testing.

Section 3a Detailed Process Description

The newly constructed Johnson Controls Lead Recycling Facility will receive approximately 595 tons of automotive and marine batteries daily (on a dry basis). These batteries as well as other non-hazardous lead bearing materials from other Johnson Controls facilities are recycled in four key areas of the plant.

- CX Plant- this area is where the batteries are dismantled and broken.
- Charge Preparation- this is where the materials are separated and categorized into individual components.
- Smelting Furnaces Room- the lead components from the Charge Preparation room are melted down inside three separate smelt furnaces and tapped from the non-lead slag.
- Refining and Casting- the lead from the kettles are refined into different purities and cast into rectangular pigs for storage and transport.

Section 3b Process Design/Normal Operating Rate

Johnson Controls proposes to conduct emission testing for Furnace No. 3 at the permitted normal or elevated worst case scenario. Table 2 shows the proposed operating rates for the initial compliance determination. Johnson Controls will record the relevant production data for each system and control device parameters. This production data will be included in the final test report as an Appendix.

Table 2 – Proposed Production Rates Johnson Controls Battery Group Florence, South Carolina		
Process	**Unit I.D No.**	**Proposed Process Rates**
Natural Gas Fired Furnace 3	ID No. 09	Lead 4.72 tons/hr Slag 0.54 tons/hr

The values in table 2 are the process weight rates as contained in the permit. The process weight rate is the mass of all materials entering the process. Please note that the process weight rate can be different than the production rate. The facility will be operating at design capacity and JCI understands operating restrictions may be imposed if the testing is not performed during design or capacity of the process.

The smelters are batch process (4 cycles/day; approximately 6 hours/cycles). Each cycle has 3 distinct steps: charging, smelting and tapping. Charging takes about 1 hour consisting of 3 charges (20 min/charge including time for the charge to spread out, moisture to evaporate, separators to burn off, etc.) Smelting takes about 4 hours. There is a lead tap in this process to take out what melts/smelts quickly to allow the remaining charge to climb the walls during rotation. Tapping takes about 1 hour (30 min for lead and 30 min for slag.) Fluxing takes place during the charging of the smelters and the first hour of the smelting for a total time of two hours of the six hour cycle.

Section 3c Proposed Operating Rate & Conditions

As required in South Carolina Department of Health and Environmental Control, *Procedures and Minimum Requirements for Source Tests in South Carolina*, an effort will be made to maintain the operating conditions as close to the permitted operating rate as possible during testing.

Section 3d Demonstration of Operating Rate

To demonstrate and verify operating rate during the testing, production data will be recorded by Johnson Control's personnel.

Section 3e Air Pollution Control Equipment

Table 3 – Air Pollution Control Equipment Johnson Controls Battery Group Florence, South Carolina		
Process	**Unit I.D No.**	**Control Device***
Natural Gas Fired Furnace 3	ID 09	Afterburner, Baghouse with HEPA filter, Wet Scrubber

Per 40 CFR 63.544, total enclosures are installed on (1) Smelting furnaces, (2) Smelting furnace charging areas, (3) Lead taps, slag taps, and molds during tapping, (4) Battery breakers, (5) Refining kettles, casting areas, (6) Dryers, (7) Agglomerating furnaces and agglomerating furnace product taps, (8) Material handling areas for any lead bearing materials except those listed in paragraph (b) of 63.544, (9) Areas where dust from fabric filters, sweepings or used fabric filters are processed.

Section 3f Continuous Emission Monitoring Equipment (CEM)

Johnson Controls has installed CEM monitors for Furnace No. 3 Unit No. 09 (NOx, CO).

Section 3g Ancillary Monitoring Devices

Operational ranges for controls device will be recorded a minimum every 15 minutes. Pressure drop readings will be recorded for each baghouse and HEPA system. Pressure drop, liquid flow rates, liquid pressure, gas flow and pH will be recorded for the Unit ID No. 09 scrubber system. The scrubber control devices liquid flow rates, exit pH and liquid to gas ratio parameters for Unit

ID No. 09 smelt furnace will be recorded. Temperature readings will be recorded for the afterburner control device for Smelt Furnace Unit ID No. 09.

Per 40 CFR 63.548(k), the enclosure monitoring systems meet the sensitivity and accuracy of 40 CFR 63.548(k)(3) and the calibrations per (k)(5) will be included in the final test report. The manufacturer range and accuracy specifications will be include in the final test report. The enclosure negative pressures from the enclosure monitoring system will be recorded at least every 15 minutes during the test and those readings included in the final test report. Note that the differential readings from each of the 3 walls on each enclosure will be recorded and included in the test report.

