TEST PLAN

Storage Box Number: _____
(YYYY MM ##)

Facility: JCI

Source: Various Sources

Permit #: 1040-0129

Id#: N/A

Type of Testing: MACT & Permitted Pollutants

Location: Florence, SC

Plan Submittal Date: October 7, 2014

D H E C
PROMOTE PROTECT PROSPER
Catherine B. Templeton, Director
Promoting and protecting the health of the public and the environment

December 3, 2014

Ms. Lizzette Danner
Johnson Controls Battery Group, Inc.
1800 Paper Mill Road
Florence, SC 29501

RE: CX Scrubber, Melter Foundry Ventilation, and Slag Warehouse MACT and Permit Required Stack Test Plan Dated October 2014 (revised November 2014)

Dear Ms. Danner:

The referenced site-specific test plan is approved by the Department provided all applicable testing and monitoring requirements specified in MACT Subpart X are followed. Any deviations from the plan, without prior approval from the Department, may be cause for rejecting the test results.

Regardless of the operating rate stated in the approved plan, the Department expects facilities to operate at rated capacity during stack tests. Facilities that conduct tests at less than rated capacity may have reduced operating and/or emission limits imposed. The level of restriction will be determined from the margin of compliance, operating rate, and other appropriate parameters.

Your request to submit the test report 45 days after completion of the testing is approved.

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

Sincerely,

L. Jake Frick
Compliance Management Division
Bureau of Air Quality

ec: Michael Shroup, BAQ
Derek Brewster, TRC

cc: Compliance File: 1040-0129

Re: Johnson Control Test Plan Revised 2

Frick, Jake

Wed 12/3/2014 9:32 AM

Sent Items

To:lizzette.danner@jci.com <lizzette.danner@jci.com>;

Cc:dbrewster@trcsolutions.com <dbrewster@trcsolutions.com>;

1 attachment

JCI 11-2014 Plan Approval.doc;

See attached copy of the approval letter.

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

From: Brewster, Derek <DBrewster@trcsolutions.com>
Sent: Friday, November 21, 2014 4:05 PM
To: Frick, Jake
Subject: Johnson Control Test Plan Revised 2

Jake,

Attached is the revised red line addressing the production documentation. Please let me know if you have any additional questions.

Thank you,

Derek Brewster
Project Manager

TRC Environmental Corporation

5540 Centerview Drive, Suite 100, Raleigh, NC 27606
T: 919.256.6233 | F: 919.838.9661 | C: 919.618.3198
Email: dbrewster@trcsolutions.com
LinkedIn | Twitter | Blog | Flickr | www.trcsolutions.com

Re: Test Plan Submittal - Johnson Control Battery Group, Florence, SC

Frick, Jake

Tue 11/18/2014 1:18 PM

Sent Items

To:dbrewster@trcsolutions.com <dbrewster@trcsolutions.com>;

All looks good except for the process/control device recording frequencies in Section 3.2. We normally require process/control device rates to be recorded at least every 15 minutes during the tests. If any process rates described in Section 2.2 are determined from rate meters those readings need to be recorded at least every 15 minutes. If they are from production or charge rate weights over time, then those measurements (initial and final weights and clock times measurements are made) must be made on an hourly basis (minimum).

Since the baghouses are required to install and operate bag leak detection devices, recording the baghouse pressure drops on a less than 15 minute basis is okay but once a day is too infrequent. The baghouse and HEPA pressure differentials should be recorded at least once per shift during the tests.

Since the scrubber pressure drop and water flow rate must be maintained, within some margin, at the levels demonstrated during the performance test, those readings (scrubber pressure drop and water flow rate) must be recorded at least every 15 minutes during the tests.

Recording scrubber pH, scrubber liquid pressure, and scrubber fan amps once per shift is acceptable and the recording/data collection frequency for the enclosures is acceptable.

Please revise the plan accordingly.

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

From: Brewster, Derek <DBrewster@trcsolutions.com>
Sent: Friday, November 14, 2014 4:44 PM
To: Frick, Jake
Subject: RE: Test Plan Submittal - Johnson Control Battery Group, Florence, SC

Jake,

Attached is a red line copy of the test protocol addressing your questions below. If you have any questions please feel free to contact me.

Derek Brewster
Project Manager

TRC Environmental Corporation
5540 Centerview Drive, Suite 100, Raleigh, NC 27606
T: 919.256.6233 | F: 919.838.9661 | C: 919.618.3198
Email: dbrewster@trcsolutions.com
LinkedIn | Twitter | Blog | Flickr | www.trcsolutions.com

From: Frick, Jake [mailto:fricklj@dhec.sc.gov]
Sent: Friday, October 17, 2014 2:13 PM
To: izzette.danner@jci.com; Brewster, Derek
Subject: Fw: Test Plan Submittal - Johnson Control Battery Group, Florence, SC

Please address, or note where appropriate, the following regarding the plan:

1) Regarding Section 2.2 of the plan, what process rates will be recorded to verify operation at greater than 90% capacity? Also what are the design rates of those processes?

