REPORT

Confirmatory Performance Testing of a Rotary Kiln Incinerator Exhaust

General Dynamics Ordnance and Tactical Systems
Munition Services
Carthage, Missouri

January 2014

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O'BRIEN & GERE

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Ordnance and Tactical Systems
Munition Services

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Re: CFPT Report and Notice of Compliance

EBV Explosive Environmental Company dba General Dynamics Ordnance and Tactical Systems Munition Services (GD-OTS MS) is submitting the Notice of Compliance and the Report for the Confirmatory Performance Test completed the week of November 18, 2013.

GD-OTS MS is in compliance with all operating parameters and emission.

Please contact me if you have any questions.

Sincerely,

David R. Zoghby
Senior Director of Marketing
& Commercial Contracts

cc: Don Murphy, MDNR APCP
Ken Herstowski, EPA Region 7
EPA Region 7
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General Dynamics Ordnance and Tactical Systems
Munition Services
Carthage, Missouri

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1. INTRODUCTION

1.1 TEST PROGRAM SUMMARY

O'Brien & Gere was retained by General Dynamics Ordnance and Tactical Systems Munition Services (GD-OTS MS) to conduct a Confirmatory Performance Test (CFPT) for the Hazardous Waste Incinerators at their facility located in Joplin, Missouri. The purpose of the test program was to satisfy the applicable requirements under 40 CFR § 63.1207 of the Hazardous Waste Combustor (HWC) National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations.

The confirmatory testing was conducted during the week of November 18, 2013. The field program was conducted in accordance with the CFPT Plan approved by the Missouri Department of Natural Resources (MoDNR) and under their oversight during the field testing program. Mr. Dave Zoghby was present to coordinate process operations with the test program and collect process data.

The results from this testing indicate that emissions for dioxins and furans (PCDDs/PCDFs) met the applicable emission standards under 40 CFR 63 Subpart EEE (otherwise known as the HWC MACT regulations). A summary of the test results can be found in Section 3 of this report.

1.2 EMISSIONS TESTING PROGRAM PARTICIPANTS

Facility

Name:	GD-OTS Munition Services
Address:	4174 County Road 180 Carthage, MO 64836
Contact:	Mr. David Zoghby
Telephone number:	(610)-298-3085

Source Emission Testing Company

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Address:	7600 Morgan Rd. Liverpool, NY 13090
Contact:	Mr. Jeff Gorman
Telephone number:	(315) 956-6022

Laboratory

Name:	Maxxam Analytics, Inc.
Address:	6740 Campobello Road Mississauga, ON L5N 2L8
Contact:	Mike Challis, Lab Manager
Number:	(905) 817-5790

1.2 INCINERATOR OVERVIEW

The main components of the GD-OTS MS explosive waste incineration operation consist of feed preparation and handling systems, feed conveying systems, a Rotary Kiln (RKI)Incinerator and a Car Bottom Furnace (CBF) incinerator, air pollution control equipment, metals and ash handling systems, and plant support systems.

The RKI is designed to incinerate explosive devices including configured munitions and bulk explosives. The CBF is used to treat and/or decontaminate large-shaped metal pieces, and for the incineration of explosive contaminated trash, such as rags, soiled uniforms, and packing material. Each incinerator has its own waste feeding system with the CBF using a mobile floor for batch feeding while the RKI uses a Continuous Feed System. Dual induced draft fans pull exhaust gases from the kiln and car bottom furnace into a common natural gas-fired horizontal secondary combustion chamber and two-stage air pollution control system (APCS).

The APCS consists of a spray dryer where a premixed soda ash solution is injected for the neutralization of acid gases and baghouses with jet pulse cleaning systems. The entire incineration system is maintained under a negative pressure by the dual induced draft fans located at the discharge end of the APCS, which, in turn, exhausts cleaned process gases to the atmosphere via a 65 meter (213.3 feet) tall stack. Residue from the combustion process is separated into ash and recyclable metals and is collected in bins. GD-OTS MS recycles the metals and the ash is sent to an EPA-approved hazardous waste landfill for disposal. All recyclable metals are inspected prior to being sent to a recycling center.

The process is monitored and controlled by a distributive control system (DCS) capable of continuously monitoring the process to assure all operational parameters are within regulatory and permit limits while waste is being fed to either unit. The DCS operates on an Uninterruptible Power Supply (UPS) in the event of commercial electrical power failure. In addition, this incinerator system is equipped with a Continuous Emissions Monitoring System (CEMS) that continuously samples the exhaust gases for percent oxygen, percent carbon monoxide, total hydrocarbons concentrations, opacity, stack flow rate and stack temperature.

1.3 PURPOSE AND OBJECTIVES OF THE CFPT

The purpose of the CFPT was to demonstrate the incinerator is in compliance with the requirements in 40 CFR Part 63, Subpart EEE. To this end, the specific objectives of this CFPT were to:

- Demonstrate compliance with the dioxin/furan emission standard of ≤0.40 ng/dscm @7%O2 TEQ basis (40 CFR § 63.1219(a)(1)(ii)) while the incinerator operates under normal conditions.
- Conduct a performance evaluation of the Continuous Monitoring Systems (CMS) required for compliance with the dioxin/furan standard (40 CFR § 63.1209 (k)).

The CFPT included feeding a variety of waste materials to the incinerators, monitoring certain process parameters and conducting emissions testing.

1.4 DOCUMENT ORGANIZATION

The remainder of this document is structured as follows:

- Section 2.0 provides a general physical description of the incineration system and associated unit operations (including the air pollution control system).
- Section 3.0 provides the test program results and discussion.
- Section 4.0 provides a summary of the test program.
- Section 5.0 provides a description of the sampling and analytical methods.
- Section 6.0 provides the test program quality assurance/control procedures.
- Section 7.0 includes the Continuous Monitoring System (CMS) Performance Evaluation that was performed as part of addressing the overall MACT testing requirements.
- Appendix A provides copies of facility process data.
- Appendix B provides a schematic of the test location.
- Appendix C provides copies of all field data and calculations.
- Appendix D provides copies of equipment calibration data.
- Appendix E provides copies of laboratory reports
- Appendix F provides copies of all CMS/CEMS performance evaluation documentation.

2. SOURCE DESCRIPTION AND OPERATING DATA

2.1 PROCESS OVERVIEW

This section presents a summary description of the GD-OTS MS reactive waste incineration system. The main components of the GD-OTS MS System consist of feed preparation and handling systems, feed conveying systems, two thermal destruction units, a secondary combustion chamber, air pollution control equipment, metals and ash handling systems, and plant support systems. The remaining plant support systems are: fuel gas supply, electric power (including a generator for backup emergency electrical power), instrument and plant air, plant water, fire water, runoff water control, and telecommunication systems. The control system for operating the incineration plant uses a distributed control system (DCS), which incorporates all necessary environmental monitoring. The DCS operates on an Uninterruptible Power Supply (UPS) in the event of commercial electrical power failure. A representative Process Flow Diagram (PFD) for this Incinerator is provided in **Figure 2-1**.

2.2 WASTE FEED SYSTEMS

Waste is brought on site by truck and taken to one of four storage magazines on the facility site. The magazines are sited and designed for 100,000 pounds Net Explosive Weight (NEW) of Class 1.1 Explosives each. The RKI is fed a wide variety of solid explosive waste materials via the Continuous Feed System. The CBF is loaded batch-wise by using steel baskets that are lifted by hoist or forklift onto the car bottom wagon. The car bottom is then moved into the furnace for combustion.

2.2.1 Rotary Kiln Continuous Waste Feed System

A wide variety of explosive wastes are introduced into the RKI via the Continuous Feed System which handles assembled items, packaged loose items, containers of liquids and sludge, and prepackaged bulk waste. This type of feeding is semi-continuous in nature, in that the feed is introduced to the kiln in finite quantities (batches), but these batches are continuously fed at a specified rate. All wastes are fed into the cooler end of the kiln.

Explosive waste material is placed in one or both of the Weigh/Feed Stations for dumping onto the Feed Conveyor. Each Weigh/Feed Station is controlled by the distributed control system (DCS) into which specific feed rate parameters are loaded for each waste material. Maximum feed weights are established and any attempt to over feed the Weigh/Feed Station results in rejection of the attempted feed.

The Feed Conveyor is enclosed with expanded metal covers to prevent loading feed other than through the Weigh/Feed Stations where the waste is weighed and the rate of feed controlled. If the material in the Weigh/Feed Stations is within the allowable weight limits, it will be transferred to the feed conveyor. The feed conveyor then carries the feed materials up and through the blast wall to the charge conveyor, which, in turn, transports the feed into the elevated feed chute of the Kiln Feed Housing at the low temperature end of the kiln.

When an automatic waste feed cutoff occurs, the Feed Conveyor is stopped. The Feed Conveyor can be reversed, if necessary, to withdraw any feed remaining on the approximately 3 feet long section of the conveyor that extends into the hot environment of the Kiln Containment Room. The Charge Conveyor inside the Kiln Containment Room, which operates at a higher speed than the Feed Conveyor, continues to operate to allow feed material already in the Kiln Room to continue into the retort. This also prevents material still being fed from exposure to the heat in the Kiln that could cause initiation of exposed material.

The Weigh/Feed Stations will accept materials up to 7 inches in diameter by 17 inches long, and weighing up to 40 pounds. The Feed Conveyor is an "S" shaped conveyor, which is 24 feet long and 24" inches wide and has a conductive rubber conveyor belt with fan fold sides and 4 inch high rubber cleats every 2 feet on the belt. The Charge Conveyor is 10 feet long and 12 inches wide. All conveyors have independent motors and positive gear drives. Each conveyor is capable of supporting a load equal to 40 pounds per linear foot. The centerline of the Feed Conveyor is offset from the centerline of the kiln for safety reasons.

2.3 MANUFACTURER, MAKE AND MODEL OF THE INCINERATOR

2.3.1 Rotary Kiln and Burner

The RKI was designed and manufactured by GD-OTS MS. It is a deactivation furnace designed with internal spiral flights that advance the waste through the kiln as it rotates. The GD-OTS MS Rotary Kiln is also referred to as having retort sections. The GD-OTS MS Rotary Kiln design is based on the APE 1236 kiln that the U.S. Army developed specifically to incinerate configured munitions and bulk explosives. There are a number of these installations throughout the continental United States and other countries. The Army kiln has been extensively tested and has proven to be a safe, effective method for the deactivation of munitions and explosives.

The standard Army APE 1236 kiln consists of four 5-foot long retort sections bolted together, with a nominal diameter of 3 feet, and wall thickness of 2 ½" and 3 ¼". As the kiln rotates, spiral flights propel the feed material through the retort. The flights prevent sympathetic explosive propagation between materials on opposite sides of the flight and increase the mixing of the waste material in the kiln with the flue gas and air, which increases the combustion efficiency. The internal spiral flights are spaced 30 inches apart and vary in height. The average height of the flight is 10 inches.

The GD-OTS MS Kiln uses six retort sections in lieu of the Army kiln design of only four sections in order to increase the material residence time by 50 percent. The increased residence time provides greater destruction efficiency for the more difficult to incinerate feeds. The overall length of the kiln, including the Kiln Feed Housing and Kiln Burner/Discharge Housing, is approximately 46 feet. The cross sectional area inside the retort is 3.7 square feet which results in a total retort volume of 109.2 cubic feet, after taking into account the volume occupied by the spiral flights. The effective combustion volume, which reflects the dimension from the point where the waste ignites to where the combustion gases exit the kiln, is 36.9 cubic feet.

The wall thickness of the GD-OTS MS kiln is 3 ¼" for all six sections. This provides extra strength to the kiln to ensure maximum safety during detonations of heat sensitive materials. The material of construction for all sections is A217 grade WC-9 cast steel for high strength and ductility at elevated temperature. Refractory or firebrick is not used for insulation because fragments and explosive pressures would destroy any of these materials.

The GD-OTS MS RKI has a single burner assembly at the hot end of the kiln, which is the opposite end from where the wastes are fed. A natural gas burner is used during the destruction of waste to sustain the operation of the GD-OTS MS Rotary Kiln. The fuel consumption varies with the specific waste material to be processed. When a high heat content material is incinerated, natural gas will only be required to support the pilot, which requires approximately 75,000 BTU/hr. of fuel. At maximum firing, the fuel consumption may be increased up to 4,000,000 BTU/hr. The burner is equipped with all accessory equipment necessary for the burner operation. A flame sensor that detects the presence of flame by sensing its ultraviolet light emissions acts as a flame failure safety device. The DCS will not allow wastes to fed to the kiln unless the flame sensor in the flame safety system detects flame from the burner.

2.3.1.1 Location of Rotary Kiln Combustion Zone Temperature Device

There are no temperature measuring devices that can survive the hostile environment in the combustion zone of the kiln due to the damage they would suffer from fragments, heat, and overpressures produced when explosive items detonate within the kiln. Therefore, the kiln feed end temperature used for controlling kiln operations, is measured using a type K thermocouple located in the kiln exhaust duct just as it exits the kiln feed end housing. The burner end temperature, also used for controlling kiln operations, is measured using a type K thermocouple located just above the burner in the kiln burner end housing at the materials discharge end of the kiln.

2.3.2 Car Bottom Furnace

The Car Bottom Furnace is a stationary natural gas fired combustion chamber that is used on an intermittent basis for treatment and decontamination of large, unusual or irregular shaped metal pieces, and for incineration of explosive contaminated trash such as, rags, soiled uniforms, manufacturing wastes, and packaging materials.

The contaminated trash/waste materials for incineration are transported to the Car Bottom Unloading Area in boxes or drums. These containers are then placed or dumped into a solid bottom steel basket. An overhead

hoist or forklift is used to lift the baskets onto the car bottom wagon. A scale is provided under the car bottom wagon, which weighs the materials prior to being moved into the incinerator. Materials are loaded onto the car bottom and the car bottom is moved into the furnace. If the allowable weight limit is exceeded, the car bottom furnace is locked out from starting. Contaminated drums and large metal items may be placed directly on the car bottom wagon.

The Car Bottom Furnace is constructed of refractory lined carbon steel. The maximum firing rate of the two forced draft natural gas burners is 3,600,000 BTU/hr. Exhaust gases from the Car Bottom Furnace are directed to the Secondary Combustor. The Car Bottom Furnace is generally operated pyrolitically (oxygen starved) in order to control the incineration process. Two water spray nozzles in the combustion chamber are activated, one at 1300°F, and the second at 1400°F, as necessary, to assist in controlling combustion temperature. An additional water spray nozzle in the exhaust duct exiting the Car Bottom Furnace is activated at 900°F to control the temperature of the exhaust gases going through the exhaust duct to the Secondary Combustor. In these water sprays, only sufficient water is added to control temperature and no liquid water effluent is generated. The Car Bottom Furnace is controlled to a maximum burn-off rate of combustible material of 300 lb/hr. Thus, if a batch of waste to be burned in the Car Bottom Furnace contains 600 pounds of combustible material, the batch cycle time would be 2 hours. The Secondary Combustor completes the burn of volatiles and partially oxidized gases contained in the Car Bottom Furnace exhaust gases. Operating parameters confirming treatment of waste by the Car Bottom Furnace are recorded and maintained via the DCS.

2.3.3 Operational Modes

The Rotary Kiln or Car Bottom Furnace can be operated alone or at the same time. This Confirmatory Performance Test Plan is for the dual operation of the furnaces. The compliance with emission standards for the individual operation of either furnace has been previously been tested with the Notice of Compliance submitted July 2004.

2.3.4 Secondary Combustor

The Secondary Combustor (SC) provides the second stage in the final combustion of the exhaust gases from either the kiln or the Car Bottom Furnace, depending on which primary combustion unit is operating. The SC is horizontally mounted, and is sized for 21,520 acfm (at 2200°F) of flue gases. The SC is capable of heating the exhaust gases from the kiln or car bottom furnace up to 1800 - 2200°F, provides greater than four second residence time, and achieves highly turbulent flow to ensure good mixing and therefore, effective destruction of waste gases. The combustion chamber is constructed of carbon steel and is internally insulated with 12 inches of modular ceramic fiber insulation.

The burner for the SC is a forced draft natural gas burner that normally fires at a rate of 9,000,000 BTU/hr. The burner is designed for a maximum heat release of 12,000,000 BTU/hr. As in other burners used at the GD-OTS MS Incineration System, the SC burner is equipped with a UV flame sensor to monitor ignition and assure flame is present when waste is being fed. Additional combustion air is provided as needed to the SC by the SC Combustion Air Blower depending on the exact requirement for each type of waste. Air for the SC is drawn from the Kiln Containment Building into the Secondary Combustor Air Blower.

2.4 AIR POLLUTION CONTROL EQUIPMENT

2.4.1 Spray Dryer

In addition to the pollution control function that the SC provides, this plant utilizes a two-stage air pollution control system (APCS). The first stage of this system is the Spray Dryer. The exhaust gases from the Secondary Combustor immediately enter the Spray Dryer where they are quenched from between 1,800-2,200°F to approximately 350-375 °F with a dilute soda ash/water solution. The temperature of the exhaust gas from the Spray Dryer is maintained by controlling the flow of quench water fed to the Spray Dryer. Concurrent with vaporization of the water, the soda ash reacts with sulfur oxides and/or hydrochloric acid, if present, to form sodium salts. These reaction products, together with the unreacted soda ash, become entrained in the gas within the Spray Dryer as solid particulate matter. The soda ash is received as a dry powder which is dissolved in water at a either a 5% or 10% concentration.(the 5% is normally used for lower feed rate requirements due to operational reliability and when high feed rates are required, the 10% concentration is used and the DSC setting

is changed). This soda ash solution feed rate is controlled by the DCS and is mixed with the quench water that is fed to the Spray Dryer. The amount of quench water fed is controlled by the Spray Dryer Exit Temperature.