Per 40 CFR 63.548(c)(1), in Section 3g of the plan that the pressure drop of each cell of the baghouse being tested and the pressure drop across each HEPA filter cleaning system will be monitored and reported in the final report.

The cleaning cycle times for each baghouse will be recorded during the test and those readings included in the final report.

Section 4.0 SAFETY CONSIDERATIONS

Section 4a Identification of Safety Concerns

Johnson Controls and CEC are committed to conducting business activities in a responsible manner; free from recognized hazards, to respect the health and safety. Please be advised that Johnson Controls is a lead-acid battery recycling manufacturing facility which consists of work areas where lead concentrations in air levels exceed the action level of 30ug/m3 and/or exceed the permissible exposure limit (50ug/m3). Lead may enter the body by breathing or injection of lead dust or fumes. All work inside the plant will require CEC to follow established personal protection equipment (PPE) requirements of Johnson Controls.

The following risks are identified as applicable to the testing and sampling personnel.

1. Tripping and falling hazards associated with an industrial environment with ladders, stairways, uneven platforms, scaffolding, and accumulated debris in walkways. Johnson Controls and CEC employees will make efforts to maintain a clean workspace and be aware of potential obstacles in their work areas. Fall protection equipment will be utilized on elevated sampling platforms.

2. Exposure to temperature extremes. Testing crew may be exposed to high heat conditions. Johnson Controls and CEC employees will wear appropriate protective clothing and maintain healthy hydration levels.

3. Weather hazards, including lightening, when working elevated sampling platforms. Johnson Controls and CEC employees will maintain awareness of weather conditions and suspend testing before conditions become unsafe at the testing locations.

4. Inadequate Illumination. Work will be restricted to daylight hours when working in elevated areas or roof tops without adequate lights. Johnson Controls and CEC will ensure that proper illumination is available if work is to be performed in low light.

5. Hazards from falling objects. Johnson Controls and CEC will barricade areas beneath test crews and make sure engineering controls are in place to prevent objects from falling below.

6. Overexertion. Test crews will be handling heavy equipment and may be working long hours, creating the potential for exhaustion and muscle strain. Johnson Controls and CEC will use available assistance for lifting and transporting heavy objects, including elevators, carts, ropes and pulleys. Proper lifting techniques will be observed.

7. Process Equipment Hazards. Johnson Controls will make sure the test crews are aware of hazards associated with process equipment, how to abate the hazards, and how to respond to process emergencies.

Section 4b Personal Protective Equipment

The minimum personal protective equipment required while working on site includes: nitrile gloves, safety glasses, hard hat, hearing protection, and steel-toed shoes. When under employees at elevated heights and when lowering equipment from elevated platforms, ground personnel must not be directly under the load and hard hats must be worn. These safety areas will be barricaded to prevent falling objects hurting personnel and damaging nearby property.

Section 5.0 SAMPLING METHODS

This section describes the sampling strategy and the sampling and analytical methods proposed for this test program. These procedures are to be adhered to throughout the course of this project.

Section 5a Strategy

Section 5.a.1 Sampling Strategy

The sampling and analytical procedures being proposed for this test program are those established by the US EPA and SC DHEC. The sampling runs will be conducted in triplicate to validate the sampling for each operating condition and emission unit. Tests are to be scheduled during normal operating conditions. CEC will test the Furnace No. 3 (ID No. 9) for visible opacity, particulate matter and metals (Antimony, Arsenic, Beryllium, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, and Manganese).

Section 5.a.2 Sampling and Analytical Procedures Summary

The location of sampling ports, the number of traverse points and presence or absence of cyclonic flow will be determined by Method 1. The determination of velocity and volumetric flow rates are to be determined by Method 2. Method 2 will be used for the assignment of a dry molecular weight of 29.0 for the gas stream for non-combustion processes. Method 3A will be used for the determination of a dry molecular weight at the combustion emission sources. The moisture content of each emission source will be determined by Method 4. Method 5 will be used to determine particulate matter concentrations and emission rates (or performed in conjunction with EPA Method 29 sampling procedures). Method 6C, 7E and 10 will be used for the determination of sulfur dioxide, oxide of nitrogen and carbon monoxide concentrations and emission rates. Visible opacity observations will be performed according to EPA Method 9 criteria. Method 29 will be used for determining multiple metal including lead emission rates. Method 101A will be used for the determination mercury emissions. Specific application of these methods is described in Section 5, Sampling Methods. These test methods are available in the Code of Federal Regulations Volume 40, Part 60 or by request from CEC.