2) How often will the process data in Section 3.2 of the plan be recorded? Also in Section 3.2, please include that the total enclosure pressure differentials from the facility data acquisition system will be recorded during the test. Note that we expect those readings to be one minute average readings and if that cannot be provided please explain why.

3) In Section 4.4.5 of the plan, what will be the length of the Hg test runs?

4) In Section 4.4.6 of the plan, what will be the length of the O2, CO2, and SO2 test runs and will the stack gas flow rates be measured continuously or intermittently (before and after, etc.)?

5) Per 40 CFR 63.550(e)(14)(i), within 60 days after completing each performance test, the results of the test must be submitted in EPA's Electronic Reporting Tool format to EPA's Webfire database. Please revise the plan to include that this will be done.

6) On June 16, 2013, performance audit samples became available for certain EPA Reference Test Methods. Method 29 referenced in your source test plan is one of the methods in which an audit sample is available. Please update the test plan to include that the testing will include a test method performance audit.

7) Note that per Sections 8.3.1.1 and 8.3.2 of Method 29, the filter and particulate rinses must not be heated prior to weighing.

Thanks

Jake Frick

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

From: Brewster, Derek <DBrewster@trcsolutions.com>
Sent: Tuesday, October 7, 2014 7:24 AM
To: Shroup, Michael
Cc: Lizzette Danner
Subject: Test Plan Submittal - Johnson Control Battery Group, Florence, SC

Mr. Shroup,

Attached is the test plan for Johnson Control Battery Group, Inc., Florence Recycling Plant. The testing is scheduled to be conducted the week of December 8, 2014. Testing will be conducted on the CX Scrubber, Melter baghouse stack, Slag Warehouse baghouse stack and the Foundry Ventilation baghouse stack. Please touch base with any questions or comments.

Thank you,

Derek Brewster
Project Manager

5540 Centerview Drive, Suite 100, Raleigh, NC 27606
T: 919.256.6233 | F: 919.838.9661 | C: 919.618.3198

LinkedIn | Twitter | Blog | Flickr | www.trcsolutions.com

Test Protocol

Performance Tests
on the CX Scrubber, Melter,
Foundry Ventilation, and Slag Warehouse
at the
Johnson Controls Battery Group, Inc.
Florence Recycling Plant

Florence, South Carolina

Prepared for:

Johnson Controls Battery Group, Inc.
Florence Recycling Plant
1800 Paper Mill Road
Florence, South Carolina 29501

Prepared by:

TRC Environmental Corporation
5540 Centerview Drive, Suite 100
Raleigh, North Carolina 27606

October 2014
Revised November 2014

TRC Project No. 223508

October 2014
Revised November 2014

TEST PROTOCOL

Performance Tests
On the CX Scrubber, Melter
Foundry Ventilation, and Slag Warehouse
At the
Johnson Controls Battery Group, Inc.
Florence Recycling Plant

Florence, South Carolina

Prepared for

Johnson Controls Battery Group, Inc.
Florence Recycling Plant
1800 Paper Mill Road
Florence, South Carolina 29501

Prepared by

TRC Environmental Corporation
5540 Centerview Drive, Suite 100
Raleigh, North Carolina 27606
(919) 828-3150

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Section **Page**

1.0 INTRODUCTION

TRC Environmental Corporation (TRC) of Raleigh, North Carolina has been retained by Johnson Controls Battery Group, Inc. (JCI) to conduct performance tests at the Florence Recycling Plant located at 1800 Paper Mill Road in Florence, South Carolina, SC Permit Number 1040-0129-CA.

Performance testing for particulate matter (PM) and lead (Pb) will be conducted at the Foundry Ventilation stack (Unit ID 10), the CX Scrubber stack (Unit ID 01), the Melter Stack (Unit ID 06) and the Slag Warehouse stack (Unit ID 14). Additionally, testing for sulfuric acid mist (H_2SO_4) will be conducted on the CX Scrubber and mercury (Hg) and sulfur dioxide (SO_2) testing will be conducted on the Melter. All testing will be conducted while the unit is operating at greater than 90% of maximum normal load under steady state conditions.

Lead testing is being performed as required by 40 CFR 63 Subpart X, Section 63.543(g)(8) and Section II.C. of permit 1040-0129-CA. All other testing described in this protocol is being conducted in accordance with Section II.C. of permit 1040-0129-CA.