The following formula is used to calculate the Soda Ash feed rate to the Spray Dryer in lbs per minute:

$$FR(SA)= \{1.495xFR(Cl) + 1.652xFR(S) + 0.663xFR(Br) + 2.790xFR(F)\} \div 0.65 \times 1.1$$

where FR(SA) is the feed rate of soda ash in lb/min,

FR(Cl) is the total feed rate of chlorine in lb/min,

FR(S) is the total feed rate of sulfur in lb/min

FR(Br) in the total feed rate of Bromine in lb/min and

FR(F) is the total feed rate of chlorine in lb/min.

The factor of 0.65 is the soda ash utilization rate. The factor of 1.1 allows an acceptable factor to assure HCL removal that meets or exceeds the statutory requirements.

GPM(SA) = FR(SA) / 0.1 (10% concentration) / 8.762 (Specific Gravity of solution) lb/gal

Of the total particulate matter, which consists of sodium salts, unreacted soda ash, and metal oxides in the form of fly ash, approximately 10 percent is expected to settle in the bottom section of the Spray Dryer. The double sliding gate valve transfers the dry solids from the bottom section of the Spray Dryer to the collection container for removal to a RCRA approved hazardous waste landfill along with other ash from the incineration system. The Spray Dryer controls are designed so that waste feed is cut off to the incinerator if the flow of soda ash/quench water solution stops. Emergency water sprays are activated in this situation to assure protection of the equipment.

2.4.2 Baghouse

The second stage of the APCS is the three-section Baghouse (ME-105A, B, C). The Baghouse is designed so that each section operates in parallel. The APCS is designed to operate with just two of the Baghouse sections on-line. Unreacted acidic components and the bulk portion of the total particulate matter are carried over to the Baghouse in the exhaust gases leaving the Spray Dryer.

The particulate matter collects on the Teflon® coated fiberglass/Gortex® bags of the Baghouse to obtain a minimum overall particulate removal efficiency of 99 percent for total fly ash, total reaction products, and total soda ash. Although the primary function of the Baghouse is to remove particulates, an additional scrubbing reaction takes place there. Unreacted soda ash, which collects on the bags, reacts with unreacted sulfur oxides and hydrochloric acid in the effluent gases from the Spray Dryer.

The Baghouses have a pulse-jet cleaning system, which uses compressed air to clean the bags. The dust, composed of the reaction products, fly ash and unreacted soda ash, is collected in the bottom section of the Baghouse. Rotary Valves in the bottom of each Baghouse section transfer the collected dust to the collection containers for offsite disposal at a hazardous waste landfill.

The Baghouse is sized to accommodate approximately 11,740 acfm of flue gas. The air to cloth ratio in the Baghouse, which is defined as the actual gas flow divided by the cloth area available for filtration, is approximately 2.5:1 ft3/min-ft2. The pressure drop across the Baghouses is 5" to 12" water column (WC). The Baghouse is bypassed only in the event that the gas exiting the Spray Dryer exceeds the maximum operating temperature of the Baghouse (approximately 450°F). An interlock is provided to activate automatic waste feed cut off if the bypass valve is opened. Emissions released during bypass operations will be minimal since the waste feed is stopped and the system will be going into shutdown mode to correct the conditions that resulted in the operation of the bypass valve.

2.4.3 Induced Draft Fans

The exhaust gases from the Baghouse enter the Induced Draft Fans at 325°F. The fans are designed to draw the flue gases out of the kiln or car bottom furnace and through the downstream equipment. Each fan is capable of handling 100 percent of the total flow. Both fans are operated continuously, each handling part of the total flow. If a fan fails, the total flow shifts to the other operating fan. This system will prevent the release of emissions due to failure of one fan.

2.4.4 Stack

The exhaust gases from the Induced Draft Fans enter the Stack where they rise through the Stack and are released to the atmosphere. The Stack is a key contributor to the emission characteristics of the plant. By design the flue gas dispersion characteristics are enhanced. The Stack for this plant is 213 feet (65 meters) tall and 2 feet in diameter. The Stack is constructed of corrosion resistant carbon steel ducting inside of a self-supporting, insulated outer stack shell, which is mounted on a concrete foundation. Condensed water from the Stack, if any, drains to the APCS pad sump.

2.5 STACK EMISSIONS MONITORING

Stack gases are monitored on a continuous basis for carbon monoxide, and oxygen via a Continuous Emissions Monitoring System (CEMS). Responses from the CEMS are fed to the DCS, where the CO hourly rolling average is calculated and interlocked to the waste feed conveyor as part of the Automatic Waste Feed Cutoff System (AWFCO) discussed in Section 2.7 below. The following provides a brief description of the CEMS instruments including the operating range and measurement principal.

Table 2-1 Continuous Emission Monitors

Parameter	Mfg.	Range	Principle
Oxygen	Rosemount OXA Extractive	0-25%	Paramagnetic
Carbon Monoxide	Teledyne Model T800	0-200 & 0-3,000ppm	Infrared

2.6 PROCESS MONITORING AND CONTROL

The GD-OTS MS incinerator is equipped with a DCS that is capable of sensing field instrument values, performing the necessary process adjustments and automatically shutting off the waste feed conveyor or shutting the entire process down if operational parameters deviate from required operating ranges. The DCS is capable of monitoring the "operational envelope" of the incinerator and is capable of performing a number of activities including:

- Control room indication of processor sensors located within the incinerator (such as pressure indication of a field installed pressure transmitter);
- Process controller for single instrument loops or an individual sub-system, such as a pressure control loop involving a sensor reading from one pressure transmitter affecting the function of one pressure control valve;
- Alarm for an exceedance of a designated set point, such as a high pressure or low temperature;
- Shut-down of individual equipment when the measured parameter exceeds a set point (such as a shut-off of waste feed conveyor when the combustion temperature is too low); and
- Shutdown of one or more subsystems when one or more measured parameters exceed a set point (such as shut-down of secondary combustion burner when high exit temperature in the spray dryer is detected).

The DCS will continuously control and monitor the operation of the incinerator. When out-of- range conditions exist, it will notify the operator of those conditions. The DCS is programmed to shut-down equipment (i.e., bring the system into a safe mode) when designated parameters are exceeded, which is a protective mechanism against potential equipment damage, operation outside of permit limits, or conditions that might lead to a release to the environment.

2.7 AUTOMATIC WASTE FEED CUT-OFF SYSTEM

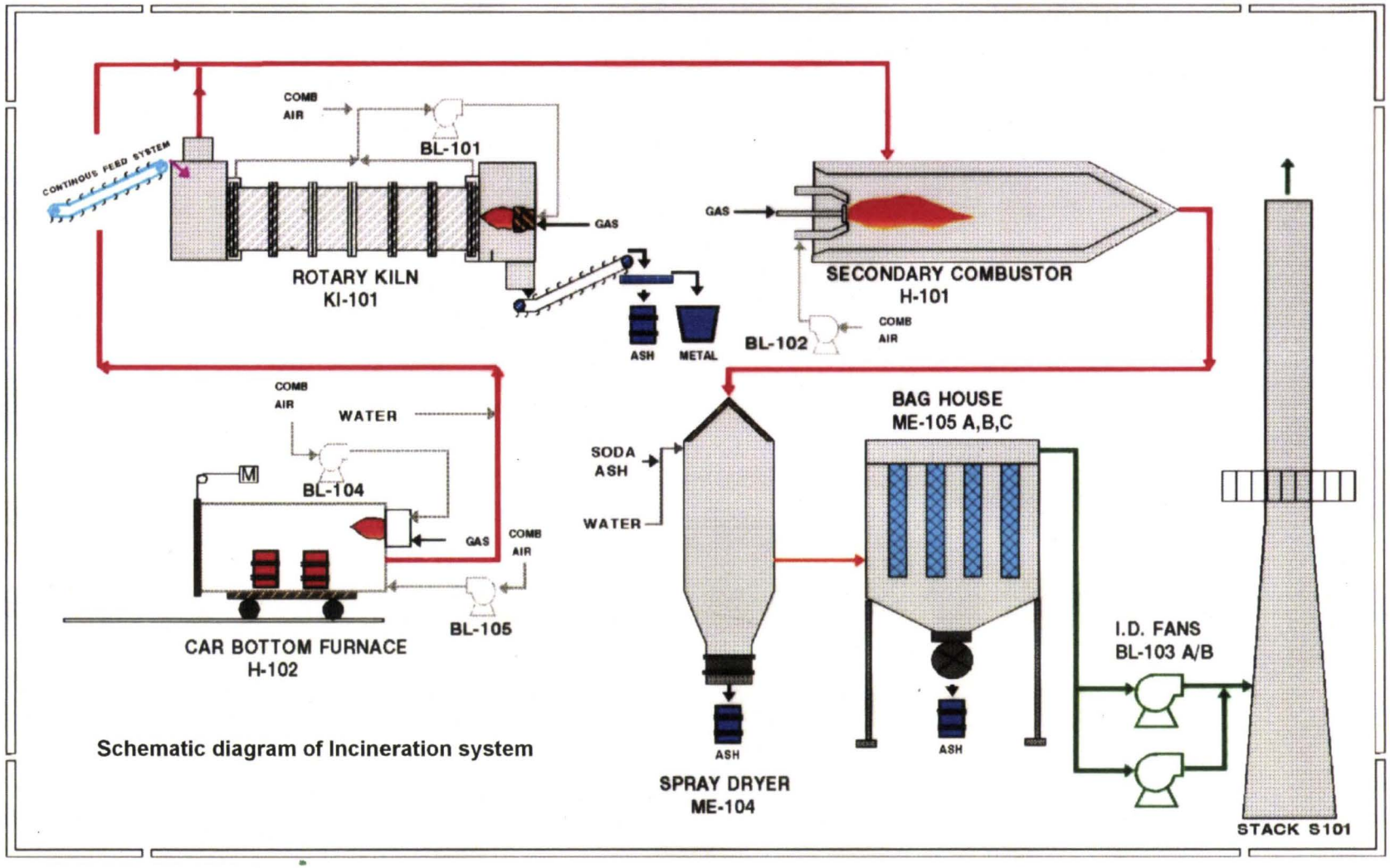
The GD-OTS MS incineration System has an Automatic Waste Feed Cut-Off (AWFCO) System that will shut waste feeds off to the kiln by stopping the feed conveyor in the event certain operating parameters deviate from allowable set points. The DCS continuously monitors operating parameters, making adjustments to the process as needed for proper control. Alarm logic is incorporated into the DCS system to automatically initiate an AWFCO. **Table 2-2** summarizes current AWFCO set points (AWFCO set points was revised for the higher rates during the CFPT). When an AWFCO is initiated during the operation of the Car Bottom Furnace, The burned is shut down and any infiltration air is minimized to limit the burning. Once the AWFCO situation has been resolved and the system is at steady state the CBF burner is re-lit and the burn is continued. AWFCO limits have been established based on regulatory or permit limits that are summarized below.

- Regulatory/permit limits – established to comply with existing permits. An example of this type of limit is the minimum temperature AWFCO, below which waste cannot be fed until the proper minimum temperature is re-established with auxiliary fuel. In addition, the HWC MACT regulations require that the AWFCO system be interlocked with the span of each process instrument that is part of the Continuous Monitoring System (CMS). A listing of these CMS instruments and their interlocked span set points is maintained as part of GD-OTS MS's Operating Record.
- In addition to the AWFCO system, operators can manually shutdown waste feeds or the entire process should this be needed. The DCS has also been programmed to stop the waste feed based on other factors summarized below.
- Process safety limits – established to assure process equipment is protected and unsafe operating conditions do not occur. An example of this is inadequate excess air in the combustion chamber that can lead to fuel rich conditions and the possibility of an explosion.
- Utility or Power failure – established to facilitate a controlled shutdown of the process during loss of process air, steam, water or electricity. An example of this is the loss of instrument air that is necessary for certain types process instruments to function properly. Wastes will not be re-introduced into the incinerators until proper operation of key instruments is re-established.

Table 2-2 Automatic Waste Feed Cutoff (AWFCO) Summary

Operating Parameter	MACT Setpoint	Monitoring Device Location	Basis for AWFCO
Max Haz Waste Feed	3,055 lbs/hr HRA	ME-108 A/B Feed Room	Average of Average Feed rate from CPT
Rotary Kiln Pressure	-0.0" wc Instantaneous	PA – 105 Kiln Feed Housing	Title V Permit
Low Secondary Combustor Temp	1819°F HRA	TT – 268 Secondary Combustor	Average of the Minimum HRA from the CPT
Minimum Soda Ash Solution Rate	0.3 gpm or calculation rate	FT – 313 Soda Ash Pump	Minimum flow or Calculation from feed rate spreadsheet
High Spray Dryer Exit Temp	375°F HRA	TT – 308 Spray Dryer Exit	Average of the Maximum HRA from the CPT
Baghouse Differential Pressure	<5.8 " wc HRA >12.0 " wc HRA	DP – 359 Duct Before & After Baghouse	Historical Experience and Previous RCRA Permit
Baghouse Bypass Damper	Open	ZS – 358 Bypass Damper	Title V Permit
Broken Bag Detector	100	XS–355, 362, 372 Outlet of each chamber	Title V Permit
High Gas Flow Rate	641,334 scfh (HRA)	FT – 412 Stack	Average of the Maximum HRA from the CPT
CO	100 ppmv (HRA)	AT – 407 Stack	Title V Permit
O2	3% (HRA)	AT – 409 Stack	Title V Permit
Total Chlorine Feed	110.1 lb/hr 12HRA	CMS	Average of the Avg HRA from the CPT
Total Ash Feed	663.4 lb/hr 12HRA	CMS	Average of the Avg HRA from the CPT as calculated from feed rate spreadsheet
Total Lead Feed	92.0 lb/hr 12HRA	CMS	Based on the extrapolation formula in the CPT Plan and SRE from CPT
Total Cadmium Feed	9.2 lb/hr 12HRA	CMS	Based on the extrapolation formula in the CPT Plan and SRE from CPT
Total Chromium Feed	44.8 lb/hr 12HRA	CMS	Based on the extrapolation formula in the CPT Plan and SRE from CPT
Total Beryllium Feed	20.16 lb/hr 12HRA	CMS	Based on the extrapolation formula in the CPT Plan and SRE from CPT
Total Mercury Feed	0.676 gr/hr 12HRA	CMS	MTEC Calculation at avg stack gas flow
SVM Emissions	0.1725 mg/dscm 12HRA	CMS	Based on the extrapolation formula in the CPT Plan and SRE from CPT
LVM Emissions	0.069 mg/dscm 12HRA	CMS	Based on the extrapolation formula in the CPT Plan and SRE from CPT
Mercury Emissions	0.130 mg/dscm 12HRA	CMS	MTEC Calculation

Figure 2-1 Process Flow Diagram



Schematic diagram of Incineration system

3. RESULTS AND DISCUSSION

This section summarizes the test program results. Appendix C presents copies of the field data and calculations. Copies of analytical reports are presented in Appendix D.

3.1 DIOXINS AND FURANS EMISSIONS

A summary of the dioxins and furans emissions is provided in **Table 3-1** below. Please note that Test Run No. 1 was voided due to a failed post-test leak check. The dioxins and furans emissions for the GD-OTS MS incinerator (emissions for Test Runs 2, 3, and 4 averaged 0.107 ng/dscm @ 7 % O_2) were well within the HWC MACT emission standard of 0.40 ng/dscm @ 7% O_2.

Table 3-1 Summary of Dioxins and Furans Emissions

Run Identification	Run 2	Run 3	Run 4	Average	Percent of Standard[a]
Run Date	20Nov13	20Nov13	21Nov13		
Start/Stop Time	1449-1754	1818-2122	0918-1224		
Run Duration (min.)	180	180	180		
Exhaust Gas Conditions					
Temperature (deg. F)	222	223	215	**220**	
Moisture (volume %)	23.9	24.0	24.0	**24.0**	
Oxygen (dry volume %)	15.50	15.60	15.60	**15.57**	
Carbon Dioxide (dry volume %)	3.8	3.6	3.5	**3.6**	
Sample and Exhaust Gas Flow Rate Data					
Sample Volume (dscf)	96.3	95.8	96.4	**96.2**	
Volumetric Flow Rate (acfm)	11,288	11,222	11,112	**11,208**	
Volumetric Flow Rate (dscfm)	6,412	6,356	6,403	**6,390**	
Dioxin/Furan Results					
PCDD/DF TEQ (ng/dscm @ 7% O_2)	0.096	0.099	0.126	**0.107**	**26.7**

[a] PCDD/DF emission limit is 0.4 ng/dscm @ 7% O_2

4. TEST PROGRAM

4.1 SUMMARY OF THE TEST PROGRAM

Triplicate test runs were performed to demonstrate compliance with the dioxin/furan emission standard while the incinerator operated under normal operating conditions. These operating conditions were within the range of the average level to the maximum or minimum level that is allowed for the following operating parameters. Process operating data collected by facility personnel is presented in **Appendix A**.

As required by 40 CFR 63.1208(b)(1)(ii), the RM 23 sampling train was operated for a minimum of 180 minutes (3 hours) to sample a minimum of 2.5 dry standard cubic meters of stack gas during each sampling run.

4.1.1 Summary of Operating Conditions

Carbon Monoxide CEMS: Carbon monoxide (CO) CEMS emissions were targeted at levels between the average value to the maximum value allowed, although levels lower than average could be seen due to the wastes being fed to the CBF generating minimal CO. During the last CPT the average CO value was 2 ppm. The average value was determined over the previous 12 months as defined in 40 CFR § 63.1207 f(i). The maximum value allowed is the emission standard cited in 40 CFR § 63.1219(a)(5)(i). CO average, maximum, and actual test run average values are displayed in **Table 4-1**.