Section 5.a.3 Sampling Ports, Traverse Points and Cyclonic Flow Determination

The sampling locations will be prepared according to the criteria in Method 1. The duct diameters upstream and downstream from the sampling ports will be determined prior to sampling. The number of isokinetic traverse points is to be chosen with respect to sampling port location. Method 1 specifies that a minimum of 8 traverse points for sampling ports located >8/>2 downstream/upstream stack diameters from flow disturbances and 24 traverse points when located >2/>0.5. The presence or absence of cyclonic flow will be determined prior to testing. CEM stratification points will be determined per EPA Method 7E Section 8.1.2.

Section 5.a.4 Velocity and Volumetric Flow Rate Determination

Method 2 is used for determining the average gas velocity in a stack from measurements of gas density and the average velocity head with a Type S (Stausscheibe or reverse type) pitot tube. This method is applicable for quantifying gas flows, which meet the criteria of Method 1.

In principle measurements of velocity head and temperature are performed at the traverse points specified by Method 1. A properly scaled differential pressure gauge will be selected for the range of Δp values encountered during the traverse. A 0 to 10 inch water inclined manometer or digital manometer will be used as the differential pressure gauge.

The sampling locations will meet the criteria detailed in Method 1. Method 3A (analyzing oxygen and carbon dioxide with instrumental method analyzers) will be used to determine a dry molecular weight at the combustion emission stacks. Method 4 will be used to determine moisture percentages at each location by EPA Methods 29 and 101A sampling trains. The principal components of the Method 2 gas velocity measurement system are:

- A calibrated stainless steel Type S pitot tube and Type K thermocouple;
- Leak-free interface tubing between pitot tube and differential pressure gauge;
- A 0 to 0.25 or 0 to 10 inch inclined manometers and;
- An NIST traceable pyrometer.

The apparatus is to be set-up according to manufacturer and reference method recommendations. Pretest and posttest leak checks will be conducted using the procedures outlined in Method 2, Section 8.1. Velocity head and temperature measurements will be performed at the traverse points specified by Method 1 during each sampling run. The atmospheric and static pressure of the stack will also be determined at the beginning of each sampling run. The volumetric flow rate calculations used will be those specified in Method 2, Section 12. A more comprehensive explanation of the reference method can be found in the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, September 30, 1994. (QA Handbook, Volume III)

Section 5.a.5 Dry Molecular Weight Determination

The dry molecular weight for each combustion emission stack will be determined by EPA Method 3A (instrumental analyzer method) with respect to the analysis of oxygen and carbon dioxide emissions.

Section 5.a.6 Moisture Determination

Method 4 involves the determination of stack gas moisture. Stack gas moisture will be measured when the flue gas flow rate or a pollutant gas concentration is determined. The moisture content is used to correct the emission concentration or mass emission rate to a dry basis. EPA Method 4 and *Field Procedure 4* of the Quality Assurance Handbook Volume III will be used to measure stack gas moisture content. *Field Procedure 4* provides detailed Method 4 information.

The moisture content prior to each isokinetic sampling run will be determined using wet bulb/dry bulb thermometers and partial pressure, vapor and saturated vapor pressure equations. This technique is described in Method 4 and is summarized below:

- Moisten the wet bulb thermometer wick with deionized water;
- Insert both thermometers into the flue gas stream and monitor the wet bulb temperature;
- When the wet bulb temperature has stabilized, record both the wet bulb and dry bulb thermometer temperatures; and
- Calculate the flue gas moisture content (PMV) using saturated vapor and moisture equations.

The moisture content for Furnace No. 3 exhaust stack will be determined in conjunction with EPA Methods 29 and 101A sampling procedures as described below in the following sections. Collected condensate measurements will be recorded on the Method 29 and 101A moisture determination data analysis forms. Calculations will be performed according to Section 12 of Method 4.

Section 5.a.7 Gaseous Pollutant Instrumental Procedures

Gaseous pollutant concentrations and emission rates will be determined according to EPA instrumental analyzer procedures. Sampling procedures to be used by CEC conform to the requirements of EPA Test Methods 3A, 6C, 7E, and 10. These methodologies utilize analyzers that sense the gas to be measured and generate an output proportional to its concentration. A portion of the sample gas stream will be continuously withdrawn from the emission source at a constant rate to be analyzed by the measurement system. The principal components of the measurement system will be sequentially:

- A 20-micron in-stack stainless steel sintered filter and a heated (248°F ±25°F) stainless steel sample probe;
- A heated (248°F ±25°F) stainless steel calibration valve assembly, 0.5 micron particulate filter, and heated Teflon sample transfer line;
- A refrigerator-type moisture removal system;
- Teflon sample transport line and pump with pressure and flow control;

- Stainless steel sample gas manifold;
- Instrumental analyzers with EPA Protocol calibration gases; and
- A data acquisition system (DAS) that continually logged one second intervals.