FACILITY CONTACT INFORMATION

Ms. Lizzette Danner
Environmental Manager
Johnson Controls Battery Group, Inc. – Florence Recycling Plant
1800 Paper Mill Road
Florence, South Carolina 29501
Telephone: 843-245-1720

TESTING FIRM INFORMATION

Derek Brewster
Project Manager
TRC Environmental Corp.
5540 Centerview Drive, Suite 100
Raleigh, NC 27606
Telephone: (919) 618-3198

CONTRACT LABORATORY INFORMATION

Steve Hunter
Laboratory Manager
First Analytical Laboratories
7517 Precision Drive, Suite 101
Raleigh, NC 27617
Telephone: (919) 942-8607

Teran Simon
Laboratory Manager
Resolution Analytical Laboratory
204 Technology Park Lane
Suite 110
Fuquay-Varina, NC 27526
Telephone: (919) 346-5740

2.0 PROJECT OVERVIEW

2.1 SCOPE OF WORK

Testing will be conducted for particulate matter (PM) and lead (Pb) at the Foundry Ventilation, the CX Scrubber, the Melter and the Slag Warehouse. Additionally, samples will be collected for sulfuric acid mist (H_2SO_4) on the CX Scrubber and mercury (Hg) and sulfur dioxide (SO_2) on the Melter. The test program approach involves conducting a series of three test runs at each location using EPA Reference Methods.

The required measurement parameters and test methods to accomplish these objectives are:

40 CFR Part 60, Appendix A, EPA Methods

- Method 1 and 2 Volumetric Flow Rate Determination
- Method 3 or 3A Oxygen and Carbon Dioxide
- Method 4 Moisture
- Method 5 Particulate matter
- Method 6C Sulfur Dioxide
- Method 8 Sulfuric Acid Mist
- Method 29 Lead
- Method 30B Mercury

2.2 OPERATING SCHEDULE

Performance testing for particulate matter, mercury, metals, sulfuric acid mist and sulfur dioxide will be conducted while the designated unit is operating under maximum representative operating conditions defined as operation at greater than 90% of capacity throughout the test period. Process rates to be recorded are as follows:

Source	Process Rate Description	Design Rate
CX	Batteries (tons/hr) broken	24.8 tons/hour[2]
Melter and Charge Preparation	Furnaces lead production and Melter lead production	4.72 tons/hour/furnace[1] 4.83 tons/hour (melter)[1]
Foundry Ventilation	Furnaces lead production	4.72 tons/hour/furnace[1]
Slag Warehouse	Furnaces lead production	4.72 tons/hour/furnace[1]

[1] The process rate will be defined as the hourly average of the batch process. The charging start time and mass will be logged as well as the final tap time and mass.
[2] The hourly rate will be calculated from the total number of pallets processed during the test run. Johnson Control has an average weight per pallet that they will apply to the total number of pallets processed. The pallet count will be logged during each test run.

3.0 FACILITY DESCRIPTION

Johnson Controls Battery Group, Inc. – Florence Recycling Plant operates several processes in which discarded lead-acid batteries are recycled.

3.1 SITE LOCATION AND SOURCE DESCRIPTION

Each emission unit in this test program is equipped with an individual, dedicated exhaust stack. The CX Scrubber (Unit ID 01) consists of multiple processes in the preparation of lead-acid batteries for recycling. The control equipment for the process is a plate scrubber. The Melter and Charge Prep Area (Unit ID 06) consists of the charge preparation area and a rotary lead melting furnace rated at 6.32 MMBtu/hr fired on natural gas. The Melter and Charge Prep Area is controlled by a baghouse system with HEPA filtration. The Foundry Ventilation system (Unit ID 10) provides negative pressure on the foundry building for collecting process fugitive emissions of the sources from lead smelting. The Foundry Ventilation is controlled by a baghouse with HEPA filtration. The Slag Warehouse (Unit ID 14) collects fugitive emissions for the slag storage facility. The emissions are controlled by a baghouse with HEPA filtration.

Complete descriptions of each location will be documented in the final test report. The test report will include all EPA Method 1 parameters including stack diameter and upstream / downstream measurements as well as cyclonic flow determinations.

3.2 PLANT PROCESS DATA

JCI personnel will be responsible for the documentation of facility operating conditions during the test program. Plant operating data collected by JCI plant personnel will be included in the final report. The process data may include and is not limited to:

- Process operating rates – as described in Section 2.2
- Slag Warehouse and Foundry Ventilation Baghouses and HEPAs pressure differential – readings collected on a per shift basis
- CX Scrubber pressure drop – readings collected every 15 minutes
- CX Scrubber liquid flow rate – readings collected every 15 minutes
- CX Scrubber pH – readings collected once per shift
- CX Scrubber liquid pressure – readings collected once per shift
- CX scrubber air flow as indicated by fan amps – readings collected once per shift
- Total enclosure pressure differentials (CX crusher and smelter enclosure) – 15 minute averages that will include at least one reading per minute.