Maximum and average spray dryer temperature: The gas temperature at the inlet to the dry particulate matter control device or baghouse is measured at the exit of the spray dryer, a K type thermocouple protruded through the duct into the gas stream. The temperature was targeted in a range between the average value to the maximum value allowed. The average value of the spray dryer exit temperature was determined by following the procedures stated in 40 CFR §63.1207 (g)(2)(ii). The maximum temperature was established during the CPT performed in June 2011. **Table 4-1** displays the minimum, average, and actual test run average spray dryer exit temperatures for this CFPT.

Minimum and average combustion chamber temperature: Combustion temperature in the secondary combustor is measured in the middle of the chamber, a R type thermocouple protruded through the refractory wall into the main chamber. The combustion temperature was targeted in a range between the average value to the minimum value allowed. The average value of the combustion chamber temperature was determined by following the procedures stated in 40 CFR §63.1207 (g)(2)(ii). The minimum combustion chamber temperature was established during the CPT performed in June 2011. **Table 4-1** displays the minimum, average, and actual test run average chamber temperatures for this CFPT.

Average and maximum flue gas flowrate: Flue gas flow rate is used as an indicator for residence time in the combustion chamber. The flue gas flow rate was targeted in a range between the average value to the maximum value allowed. The average value of the flue gas flow rate was determined by following the procedures stated in 40 CFR §63.1207 (g)(2)(ii). The maximum flue gas flow rate was established by the CPT performed in June 2011. The average, maximum, and actual test run average flue gas flow rates for this CFPT are displayed in **Table 4-1**.

Average and maximum hazardous waste feed rate: The hazardous waste feed rate to the RKI and CBF was targeted in a range between the average values to the maximum values allowed. The average hazardous waste feed rate for the RKI and for the CBF was determined following the procedures stated in 40 CFR §63.1207 (g)(2)(ii). Maximum hazardous waste feed rates were established by the CPT performed in June 2011. **Table 4-1** displays the average, maximum, and actual test run average hazardous waste feed rates.

Chlorine feed rate: The actual chlorine levels fed to the incinerator was dependent on the waste feeds available at the time of testing as the chlorine content of the incinerator's normal waste feeds are highly variable depending on the products being made at the time. **Table 4-1** displays the average, maximum, and actual test run average chlorine feed rates.

4.1.2 Description of CFPT Feeds

A summary of the feed rates observed during the test program is presented in **Appendix A**.

4.1.2.1 Car Bottom Furnace Feeds

To demonstrate compliance with the dioxin/furan emission standard, GD-OTS MS fed combustible materials, such as paper and wood, that simulates plant trash from explosive manufacturing operations at a target quantity of 250 lbs/hr to the Car Bottom Furnace.

4.1.2.2 Kiln Maximum Throughput Condition Feeds

To demonstrate compliance with the dioxin/furan emission standard, GD-OTS MS fed the following material at the listed target rates:

- CBU Bomblet Halves – 1.650 lbs/hr
- Chlorine in the form of AP Propellant, - 5 lbs/hr Chlorine = 24 lbs / hr Propellant

Table 4-1 Summary of Operating Conditions

Parameter/Units	Min Value*	Average Value	Max Value*	Actual Test Run Averages		
				Run 2	Run 3	Run 4
Total RKI Hazardous Waste Feed Rate (lb/hr)	-	1,578	3,055	1,653	1,660	1,640
Total Chlorine Feed Rate (lb/hr)	-	3	110	6.7	6.7	6.7
Total CBF Hazardous Waste Feed Rate (lb/hr)	-	224	300	247.2	246.5	247.4
Secondary Combustor Outlet Temperature (deg F)	1,819	1,889	-	1,870	1,870	1,870
Spray Dryer Outlet Temperature (deg F)	375	353	-	360	360	360
Stack Flow (scfh)	-	627,263	641,334	637,994	637,929	637,994
CO (ppm)		6.6	100	0.3	0.2	0.1

*Minimum and Maximum values were established from the comprehensive performance test performed in June 2011.

5. SAMPLING AND ANALYTICAL PROCEDURES

This section describes the sampling and analytical procedures that were utilized as part of the testing program.

5.1 SAMPLING PROCEDURES

The sampling activities described below were conducted during all test runs. All field activities were documented in accordance with EPA accepted procedures and copies of all field data sheets are included in **Appendix C**.

Gases discharged from the exhaust stack were sampled by O'Brien & Gere for the following parameters:

- Flue gas velocity, flow rate, temperature, moisture content and fixed gas (O_2 and CO_2) composition;
- Dioxins and Furans (PCDDs/PCDFs)

5.1.1 Dioxins and Furans (PCDDs/PCDFs)

An EPA RM 23 sampling train was used to sample for emissions of polychlorinated dibenzo dioxin and furans (PCDD/PCDFs). The stack gas was sampled by isokinetically passing the gas through a pre-extracted filter, into a cooling condenser and through the XAD-2 resin trap. After exiting the XAD-2 resin trap the exhaust gas was bubbled through a four impinger train with the first two impingers containing 100 milliliters (mls) of deionized water, the third was empty and the fourth contained a known amount of indicating type silica gel.

5.1.2 Gas Stream Velocity, Moisture and Fixed Gases

Gas stream flowrate, moisture and fixed gas concentration were determined concurrent with the Method 23 sampling train. Gas stream velocity was determined using a pitot tube and water manometer in accordance with EPA Method 2. Gas stream temperature was determined at each of the Method 2 traverse points using a Type "K" thermocouple and pyrometer. Gas stream moisture was determined as specified in EPA Method 4 concurrent with the isokinetic sampling train. In this procedure the impinger contents are measured or weighed before and after each test run and used in conjunction with the metered gas volume to determine the gas stream moisture content. CO_2 concentration for gas stream molecular weight determination was determined in accordance with EPA Method 3 (Fyrite procedure) during each test run. O_2 concentration for constituent oxygen correction and gas stream molecular weight determination was measured by the facility CEMS.

5.1.3 Test Port and Traverse Point Locations

Sample ports in the circular 30-inch inside diameter (ID) stack are located approximately 20-feet (8.0 diameters) downstream of the breaching and approximately 175-feet (70.0 diameters) upstream of the stacks exit to atmosphere. A schematic of the test port locations is presented in **Appendix B**.

5.2 ANALYTICAL PROCEDURES

This section describes the analytical protocols that were used to analyze samples during this CFPT. Samples of stack gas were collected and analyzed for the parameters previously discussed using the appropriate laboratory protocols detailed in this section.

5.2.1 Analysis for PCDDs/PCDFs

Stack flue gas samples collected using the Method 23 sampling train was analyzed for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs). Each Method 23 train was prepared and split appropriately for analyses for PCDDs/PCDFs: combined front-half and back-half analyses was performed in accordance with Method 23.

Briefly, the XAD and filter was spiked with internal standards and then sequentially extracted with toluene. Method 23 analyses (which include high resolution GC/MS as per EPA Method 8290) incorporate five isotopically labeled PCDD and PCDF field surrogates and nine labeled PCDD/PCDF internal standards. The field surrogates are spiked into the XAD resin prior to field sampling; their recoveries are monitored to assess overall method accuracy and precision. The internal standards are added at a level of 2,000 pg/sample prior to Soxhlet extraction. These internal standards are used for direct quantification of all surrogate and native PCDD/PCDF

species. The addition of these standards prior to the extraction and cleanup procedures permits internal correction for any losses of target analytes that might occur during the preparation steps.

Method 8290 details instrument tune, GC column performance and instrument calibration requirements for the analysis of stack gas samples by high resolution gas chromatography/high resolution mass spectrometry. Instrument calibration was performed for all 17 2,3,7,8- substituted PCDD and PCDF isomers; data was reported for each of these target analytes and for the total dioxins and total furans at each level of chlorination from Cl_4 through Cl_8.

6. QUALITY ASSURANCE/QUALITY CONTROL

This section presents the results of all QA/QC measures implemented during the field sampling program and all phases of subsequent analysis. Data generated for the program are judged to be valid as overall accuracy and precision results are consistent with general objectives. Analytical QA/QC data are presented to support all sample results used for determining compliance with performance criteria or emission standards.

6.1 SAMPLE COLLECTION QA/QC

One (1) field reagent blank of the M23 sampling train was submitted for analysis for this test program. Sampling QA/QC measures for this program included the calibration of all applicable sampling equipment used as described below. Field equipment were calibrated according to EPA procedures specified in EPA/600/R-94/038e (September 1994) and 40 CFR 60, Methods 1-5, as well as manufacturer's specifications.

- **Dry Gas Meters and Orifice Meters (EPA Method 5 Type)** - Dry gas meters for all sampling trains were calibrated using critical orifices. The procedure entails five runs using five separate critical orifices running at an actual vacuum 1-2 in. greater than the theoretical critical vacuum. The minimum sample volume required per orifice is 5 ft^3. Meter boxes are calibrated annually and after each test program. All annual and post-test calibration forms for the meter box is provided in **Appendix D**.
- **Sampling Nozzles** - Each glass nozzle was calibrated with a micrometer prior to testing and identified with a unique ID number. These data were then checked onsite prior to use. The internal diameter of each nozzle used is measured to 0.001 inches along three points of the circumference with a dial vernier caliper and the three measurements are then averaged. Nozzle calibration data are provided in **Appendix D**.
- **Balance** - The analytical balance used in the field to determine initial and final silica gel weights is calibrated against Class M weights provided by the Mettler Corporation.
- **Thermocouples** - The Type K thermocouples in each meter control box, heated sample box, impinger umbilical connector, XAD resin trap and sample probe are calibrated against ASTM mercury-in-glass thermometers at two or more points: an ice bath, ambient temperature and/or boiling water bath. Calibration data are provided in **Appendix D**.
- **Pitot Tubes** - Each S-type stainless steel pitot tube used is designed to meet geometric configurations as defined in EPA Method 2. Sample probe calibration data forms are provided in **Appendix D**.

6.2 SAMPLE TRAIN LEAK CHECKS

Pitot tube leak checks were conducted in accordance with EPA RM 2. Leak checks were conducted on the EPA Method 23 sampling train prior to and following each test run in accordance with the test method. Please note that the post test leak check for Test Run No. 1 failed to meet the applicable requirements and therefore was voided and a fourth test run was conducted.

6.3 SAMPLE ANALYSIS QA/QC

This section provides a detailed presentation of QA/QC results from sample analysis as reported by the analytical laboratory. Key QC data related to matrix spikes, surrogate spikes, duplicate analyses, laboratory control samples (blank spikes), method blanks and/or field blank results are presented in tabular format. Other routine QC procedures followed such as calibration checks and additional method-specific protocols are described in the case narratives and analytical data packages provided in **Appendix E**. Also, unless noted otherwise, all holding times and method-specific QC criteria were met and reported results met all applicable NELAC requirements.

6.3.1 PCDDs/PCDFs

Evaluation of the validity of the PCDD/PCDF data resultant from the analysis of the Method 23 sampling train samples was based on the following criteria:

- Recoveries of internal, pre-spike recovery standards added to the samples prior to sampling or sample extraction.

- Results of duplicate analyses.
- Results of analyses of reagent and method blank samples.

On the basis of the QC results summarized in **Table 6-1**, no sample analyses were rejected, and all data were determined to be valid.

Table 6-1 QA/QC Summary for EPA Method 23 Samples

QC Parameter	Target Criteria	Program Results
Reagent Blank	Below detection limit	Below reportable detection limit for all 17 congeners
Method Blank	Below detection limit	Below reportable detection limit
Surrogate Recoveries	40 – 130% recovery	All congeners within limits
Duplicate Analyses	0-20% RPD	All samples within limits
Spiked Blank Recoveries	Various limts	All congeners within limits

7. CONTINUOUS MONITORING SYSTEM PERFORMANCE EVALUATION TEST

7.1 INTRODUCTION

As part of complying with the requirements of the HWC MACT regulations, facilities must perform an evaluation of their "Continuous Monitoring System" (CMS) as part of the MACT Confirmatory Performance Test (CFPT). EPA defines the CMS in 40 CFR 63.2:

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

Based on the above definition, the main components of the CMS for the GD-OTS MS incinerator includes the following:

- Process instruments that monitor or control key process parameters, including the Unit's Continuous Emissions Monitoring system;
- The DCS and Data Acquisition System (or DAS);
- The AWFCO system; and
- The programmable logic that utilizes regulatory set-points to assure compliance.

Section 5.0 of the CFPT test plan submitted in August 2013 described a combination of activities to accomplish its objective, which is to verify that the incinerator is properly controlled and that the equipment and systems that are used are operating properly and are accurate. Prior to commencing the CFPT, GD-OTS MS personnel performed a complete evaluation of the CMS in accordance with the CFPT Plan. This evaluation included instrument audits or calibrations and auditing the function of the AWFCO system and the programmable logic used in the DCS. This report describes activities that took place and the results of the performance evaluation.

7.2 QUALITY ASSURANCE

The quality assurance (QA) requirements for this Performance Evaluation are summarized in **Table 7-1**. The QA requirements for CMS equipment components are established by other criteria outside this Performance Evaluation.

Table 7-1 QA Requirements for the CMS Performance Evaluation

CMS Component	Basis for QA Requirement	QA Specification
Field Instruments	Manufacturer recommendations	Audit/calibration meets recommended specifications for all affected instruments
AWFCO System Evaluation	MACT requirement	No failures of the AWFCO system

7.3 CONTINUOUS MONITORING SYSTEM DESCRIPTION

This section provides an overview of the key components of the CMS and the results of the performance evaluation. This CMS evaluation includes field instrumentation; the DCS/DAS, the programmable logic and field control (e.g., control and block valves).

7.3.1 Field Instrumentation

Table 2-2 in Section 2.0 of GD-OTS MS's CFPT Plan provides information pertaining to field instruments that are part of the overall CMS. These instruments monitor and control certain process operations to assure the unit is operating safely and in compliance with applicable environmental requirements. The instruments used for these aspects of process control meet the definition of "Continuous Monitor" in 40 CFR 63.1201.

As part of initial instrument specification prior to installation and use in the process, instrument audit and calibration procedures are identified or developed. These procedures specify the frequency of auditing the instrument's function and accuracy and the actual procedure for verification. These procedures specify both the specific steps and the acceptable accuracy requirements that the instrument must meet to "pass". Troubleshooting procedures are typically included to help plant personnel correct any problems and get the instruments operational.

7.3.2 Continuous Emissions Monitoring System

In addition to other field instrumentation, the operation of the incinerator also relies on its Continuous Emission Monitoring System (CEMS) to monitor stack emissions concentrations. This system is described in Section 2.5 of the CFPT Plan. When emission levels deviate from allowable limits, the DCS takes appropriate action up to and including initiating an AWFCO.

7.3.3 Process Control

The process control systems for this incinerator are described in Section 2.7 of the CFPT Plan. It detects signals from process instruments, performs calculations according to the programmable logic, adjusts control equipment and notifies operators when key process parameters deviate outside acceptable limits. In addition to notifying operating personnel the AWFCO system described in Section 2.8 of the CFPT Plan will automatically shut down the waste feeds and the overall process itself in the event of deviations outside acceptable operating limits.

7.3.4 CMS Operation

All the components of the CMS must be operational for the incinerator to burn waste. The DCS and overall process control system are designed in such a manner as to continually verify that operation while the unit is running. Field instrumentation (both sensing and control) are connected to the DCS in "control loops" with common wiring, electrical signal transmitters, input/output devices and related programmable logic. All components of each control loop related to the feeding of a certain type of waste (i.e., liquid organic, liquid aqueous or process vents) must be operating for the incinerator to be enabled to burn that waste. The programmable logic is designed in such a way that it can sense and verify that various components of the process and the process itself are operating as required. For example, if power is lost to a flow meter on a waste feed line, the programmable logic will sense this signal loss and initiate either an alarm or shutdown. Similarly, if the actual field position of a specific control valve disagrees beyond a certain amount with what the programmable logic calculates it should be, again, appropriate alarms and/or shutdowns are initiated.

7.4 CMS PERFORMANCE EVALUATION TEST

As described above, the CMS performance evaluation test relied on a combination of activities to determine whether the CMS is operating properly. This includes the following:

- Auditing the instrument maintenance and calibration program;
- Calibrating field instruments;
- Auditing the AWFCO Testing Program; and
- Auditing portions of the programmable logic to verify that the AWFCO set-points used assure regulatory limits will be met.

Personnel who are knowledgeable of GD-OTS MS incinerator operations, their process control systems and relevant regulatory requirements, perform these activities.

7.4.1 Instrument Audit and Calibration

Calibration of Field Instrumentation was conducted prior to commencing the MACT CFPT. Instrument information and calibration dates can be found in **Table 7-2** which follows this section.

Because certain instruments could not be audited or calibrated without taking the incinerator offline, these were scheduled over a period of time prior to the test program to minimize process interruptions and shutdowns.

7.4.2 AWFCO System Performance Evaluation

Another component of the CMS Performance Evaluation was auditing the AWFCO system and related DCS logic. This was accomplished by reviewing the last year of AWFCO testing logs to assess whether there were any recurring problems with the AWFCO system. Any incidences of problems with the AWFCO system were identified for follow-up and correction prior to testing.

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

The AWFCO system is tested to ensure operability on a weekly basis. Prior to performing the CFPT, the AWFCO system was tested and successfully demonstrated proper operation.

7.4.3 Auditing the CEMS

The CEMS used at the GD-OTS MS incinerator are installed, operated and maintained to comply with the provisions of the applicable performance specifications and/or EPA Reference Methods. In general, this means the CEMS are calibrated daily (zero/span), quarterly (gas audits) and annually (Relative Accuracy Test Audits). Thus, the evaluation of the performance of this system was performed as part of meeting those requirements and a separate evaluation was not conducted under this evaluation.

These results show that the CEMS met the requirements of the applicable performance specifications and/or EPA Reference Methods.