Prior to testing, all heated elements of the system will be heated to 250°F to prevent condensation of moisture. The gas conditioning system will be allowed to reach 40°F or lower before operating. Calibration procedures will commence with the introduction of zero and high-level calibration gas into the sampling system for each analyzer. The necessary adjustments will be made and the response to the mid-level gas will be recorded. A three-point analyzer calibration error test will be performed before the first run and again after any failed system bias test or failed drift test. The analyzer response will be recorded for each gas and the analyzer error will be calculated according to Method 7E Section 12. The analyzer calibration test is deemed acceptable if each calibration gas level (low, mid and high) is either within ± 2 percent of the calibration span or $\leq$ 0.5 parts per million by volume (ppmv) of the manufacturer certified concentration of the calibration gas.

A converter efficiency test for the NO_x analyzer will be performed per Method 7E Section 8.2.4.1 or 16.2 prior to the field test to verify the NO_2 to NO conversion efficiency of the analyzer. The converter efficiency must be $\geq$ 90 percent to comply with EPA Method 7E Section 8.2.4.

The initial system bias or two point system test for each analyzer will be performed by introducing the high-level or mid-level calibration gas (whichever best approximates the emissions) and zero gas concentrations into the measurement system at the probe upstream of all of the conditioning components in the measurement system. The system bias will be performed prior to the start of the test and after each sampling run. During the initial system bias, the response time for the system will be determined by measuring the time it takes for the upscale and low-level gases to achieve 95% of the stable response (or ±0.5 ppm of the certified gas concentration, whichever is less stringent). The response time is to be the longer interval of two response times. The pre- and post-run system bias must be within ± 5.0 percent of the calibration span for the low level and upscale calibration gases or $\leq$ 0.5 ppmv of the manufacturer certified concentration of the calibration gas.

Prior to sampling, a stratification test at each test site will be performed to determine the appropriate number of sample traverse points. If a stratification test is not performed, 12 points will be sampled (six point a traverse). The stratification test will be performed with a probe of appropriate length to measure the O_2, CO_2, SO_2, NO_x and CO concentrations at twelve traverse points located according to Method 1. Alternatively, three points on a line passing through the centroidal area of the duct at points spaced at 16.7, 50.0, and 83.3 percent of the measurement line. The stratification test will consist of sampling for a minimum of twice the system response time at each of the predetermined sampling points. If the concentration (any one pollutant or diluent of interest) at each traverse point differs from the mean concentration for all the traverse points by no more than: a) ± 5 percent of the mean concentration; or b) ± 0.5 ppm (whichever is less restrictive), the gas stream is considered unstratified and sample collection from a single point which represents or closely matches the mean concentration can be used. If the concentration at each traverse point differs from the mean concentration for all the traverse points by no more than: a) ± 10.0 percent of the mean concentration; or b) ± 1.0 ppm (whichever is less restrictive), the gas stream is considered to be minimally stratified and sample collection from three points spaced at 16.7, 50.0, and 83.3 percent of the measurement line can be used. For stack diameters greater than 2.4 meters (7.8 ft.), the Method allows three point sampling located in the line exhibiting the highest average concentration during the stratification test at 0.4, 1.0, and 2.0 meters from the duct wall. If the gas stream is found to be stratified (exceeds the 10.0 percent or 1.0 ppm criterion), twelve traverse points as determined by Table 1-1 or 1-2 of Method 1 will be used for the testing.

Sampling will be initiated immediately following instrument calibration and after waiting at least two times the system response time. The minimum sampling time at each point is two times the response time. Subsequent traverse points will be recorded by omitting the two times the response time before recording except when the probe is removed from the source. The sampling points will be traversed with an equal length time at each traverse point for the sampling run. CEC logs data every second and at least one valid data point per minute will be recorded and reported. Sulfur dioxide, oxides of nitrogen, and carbon monoxide (dry-basis) concentration will be recorded in parts per million (ppm) while the oxygen and carbon dioxide concentrations will be recorded on a percent basis. The concentrations will be subsequently corrected for any system bias before using these values in determining the pollutant emission rates. Data obtained during the test program from CEC's data acquisition system will be archived on a compact disc and will be presented with the sampling report.

At the conclusion of the each run, the zero and upscale-level calibration gases will be reintroduced and their respective responses recorded by the data acquisition system to determine drift. The drift for a sampling run is acceptable if the drift is ≤ 3.0 percent of the calibration span. The data is deem acceptable if the criteria for the system bias and drift checks meet the required QC of EPA Method 7E and the run average of the sampling run is within the calibration span.