4.0 TEST METHODS AND PROCEDURES

4.1 OVERVIEW

This section describes the procedures that the testing contractor will follow during the field sampling program. Throughout the program, the testing contractor will follow EPA Reference Methods 40 CFR Part 60 Appendix A and Appendix B sampling protocols. The testing contractor project manager, the JCI project coordinator and South Carolina Department of Health and Environmental Control (SC DHEC) will approve deviations from the specified test methods. Modifications will be documented in the final report.

The remainder of this section is divided into the following subsections: Field Program Description, Pre-sampling Activities, and Onsite Sampling Activities.

4.2 FIELD PROGRAM DESCRIPTION

The following test methods will be used:

The test methods to be utilized in accordance with 40 CFR Part 60 will be as follows:

- EPA Method 1 — Sample Velocity Traverse for Stationary Sources
- EPA Method 2 — Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot tube)
- EPA Method 3 — Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources
- EPA Method 3A — Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)
- EPA Method 4 — Determination of Moisture Content in Stack Gases
- EPA Method 5 — Determination of Filterable Particulate from Stationary Sources

- EPA Method 6C — Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)
- EPA Method 8 — Determination of Sulfuric Acid Mist and Sulfur Dioxide Emissions from Stationary Sources
- EPA Method 29 — Determination of Metals Emissions from Stationary Sources
- EPA Method 30B — Determination of Total Vapor-Phase Mercury using Carbon Sorbent Traps.

4.3 PRE-SAMPLING ACTIVITIES

Pre-sampling activities include equipment calibration and other miscellaneous tasks. Each of these activities are described or referenced in the following subsections. Other pre-sampling activities include team meetings, equipment packing, and finalization of all details leading up to the coordinated initiation of the sampling program.

4.3.1 Equipment Calibration

The testing contractor will follow an orderly program of positive actions to prevent the failure of equipment or instruments during use. Preventative maintenance and careful calibration help to ensure accurate measurements from field and laboratory instruments.

Once the equipment has gone through the cleaning and repair process, it is then calibrated. All equipment that is scheduled for field use is cleaned and checked prior to calibration. Once the equipment has been calibrated, it is packed and stored to ensure the integrity of the equipment. An adequate supply of spare parts is taken in the field to minimize downtime from equipment failure.

Inspection and calibration of the equipment is a crucial step in ensuring the successful completion of the field effort. All equipment is inspected for proper operation and durability prior to calibration. Calibration of the following equipment is conducted in accordance with the procedures outlined in EPA documents entitled "*Quality Assurance Handbook for Air Pollution Measurement Systems; Volume III - Stationary Source Specific Methods*" (EPA-600/4-77-027b) and 40 CFR Part 60 Appendix A. All calibrations will be performed prior to test program.

4.3.2 Source Sampling Equipment

Each sampling console dry gas meter is calibrated with critical orifices or by comparison to a reference gas meter. The resulting gas meter coefficient (γ or gamma) and the orifice pressure differential (Delta H@) are clearly labeled on the meterbox as applicable. The pitot tubes are checked for conformance to the geometric specification in EPA Method 2 and are assigned a coefficient of 0.84. Thermocouples are initially calibrated by comparison with an ASTM-3F mercury-in-glass thermometer at three points. Each thermocouple will agree within 1.5 percent of the reference thermometer, expressed in Kelvin, throughout the entire calibration range. Digital temperature indicators are checked by comparing the indicator reading with a series of input signals from a digital readout calibrator.

4.4 ONSITE SAMPLING ACTIVITIES

4.4.1 Velocity Measurements

Velocity traverses will be conducted at each stack with an S-type pitot assembly in accordance with EPA Reference Methods 1 and 2. An S-type pitot tube with an attached inclined manometer will be used to measure the exhaust velocities at the sampling location. An attached Type-K thermocouple with remote digital display will be used to determine the flue gas temperature. During the test program, velocity measurements will be conducted during each test run while operating the isokinetic sampling train(s). The required number of velocity measurement points for each sampling location will be determined following EPA Method 1.

Cyclonic flow checks will be conducted in accordance with Section 2.4 of EPA Method 1. This procedure is referred to as the nulling technique. An S-type pitot tube connected to an inclined manometer will be used in this method. The pitot tube will be positioned at each traverse point so that the face openings of the pitot tube are perpendicular to the stack cross-sectional plane. This position is called the "0° reference". The velocity pressure (ΔP) measurement is noted. If the ΔP reading is zero, the cyclonic angle is recorded as 0°. If the ΔP reading is not zero, the pitot tube is rotated clockwise or counter clockwise until the ΔP reading becomes zero. This angle is then measured with a leveled protractor and reported to the nearest degree. After this null technique is applied at each traverse point, the average of the cyclonic angles is calculated. If this average is less than 20°, the flow condition is acceptable to test.