Table 7-2 Field Instrumentation and Calibration Dates

Equipment #	Equipment Description	Task Description	Next Date Due	Last Date Performed
PDI-102	PRESSURE TRANSMITTER	WEEKLY KILN CALIBRATION.	11/18/2013	11/14/2013
PDI-113	PRESSURE TRANSMITTER	WEEKLY KILN CALIBRATION.	11/18/2013	11/14/2013
PDI-120	PRESSURE TRANSMITTER	WEEKLY KILN CALIBRATION.	11/18/2013	11/14/2013
PI-307	PRESSURE TRANSMITTER	WEEKLY KILN CALIBRATION.	11/18/2013	11/14/2013
TT-104 A	TEMP.TRANS. FOR KILN EXIT GAS	ANNUAL CALIBRATION OF TT-104 A & B	2/5/2014	3/5/2013
TT-104 B	TEMP.TRANS. FOR KILN EXIT GAS	ANNUAL CALIBRATION OF TT-104 A & B	2/5/2014	3/7/2013
TT-268A	TEMP.TRANSMITTER	ANNUAL CALIBRATION TT-268A TT-268B TT-268C	2/5/2014	3/5/2013
TT-268B	TEMP.TRANSMITTER	ANNUAL CALIBRATION TT-268A TT-268B TT-268C	2/5/2014	3/5/2013
TT-268C	TEMP.TRANSMITTER	ANNUAL CALIBRATION TT-268A TT-268B TT-268C	2/5/2014	3/5/2013
TT-308A	TEMP. TRANS. TT-308A	ANNUAL CALIBRATION OF TT-308 A B C	2/5/2014	3/5/2013
TT-308B	TEMP. TRANS. TT-308B	ANNUAL CALIBRATION OF TT-308 A B C	2/5/2014	3/7/2013
TT-308C	TEMP. TRANS. TT-308C	ANNUAL CALIBRATION OF TT-308 A B C	2/5/2014	3/7/2013
TT-204	C.B.F. EXIT GAS TEMPERATURE TRANSMITTER	ANNUAL CALIBRATION OF TT-204	2/5/2014	3/5/2013
XSH-355	DUST ALARM BROKEN BAG DETECTOR	DUST ALARM BROKEN BAG DETECTOR CALIBRATION	2/19/2014	3/19/2013
XSH-362	DUST ALARM BROKEN BAG DETECTOR	DUST ALARM BROKEN BAG DETECTOR CALIBRATION	2/19/2014	3/19/2013
XSH-372	DUST ALARM BROKEN BAG DETECTOR	DUST ALARM BROKEN BAG DETECTOR CALIBRATION	2/19/2014	3/19/2013
FT-313	MAGNETIC FLOW TRANSMITTER & FLOW TUBE	ANNUAL CALIBRATION OF FIT-313 AND FIT-315	3/3/2014	4/1/2013
FT-315	WATER FLOW TRANSMITTER & FLOW TUBE	ANNUAL CALIBRATION OF FIT-313 AND FIT-315	3/3/2014	4/1/2013
BLDG-06F	ANALYZER HOUSE	ANALYZER HOUSE CALIBRATION	6/9/2014	10/8/2013
ME-108A	FEED WEIGH SCALES (WI-22)	ANNUAL CALIBRATION OF SCALES	7/21/2014	8/20/2013

Equipment #	Equipment Description	Task Description	Next Date Due	Last Date Performed
ME-108B	FEED WEIGH SCALE (WI-4)	ANNUAL CALIBRATION OF SCALES	7/21/2014	8/20/2013
opacity	opacity lens out for cal	Opacity lens calibration	8/18/2014	9/17/2013
FT-412	FLOW TRANSMITTER(ROSEMOUNT)	ANNUAL CALIBRATION OF FIT-412 C.E.M.'S BLDG.	10/15/2014	11/15/2013
PDT-359	PRESSURE DIFF. TRANS.	ANNUAL CALIBRATION OF PDT-359	10/15/2014	11/15/2013
PT-105	PRESSURE TRANS.(FOXBORO)	ANNUAL CALIBRATION OF PT-105	10/15/2014	11/15/2013
PT-302	PRESSURE TRANS. (FOXBORO)	ANNUAL CALIBRATION CHECK PT-302	10/15/2014	11/15/2013

Plant Operating Data

Summary of Operating Data for the CPT Runs

		AIT-407 CO CEMS	AIT-409 O2 CEMS	AIT-411 Stack Opacity CEMS	FT-313 Soda Ash Flow gpm	FT-412 Stack Flow SCFH OMA	FT-412 Stack Flow SCFH HRA	PDI-359 Bag house DP in H2O	PI-105 Kiln Pres in H2O	ST-112 Kiln Speed RPM	TI-104 Kiln Flue Temp	TI-204 CBF Exit Gas Temp	TI-268 SCC Outlet Temp	TI-308 SD Exit Temp	Kiln Feed Rate lbs/hr HRT	Chlorine Feed Rate to Kiln	Weight/Hr for CBF Batch
	Target	3.0					634,000						1,845	364	1,650	5	250
Run 1	Average	(0.3)	15.5	2.0	0.7	638,676	637,994	7.7	(14.5)	3.1	758	845	1,870	360	1,653	6.7	247.2
	Minimum	(0.4)	14.2	1.9	0.7	621,661	637,529	7.1	(14.5)	3.1	663	391	1,861	356	1,622		
	Maximum	(0.1)	16.4	2.4	0.8	653,023	638,407	8.3	(14.4)	3.1	846	1,126	1,883	364	1,679		
Run 2	Average	(0.2)	15.6	1.7	0.7	638,435	637,929	7.7	(14.5)	3.1	808	789	1,870	360	1,660	6.7	246.5
	Minimum	(0.4)	14.3	1.5	0.6	625,515	637,209	7.0	(14.5)	3.0	721	376	1,863	356	1,630		
	Maximum	6.3	16.3	1.9	0.8	655,771	638,728	8.4	(14.4)	3.2	886	1,112	1,884	363	1,684		
Run 3	Average	(0.1)	15.6	0.2	0.8	638,073	637,994	7.7	(14.5)	3.1	708	773	1,870	360	1,640	6.7	247.4
	Minimum	(0.3)	14.2	0.0	0.7	619,324	637,262	7.1	(14.7)	2.7	505	362	1,858	353	1,423		
	Maximum	3.8	16.4	0.4	0.8	651,204	638,601	8.3	(14.5)	3.3	823	1,095	1,885	366	1,704		
Average of Averages		(0.2)	15.5	1.3	0.7	638,395	637,972	7.7	(14.5)	3.1	758	802	1,870	360	1,651	6.7	247.1

DateTime	STACK CARBON MONOXIDE DETECTOR AIT_407_A.\	O2 ANALYZER B AIT_409_B_	Stack Opacity Detector AIT_411.V	Spray Dryer Soda Ash Flow Cntrl FT_313.Valu	Stack Flow (1 Min Running Avg) FT_412.V:	STACK GAS ONE HR AV STACK_GA:	Pressure Drop Across Bag House PDI_359.V:	KI-101 Feed Assembly Pressure PI_105.Val	Kiln Speed Controller ST_112.Va	KILN FLUE GAS TEMP HI SELECT TI_104HSI	CBF Exit Gas Temp TI_204.V:	SCC OUTLET TEMP (MEDIAN) TI_268MEI	SPRAY DRYER FLUE GAS TEMP TI_308MEI	KILN FEED HOUR RATE TOTAL KILN_FEEI	B Scale HRT lbs MAX_WT_B.Value	Chlorine Feed Rate to Kiln CBF_BATCH_TIME_SEC.Value	CBF Batch Time sec	Weight/Hr for CBF Batch
Target	3.0					634,000						1,845	364	1,650		5		250
Average	(0.3)	15.5	2.0	0.7	638,676	637,994	7.7	(14.5)	3.1	758	845	1,870	360	1,653	Lbs Cl/hr	6.7		
Minimum	(0.4)	14.2	1.9	0.7	621,661	637,529	7.1	(14.5)	3.1	663	391	1,861	356	1,622	Minutes Fed	185	Batch	
Maximum	(0.1)	16.4	2.4	0.8	653,023	638,407	8.3	(14.4)	3.1	846	1,126	1,883	364	1,679	Cl%	21.14%	Lbs/hr	247.2
															Lbs fed	98.2		
11/20/13 14:49	(0.3)	15.3	2.0	0.75	636,308	638,299	7.4	(14.4)	3.1	744	1,066	1,868	361	1,679	26		3,327	
11/20/13 14:50	(0.3)	15.3	2.1	0.76	632,597	638,265	7.5	(14.5)	3.1	811	1,072	1,867	360	1,658	27		3,387	
11/20/13 14:51	(0.3)	15.2	2.0	0.77	644,246	638,221	7.5	(14.4)	3.1	741	1,060	1,868	359	1,659	27		3,446	
11/20/13 14:52	(0.2)	15.5	2.0	0.77	642,141	638,189	7.7	(14.5)	3.1	773	1,040	1,866	358	1,663	28		3,506	
11/20/13 14:53	(0.1)	15.8	2.0	0.76	633,471	638,123	7.7	(14.5)	3.1	779	1,021	1,867	359	1,667	28		3,565	
11/20/13 14:54	(0.1)	15.7	2.0	0.75	631,223	638,169	7.7	(14.5)	3.1	732	999	1,867	360	1,669	29		3,625	
11/20/13 14:55	(0.3)	15.7	2.0	0.75	634,363	638,187	7.7	(14.5)	3.1	738	978	1,871	360	1,670	29		3,683	
11/20/13 14:56	(0.2)	16.1	2.0	0.75	639,340	638,164	7.6	(14.5)	3.1	780	959	1,871	360	1,671	30		3,743	
11/20/13 14:57	(0.2)	15.7	2.0	0.74	638,020	638,024	7.4	(14.5)	3.1	744	943	1,869	360	1,673	30		3,803	
11/20/13 14:58	(0.3)	15.8	2.1	0.74	643,354	637,950	7.9	(14.5)	3.1	730	932	1,870	360	1,673	31		3,864	
11/20/13 14:59	(0.3)	15.9	2.1	0.75	636,611	637,995	7.9	(14.5)	3.1	740	930	1,872	360	1,674	31		3,923	
11/20/13 15:00	(0.2)	15.3	2.0	0.75	642,694	637,991	7.8	(14.4)	3.1	729	949	1,872	359	1,655	32	6	3,983	
11/20/13 15:01	(0.3)	15.1	2.1	0.76	644,068	637,900	8.0	(14.5)	3.1	775	984	1,871	359	1,658	1		4,041	
11/20/13 15:02	(0.3)	15.1	2.1	0.75	631,990	637,937	7.7	(14.5)	3.1	753	1,022	1,870	360	1,659	1		4,101	
11/20/13 15:03	(0.4)	15.5	2.4	0.75	628,904	637,878	8.2	(14.5)	3.1	712	1,055	1,866	360	1,662	2		4,161	
11/20/13 15:04	(0.2)	14.7	2.1	0.75	644,068	637,911	8.0	(14.5)	3.1	717	1,077	1,873	361	1,645	2		4,219	
11/20/13 15:05	(0.2)	15.2	2.0	0.75	643,390	637,886	7.9	(14.5)	3.1	744	1,080	1,876	360	1,643	3		4,280	
11/20/13 15:06	(0.2)	15.7	2.1	0.75	638,341	637,988	7.5	(14.5)	3.1	737	1,064	1,873	360	1,644	3		4,340	
11/20/13 15:07	(0.2)	16.0	2.1	0.75	635,719	637,981	7.6	(14.4)	3.1	747	1,043	1,867	359	1,662	4		4,399	
11/20/13 15:08	(0.3)	15.4	2.1	0.76	642,106	638,005	7.8	(14.5)	3.1	776	1,016	1,867	359	1,641	4		4,458	
11/20/13 15:09	(0.3)	16.0	2.1	0.76	639,037	638,048	7.4	(14.5)	3.1	753	990	1,866	359	1,663	5		4,518	
11/20/13 15:10	(0.2)	15.6	2.0	0.75	641,856	637,985	7.4	(14.5)	3.1	733	965	1,867	360	1,660	5		4,578	
11/20/13 15:11	(0.2)	15.9	2.0	0.75	639,626	637,961	7.6	(14.5)	3.1	771	944	1,867	360	1,659	6		4,637	
11/20/13 15:12	(0.3)	16.1	2.0	0.74	630,510	637,978	7.4	(14.5)	3.1	759	928	1,865	360	1,657	6		4,697	
11/20/13 15:13	(0.3)	15.4	2.1	0.75	638,734	638,058	7.6	(14.5)	3.1	747	923	1,867	360	1,651	7		4,755	
11/20/13 15:14	(0.3)	16.0	2.0	0.75	633,257	637,967	7.7	(14.5)	3.1	702	937	1,866	360	1,651	7		4,816	
11/20/13 15:15	(0.2)	15.4	2.1	0.75	644,211	637,995	8.0	(14.5)	3.1	674	972	1,870	360	1,670	8		4,875	
11/20/13 15:16	(0.3)	14.7	2.0	0.75	637,110	637,993	7.7	(14.5)	3.1	665	1,012	1,883	360	1,647	8		4,935	
11/20/13 15:17	(0.3)	15.5	2.0	0.76	627,762	637,887	7.9	(14.5)	3.1	739	1,047	1,879	360	1,643	9		4,994	
11/20/13 15:18	(0.3)	15.2	2.0	0.76	625,729	637,881	8.0	(14.5)	3.1	703	1,077	1,872	360	1,657	10		5,054	
11/20/13 15:19	(0.3)	15.1	2.0	0.75	643,747	637,865	7.8	(14.5)	3.1	756	1,088	1,872	361	1,657	10		5,114	
11/20/13 15:20	(0.3)	15.6	2.0	0.75	644,728	637,871	7.6	(14.4)	3.1	748	1,078	1,868	361	1,639	11		5,173	
11/20/13 15:21	(0.3)	15.6	2.0	0.74	634,488	637,912	7.9	(14.5)	3.1	728	1,059	1,866	360	1,658	11		5,233	
11/20/13 15:22	(0.3)	15.8	2.0	0.75	644,978	637,955	7.9	(14.5)	3.1	685	1,032	1,868	359	1,658	12		5,290	
11/20/13 15:23	(0.2)	15.9	2.1	0.76	641,713	637,894	7.7	(14.5)	3.1	759	1,006	1,870	358	1,676	12		5,352	
11/20/13 15:24	(0.3)	15.8	2.0	0.76	634,952	637,955	8.0	(14.5)	3.1	742	981	1,870	359	1,674	13		5,409	
11/20/13 15:25	(0.3)	15.8	2.1	0.75	646,494	637,898	7.9	(14.4)	3.1	709	959	1,870	359	1,667	13		5,472	
11/20/13 15:26	(0.3)	16.2	2.1	0.75	638,020	637,903	7.8	(14.5)	3.1	764	941	1,868	360	1,668	14		5,530	
11/20/13 15:27	(0.3)	15.6	2.0	0.74	644,371	637,857	7.7	(14.4)	3.1	749	928	1,870	360	1,652	14		5,591	
11/20/13 15:28	(0.2)	16.0	2.1	0.74	645,584	637,852	7.7	(14.5)	3.1	735	926	1,870	360	1,675	15		5,649	
11/20/13 15:29	(0.3)	15.5	2.0	0.75	639,340	637,836	7.8	(14.5)	3.1	731	945	1,873	360	1,655	15		5,710	
11/20/13 15:30	(0.3)	15.3	2.1	0.74	635,755	637,768	8.0	(14.5)	3.1	723	983	1,873	360	1,657	16		5,769	
11/20/13 15:31	(0.3)	15.3	2.0	0.75	639,876	637,728	8.1	(14.5)	3.1	753	1,022	1,871	360	1,677	16		5,829	
11/20/13 15:32	(0.3)	15.0	2.0	0.76	647,279	637,762	7.7	(14.5)	3.1	743	1,056	1,870	360	1,656	17		5,888	
11/20/13 15:33	(0.3)	15.1	2.0	0.76	634,060	637,843	7.7	(14.5)	3.1	740	1,081	1,870	360	1,651	18		5,948	
11/20/13 15:34	(0.3)	15.4	2.0	0.76	647,011	637,913	7.8	(14.5)	3.1	793	1,084	1,869	359	1,672	18		6,007	
11/20/13 15:35	(0.3)	15.2	2.0	0.76	644,121	638,035	7.5	(14.5)	3.1	767	1,069	1,869	360	1,667	19		6,067	
11/20/13 15:36	(0.3)	16.0	2.0	0.75	646,405	638,043	7.6	(14.5)	3.1	778	1,047	1,865	360	1,662	19		6,126	
11/20/13 15:37	(0.3)	15.3	2.0	0.75	627,531	637,938	7.2	(14.5)	3.1	780	1,022	1,868	360	1,661	20		6,186	
11/20/13 15:38	(0.3)	16.1	2.0	0.74	633,525	637,843	7.8	(14.5)	3.1	760	997	1,866	360	1,656	20		6,246	
11/20/13 15:39	(0.3)	15.7	2.0	0.74	638,877	637,854	7.5	(14.5)	3.1	732	975	1,867	360	1,677	21		6,305	
11/20/13 15:40	(0.3)	15.7	2.0	0.75	638,769	637,770	7.7	(14.5)	3.1	766	955	1,868	360	1,654	21		6,364	
11/20/13 15:41	(0.3)	15.8	2.0	0.75	643,729	637,763	7.9	(14.5)	3.1	819	940	1,868	360	1,675	22		6,424	
11/20/13 15:42	(0.3)	15.7	2.0	0.75	638,074	637,725	7.7	(14.5)	3.1	750	930	1,867	360	1,675	22		6,483	
11/20/13 15:43	(0.3)	15.8	1.9	0.76	641,713	637,716	8.1	(14.5)	3.1	749	933	1,869	360	1,649	23		6,543	
11/20/13 15:44	(0.3)	15.5	2.0	0.75	633,971	637,794	7.7	(14.5)	3.1	799	957	1,872	360	1,670	23		6,602	
11/20/13 15:45	(0.3)	15.2	1.9	0.74	638,341	637,787	7.8	(14.5)	3.1	720	994	1,872	361	1,669	24		6,663	
11/20/13 15:46	(0.3)	15.5	1.9	0.75	636,183	637,830	7.6	(14.5)	3.1	710	1,032	1,873	361	1,644	24		6,721	
11/20/13 15:47	(0.4)	14.8	2.0	0.75	644,443	637,881	7.6	(14.4)	3.1	698	1,047	1,881	361	1,645	25		6,781	
11/20/13 15:48	(0.3)	16.0	1.9	0.75	642,480	637,841	7.6	(14.4)	3.1	750	1,018	1,875	360	1,663	25		6,805	
11/20/13 15:49	(0.3)	16.3	1.9	0.75	641,106	637,845	7.7	(14.5)	3.1	727	959	1,866	360	1,644	26		6,805	
11/20/13 15:50	(0.3)	15.9	2.0	0.76	637,895	637,795	7.7	(14.4)	3.1	692	895	1,866	359	1,644	27		6,805	
11/20/13 15:51	(0.3)	16.0	2.0	0.75	635,433	637,866	7.6	(14.5)	3.1	742	837	1,867	359	1,641	27		6,805	
11/20/13 15:52	(0.2)	15.7	1.9	0.75	637,824	637,937	7.7	(14.5)	3.1	707	788	1,870	359	1,661	28		6,805	
11/20/13 15:53	(0.3)	16.1	1.9	0.75	635,933	637,969	7.9	(14.5)	3.1	714	746	1,870	360	1,636	28		6,805	
11/20/13 15:54	(0.3)	16.2	2.0	0.74	635,612	637,970	8.1	(14.5)	3.1	682	711	1,868	360	1,656	29		6,805	
11/20/13 15:55	(0.2)	16.0	2.0	0.74	635,612	638,049	7.9	(14.4)	3.1	684	682	1,869	360	1,653	29		6,805	
11/20/13 15:56	(0.2)	16.0	2.0	0.74	640,536	638,053	7.8	(14.5)	3.1	747	656	1,866	360	1,633	30		6,805	
11/20/13 15:57	(0.2)	16.1	1.9	0.76	635,130	638,163	7.9	(14.5)	3.1	714	634	1,864	360	1,653	30		6,805	
11/20/13 15:58	(0.2)	16.0	2.0	0.76	638,662	638,076	7.7	(14.5)	3.1	742	615	1,866	360	1,655	31		6,805	
11/20/13 15:59	(0.3)	16.0	1.9	0.76	634,791	638,098	7.8	(14.5)	3.1	731	598	1,865	360	1,637	31		6,805	
11/20/13 16:00	(0.3)	15.7	2.0	0.75	634,970	638,138	7.9	(14.4)	3.1	746	583	1,865	359	1,659	32	32	6,805	
11/20/13 16:01	(0.3)	16.0	2.0	0.76	634,577	638,162	7.7	(14.4)	3.1	738	569	1,864	359	1,656	1		6,805	
11/20/13 16:02	(0.2)	15.9	2.0	0.75	653,023	638,178	7.3	(14.5)	3.1	773	558	1,864	359	1,635	1		6,805	
11/20/13 16:03	(0.3)	16.0	1.9	0.74	635,523	638,355	7.3	(14.4)	3.1	747	546	1,864	360	1,651	2		6,805	
11/20/13 16:04	(0.2)	15.8	2.0	0.74	646,369	638,265	7.4	(14.5)	3.1	803	535	1,865	361	1,649	2		6,805	
11/20/13 16:05	(0.3)	15.9	2.0	0.73	636,950	638,202	7.2	(14.4)	3.1	740	525	1,864	362	1,669	3		6,805	
11/20/13 16:06	(0.2)	15.8	2.0	0.75	642,766	638,133	7.4	(14.5)	3.1	758	517	1,863	362	1,666	3		6,805	
11/20/13 16:07	(0.3)	16.0	1.9	0.75	637,414	638,118	7.4	(14.5)	3.1	779	508	1,863	361	1,665	4		6,805	
11/20/13 16:08	(0.3)	15.8	1.9	0.75	639,983	638,028	7.5	(14.5)	3.1	767	500	1,865	360	1,667	4		6,805	
11/20/13 16:09	(0.3)	15.6	1.9	0.75	651,561	638,002	7.1	(14.5)	3.1	755	493	1,867	360	1,648	5		6,805	
11/20/13 16:10	(0.3)	16.0	2.0	0.76	639,126	637,984	7.6	(14.5)	3.1	743	485	1,870	359	1,666	5		6,805	
11/20/13 16:11	(0.3)	15.9	1.9	0.76	634,809	637,938	7.2	(14.5)	3.1	706	478	1,872	359	1,661	6		6,805	
11/20/13 16:12	(0.3)	15.8	1.9	0.75	643,836	637,973	7.4	(14.4)	3.1	703	472	1,874	360	1,661	6		6,805	
11/20/13 16:13	(0.3)	16.4	2.0	0.75	647,440	637,937	7.6	(14.5)	3.1	685	466	1,869	360	1,663	7		6,805	
11/20/13 16:14	(0.2)	16.4	2.0	0.74	630,938	638,048	7.5	(14.5)	3.1	668	460	1,861	361	1,664	7		6,805	
11/20/13 16:15	(0.2)	15.9	1.9	0.75	638,841	638,038	7.4	(14.5)	3.1	744	454	1,861	360	1,643	8		6,805	
11/20/13 16:16	(0.3)	15.6	1.9	0.75	635,398	638,062	7.7	(14.4)	3.1	752	449	1,865	360	1,659	8		6,805	
11/20/13 16:17	(0.3)	15.5	1.9	0.75	642,302	638,115	7.8	(14.4)	3.1	759	443	1,868	359	1,661	9		6,805	
11/20/13 16:18	(0.3)	16.1	1.9	0.75	631,045	638,011	8.0	(14.5)	3.1	779	438	1,867	360	1,664	10		6,805	
11/20/13 16:19	(0.2)	15.7	1.9	0.74	636,932	638,039	7.8	(14.5)	3.1	764	432	1,868	360	1,661	10		6,805	
11/20/13 16:20	(0.2)	16.1	1.9	0.74	639,911	637,999	7.7	(14.5)	3.1	738	428	1,867	360	1,676	11		6,805	
11/20/13 16:21	(0.2)	16.2	1.9	0.74	642,623	638,050	7.8	(14.5)	3.1	693	423	1,866	360	1,658	11		6,805	