Section 5.a.8 Verification of Gas Dilution Systems for Field Instrument Calibrations

A gas dilution system may be used to provide known values of calibration gases through controlled dilution of high-level EPA Protocol 1 calibration gases with an appropriate dilution gas. USEPA Method 205 allows the use of a dilution system that produces known low-level calibration gases from high-level calibration gases, may be used for compliance tests in lieu of multiple calibration gases when the gas dilution system has demonstrated to meet the requirements of this method. The gas dilution system (Environics Model 4000) will be evaluated at the test site on one analyzer once during each field test. A precalibrated analyzer is chosen to demonstrate that the gas dilution system produces predictable gas concentrations within ± 2 percent of the predicted values spanning a range of concentrations. At a minimum, two dilutions with three injections at each level within the range of each dilution device (mass flow controller) utilized in the dilution system. The predicted values are calculated based on the certified concentration of the protocol gas and the gas flow rates though the gas dilution system. No single injection will differ by more than ± 2 percent from the average instrument response for that dilution. The average instrument response will be ± 2 percent from predicted value. The mid-level supply gas will be introduced directly to the precalibrated analyzer three times, by passing the dilution system. The average difference between the analyzer and the certified concentration of the mid-level supply gas will be within ± 2 percent. The gas dilution system is recalibrated annually using NIST-traceable primary flow standards with an uncertainty ≤ 0.25 percent. After meeting the requirements of this method, the remaining analyzers may be calibrated with the dilution system in accordance to the requirements of the applicable method for the duration of the field test.

Section 5.a.9 Oxygen and Carbon Dioxide Instrumental Analyzer Description

The oxygen concentration in the effluent will be determined by a California Analytical Instruments, Inc. Model 200 analyzer. Due to the magnetic properties of oxygen, the analyzer utilizes the phenomenon of paramagnetism to measure oxygen in the sample stream and generates a proportional electrical current.

The carbon dioxide concentration in the effluent will be determined by California Analytical Instruments, Inc. Model 200 Infrared Gas Analyzer. The analyzer utilizes a nondispersive infrared (NDIR) microflow detector to measure carbon dioxide in the sample stream and generates a proportional electrical current. The amplified and rectified voltage signal is recorded by the data acquisition system as percent carbon dioxide in the range of 0 to 20 percent. The electrical output signal is directly proportional to the concentration of the sample gas.

Section 5.a.10 Sulfur Dioxide Instrumental Analyzer Description

Sulfur dioxide concentrations will be determined according to EPA Method 6C. A Bovar Model 721 or Ametek 921 non-dispersive ultraviolet analyzer measures the absorbency of light at a discrete wavelength and then calculates the concentration of sulfur dioxide in the sample cell using the Beer-Lambert Law extended by using a system of linear equations. The resultant photomultiplier signals are amplified and the logarithm of the reciprocal of the transmittance gives an output that is directly proportional to the sulfur dioxide concentration which is sent to the DAS.

Section 5.a.11 Oxides of Nitrogen Instrumental Analyzer Description

Oxides of nitrogen concentrations will be determined according to EPA Method 7E. This methodology utilizes an analyzer based on the principles of chemiluminescent absorption analytical techniques. The oxides of nitrogen concentrations will be determined using an Air Pollution Corporation (API) Model 200AH or 200E analyzer which utilizes full scale ranges from 5 to 5,000 ppm. The unit output signal is linearly proportional to the nitric oxide concentration. The signal is directed to a front panel meter and to the DAS.

The unit only measures nitric oxide and therefore nitrogen dioxide must first be converted to nitric oxide for the determination of total oxides of nitrogen (nitric oxide + nitrogen dioxide). The API Model 200AH or 200E houses a self-contained nitrogen dioxide to nitric oxide converter for the dissociation of nitrogen dioxide to nitric oxide via a heated stainless steel converter chamber.

Section 5.a.12 Carbon Monoxide Instrumental Analyzers

Carbon monoxide concentrations and emission rates will be determined according to EPA Method 10. The carbon monoxide concentrations will be determined using an API Model 300 analyzer. This instrument utilizes the techniques of non-dispersive infrared (NDIR) for measurement of carbon monoxide. The system responds specifically to carbon monoxide and the detector signal is sent to the data acquisition system (DAS).