4.4.2 Flue Gas Moisture

Moisture will be determined for each test run according to EPA Reference Method 4, "*Determination of Moisture Content in Stack Gases*". The principle of this method is to remove the moisture from the sample stream and determine moisture either volumetrically or gravimetrically. Method 4 will be used in conjunction with the metals and sampling train. A stand-alone moisture train will consist of four impingers. The first two impingers will contain water, the third will remain empty and the fourth will contain silica gel. Stand-alone Moisture samples will be collected from a single point for 30 minutes. Each moisture sample collected will be applied to two volumetric flow measurements.

4.4.3 Flue Gas Molecular Weight

Molecular weight will be determined for each test run according to EPA Reference Method 3 or 3A, "*Determination of Dry Molecular Weight*". Concurrent with the isokinetic sampling, an integrated tedlar bag sample will be collected. The bag will be analyzed with an Orsat analyzer for the percent oxygen and carbon dioxide in the gas stream. This data will be used for determining the dry molecular weight of the stack gas. Instrumental reference method sampling for oxygen and carbon dioxide may be used for determination of flue gas molecular weight. Details of the instrumental procedure are found in Section 4.4.5.

4.4.4 Particulate Matter and Metals

Sample Collection. Samples are withdrawn isokinetically from the stack using an EPA Method 5 and 29 sampling train. The sampling train will consist of a glass nozzle, a heated glass probe with a Type S Pitot tube attached, a heated filter, four chilled impingers, and a metering console. The filter will be a tared Pallflex 2500QAT-UP, or equivalent, quartz fiber filter maintained at a temperature of 248°F ± 25°F. The first two impingers will each contains 100 ml of 5% nitric acid (HNO_3) / 10% hydrogen peroxide (H_2O_2) reagent, the third will remain empty and the fifth will contain pre-weighed silica gel. Each point will be sampled for an equal amount of time, resulting in net run times of 240 minutes and a minimum sample volume of 70 dry standard cubic feet. The actual number of sampling points will be determined after evaluating the Method 1 criteria. Test runs on the CX scrubber will be 120 minutes in duration.

Sample Recovery. The sample train will be transported to the on-site trailer for clean-up. The filter is removed from the filter holder and placed in a petri dish. The impingers are weighed

prior to sample train recovery. The silica gel is returned to the original container. The volume of water vapor condensed in the impingers and the volume of water vapor collected in the silica gel are summed and entered into moisture content calculations. All front-half components of the sampling train including the nozzle, probe, and filter holder are rinsed with acetone into a reagent jar followed by 100 ml nitric acid rinse into a separate reagent jar. The first through third impingers are emptied into a 1000 ml reagent jar. The back-half of the filter holder through the third impinger are then rinsed with 100 ml 0.1N HNO_3 into the same jar. Three (3) unused filters from the same lot and treated in the same manner as above will be designated as a blank. Reagent blanks will be collected as described in EPA Method 29. A spike is added to one run during analysis to obtain the recovery efficiency.

Sample Analysis. EPA Method 5 analytical procedures are used to analyze the filter and acetone rinse for total filterable particulate matter following the procedures outlined in section 8.3.1.1 and 8.3.2 of Method 29. EPA Method 29 analytical procedures are used to analyze the sample train for antimony lead (Pb). Method 29 front and back half fractions are analyzed separately. Duplicate metals analysis is performed for approximately 10% of the samples for metals except for mercury. All mercury samples are analyzed in duplicate.

4.4.5 Mercury

Sample Collection**.** Samples are withdrawn at a constant rate from the source using an EPA Method 30B sampling system. Each of the paired legs, designated A and B, of the sampling train consist of a 10mm O.D. charcoal tube, a heated probe, a moisture knock out, and a metering console. At the conclusion of each sampling run, the charcoal tube from each leg is leak checked, removed from the heated probe, labeled, and sealed. The analyte measured is total vapor-phase Hg in the flue gas, which represents the sum of elemental Hg (Hg^0) and oxidized forms of Hg, in mass concentration units of micrograms per dry standard cubic meter (µg/dscm). The sorbent traps are recovered from the sampling system and delivered to the analytical laboratory. The spiked traps will be calculated based on a stack concentration of 0.5 µg/dscm and the target sample volume will be roughly 300 L. The actual run time will be determined based on equipment configuration and actual sample rate that can be achieved. The target run time will be 180 - 240 minutes. All three sample runs will be the same duration and method required sample volume criteria will be met.