11/20/13 16:22	(0.3)	15.5	1.9	0.75	631,651	638,062	7.5	(14.5)	3.1	691	418	1,880	359	1,655	12		6,805	
11/20/13 16:23	(0.3)	16.3	1.9	0.75	651,561	638,279	7.5	(14.4)	3.1	683	414	1,880	359	1,656	12		6,805	
11/20/13 16:24	(0.2)	16.0	1.9	0.75	639,430	638,403	7.3	(14.4)	3.1	697	410	1,875	359	1,653	13		6,805	
11/20/13 16:25	(0.2)	15.9	1.9	0.75	642,088	638,407	7.6	(14.4)	3.1	663	406	1,874	358	1,659	13		6,805	
11/20/13 16:26	(0.3)	16.0	1.9	0.77	639,287	638,339	7.2	(14.5)	3.1	691	402	1,877	357	1,664	14		6,805	
11/20/13 16:27	(0.3)	15.8	1.9	0.76	636,486	638,344	7.6	(14.4)	3.1	674	399	1,874	356	1,663	14		6,805	
11/20/13 16:28	(0.3)	16.0	2.0	0.75	637,128	638,311	7.6	(14.5)	3.1	720	396	1,874	357	1,645	15		6,805	
11/20/13 16:29	(0.2)	15.6	1.9	0.75	638,002	638,291	7.7	(14.5)	3.1	674	397	1,873	357	1,642	15		6,805	
11/20/13 16:30	(0.2)	16.0	1.9	0.75	630,421	638,402	7.4	(14.5)	3.1	714	398	1,875	357	1,659	16		6,805	
11/20/13 16:31	(0.3)	15.7	1.9	0.75	648,706	638,323	7.6	(14.5)	3.1	701	399	1,873	357	1,637	16		6,805	
11/20/13 16:32	(0.2)	15.7	1.9	0.75	631,402	638,393	7.5	(14.5)	3.1	721	402	1,871	357	1,637	17		6,805	
11/20/13 16:33	(0.3)	16.1	1.9	0.75	635,826	638,386	7.2	(14.5)	3.1	713	404	1,867	357	1,656	18		6,805	
11/20/13 16:34	(0.2)	15.6	2.0	0.75	635,166	638,294	7.8	(14.5)	3.1	712	406	1,869	356	1,656	18		6,805	
11/20/13 16:35	(0.3)	15.7	1.9	0.75	636,201	638,253	7.6	(14.5)	3.1	766	408	1,872	356	1,632	19		6,805	
11/20/13 16:36	(0.3)	15.6	2.0	0.75	627,548	638,163	7.7	(14.5)	3.1	710	410	1,872	356	1,633	19		6,805	
11/20/13 16:37	(0.2)	16.0	1.9	0.74	649,402	638,076	7.7	(14.5)	3.1	738	411	1,871	357	1,637	20		-	77
11/20/13 16:38	(0.3)	16.0	1.9	0.75	644,532	638,085	7.7	(14.5)	3.1	781	410	1,869	357	1,639	20		44	
11/20/13 16:39	(0.3)	15.5	1.9	0.74	637,039	638,144	7.6	(14.4)	3.1	737	401	1,868	358	1,644	21		103	
11/20/13 16:40	(0.3)	16.2	1.9	0.74	636,647	638,149	7.8	(14.5)	3.1	803	391	1,865	359	1,626	21		162	
11/20/13 16:41	(0.2)	15.6	1.9	0.74	639,661	638,062	7.8	(14.4)	3.1	772	394	1,868	360	1,631	22		222	
11/20/13 16:42	(0.3)	14.9	1.9	0.74	640,179	638,081	7.9	(14.4)	3.1	744	426	1,878	360	1,636	22		282	
11/20/13 16:43	(0.3)	14.8	1.9	0.75	633,096	638,119	7.7	(14.4)	3.1	799	472	1,882	360	1,634	23		341	
11/20/13 16:44	(0.3)	14.6	2.0	0.76	641,838	638,158	7.7	(14.5)	3.1	771	523	1,882	360	1,635	23		401	
11/20/13 16:45	(0.3)	15.0	1.9	0.76	643,158	638,176	7.5	(14.5)	3.1	766	576	1,876	360	1,634	24		459	
11/20/13 16:46	(0.3)	14.9	1.9	0.76	635,737	638,108	7.8	(14.5)	3.1	799	626	1,873	359	1,634	24		519	
11/20/13 16:47	(0.3)	14.3	1.9	0.76	639,073	638,103	7.8	(14.5)	3.1	802	672	1,877	359	1,637	25		579	
11/20/13 16:48	(0.3)	14.7	1.9	0.75	637,467	638,228	7.8	(14.5)	3.1	797	717	1,876	359	1,657	25		639	
11/20/13 16:49	(0.3)	14.5	1.9	0.75	636,308	638,153	7.6	(14.4)	3.1	778	758	1,877	359	1,637	26		699	
11/20/13 16:50	(0.3)	14.8	1.9	0.75	635,969	638,236	7.4	(14.5)	3.1	788	800	1,875	359	1,651	27		758	
11/20/13 16:51	(0.3)	14.2	1.9	0.74	632,383	638,125	8.0	(14.5)	3.1	846	838	1,882	360	1,651	27		817	
11/20/13 16:52	(0.3)	14.6	1.9	0.75	643,997	638,152	7.7	(14.5)	3.1	763	869	1,879	360	1,651	28		878	
11/20/13 16:53	(0.3)	14.8	1.9	0.75	636,361	638,154	7.7	(14.5)	3.1	739	896	1,876	360	1,647	28		935	
11/20/13 16:54	(0.3)	14.3	1.9	0.75	638,431	638,119	7.6	(14.4)	3.1	771	928	1,880	359	1,651	29		997	
11/20/13 16:55	(0.3)	14.5	1.9	0.76	636,094	637,963	8.0	(14.5)	3.1	801	960	1,879	359	1,646	29		1,056	
11/20/13 16:56	(0.3)	14.4	1.9	0.75	633,721	637,963	8.2	(14.4)	3.1	745	987	1,877	359	1,647	30		1,115	
11/20/13 16:57	(0.3)	14.5	1.9	0.75	642,141	637,953	7.9	(14.4)	3.1	742	1,013	1,878	360	1,647	30		1,175	
11/20/13 16:58	(0.3)	14.7	1.9	0.75	644,211	637,928	7.7	(14.5)	3.1	813	1,038	1,877	360	1,644	31		1,234	
11/20/13 16:59	(0.4)	14.4	2.0	0.74	624,658	637,918	7.7	(14.4)	3.1	758	1,063	1,875	361	1,656	31		1,294	
11/20/13 17:00	(0.3)	14.5	1.9	0.74	649,384	637,824	8.1	(14.5)	3.1	826	1,084	1,875	360	1,656	32	32	1,354	
11/20/13 17:01	(0.4)	14.4	1.9	0.75	631,223	637,868	8.1	(14.4)	3.1	774	1,103	1,874	360	1,633	1		1,413	
11/20/13 17:02	(0.3)	14.7	2.0	0.75	635,095	637,840	8.3	(14.4)	3.1	795	1,113	1,871	360	1,634	1		1,471	
11/20/13 17:03	(0.4)	15.1	2.0	0.75	631,170	637,791	7.9	(14.5)	3.1	802	1,126	1,868	359	1,654	2		1,531	
11/20/13 17:04	(0.3)	15.1	2.0	0.76	635,166	637,656	7.7	(14.5)	3.1	805	1,117	1,867	359	1,652	2		1,590	
11/20/13 17:05	(0.3)	15.4	2.0	0.76	634,577	637,706	7.8	(14.4)	3.1	780	1,089	1,868	358	1,651	3		1,651	
11/20/13 17:06	(0.3)	15.9	2.1	0.76	626,460	637,747	7.7	(14.5)	3.1	819	1,059	1,866	358	1,651	3		1,712	
11/20/13 17:07	(0.2)	15.3	2.0	0.74	627,477	637,746	8.1	(14.4)	3.1	796	1,032	1,870	358	1,651	4		1,771	
11/20/13 17:08	(0.3)	15.8	2.0	0.73	651,632	637,628	7.4	(14.5)	3.1	789	1,011	1,868	359	1,634	4		1,831	
11/20/13 17:09	(0.3)	15.4	2.0	0.72	649,634	637,529	7.4	(14.5)	3.1	779	994	1,866	361	1,653	5		1,890	
11/20/13 17:10	(0.3)	15.5	2.1	0.74	643,889	637,653	7.3	(14.5)	3.1	831	974	1,865	363	1,651	5		1,950	
11/20/13 17:11	(0.3)	15.4	2.0	0.74	637,878	637,761	7.6	(14.5)	3.1	796	955	1,866	364	1,631	6		2,009	
11/20/13 17:12	(0.2)	16.0	2.0	0.75	639,037	637,792	7.6	(14.5)	3.1	809	935	1,863	364	1,654	6		2,068	
11/20/13 17:13	(0.2)	15.6	2.0	0.74	636,022	637,836	7.9	(14.5)	3.1	755	918	1,863	363	1,631	7		2,128	
11/20/13 17:14	(0.2)	16.0	2.0	0.75	626,389	637,827	7.8	(14.5)	3.1	767	916	1,862	361	1,630	7		2,188	
11/20/13 17:15	(0.3)	15.0	2.0	0.76	640,589	637,719	7.6	(14.5)	3.1	741	947	1,869	359	1,632	8		2,247	
11/20/13 17:16	(0.3)	14.8	2.0	0.75	621,661	637,774	7.9	(14.5)	3.1	752	991	1,878	359	1,651	8		2,306	
11/20/13 17:17	(0.4)	14.7	2.0	0.75	646,619	637,781	7.6	(14.5)	3.1	731	1,042	1,878	360	1,635	9		2,365	
11/20/13 17:18	(0.3)	15.0	2.1	0.74	637,913	637,780	7.8	(14.5)	3.1	788	1,078	1,871	362	1,638	10		2,426	
11/20/13 17:19	(0.4)	15.3	2.0	0.73	636,504	637,887	7.8	(14.4)	3.1	781	1,092	1,865	363	1,635	10		2,483	
11/20/13 17:20	(0.3)	15.0	2.1	0.76	637,039	637,889	7.7	(14.5)	3.1	764	1,084	1,864	363	1,637	11		2,545	
11/20/13 17:21	(0.3)	15.4	2.0	0.75	635,202	638,018	7.6	(14.5)	3.1	800	1,060	1,866	361	1,635	11		2,604	
11/20/13 17:22	(0.4)	15.8	2.0	0.75	649,616	637,917	7.7	(14.5)	3.1	795	1,035	1,865	360	1,634	12		2,664	
11/20/13 17:23	(0.3)	15.5	2.0	0.77	637,574	637,945	7.6	(14.5)	3.1	777	1,011	1,866	359	1,637	12		2,722	
11/20/13 17:24	(0.3)	15.8	2.0	0.77	638,859	637,742	7.9	(14.5)	3.1	802	985	1,867	358	1,638	13		2,784	
11/20/13 17:25	(0.3)	15.9	2.0	0.75	639,251	637,559	7.5	(14.4)	3.1	790	963	1,867	359	1,642	13		2,842	
11/20/13 17:26	(0.3)	15.6	2.0	0.74	640,250	637,662	8.0	(14.5)	3.1	823	942	1,868	361	1,622	14		2,902	
11/20/13 17:27	(0.4)	16.0	2.1	0.73	644,978	637,771	8.0	(14.5)	3.1	779	927	1,868	362	1,639	14		2,960	
11/20/13 17:28	(0.3)	15.6	2.0	0.75	636,522	637,789	8.0	(14.5)	3.1	763	919	1,870	362	1,640	15		3,022	
11/20/13 17:29	(0.3)	15.8	2.0	0.74	638,787	637,832	8.0	(14.4)	3.1	767	931	1,869	361	1,639	15		3,081	
11/20/13 17:30	(0.3)	15.1	2.0	0.75	647,511	637,897	8.1	(14.5)	3.1	820	963	1,872	360	1,661	16		3,141	
11/20/13 17:31	(0.3)	14.7	2.1	0.75	635,005	637,844	8.0	(14.5)	3.1	796	1,002	1,875	360	1,641	16		3,199	
11/20/13 17:32	(0.3)	15.1	2.0	0.75	633,346	637,760	8.2	(14.5)	3.1	838	1,036	1,873	360	1,659	17		3,260	
11/20/13 17:33	(0.3)	14.8	2.0	0.74	651,453	637,740	7.2	(14.5)	3.1	783	1,066	1,871	361	1,640	18		3,319	
11/20/13 17:34	(0.3)	15.2	1.9	0.75	648,563	637,819	7.6	(14.5)	3.1	822	1,084	1,867	361	1,642	18		3,379	
11/20/13 17:35	(0.2)	15.4	2.0	0.74	645,013	637,936	7.5	(14.5)	3.1	798	1,082	1,865	362	1,659	19		3,437	
11/20/13 17:36	(0.3)	15.3	1.9	0.75	632,008	637,964	7.2	(14.5)	3.1	773	1,067	1,866	363	1,659	19		3,498	
11/20/13 17:37	(0.3)	15.8	2.0	0.75	649,063	638,021	7.2	(14.5)	3.1	835	1,045	1,865	363	1,654	20		3,557	
11/20/13 17:38	(0.3)	15.7	1.9	0.75	635,095	638,152	7.5	(14.5)	3.1	809	1,023	1,867	362	1,663	20		3,617	
11/20/13 17:39	(0.3)	15.6	1.9	0.75	636,950	638,237	7.4	(14.5)	3.1	783	1,001	1,868	360	1,656	21		3,674	
11/20/13 17:40	(0.3)	16.0	2.0	0.76	633,507	638,236	7.6	(14.5)	3.1	779	981	1,866	359	1,670	21		3,734	
11/20/13 17:41	(0.2)	15.7	1.9	0.76	639,037	638,255	7.4	(14.5)	3.1	838	961	1,867	359	1,667	22		3,796	
11/20/13 17:42	(0.3)	15.5	1.9	0.77	640,892	638,271	7.6	(14.5)	3.1	797	944	1,869	360	1,640	22		3,855	
11/20/13 17:43	(0.3)	16.2	1.9	0.75	642,248	638,212	7.6	(14.5)	3.1	828	931	1,866	361	1,667	23		3,915	
11/20/13 17:44	(0.3)	15.6	1.9	0.74	647,243	638,104	7.7	(14.5)	3.1	792	926	1,867	361	1,664	23		3,974	
11/20/13 17:45	(0.3)	15.7	1.9	0.74	641,356	638,138	7.8	(14.5)	3.1	826	941	1,869	362	1,665	24		4,033	
11/20/13 17:46	(0.3)	15.2	1.9	0.74	627,531	638,041	7.8	(14.4)	3.1	754	972	1,871	362	1,664	24		4,092	
11/20/13 17:47	(0.3)	15.2	2.0	0.74	637,289	638,066	7.6	(14.5)	3.1	829	1,011	1,871	362	1,664	25		4,152	
11/20/13 17:48	(0.3)	15.0	1.9	0.75	643,319	638,046	7.2	(14.4)	3.1	803	1,046	1,873	361	1,663	25		4,213	
11/20/13 17:49	(0.3)	14.9	1.9	0.73	639,287	637,998	7.7	(14.5)	3.1	834	1,074	1,873	361	1,663	26		4,272	
11/20/13 17:50	(0.3)	15.1	1.9	0.71	622,214	637,977	7.7	(14.5)	3.1	831	1,085	1,872	360	1,661	27		4,331	
11/20/13 17:51	(0.3)	15.5	2.0	0.75	646,048	637,949	7.8	(14.5)	3.1	793	1,078	1,868	360	1,660	27		4,389	
11/20/13 17:52	(0.2)	15.6	2.0	0.71	641,303	638,055	7.8	(14.5)	3.1	780	1,059	1,866	360	1,676	28		4,450	
11/20/13 17:53	(0.3)	16.0	2.0	0.71	632,597	638,007	7.9	(14.5)	3.1	806	1,037	1,867	360	1,653	28		4,509	
11/20/13 17:54	(0.3)	15.7	1.9	0.73	650,258	637,982	7.8	(14.5)	3.1	755	1,013	1,870	360	1,651	29	29	4,569	317