Section 5.a.13 Particulate Matter and Multiple Metal Sampling and Analysis

Testing for total filterable particulate matter and metals (antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), lead (Pb), manganese (Mn), nickel (Ni), and selenium (Se)) will be performed according to USEPA Method 29. Gaseous and particulate pollutants will be withdrawn isokinetically from the emission source and collected in a multi-component sampling train. In principle, particulate matter includes any material that is condensed at or above the filtration temperature of approximately 250 degrees Fahrenheit and will be collected on a tared quartz fiber filter. The gaseous components will be bubbled through a measured volume of 5% nitric acid / 10% hydrogen peroxide to determine the moisture and multiple metal content of the emission source. The principal components of the sampling system are sequentially:

- A borosilicate sample nozzle and probe liner;
- A heated (248°F ±25°F) probe and filter assembly with tared quartz fiber filter;
- An impinger train consisting of five sequential impingers. The first two impingers containing 100 ml each of 5% nitric acid/10% hydrogen peroxide followed by an empty impinger, the fourth and fifth impingers containing 200 grams of silica gel each; and
- A metering system capable of maintaining an isokinetic sampling rate and accurately determining the sample volume according to those specifications in APTD-0581.

After the test run is finished and the post leak checks will be completed, the filter which collected the sample will be carefully removed from the Teflon filter support and sealed in a Petri-dish. The nozzle, probe liner, and front filter-half of the filter assembly will be rinsed with acetone into a glass storage container (Fraction No. 2) which will be sealed and the liquid level will be marked. Following the acetone rinse for particulate matter, the nozzle, probe liner, and front filter-half of the filter assembly will be rinsed with 0.1N nitric acid into a 250 milliliter high density polyethylene (HDPE) storage container (Fraction No. 3). The liquid in the first three impingers (if knock-out impinger is used) will be measured to the nearest milliliter. The collected sample will be stored in a one liter glass storage container (Fraction No. 4) along with the 0.1N nitric acid rinse of the first three impingers and connecting glassware. The moisture collected by the silica gel in the fourth and fifth impingers will be determined to the nearest 0.1 gram. The collected condensate measurements will be recorded on the Method 4/29 moisture determination data analysis form. These samples along with the filters and the chain-of –custody will be shipped to Element One Laboratories in Wilmington, North Carolina for filterable particulate matter, and metal analysis. Samples method blanks and spiked samples will be analyzed by inductively coupled plasma-mass spectrometer (ICP-MS).

Section 5.a.14 Determination of Particulate and Gaseous Mercury Emissions

Particulate and gaseous mercury emissions sampling will be performed according to US EPA Method 101A. Particulate and gaseous mercury emissions will be withdrawn isokinetically from Furnace No. 3. Particulate matter and gaseous components will be drawn through a measured volume of acidified potassium permanganate ($KMnO_4$) to determine the moisture and particulate and gaseous mercury content of the emission source. The mercury collected will be reduced to elemental mercury, which is aerated from the solution into an optical cell and measured by atomic absorption spectrophotometry. The principal components of the sampling system will be sequentially:

- A borosilicate sample nozzle and probe liner;
- A heated (248°F ±25°F) probe;
- The optional filter assembly with a quartz fiber filter and Teflon frit will **not** be used in this project. Furnace No. 3 is expected to have minimal organic particulate matter in the gas stream;
- An impinger train consisting of four sequential impingers. The first impinger containing 50mL of acidified potassium permanganate, the second and third impingers contain 100 ml each of acidified potassium permanganate ($KMnO_4$), and final impinger containing 200 grams of silica gel. An optional knock out impinger may be placed before the silica gel impinger; and
- A metering system capable of maintaining an isokinetic sampling rate and accurately determining the sample volume according to those specifications in APTD-0581.

After the test run, care will be used to remove dust on the outside of exterior surfaces (i.e. probe and nozzle). The filter (if deemed necessary) will be removed from the Teflon frit and folded with the particulate side folded in. The optional filter may be placed in a 250 mL amber glass bottle (Container No. 3). Any particulate matter or filter fibers will be brushed with a dry nylon brush. 20 to 40 mL of absorbing solution ($KMnO_4$) will be added to the sample container and the container will be sealed.

The liquid in the first three impingers will be measured to the nearest milliliter or 0.1 gram. The collected sample will be stored in a one liter amber borosilicate glass storage container (Container No. 1). The nozzle, probe liner, filter housing (if applicable) and three impingers will be rinsed with a total of 400 mL of fresh absorbing solution ($KMnO_4$) into Container No.1. The absorbing solution rinse will be followed with approximately 100 mL rinse with deionized water. Container No. 1 will be sealed and the level of liquid in the storage bottle will be marked.