EPA Method 30B analytical procedures are used to analyze the charcoal tubes for mercury. All paired tubes used in the calculations need to be within the allowable relative difference of 10%,

and the average spike recovery within the allowable 85% to 115% range. Breakthrough parameters include the second fraction of the individual tube being less than 10% of the total concentration.

Sample Analysis. Analysis of each paired sorbent tube will be conducted using an Ohio Lumex model RA-915 fitted with the RP-M324 thermal attachment to analyze each fraction of the charcoal tubes. The Ohio Lumex analyzer will calibrated from 10 ng to 1,000 ng using NIST traceable standards. A 500 ng continuing calibration verification (CCV) will be prepared in accordance with the method, at a minimum every tenth sample. The charcoal tube is processed and sorbent is transferred onto a quartz ladle. The ladle is inserted into the analyzer thermo catalytic conversion chamber (RP-M324) heated to ~ 700°C wherein mercury is converted from a bound state to the atomic state by thermal decomposition in a two-section furnace. Mercury measurements take place in the heated cell zone of converter directly coupled to spectrometer. High temperature (~ 700ºC) and short residence time prevents mercury atoms from recombining with any "active" species generated due to high temperature decomposition of sample matrix. An external pump is used to draw ambient air and purify it for combustion.

The RA-915 is also equipped with custom integration software that charts and records each individual sample. This software integrates each sample peak providing the user with an area count equivalent that is be used to generate nanograms (ng) mercury per sample fraction.

The charcoal sorbent tube consists of two fractions separated by a layer of glass wool. The first section is the sample fraction. The second fraction is analyzed for breakthrough. The two fractions from each tube are summed and the total mercury analyzed is used to determine concentration. In the event that the second fraction was analyzed to be less than the minimum detection limit (MDL) of the instrument, the MDL was used as the Hg catch for that fraction.

4.4.6 Continuous Emissions Monitoring for O_2, CO_2 and SO_2

Instrumental Reference Method testing will be conducted for Sulfur dioxide (EPA Method 6C) at the Melter exhaust stack. Oxygen (EPA Method 3A) and carbon dioxide (EPA Method 3A) will be measured to calculate stack gas molecular weight for flow rate determination. The instrumental test data will be collected concurrent with the isokinetic sampling and volumetric flow rates will determined during the isokinetic sampling will be applied.

The reference method CEMS sampling train will start with a stainless-steel sampling probe. The sample stream will be then drawn through a glass fiber filter, heated (248°F ± 25°F) Teflon sample line, and a sample conditioner to remove the moisture and particulate from the gas stream. The sample will then be drawn through Teflon tubing by a leak-free Teflon pump to a stainless-steel sample manifold with an atmospheric by-pass rotameter. The O_2, CO_2, and SO_2 analyzers will withdraw samples from this manifold.

CEMS data will be recorded as averages by a digital data logger designed to receive and log instrument signals. The results will be expressed in ppmvd for SO_2, and in percent for O_2 and CO_2.

4.4.7 Sulfuric Acid Mist

Sample Collection. Sulfuric Acid Mist (H_2SO_4), including sulfur trioxide (SO_3), samples will be collected using the procedures outlined in EPA Method 8. The sampling train consisted of a glass nozzle, a heated glass probe with a Type S Pitot tube attached, a heated filter, four chilled impingers, and a metering console. The first impinger will contain 100 ml of 80% IPA followed by a second, un-heated, filter. The second and third impingers will each contained 100 ml of 3% H_2O_2 and the fourth contains pre-weighed silica gel. Each point will be sampled for an equal amount of time, resulting in net run times of 120 minutes. The actual number of sampling points will be determined after evaluating the Method 1 criteria.

Sample Recovery. At the conclusion of each test run, the filter will removed from the filter holder and placed in the reagent jar. The sample train is purged with ambient air for 15 minutes. The nozzle, probe and heated filter holder are rinsed with 80% IPA into a reagent jar. The impingers are weighed and volume of water vapor condensed in the impingers and the volume of water vapor collected in the silica gel are summed and entered into moisture content calculations. The contents of impinger one are collected in the reagent jar and rinsed three times with 80% IPA. The second unheated filter is added to the reagent jar and the front half of the filter holder is rinsed with 80% IPA into the same reagent jar. Impingers two and three are collected in a 500 ml sample jar and three DI rinses are conducted.

Sample Collection. The single reagent collected from the nozzle to the second filter is analyzed as a single fraction for sulfuric acid mist including sulfur trioxide. The reagent recovered from the second and third Impinger will be archived.