DateTime	STACK CARBON MONOXIDE DETECTOR AIT_407_A.\	O2 ANALYZER B AIT_409_B_	Stack Opacity Detector AIT_411.V	Spray Dryer Soda Ash Flow Cntrl FT_313.Value	Stack Flow (1 Min Running Avg) FT_412.Valu	STACK GAS ONE HR AV STACK_GAS_	Pressure Drop Across Bag House PDI_359.Val	KI-101 Feed Assembly Pressure PI_105.Valu	Kiln Speed Controller ST_112.Val	KILN FLUE GAS TEMP HI SELECT TI_104HSEL	CBF Exit Gas Temp TI_204.V:	SCC OUTLET TEMP (MEDIAN) TI_268MEI	SPRAY DRYER FLUE GAS TEMP TI_308ME	KILN FEED HOUR RATE TOTAL KILN_FEED_	B Scale HRT lbs MAX_WT_B.Value	Chlorine Feed Rate to Kiln CBF_BATCH_TIME_SEC.Value	CBF Batch Time sec	Weight/Hr for CBF Batch
Target	3.0					634,000						1,845	364	1,650		5.0		250.0
Average	(0.2)	15.6	1.7	0.7	638,435	637,929	7.7	(14.5)	3.1	808	789	1,870	360	1,660	Lbs Cl/hr	6.7		
Minimum	(0.4)	14.3	1.5	0.6	625,515	637,209	7.0	(14.5)	3.0	721	376	1,863	356	1,630	Minutes Fed	184.0	Batch	
Maximum	6.3	16.3	1.9	0.8	655,771	638,728	8.4	(14.4)	3.2	886	1,112	1,884	363	1,684	Cl%	0.2	Lbs/hr	246.5
															Lbs fed	97.7		
11/20/13 18:18	(0.4)	15.2	1.9	0.8	638,199	638,728	7.3	(14.5)	3.1	799	1,016	1,875	357	1,659	9.5		5,997	
11/20/13 18:19	(0.4)	15.3	1.8	0.7	644,996	638,699	7.3	(14.5)	3.1	780	1,047	1,871	358	1,660	10.1		6,057	
11/20/13 18:20	(0.3)	14.9	1.9	0.7	640,643	638,684	7.4	(14.5)	3.1	795	1,072	1,873	359	1,657	10.6		6,118	
11/20/13 18:21	(0.3)	15.1	1.8	0.7	640,536	638,593	7.5	(14.5)	3.1	778	1,077	1,876	360	1,660	11.1		6,178	
11/20/13 18:22	(0.3)	15.5	1.9	0.8	635,969	638,574	7.6	(14.5)	3.1	822	1,068	1,875	360	1,664	11.7		6,237	
11/20/13 18:23	(0.4)	15.5	1.8	0.8	631,580	638,550	7.6	(14.4)	3.1	781	1,050	1,873	359	1,661	12.2		6,296	
11/20/13 18:24	(0.3)	16.1	1.9	0.8	653,790	638,561	7.7	(14.5)	3.1	780	1,009	1,868	358	1,642	12.7		6,299	
11/20/13 18:25	(0.3)	16.0	1.8	0.8	639,019	638,605	7.5	(14.5)	3.1	820	948	1,866	357	1,662	13.3		6,299	
11/20/13 18:26	(0.3)	15.8	1.9	0.8	636,986	638,527	7.5	(14.5)	3.1	795	886	1,866	356	1,660	13.8		6,299	
11/20/13 18:27	(0.3)	15.6	1.9	0.8	635,648	638,434	7.7	(14.5)	3.1	802	833	1,869	357	1,658	14.3		6,299	
11/20/13 18:28	(0.3)	16.1	1.9	0.7	644,710	638,419	7.4	(14.5)	3.1	810	788	1,868	358	1,654	14.9		6,299	
11/20/13 18:29	(0.3)	15.7	1.8	0.7	629,885	638,395	7.7	(14.4)	3.1	802	749	1,869	359	1,673	15.4		6,299	
11/20/13 18:30	(0.3)	16.3	1.8	0.7	626,407	638,346	7.6	(14.4)	3.1	817	717	1,866	359	1,652	15.9		6,299	
11/20/13 18:31	(0.3)	15.7	1.8	0.8	629,939	638,329	7.6	(14.4)	3.1	802	689	1,868	359	1,655	16.4		6,299	
11/20/13 18:32	(0.4)	16.1	1.8	0.8	636,629	638,464	7.5	(14.5)	3.1	831	665	1,869	359	1,657	17.0		6,299	
11/20/13 18:33	(0.3)	15.6	1.9	0.8	639,091	638,435	7.6	(14.4)	3.1	798	644	1,871	358	1,660	17.5		6,299	
11/20/13 18:34	(0.3)	16.1	1.8	0.8	638,680	638,299	7.9	(14.4)	3.1	793	626	1,870	358	1,657	18.0		6,299	
11/20/13 18:35	(0.3)	16.2	1.9	0.8	631,973	638,162	7.9	(14.5)	3.1	775	611	1,870	358	1,667	18.6		6,299	
11/20/13 18:36	(0.2)	15.9	1.8	0.7	638,734	638,159	7.8	(14.4)	3.1	755	596	1,871	359	1,665	19.1		6,299	
11/20/13 18:37	(0.3)	15.8	1.8	0.7	634,024	638,102	8.0	(14.4)	3.1	790	583	1,869	359	1,664	19.6		6,299	
11/20/13 18:38	(0.3)	16.3	1.9	0.7	639,340	638,130	7.7	(14.5)	3.1	737	572	1,865	360	1,653	20.2		6,299	
11/20/13 18:39	(0.3)	15.7	1.8	0.8	643,800	638,192	7.7	(14.5)	3.1	754	561	1,873	360	1,657	20.7		6,299	
11/20/13 18:40	(0.3)	16.1	1.8	0.8	638,538	638,099	7.6	(14.5)	3.1	781	551	1,876	359	1,660	21.2		6,299	
11/20/13 18:41	(0.3)	15.9	1.8	0.8	636,058	638,060	7.7	(14.4)	3.1	794	542	1,873	359	1,661	21.8		6,299	
11/20/13 18:42	(0.4)	16.1	1.8	0.8	629,011	638,120	7.5	(14.5)	3.1	804	533	1,868	359	1,664	22.3		6,299	
11/20/13 18:43	(0.3)	15.9	1.8	0.8	643,925	638,198	7.9	(14.5)	3.1	783	525	1,864	358	1,660	22.8		6,299	
11/20/13 18:44	(0.3)	15.6	1.8	0.8	639,876	638,216	7.8	(14.4)	3.1	791	518	1,868	359	1,664	23.4		6,299	
11/20/13 18:45	(0.3)	16.1	1.8	0.8	637,200	638,148	7.5	(14.4)	3.1	779	510	1,868	359	1,646	23.9		6,299	
11/20/13 18:46	(0.3)	15.9	1.8	0.8	628,761	638,143	8.0	(14.5)	3.1	776	503	1,869	359	1,648	24.4		6,299	
11/20/13 18:47	(0.3)	15.8	1.7	0.8	631,116	638,044	8.1	(14.5)	3.1	803	496	1,868	359	1,671	24.9		6,299	
11/20/13 18:48	(0.3)	16.2	1.8	0.7	639,269	638,004	7.6	(14.5)	3.1	817	490	1,865	360	1,630	25.5		6,299	
11/20/13 18:49	(0.3)	15.7	1.6	0.6	638,395	637,937	8.0	(14.5)	3.1	816	484	1,865	360	1,651	26.0		6,299	
11/20/13 18:50	(0.3)	16.1	1.7	0.7	643,194	638,006	7.8	(14.5)	3.1	820	477	1,864	360	1,637	26.5		6,299	
11/20/13 18:51	(0.3)	15.6	1.7	0.7	635,879	638,082	8.1	(14.5)	3.1	783	471	1,866	360	1,640	27.1		6,299	
11/20/13 18:52	(0.3)	16.1	1.7	0.8	641,784	638,087	8.0	(14.4)	3.1	829	466	1,866	361	1,642	27.6		6,299	
11/20/13 18:53	(0.4)	15.9	1.7	0.8	634,470	638,070	8.2	(14.4)	3.1	822	460	1,867	360	1,645	28.1		6,299	
11/20/13 18:54	(0.3)	15.7	1.7	0.8	635,309	638,044	8.0	(14.4)	3.1	804	455	1,868	360	1,664	28.7		6,299	
11/20/13 18:55	(0.3)	15.9	1.7	0.8	636,647	637,987	7.7	(14.5)	3.1	828	450	1,869	360	1,641	29.2		6,299	
11/20/13 18:56	(0.2)	16.1	1.7	0.7	643,675	637,965	7.9	(14.5)	3.1	800	445	1,866	359	1,639	29.7		6,299	
11/20/13 18:57	(0.2)	16.0	1.7	0.7	647,225	637,941	7.5	(14.5)	3.1	851	440	1,866	359	1,662	30.2		6,299	
11/20/13 18:58	(0.3)	15.5	1.7	0.8	655,771	638,029	7.1	(14.5)	3.1	784	435	1,867	360	1,644	30.8		6,299	
11/20/13 18:59	(0.3)	16.0	1.7	0.7	638,002	638,248	7.0	(14.5)	3.1	827	431	1,867	361	1,633	31.3		6,299	
11/20/13 19:00	(0.4)	16.0	1.6	0.7	633,935	638,292	7.2	(14.5)	3.1	797	426	1,865	363	1,655	31.8	22.3	6,299	
11/20/13 19:01	(0.3)	15.7	1.7	0.7	640,339	638,218	7.1	(14.4)	3.1	791	422	1,865	363	1,661	0.5		6,299	
11/20/13 19:02	(0.3)	15.9	1.6	0.7	629,939	638,182	7.3	(14.5)	3.1	841	418	1,865	362	1,681	1.0		6,299	
11/20/13 19:03	(0.3)	15.7	1.7	0.8	628,583	638,107	7.2	(14.5)	3.1	828	413	1,866	361	1,660	1.6		6,299	
11/20/13 19:04	(0.3)	15.6	1.7	0.8	634,292	637,984	7.7	(14.5)	3.1	856	409	1,867	361	1,662	2.1		6,299	
11/20/13 19:05	(0.3)	15.9	1.7	0.8	644,871	638,070	7.6	(14.5)	3.1	823	405	1,865	361	1,661	2.6		6,299	
11/20/13 19:06	(0.3)	15.7	1.7	0.7	632,347	638,080	7.6	(14.4)	3.1	799	401	1,865	361	1,679	3.2		6,299	
11/20/13 19:07	(0.3)	16.1	1.7	0.8	634,898	637,989	7.5	(14.5)	3.1	841	397	1,863	362	1,677	3.7		6,299	
11/20/13 19:08	(0.3)	16.0	1.6	0.7	641,802	637,872	7.8	(14.4)	3.1	815	393	1,863	362	1,659	4.2		6,299	
11/20/13 19:09	(0.3)	15.6	1.7	0.7	638,020	637,863	7.9	(14.4)	3.1	815	389	1,866	362	1,662	4.8		6,299	
11/20/13 19:10	(0.3)	16.1	1.6	0.7	635,879	637,773	7.7	(14.5)	3.1	850	386	1,867	362	1,666	5.3		6,299	
11/20/13 19:11	(0.3)	15.8	1.7	0.8	640,446	637,709	7.7	(14.5)	3.1	797	382	1,868	362	1,654	5.8		6,299	
11/20/13 19:12	(0.3)	15.6	1.7	0.8	638,074	637,609	7.8	(14.4)	3.1	789	379	1,873	362	1,653	6.4		6,299	
11/20/13 19:13	(0.3)	16.3	1.6	0.8	637,592	637,645	7.6	(14.5)	3.1	789	376	1,870	361	1,672	6.9		6,299	
11/20/13 19:14	(0.3)	15.9	1.6	0.8	628,654	637,448	7.6	(14.5)	3.1	749	376	1,865	361	1,670	7.4		6,299	
11/20/13 19:15	(0.2)	16.1	1.6	0.8	637,378	637,350	7.8	(14.5)	3.1	736	379	1,864	359	1,650	8.0		6,299	
11/20/13 19:16	(0.2)	16.1	1.7	0.8	641,856	637,347	7.8	(14.5)	3.1	810	383	1,867	359	1,669	8.5		6,299	
11/20/13 19:17	(0.3)	15.6	1.6	0.8	647,493	637,209	7.8	(14.5)	3.1	767	387	1,872	359	1,654	9.0		6,299	
11/20/13 19:18	(0.3)	15.9	1.7	0.7	641,499	637,293	7.7	(14.5)	3.1	765	392	1,872	360	1,676	9.5		6,299	
11/20/13 19:19	(0.2)	15.9	1.6	0.7	638,966	637,227	8.0	(14.5)	3.1	795	395	1,871	361	1,660	10.1		6,299	
11/20/13 19:20	(0.3)	16.1	1.6	0.7	646,869	637,260	7.9	(14.5)	3.1	721	398	1,868	361	1,662	10.6		6,299	
11/20/13 19:21	(0.3)	16.1	1.7	0.8	631,973	637,273	7.9	(14.5)	3.1	757	399	1,866	361	1,663	11.1		6,299	
11/20/13 19:22	(0.2)	15.5	1.6	0.8	638,984	637,309	8.0	(14.5)	3.1	806	400	1,871	360	1,661	11.7		6,299	
11/20/13 19:23	(0.3)	15.8	1.6	0.8	635,273	637,327	8.0	(14.5)	3.1	761	401	1,873	359	1,678	12.2		6,299	
11/20/13 19:24	(0.3)	16.0	1.6	0.8	641,303	637,318	7.9	(14.5)	3.1	754	401	1,870	359	1,677	12.7		6,299	
11/20/13 19:25	(0.2)	15.8	1.6	0.7	642,337	637,318	7.8	(14.4)	3.1	744	401	1,870	359	1,656	13.3		6	106
11/20/13 19:26	(0.2)	16.1	1.6	0.7	645,638	637,391	7.6	(14.5)	3.1	815	397	1,869	360	1,661	13.8		64	
11/20/13 19:27	(0.3)	15.8	1.6	0.7	637,324	637,443	8.0	(14.5)	3.1	773	387	1,867	362	1,660	14.3		124	
11/20/13 19:28	(0.3)	15.9	1.6	0.7	641,463	637,431	7.5	(14.4)	3.1	788	376	1,866	363	1,664	14.8		183	
11/20/13 19:29	(0.3)	15.8	1.7	0.7	641,695	637,390	7.5	(14.5)	3.1	804	387	1,870	363	1,661	15.4		244	
11/20/13 19:30	(0.3)	14.3	1.6	0.8	642,730	637,462	7.9	(14.5)	3.1	810	430	1,884	363	1,661	15.9		302	
11/20/13 19:31	(0.3)	15.2	1.6	0.8	634,916	637,481	7.7	(14.5)	3.1	833	488	1,882	363	1,659	16.4		362	
11/20/13 19:32	(0.4)	14.7	1.6	0.8	638,662	637,490	7.7	(14.4)	3.1	787	546	1,877	362	1,661	17.0		422	
11/20/13 19:33	(0.3)	14.9	1.6	0.8	635,433	637,457	7.9	(14.5)	3.1	812	607	1,872	361	1,657	17.5		482	
11/20/13 19:34	(0.3)	14.9	1.7	0.8	637,895	637,487	7.8	(14.5)	3.1	853	661	1,872	361	1,679	18.0		542	
11/20/13 19:35	(0.4)	14.5	1.6	0.7	637,271	637,574	7.9	(14.5)	3.1	818	710	1,876	362	1,656	18.6		602	
11/20/13 19:36	(0.2)	15.1	1.6	0.7	639,430	637,528	7.9	(14.5)	3.1	797	754	1,872	362	1,655	19.1		661	
11/20/13 19:37	(0.3)	14.9	1.6	0.7	641,481	637,564	7.8	(14.5)	3.1	817	793	1,870	362	1,641	19.6		721	
11/20/13 19:38	(0.3)	14.5	1.6	0.8	634,559	637,522	8.0	(14.4)	3.1	783	826	1,872	363	1,640	20.2		780	
11/20/13 19:39	(0.3)	14.7	1.6	0.7	644,175	637,429	7.9	(14.5)	3.1	824	857	1,876	363	1,664	20.7		839	
11/20/13 19:40	(0.3)	14.6	1.7	0.7	643,997	637,519	7.8	(14.5)	3.1	831	884	1,876	363	1,642	21.2		898	
11/20/13 19:41	(0.3)	14.6	1.6	0.7	634,149	637,625	7.9	(14.5)	3.1	816	909	1,874	363	1,644	21.8		958	
11/20/13 19:42	(0.3)	15.3	1.6	0.7	630,278	637,636	8.1	(14.5)	3.1	792	932	1,867	362	1,663	22.3		1,018	
11/20/13 19:43	(0.3)	14.5	1.6	0.8	639,947	637,605	8.0	(14.5)	3.1	794	954	1,871	361	1,639	22.8		1,077	
11/20/13 19:44	(0.4)	14.8	1.6	0.8	643,372	637,708	8.0	(14.5)	3.1	846	975	1,873	361	1,639	23.3		1,137	
11/20/13 19:45	(0.4)	14.3	1.7	0.8	640,553	637,746	8.0	(14.4)	3.1	788	996	1,876	362	1,655	23.9		1,197	
11/20/13 19:46	(0.3)	15.1	1.6	0.7	637,699	637,751	8.3	(14.5)	3.1	829	1,017	1,873	362	1,655	24.4		1,256	
11/20/13 19:47	(0.3)	14.6	1.7	0.8	654,415	637,947	7.4	(14.5)	3.1	818	1,039	1,872	362	1,652	24.9		1,316	
11/20/13 19:48	(0.3)	14.4	1.5	0.7	637,110	637,981	7.3	(14.5)	3.1	788	1,060	1,871	362	1,646	25.5		1,375	
11/20/13 19:49	(0.3)	14.5	1.6	0.7	643,265	638,000	7.6	(14.5)	3.1	834	1,079	1,872	363	1,668	26.0		1,434	
11/20/13 19:50	(0.4)	14.7	1.6	0.7	653,701	638,166	7.2	(14.5)	3.1	789	1,098	1,871	363	1,668	26.5		1,493	
11/20/13 19:51	(0.0)	14.4	1.6	0.7	643,533	638,296	7.4	(14.4)	3.1	809	1,112	1,875	362	1,669	27.0		1,553	
11/20/13 19:52	6.3	14.7	1.5	0.8	636,058	638,304	7.0	(14.4)	3.1	830	1,107	1,875	360	1,684	27.6		1,613	
11/20/13 19:53	1.3	15.1	1.6	0.8	630,938	638,210	7.1	(14.5)	3.1	857	1,086	1,873	358	1,665	28.1		1,674	