Residual brown deposits, if present on the glassware (the impingers and connecting glassware) after the potassium permanganate and water rinse, will be rinsed with 25 mL of 8 N HCl. The HCl will be poured into a 500 mL amber borosilicate glass storage bottle containing 200 mL of deionized water. This container will be labeled Container 1A. The three containers will be sealed and the liquid level marked. The moisture collected by the silica gel in the fourth impinger will be determined to the nearest 0.1 gram. The collected condensate measurements will be recorded on the Method 4 moisture determination data analysis form.

The samples will be transported to Element One of Wilmington, North Carolina along with the chain-of-custody documentation. Samples run containers and method blanks will be analyzed by inductively coupled plasma-mass spectrometer (ICP-MS). The laboratory results and quality assurance documentation will be attached to the report in Appendix C.

Section 5b Total Tests Conducted

One test series will be conducted for Furnace No. 3 emission stack.

Section 5c Total Runs Per Test

A minimum of three runs per test will be performed. Additional tests may be done to insure that data is available, uninterrupted by production or instrument problems.

Section 5d Duration of Test Runs

See Table 1.

Section 5e Minimum Sample Volumes

The minimum sampling volume for the metal methods will be 70 dry standard cubic feet for each run.

Section 5f Simultaneous Sampling

Some methods (example CEMs and isokinetic methods) will be sampled during the same time intervals in order to calculate flow rates and moisture with gaseous compounds analysis.

Section 5g Sample Recovery Location

The wet chemistry post sample run cleanups will be performed onsite inside a sample recovery trailer.

Section 5h Blank Recovery Application

Sample blanks will be performed according to EPA Method 29, and 101A procedures (see the previous sampling and analysis section for each method description).

Section 5i Sample Hold Time

Sample hold times are method specific but the samples after recovery will be analyzed within 14 days of receipt from the referenced two contract laboratories.

Section 6.0 SAMPLING LOCATIONS AND DOCUMENTATION

Section 6a Sampling Sites Schematics

Sample ports are installed to meet Method 1 testing requirements. Method 1 information will be verified on setup day prior to testing for compliance demonstrations.

Section 6b Fugitive Emission Points

There are no other emission points or fugitive emissions, associated with these sources.

Section 6c Cyclonic Flow Check

Verification of the absence of cyclonic or non-parallel stack gas flow will be performed prior to starting the test program for each source according to Reference Method 1, Section 11.4 and Quality Assurance Handbook, Volume III, Field Procedure 1a, *Flow Verification*.

Section 7.0 QUALITY ASSURANCE

Pretest and posttest calibrations will be conducted in accordance with United States Environmental Protection Agency (US EPA) specifications. CEC follows the calibration procedures outlined in EPA Reference Methods found in the Code of Federal Regulations (Volume 40, Part 60) and those recommended in the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, September 30, 1994. When the Reference Methods do not detail procedures, CEC uses methods such as those prescribed by the American Society for Testing and Materials (ASTM).

Section 7a Reference Method QA/QC Procedures

The following is a citation of the Quality Assurance Quality Control Procedures specified in Reference Methods 1, 2, 3, 4, 7E (for 3A, 6C & 10), 29, 101A and the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, September 30, 1994. (QA Handbook, Volume III)

Section 7.a.1

Data sheets will be checked for completeness, legibility, accuracy, specifications, and reasonableness as suggested and defined in Part I 1.0 introduction and 2.0 Quality Assurance Plan of QA Handbook, Volume III.

Section 7.a.2

CEC's quality assurance procedures for Reference Method 2 include calibrations according to Calibration Procedure 2-*Type S Pitot tube Inspection*, Calibration Procedure 2d-*Barometer*, and Quality Control procedure 5-*Metering System/Orifice* Check, of Reference Method 5. In addition, Reference Method 2 equipment is calibrated in accordance with Section 10.0 Calibration.

Section 7b Chain-of-Custody Procedures

CEC has developed chain-of-custody procedures based on Section 1.3.2 and 2.8.4 of QA Handbook Volume III procedures, including the attached form. In addition, CEC sampling personnel are trained on Chain-of-Custody procedures using US EPA APT II Course 443-Chain-of-Custody Guidebook.

Section 7c Leak Check Procedures

CEC performs leak checks on vacuum lines, pitot tubes, tanks and other applicable equipment as normal pretest operations. The Method 4 sampling trains will be leak checked before and after the test runs according to Section 8.4 of Reference Method 5 and QA, Handbook Volume III, Field Procedure 5a-*Leak Check of Isokinetic Sampling Train*. Pitot tubes are leak-checked according to Reference Method 2, Section 8.1 and QA Handbook, Volume III, Field Procedure 2a-*Leak Check of Pitot tube System*. Leak check results will be recorded on applicable field data sheets.