5.0 CALCULATIONS

5.1 Concentration, grains per dry standard cubic foot

$$C\ (gr/dscf) = 15.4324 \times \frac{g}{Vmstd}$$

Where:

C	= Concentration, gr/dscf
15.4324	= conversion gr/mg, (7,000 gr/lb) / (453.592 mg/lb)
Vmstd	= Volume metered @ standard conditions

5.2 Emission Rate, pounds per hour

Concentrations, parts per million (ppm) and milligrams per dry standard cubic meter (mg/dscm) will be corrected to 7% oxygen using the following equation:

$$Rt\ (lb/hr) = \frac{60}{453.592} \times \frac{g}{Vmstd} \times Qsd$$

OR

$$Rt\ (lb/hr) = \frac{60 \times fwt \times Qsd}{385.3 \times 10^{6}}$$

Where:

Rt	= Emission Rate, lb/hr
Qsd	= Volumetric Flow Rate, DSCFM
Fwt	= Formula Weight of Pollutant, lb/lb-mole

6.0 QUALITY ASSURANCE

6.1 OVERVIEW

The testing contractor management will be fully committed to an effective Quality Assurance/Quality Control Program whose objective is the delivery of a quality product. That product is data resulting from field measurements, sampling and analysis activities, engineering assessments, and the analysis of gathered data for planning purposes. The Quality Assurance Program works to provide complete, precise, accurate, representative data in a timely manner for each project, considering both the project's needs and budget constraints.

This section highlights the specific QA/QC procedures to be followed on this Test Program.

6.2 FIELD QUALITY CONTROL SUMMARY

6.2.1 Calibration Procedures

Calibration of the field sampling equipment will be performed prior to the field sampling effort. Copies of the calibration sheets will be submitted to the field team leader to take onsite and for the project file. Calibrations will be performed as described in the EPA publications "*Quality Assurance Handbook for Air Pollution Measurement Systems; Volume III - Stationary Source Specific Methods*" (EPA-600/4-77-027b) and EPA 40 CFR Part 60 Appendix A.

The following EPA approved alternative will be used for thermocouple calibration:

> Post-test thermocouple calibration will be performed in accordance with EPA ALT-011 using a single point calibration against an ASTM mercury-in-glass thermometer in addition to a continuity check of the thermocouple. The continuity check involves verifying that the thermocouple read-out trends in the appropriate direction when exposed to a temperature change. A complete copy of EPA ALT-011 is available from EPA from the EMC website at *http://www.epa.gov/ttn/emc/*.

6.3 DATA REDUCTION, VALIDATION, AND REPORTING

Specific QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in all projects.

6.3.1 Field Data Reduction

Standardized forms will be used to record field sampling data. The data collected will be reviewed in the field by the Field Team Leader and at least one other field crew member. Errors or discrepancies will be noted in a field log.

6.3.2 Data Validation

The testing contractor supervisory and QC personnel will use validation methods and criteria appropriate to the type of data and the purpose of the measurement. Records of all data will be maintained, including that judged to be an "outlying" or spurious value. The persons validating the data will have sufficient knowledge of the technical work to identify questionable values.

Field sampling data will be validated by the Field Team Leader and/or the Field QC Coordinator based on their review of the adherence to an approved sampling protocol and written sample collection procedure.

The following criteria will be used to evaluate the field sampling data:

- Use of approved test procedures;
- Proper operation of the process being tested;
- Use of properly operating and calibrated equipment;
- Leak checks conducted before and after tests;
- Use of reagents conforming to QC specified criteria; and
- Maintain proper chain-of-custody.

6.3.3 Data Reporting

All data will be reported in standard units depending on the measurement and the ultimate use of the data. The bulk of the data will be processed following delivery of the laboratory results.

6.4 STATIONARY SOURCE AUDIT SAMPLES

Stationary source audit samples will be ordered for this test program. The order will include an EPA Method 29 audit for metals on filter paper and in impinger solutions. The analysis will be for Lead. An additional audit sample will be ordered for sulfuric acid mist by EPA Method 8. All audit samples will be analyzed with the field samples.

6.5 EXCEPTIONS

Any deviations from this test plan must be approved by the JCI project coordinator and SC DHEC. Deviations will be documented in the final report.

7.0 FINAL REPORT SUMMARY

This section will serve as an outline of the Final Reports for submittal to JCI. This test program is projected to occur the week of December 8, 2014. Two (2) test reports will be submitted summarizing the results of the test program. The performance test report will be submitted within 45 days of completion of the test program. The report will follow the same basic outline as described in the following sections.

7.1 INTRODUCTION

The introduction will include the following items:

- The overall goals of the test;
- The specific goals of the test;
- Names and locations of all businesses, contractors, and agencies involved in the tests;
- Dates and duration of the test period;
- A brief outline of the remainder of the report.

7.2 SUMMARY AND DISCUSSION OF RESULTS

This section will be a two-part discussion summarizing the results and conclusions drawn from the data.