11/20/13 19:54	(0.1)	15.1	1.6	0.8	642,659	638,242	7.4	(14.5)	3.1	820	1,067	1,871	356	1,667	28.7		1,732
11/20/13 19:55	(0.3)	15.6	1.6	0.8	636,450	638,223	7.4	(14.5)	3.1	841	1,047	1,869	356	1,671	29.2		1,791
11/20/13 19:56	(0.2)	15.5	1.6	0.7	635,987	638,202	7.1	(14.5)	3.1	809	1,032	1,868	358	1,673	29.7		1,851
11/20/13 19:57	(0.3)	15.3	1.6	0.7	638,466	638,208	7.5	(14.5)	3.1	845	1,010	1,872	360	1,676	30.3		1,910
11/20/13 19:58	(0.4)	15.5	1.6	0.7	643,515	638,119	7.0	(14.4)	3.1	783	989	1,873	361	1,672	30.8		1,971
11/20/13 19:59	(0.3)	15.7	1.6	0.7	634,131	637,883	7.7	(14.5)	3.1	839	968	1,872	360	1,674	31.3		2,031
11/20/13 20:00	(0.4)	15.5	1.7	0.8	641,624	637,831	7.2	(14.5)	3.1	839	950	1,873	359	1,676	31.8	31.8	2,090
11/20/13 20:01	(0.3)	15.3	1.6	0.8	636,058	637,926	7.5	(14.4)	3.1	818	941	1,874	358	1,657	0.5		2,150
11/20/13 20:02	(0.3)	15.8	1.7	0.8	636,932	637,961	7.5	(14.5)	3.1	842	935	1,872	358	1,651	1.0		2,209
11/20/13 20:03	(0.3)	15.4	1.6	0.7	636,290	638,091	7.3	(14.5)	3.1	809	935	1,873	357	1,653	1.6		2,269
11/20/13 20:04	(0.3)	15.3	1.6	0.7	635,433	638,177	7.7	(14.4)	3.1	799	950	1,874	358	1,653	2.1		2,328
11/20/13 20:05	(0.3)	15.2	1.7	0.7	636,486	638,209	7.5	(14.5)	3.2	839	978	1,874	360	1,673	2.6		2,388
11/20/13 20:06	(0.3)	14.8	1.6	0.7	637,360	638,224	7.6	(14.4)	3.1	807	1,008	1,875	360	1,673	3.2		2,447
11/20/13 20:07	(0.3)	14.8	1.7	0.8	642,337	638,199	7.5	(14.5)	3.1	816	1,037	1,877	360	1,653	3.7		2,507
11/20/13 20:08	(0.3)	15.0	1.6	0.8	628,958	638,263	7.3	(14.5)	3.1	834	1,062	1,875	360	1,655	4.2		2,564
11/20/13 20:09	(0.3)	14.7	1.7	0.8	637,806	638,282	7.4	(14.5)	3.1	840	1,082	1,875	359	1,673	4.8		2,626
11/20/13 20:10	(0.3)	14.7	1.6	0.7	642,195	638,251	7.7	(14.5)	3.1	822	1,084	1,874	359	1,671	5.3		2,686
11/20/13 20:11	(0.3)	15.8	1.7	0.7	633,204	638,367	7.2	(14.5)	3.1	794	1,071	1,869	359	1,670	5.8		2,745
11/20/13 20:12	(0.3)	15.7	1.6	0.7	627,513	638,367	7.5	(14.5)	3.1	850	1,054	1,868	359	1,666	6.4		2,804
11/20/13 20:13	(0.3)	15.2	1.6	0.7	647,636	638,303	7.4	(14.5)	3.1	779	1,032	1,870	359	1,665	6.9		2,865
11/20/13 20:14	(0.2)	16.2	1.7	0.7	639,733	638,343	7.7	(14.4)	3.1	761	1,007	1,868	359	1,663	7.4		2,924
11/20/13 20:15	(0.2)	15.9	1.7	0.8	641,338	638,358	7.6	(14.5)	3.1	823	982	1,868	359	1,675	7.9		2,982
11/20/13 20:16	(0.2)	15.5	1.6	0.8	638,288	638,443	7.4	(14.5)	3.1	759	958	1,870	359	1,674	8.5		3,042
11/20/13 20:17	(0.3)	16.0	1.7	0.7	637,164	638,447	7.7	(14.5)	3.1	811	938	1,870	359	1,653	9.0		3,102
11/20/13 20:18	(0.3)	15.7	1.7	0.8	645,584	638,455	7.4	(14.5)	3.1	828	924	1,871	359	1,670	9.5		3,162
11/20/13 20:19	(0.3)	15.4	1.7	0.8	636,968	638,522	7.5	(14.4)	3.1	793	919	1,873	359	1,651	10.1		3,220
11/20/13 20:20	(0.3)	15.5	1.7	0.7	636,094	638,573	7.6	(14.5)	3.1	816	937	1,873	359	1,665	10.6		3,281
11/20/13 20:21	(0.3)	15.0	1.7	0.7	640,054	638,485	7.9	(14.5)	3.1	807	971	1,875	360	1,663	11.1		3,341
11/20/13 20:22	(0.3)	15.2	1.8	0.7	643,372	638,474	7.6	(14.5)	3.1	833	1,010	1,873	360	1,664	11.7		3,400
11/20/13 20:23	(0.3)	14.6	1.7	0.7	632,436	638,516	7.5	(14.5)	3.1	827	1,047	1,875	360	1,662	12.2		3,460
11/20/13 20:24	(0.3)	15.1	1.7	0.7	633,881	638,465	7.5	(14.4)	3.1	808	1,076	1,873	361	1,647	12.7		3,519
11/20/13 20:25	(0.3)	15.0	1.7	0.8	636,058	638,556	7.6	(14.5)	3.1	781	1,090	1,870	360	1,646	13.3		3,579
11/20/13 20:26	(0.3)	15.4	1.7	0.8	639,947	638,478	8.0	(14.4)	3.1	839	1,083	1,868	360	1,663	13.8		3,638
11/20/13 20:27	(0.3)	15.0	1.7	0.8	635,951	638,431	7.6	(14.5)	3.1	832	1,064	1,872	360	1,655	14.3		3,699
11/20/13 20:28	(0.3)	16.0	1.7	0.8	638,752	638,395	7.6	(14.5)	3.1	798	1,042	1,870	360	1,655	14.9		3,758
11/20/13 20:29	(0.3)	15.6	1.7	0.8	639,340	638,387	7.7	(14.4)	3.1	776	1,020	1,871	360	1,653	15.4		3,817
11/20/13 20:30	(0.3)	15.9	1.7	0.8	631,919	638,452	7.8	(14.5)	3.1	849	1,000	1,871	359	1,652	15.9		3,877
11/20/13 20:31	(0.2)	15.5	1.7	0.7	634,363	638,348	7.6	(14.5)	3.1	788	982	1,872	359	1,651	16.5		3,936
11/20/13 20:32	(0.2)	16.0	1.7	0.7	642,712	638,294	7.7	(14.5)	3.1	831	966	1,870	359	1,652	17.0		3,995
11/20/13 20:33	(0.3)	15.6	1.7	0.7	634,327	638,323	8.1	(14.5)	3.1	774	951	1,870	359	1,652	17.5		4,056
11/20/13 20:34	(0.2)	16.2	1.8	0.8	637,895	638,305	7.9	(14.5)	3.1	833	939	1,869	359	1,652	18.0		4,115
11/20/13 20:35	(0.3)	15.7	1.7	0.7	636,290	638,255	7.9	(14.5)	3.1	813	931	1,869	360	1,634	18.6		4,175
11/20/13 20:36	(0.3)	15.4	1.7	0.8	634,149	638,198	7.6	(14.4)	3.1	801	939	1,871	361	1,654	19.1		4,234
11/20/13 20:37	(0.3)	15.4	1.7	0.7	627,192	638,278	7.7	(14.5)	3.1	852	966	1,872	361	1,654	19.6		4,294
11/20/13 20:38	(0.3)	14.7	1.7	0.8	634,666	638,063	8.4	(14.5)	3.1	806	1,002	1,875	361	1,666	20.2		4,353
11/20/13 20:39	(0.4)	15.5	1.7	0.8	634,470	637,990	8.1	(14.4)	3.1	830	1,036	1,871	362	1,665	20.7		4,412
11/20/13 20:40	(0.3)	14.6	1.7	0.7	650,526	637,982	7.5	(14.5)	3.1	795	1,065	1,871	362	1,660	21.2		4,472
11/20/13 20:41	(0.3)	15.3	1.7	0.8	635,772	638,075	7.4	(14.5)	3.1	811	1,080	1,868	363	1,663	21.8		4,532
11/20/13 20:42	(0.3)	15.1	1.7	0.8	637,539	638,040	7.5	(14.5)	3.1	793	1,077	1,867	363	1,678	22.3		4,591
11/20/13 20:43	(0.3)	15.6	1.7	0.7	640,268	638,042	7.4	(14.5)	3.1	845	1,060	1,866	363	1,655	22.8		4,651
11/20/13 20:44	(0.3)	15.7	1.7	0.7	645,120	638,025	7.4	(14.5)	3.1	818	1,040	1,865	362	1,675	23.4		4,711
11/20/13 20:45	(0.3)	15.6	1.7	0.8	640,429	637,974	7.4	(14.5)	3.1	798	1,017	1,867	362	1,675	23.9		4,768
11/20/13 20:46	(0.3)	15.9	1.8	0.8	631,437	637,897	7.4	(14.5)	3.1	832	994	1,868	361	1,657	24.4		4,829
11/20/13 20:47	(0.3)	15.8	1.7	0.8	631,669	637,978	7.8	(14.5)	3.1	808	973	1,867	360	1,673	25.0		4,889
11/20/13 20:48	(0.3)	15.6	1.8	0.8	647,065	637,880	7.6	(14.5)	3.1	847	956	1,868	361	1,655	25.5		4,949
11/20/13 20:49	(0.3)	15.9	1.7	0.8	644,924	637,847	7.8	(14.5)	3.1	812	942	1,867	362	1,672	26.0		5,007
11/20/13 20:50	(0.2)	15.7	1.8	0.7	633,007	637,792	7.7	(14.5)	3.1	837	934	1,869	362	1,651	26.5		5,068
11/20/13 20:51	(0.3)	15.7	1.8	0.8	651,186	637,616	8.0	(14.5)	3.1	773	936	1,868	362	1,668	27.1		5,127
11/20/13 20:52	(0.2)	15.4	1.8	0.7	636,290	637,414	7.7	(14.4)	3.1	766	958	1,872	362	1,648	27.6		5,184
11/20/13 20:53	(0.3)	15.4	1.7	0.7	645,513	637,321	7.6	(14.5)	3.1	834	992	1,873	362	1,666	28.1		5,245
11/20/13 20:54	(0.3)	14.9	1.7	0.8	637,931	637,419	8.0	(14.4)	3.1	802	1,025	1,874	362	1,665	28.7		5,307
11/20/13 20:55	(0.4)	15.5	1.8	0.8	637,788	637,330	7.7	(14.5)	3.1	842	1,055	1,869	362	1,640	29.2		5,366
11/20/13 20:56	(0.4)	14.8	1.7	0.7	643,818	637,377	7.9	(14.5)	3.1	815	1,074	1,870	362	1,658	29.7		5,426
11/20/13 20:57	(0.3)	15.7	1.7	0.7	633,400	637,365	7.6	(14.5)	3.1	830	1,075	1,867	361	1,655	30.3		5,485
11/20/13 20:58	(0.3)	15.5	1.7	0.8	638,734	637,248	7.9	(14.5)	3.1	807	1,062	1,867	361	1,652	30.8		5,545
11/20/13 20:59	(0.3)	15.7	1.8	0.7	640,553	637,353	7.6	(14.5)	3.1	855	1,044	1,867	360	1,647	31.3		5,604
11/20/13 21:00	(0.3)	15.8	1.8	0.8	636,629	637,404	8.0	(14.5)	3.1	789	1,021	1,867	360	1,657	31.8	31.8	5,664
11/20/13 21:01	(0.3)	15.7	1.8	0.8	643,301	637,452	7.7	(14.5)	3.1	783	999	1,871	360	1,668	0.5		5,723
11/20/13 21:02	(0.3)	16.1	1.8	0.7	638,092	637,366	7.7	(14.5)	3.1	822	979	1,871	361	1,667	1.0		5,783
11/20/13 21:03	(0.3)	15.5	1.7	0.7	645,085	637,344	7.7	(14.5)	3.1	817	960	1,872	361	1,668	1.6		5,839
11/20/13 21:04	(0.3)	16.1	1.8	0.7	641,481	637,299	8.1	(14.5)	3.1	828	945	1,867	361	1,668	2.1		5,902
11/20/13 21:05	(0.2)	15.6	1.7	0.7	633,400	637,288	8.1	(14.5)	3.1	814	937	1,867	361	1,663	2.6		5,961
11/20/13 21:06	(0.3)	16.2	1.8	0.8	646,762	637,276	7.7	(14.5)	3.1	823	936	1,866	361	1,663	3.2		6,021
11/20/13 21:07	(0.3)	15.4	1.7	0.8	646,548	637,342	7.4	(14.5)	3.1	801	953	1,868	361	1,684	3.7		6,079
11/20/13 21:08	(0.3)	15.2	1.7	0.7	640,928	637,496	7.6	(14.5)	3.1	857	984	1,872	362	1,680	4.2		6,139
11/20/13 21:09	(0.3)	15.2	1.7	0.7	636,415	637,544	7.7	(14.5)	3.1	793	998	1,871	363	1,661	4.8		6,198
11/20/13 21:10	(0.3)	16.0	1.7	0.8	633,293	637,498	7.6	(14.5)	3.1	850	982	1,868	363	1,681	5.3		6,259
11/20/13 21:11	(0.3)	15.8	1.7	0.8	625,515	637,553	7.6	(14.4)	3.1	784	950	1,867	362	1,663	5.8		6,272	436
11/20/13 21:12	(0.3)	16.2	1.7	0.8	631,045	637,480	7.7	(14.4)	3.1	822	898	1,863	360	1,666	6.3		6,272
11/20/13 21:13	(0.3)	15.7	1.7	0.8	635,790	637,560	7.9	(14.4)	3.1	824	840	1,865	360	1,680	6.9		6,272
11/20/13 21:14	(0.3)	16.2	1.7	0.8	632,650	637,442	7.5	(14.5)	3.1	823	791	1,864	360	1,657	7.4		6,272
11/20/13 21:15	(0.3)	15.9	1.7	0.7	635,737	637,459	7.7	(14.5)	3.1	800	747	1,864	361	1,643	8.0		6,272
11/20/13 21:16	(0.2)	15.9	1.7	0.7	637,842	637,369	7.7	(14.5)	3.1	827	711	1,864	361	1,664	8.5		6,272
11/20/13 21:17	(0.3)	15.8	1.7	0.7	638,752	637,423	8.0	(14.5)	3.1	886	679	1,865	362	1,661	9.0		6,272
11/20/13 21:18	(0.3)	15.8	1.7	0.7	643,301	637,464	7.9	(14.4)	3.0	813	651	1,866	362	1,662	9.6		6,272
11/20/13 21:19	(0.2)	16.1	1.7	0.8	640,768	637,437	7.8	(14.5)	3.1	851	629	1,865	361	1,660	10.1		6,272
11/20/13 21:20	(0.3)	16.1	1.6	0.8	633,186	637,319	7.9	(14.5)	3.1	830	609	1,864	360	1,648	10.6		6,272
11/20/13 21:21	(0.3)	15.8	1.6	0.8	640,125	637,432	7.9	(14.4)	3.1	812	592	1,865	360	1,669	11.1		6,272
11/20/13 21:22	(0.3)	15.9	1.6	0.8	646,904	637,370	7.6	(14.5)	3.1	845	577	1,866	360	1,647	11.7	11.7	6,272