Section 7d Equipment Calibration

Calibrations are conducted in accordance with United States Environmental Protection Agency (US EPA) specifications. CEC follows the calibration procedures outlined in EPA Reference Methods found in the Code of Federal Regulations (Volume 40, Part 60) and those recommended in the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III (EPA/600/R-94/038c). When the Reference Methods do not detail procedures, CEC, Inc. uses methods such as those prescribed by the American Society for Testing and Materials (ASTM).

Section 7.d.1 Pitot Tubes

CEC's Type S Pitot tubes are constructed and calibrated in accordance with the procedures contained in EPA Reference Method 2. A Type S pitot tube will have a coefficient of 0.84 ±0.02. A standard pitot tube will have a coefficient of 0.99. The pitot tubes will be visually inspected prior to field use.

Section 7.d.2 Dry Gas Meter and Orifice

Metering systems receive a full calibration at the time of purchase and annually, thereafter. Post-test calibrations (comparison with a wet test meter or using ALT-009 procedures) are performed after the source test. If the calibration factor, γ (gamma), deviates by less than five percent from the initial value, the test data are acceptable. If γ deviates by more than five percent, the meter is recalibrated and the meter coefficient (initial or recalibrated) that yields the lowest sample volume for the test runs is used. Standard practice at CEC is to recalibrate the dry gas meter anytime ☐ is found to be outside the range of $0.97 \leq \gamma \leq 1.03$.

Section 7.d.3 Barometer

Field barometers are calibrated to agree within ± 0.1 inches Hg of a reference mercury barometer. The barometric pressure is corrected for pressure and temperature. Prior to and following the field test the field barometer is verified. The field test barometer will be calibrated prior to and after the test program.

Section 7.d.4 Thermometers

New thermometers, pyrometers and thermocouples purchased or fabricated by CEC are calibrated in accordance with US EPA Protocol. Calibration tolerance limits are as follow:

Impinger Temperature Gauge	±1°C or 2°F
Dry Gas Meter Temperature Gauge	±3°C or 5.4°F
Stack Thermocouples	±1.5% of absolute temperature

Thermometers and thermocouples are inspected and calibrated prior to and following the field test. Regardless of usage, thermometers and thermocouples are inspected and recalibrated on a yearly basis.

Section 7.d.5 Laboratory Equipment

CEC has a written quality assurance document that covers calibration and maintenance of laboratory equipment. This includes calibration of the analytical balance against Class S weights. Calibration of thermometers, barometers, and wet test meters are traceable to NIST. A copy of our quality assurance document may be obtained by written request.

Section 7e Analytical Detection Limit

Instrumental methods will have sensitivity values of < 2% of calibration span for O_2, CO_2, SO_2, NOx and CO. Particulate matter detection limits will be 0.1 mg, and multi-metals detection limits are listed in Table 29-1 of Method 29 and referenced in Section 13.3.

Section 7f Subcontract Laboratory Information

See Section 1d on page 1 and 2 of this document.

Section 7g Audit Samples

Not Applicable

Section 8.0 FINAL TEST REPORT OUTLINE

Section 8a Outline

Section 8.a.1 Introduction

This section describes the purpose, a brief outline including the sampling and analytical strategy, and the personnel involved in the test program.

Section 8.a.2 Process Description

This section contains a brief description of the process, the type and amount of materials handled, and a typical process air flow schematic.

Section 8.a.3 Sampling Methods

This section describes the sampling strategy, sampling and analytical methods, and quality assurance/quality control procedures implemented during the project.

Section 8.a.4 Results

This section presents the mean pollutant sampling results. Tabular results will also be provided to present data from individual sampling runs collected during the project.

Section 8.a.5 Appendices

This section will contain detailed supportive documentation that encompasses relevant aspects of the emission test program. Its contents will serve as the foundation for the test report. The emission test report presents a summary of the information gathered during the sampling activities. The information to be contained in the appendices is necessary to facilitate the review of the emission test report and determine whether proper procedures were used to accomplish the test plan objectives.

Defensible data and the subsequent pollutant concentrations and emission rates is one of the primary objectives of emission test program. To this end, results, example calculations, field data sheets, sample recovery, laboratory results, Chain-of-Custody documentation, and equipment calibrations will be provided to support these objectives.

Section 8b Example Calculations

Example calculation to be used for reporting test results will be found in Appendix A, *Summary of Results and Example Calculations* of the sampling report.

Section 8c Proposed Report Submission Date

CEC's normal report submission date is twenty five business days after completion of field testing. CEC will submit its final report to Johnson Controls no later than 30 business days after completion of field activities.