7.2.1 Summary of Results

This section will provide an overview of the entire stack gas sampling effort. Emission rates and concentrations will be expressed in the units as noted in Section 6.3.

Process upsets and deviations from the Test Plan will be fully described. Events, whether field or laboratory, pertinent to this project that may have an impact on the quality of the data will be fully documented in this section.

7.2.2 Discussion of Results

In this section, the testing contractor will correlate the emissions data with pertinent process data to further explain the results. Explanations or justifications for data discrepancies will be given. Areas where the data may appear technically weak will be pointed out.

7.3 PROCESS DESCRIPTION AND OPERATION

This section of the report will be in two parts, the process description subsection and the process operation subsection.

7.3.1 Process Description

A complete step-wise description of the entire process will be documented in this subsection. Design capacities and all pertinent process parameters will be listed.

7.3.2 Process Operations

Actual process data relevant to the emissions testing will be provided by the facility for inclusion in an appendix.

7.4 SAMPLING LOCATIONS

This will be similar to Section 3.0 of this Test Plan. Any deviations will be addressed.

7.5 SAMPLING PROCEDURES

This section will describe the methods used and any deviations from the Test Plan. This section will include a full discussion of any problems encountered during sampling.

7.6 DATA REPORTING

The data generated from this test program will be organized into tables depicting the pollutant concentrations from the sampling locations. All data undergoes extensive QA/QC procedures validating the results. All data will be reported in standard units depending on the measurement and the ultimate use of the data.

7.7 APPENDICES

The following appendices will be included in the Final Report:

A. Summary of Results and Example Calculations
B. Field Sampling Data Sheets
C. Laboratory Analytical Data
D. Equipment Calibration Sheets
E. Process Data
F. Qualified Individual Certification

7.8 REPORT APPROVAL

Senior staff members and QA personnel will review the final report for accuracy and completeness prior to submittal.

7.9 ELECTRONIC REPORTING TOOL

The data collected to meet the 40 CFR 63 Subpart X requirements will be entered in the EPA Webfire database using the EPA Electronic Reporting Tool. This data will be populated within 60 days of the test program completion.

Attachment A

Example Chain of Custody

SAMPLE LOG and CHAIN OF CUSTODY RECORD

Client:	**TRC Environmental Corporation**	TRC Project Manager :	**Derek Brewster**
Location:	Raleigh, NC	Telephone No.	(919) 256-6233
Project Name :	Johnson Controls	TRC Project No.	**210315**
	Florence, SC	Carrier or Delivery:	Delivered by TRC
		Date Delivered to Lab:	
Sample I.D. No. and Description		Results Due Date:	**Standard TAT**

Location :	Method	Run #	Fraction :	Sample Date :	Sample Type :	Type of Container :	Analysis Requested
	M29	M29-1	Filter		Filter	Petri	Pb & Hg by M29
	M29	M29-1	FH HNO_3 Rinse		HNO_3	250 ml glass	Pb & Hg by M29
	M29	M29-1	HNO_3/H_2O_2		HNO_3/H_2O_2	950 ml glass	Pb & Hg by M29
	M29	M29-1	Impinger 4		HNO_3	250 ml glass	Pb & Hg by M29
	M29	M29-1	$KMnO_4$		$KMnO_4$	500 ml Amber	Hg by M29
	M29	M29-1	HCl		HCl in H_2O	500 ml glass	Hg by M29
	M29	M29-2	Filter		Filter	Petri	Pb & Hg by M29
	M29	M29-2	FH HNO_3 Rinse		HNO_3	250 ml glass	Pb & Hg by M29
	M29	M29-2	HNO_3/H_2O_2		HNO_3/H_2O_2	950 ml glass	Pb & Hg by M29
	M29	M29-2	Impinger 4		HNO_3	250 ml glass	Pb & Hg by M29
	M29	M29-2	$KMnO_4$		$KMnO_4$	500 ml Amber	Hg by M29
	M29	M29-2	HCl		HCl in H_2O	500 ml glass	Hg by M29
	M29	M29-3	Filter		Filter	Petri	Pb & Hg by M29
	M29	M29-3	FH HNO_3 Rinse		HNO_3	250 ml glass	Pb & Hg by M29
	M29	M29-3	HNO_3/H_2O_2		HNO_3/H_2O_2	950 ml glass	Pb & Hg by M29
	M29	M29-3	Impinger 4		HNO_3	250 ml glass	Pb & Hg by M29
	M29	M29-3	$KMnO_4$		$KMnO_4$	500 ml Amber	Hg by M29
	M29	M29-3	HCl		HCl in H_2O	500 ml glass	Hg by M29

Released by TRC			Accepted by Laboratory	
	Signature	Date		Signature and Date