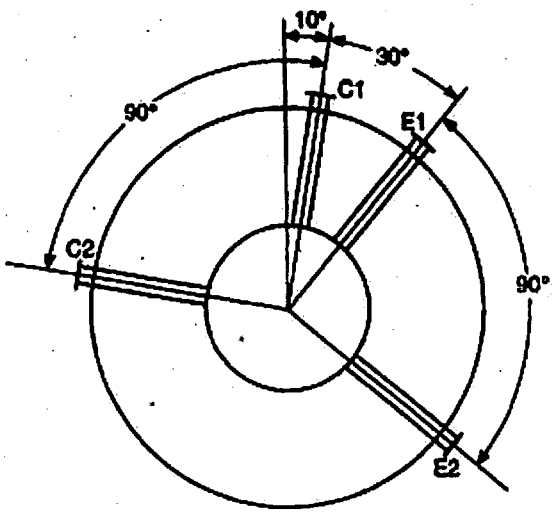
DateTime	STACK CARBON MONOXIDE DETECTOR AIT_407_A.Val	O2 ANALYZER B AIT_409_B	Stack Opacity Detector AIT_411.Value	Spray Dryer Soda Ash Flow Cntrl FT_313.Val	Stack Flow (1 Min Running Avg) FT_412.Val	STACK GAS ONE HR AV STACK_GA	Pressure Drop Across Bag House PDI_359.Va	KI-101 Feed Assembly Pressure PI_105.Valu	Kiln Speed Controller ST_112.Val	KILN FLUE GAS TEMP HI SELECT TI_104HSEL	CBF Exit Gas Temp TI_204.Va	SCC OUTLET TEMP (MEDIAN) TI_268MED	SPRAY DRYER FLUE GAS TEMP TI_308MEI	KILN FEED HOUR RATE TOTAL KILN_FEED_I	B Scale HRT lbs MAX_WT_B.Value	Chlorine Feed Rate to Kiln CBF_BATCH_TIME_SEC	CBF Batch Time sec .Value	Weight/Hr for CBF Batch
Target	3.00					634,000						1,845	364	1,650		5.0		250.0
Average	(0.1)	15.6	0.2	0.8	638,073	637,994	7.7	(14.5)	3.1	708	773	1,870	360	1,640	Lbs Cl/hr	6.7		
Minimum	(0.3)	14.2	0.0	0.7	619,324	637,262	7.1	(14.7)	2.7	505	362	1,858	353	1,423	Minutes Fed	186	Batch	
Maximum	3.8	16.4	0.4	0.8	651,204	638,601	8.3	(14.5)	3.3	823	1,095	1,885	366	1,704	Cl%	21.14%	Lbs/hr	247.4
															Lbs fed	98.8		
11/21/13 9:18	(0.2)	15.7	0.1	0.7	635,826	638,427	7.5	(14.5)	3.0	558	505	1,885	354	1,511	9.5		6,941	482
11/21/13 9:19	(0.2)	16.2	0.1	0.7	629,992	638,392	7.7	(14.5)	3.0	588	497	1,879	356	1,552	10.1		6,941	
11/21/13 9:20	(0.2)	16.1	0.1	0.7	636,076	638,481	7.7	(14.5)	3.0	617	488	1,868	358	1,570	10.6		6,941	
11/21/13 9:21	(0.2)	15.7	0.0	0.8	645,388	638,542	7.5	(14.5)	3.0	617	481	1,864	358	1,605	11.1		6,941	
11/21/13 9:22	(0.2)	16.0	0.0	0.8	638,877	638,456	7.4	(14.5)	3.0	580	474	1,864	356	1,625	11.7		6,941	
11/21/13 9:23	(0.2)	15.4	0.2	0.8	641,428	638,513	7.5	(14.5)	3.0	544	467	1,879	355	1,662	12.2		6,941	
11/21/13 9:24	(0.3)	16.0	0.0	0.8	635,130	638,513	7.5	(14.5)	3.0	545	460	1,884	354	1,682	12.7		6,941	
11/21/13 9:25	(0.0)	16.0	0.0	0.8	630,117	638,579	7.6	(14.5)	3.0	597	454	1,880	353	1,704	13.3		6,941	
11/21/13 9:26	(0.0)	15.7	0.0	0.8	639,126	638,601	7.8	(14.5)	3.0	615	448	1,872	354	1,704	13.8		6,941	
11/21/13 9:27	(0.1)	16.2	0.1	0.7	634,524	638,523	7.6	(14.5)	3.0	662	442	1,863	355	1,684	14.3		6,941	
11/21/13 9:28	(0.0)	15.7	0.1	0.7	640,090	638,520	7.7	(14.5)	3.0	615	436	1,863	357	1,679	14.9		6,941	
11/21/13 9:29	(0.1)	15.8	0.0	0.7	641,552	638,427	7.7	(14.5)	3.0	580	431	1,869	358	1,659	15.4		6,941	
11/21/13 9:30	(0.1)	15.6	0.1	0.8	639,626	638,386	7.6	(14.5)	3.0	559	426	1,880	359	1,638	15.9		6,941	
11/21/13 9:31	(0.0)	15.9	0.0	0.7	644,335	638,306	7.7	(14.5)	3.0	541	421	1,883	359	1,647	16.4		6,941	
11/21/13 9:32	(0.1)	16.3	0.1	0.8	639,323	638,329	7.6	(14.5)	3.0	542	416	1,879	359	1,627	17.0		6,941	
11/21/13 9:33	(0.0)	16.0	0.1	0.7	634,327	638,310	7.8	(14.5)	3.0	523	411	1,877	357	1,628	17.5		6,941	
11/21/13 9:34	(0.1)	16.4	0.1	0.8	637,485	638,045	7.8	(14.5)	3.0	505	407	1,870	356	1,602	18.0		6,941	
11/21/13 9:35	(0.1)	15.9	0.1	0.8	636,361	637,969	7.9	(14.5)	3.0	511	403	1,870	355	1,587	18.6		6,941	
11/21/13 9:36	(0.2)	15.9	0.1	0.8	636,754	637,973	7.8	(14.5)	3.0	580	398	1,872	355	1,630	19.1		6,941	
11/21/13 9:37	(0.1)	15.7	0.1	0.7	635,612	637,995	7.7	(14.5)	3.0	577	394	1,870	356	1,607	19.6		6,941	
11/21/13 9:38	(0.1)	16.1	0.1	0.7	645,673	638,089	8.0	(14.5)	3.0	545	390	1,867	358	1,604	20.2		6,941	
11/21/13 9:39	(0.2)	15.6	0.1	0.7	641,338	638,123	7.9	(14.5)	3.0	522	387	1,877	359	1,603	20.7		6,941	
11/21/13 9:40	(0.2)	16.0	0.1	0.8	635,612	638,065	7.8	(14.7)	3.0	608	386	1,876	359	1,582	21.2		6,941	
11/21/13 9:41	(0.2)	15.6	0.1	0.8	649,295	638,000	7.7	(14.6)	3.0	588	387	1,874	358	1,575	21.8		6,941	
11/21/13 9:42	(0.2)	16.1	0.1	0.7	637,307	638,057	7.7	(14.7)	3.0	584	389	1,868	356	1,564	22.3		6,941	
11/21/13 9:43	(0.2)	15.8	0.1	0.8	631,705	638,106	8.0	(14.5)	3.0	620	391	1,866	355	1,538	22.8		-	140
11/21/13 9:44	(0.2)	15.7	0.1	0.8	639,037	638,067	7.6	(14.5)	3.0	625	392	1,867	354	1,508	23.4		52	
11/21/13 9:45	(0.2)	15.7	0.1	0.8	639,786	638,116	7.8	(14.5)	3.0	650	387	1,869	354	1,501	23.9		111	
11/21/13 9:46	(0.2)	16.0	0.1	0.7	633,221	638,166	7.9	(14.5)	3.0	641	377	1,866	357	1,492	24.4		171	
11/21/13 9:47	(0.2)	15.7	0.1	0.7	634,577	638,109	7.8	(14.5)	3.0	633	369	1,863	359	1,468	24.9		232	
11/21/13 9:48	(0.0)	15.6	0.1	0.7	637,164	638,092	7.9	(14.5)	3.0	639	365	1,866	360	1,447	25.5		289	
11/21/13 9:49	0.1	15.6	0.1	0.8	639,572	638,191	8.0	(14.5)	3.0	636	363	1,868	361	1,446	26.0		351	
11/21/13 9:50	0.1	15.5	0.2	0.8	635,219	638,185	7.9	(14.5)	3.0	637	362	1,869	361	1,424	26.5		411	
11/21/13 9:51	0.0	15.6	0.1	0.8	640,839	638,121	7.8	(14.5)	3.0	702	363	1,869	360	1,423	27.1		470	
11/21/13 9:52	(0.1)	15.2	0.2	0.7	639,233	638,163	7.9	(14.5)	3.0	658	364	1,870	359	1,446	27.6		529	
11/21/13 9:53	0.1	15.9	0.1	0.8	639,947	638,167	7.9	(14.5)	3.0	669	366	1,867	357	1,469	28.1		589	
11/21/13 9:54	(0.0)	15.4	0.2	0.8	637,003	638,174	7.9	(14.5)	3.0	663	369	1,868	357	1,491	28.7		649	
11/21/13 9:55	(0.0)	15.8	0.2	0.8	622,482	638,148	7.8	(14.5)	3.0	619	372	1,868	357	1,533	29.2		709	
11/21/13 9:56	0.1	15.4	0.2	0.7	642,409	638,021	7.9	(14.5)	3.0	589	376	1,875	358	1,555	29.7		767	
11/21/13 9:57	(0.1)	15.8	0.2	0.7	640,143	638,047	8.1	(14.5)	3.0	638	381	1,877	360	1,576	30.3		828	
11/21/13 9:58	(0.1)	15.4	0.2	0.7	636,397	638,027	8.3	(14.5)	3.0	661	388	1,875	361	1,620	30.8		886	
11/21/13 9:59	(0.1)	15.8	0.2	0.8	637,146	638,007	8.1	(14.5)	3.0	637	398	1,869	361	1,639	31.3		947	
11/21/13 10:00	(0.1)	15.6	0.2	0.8	649,580	638,137	7.8	(14.6)	3.0	659	407	1,865	360	1,661	31.9	22.3	1,005	
11/21/13 10:01	(0.1)	15.3	0.1	0.8	640,090	638,164	7.7	(14.6)	3.0	679	415	1,868	360	1,681	0.5		1,065	
11/21/13 10:02	(0.0)	15.6	0.1	0.8	639,483	638,255	7.7	(14.5)	3.0	629	422	1,867	359	1,635	1.0		1,125	
11/21/13 10:03	(0.1)	15.2	0.2	0.8	627,780	638,189	7.9	(14.5)	3.0	588	427	1,875	359	1,654	1.6		1,185	
11/21/13 10:04	(0.1)	16.0	0.1	0.7	648,635	638,124	7.8	(14.6)	3.0	663	432	1,874	359	1,653	2.1		1,243	
11/21/13 10:05	(0.1)	15.6	0.1	0.7	644,443	637,929	7.9	(14.6)	3.0	655	435	1,870	360	1,634	2.6		1,303	
11/21/13 10:06	(0.0)	15.8	0.2	0.7	641,660	637,917	7.7	(14.5)	3.0	650	438	1,863	361	1,657	3.2		1,361	
11/21/13 10:07	(0.1)	15.5	0.1	0.7	630,545	637,918	7.8	(14.5)	3.0	648	443	1,864	362	1,638	3.7		1,423	
11/21/13 10:08	(0.0)	15.5	0.1	0.7	636,129	637,807	7.7	(14.6)	3.0	714	463	1,870	363	1,660	4.2		1,481	
11/21/13 10:09	(0.1)	14.5	0.1	0.7	641,338	637,886	7.9	(14.5)	3.0	666	516	1,879	363	1,659	4.8		1,542	
11/21/13 10:10	0.0	14.6	0.1	0.8	640,928	637,851	7.7	(14.5)	3.0	739	582	1,882	362	1,637	5.3		1,602	
11/21/13 10:11	(0.1)	14.4	0.1	0.8	632,347	637,793	8.1	(14.5)	3.0	691	650	1,879	361	1,659	5.8		1,661	
11/21/13 10:12	(0.1)	14.6	0.1	0.8	637,556	637,717	7.7	(14.6)	3.0	677	713	1,875	360	1,675	6.4		1,721	
11/21/13 10:13	(0.1)	14.4	0.1	0.7	634,898	637,454	8.1	(14.5)	3.0	684	771	1,877	360	1,670	6.9		1,778	
11/21/13 10:14	(0.1)	14.8	0.1	0.7	636,040	637,418	7.9	(14.6)	3.0	635	819	1,874	360	1,664	7.4		1,840	
11/21/13 10:15	(0.0)	14.4	0.1	0.7	631,473	637,384	8.0	(14.6)	3.0	659	861	1,880	361	1,666	8.0		1,899	
11/21/13 10:16	(0.0)	14.6	0.2	0.7	638,538	637,417	7.8	(14.6)	3.0	708	899	1,882	362	1,667	8.5		1,958	
11/21/13 10:17	(0.1)	14.2	0.1	0.8	619,324	637,473	8.0	(14.5)	3.0	666	932	1,882	363	1,671	9.0		2,017	
11/21/13 10:18	(0.0)	14.5	0.1	0.8	643,693	637,274	8.2	(14.6)	3.0	729	961	1,883	363	1,671	9.5		2,078	
11/21/13 10:19	3.8	14.2	0.1	0.8	634,934	637,318	8.1	(14.6)	3.0	680	990	1,885	363	1,654	10.1		2,138	
11/21/13 10:20	3.6	14.5	0.0	0.8	637,449	637,347	7.5	(14.5)	3.0	701	1,015	1,880	363	1,658	10.6		2,197	
11/21/13 10:21	0.4	14.7	0.1	0.8	640,839	637,448	7.5	(14.5)	3.0	743	1,041	1,872	362	1,667	11.1		2,256	
11/21/13 10:22	(0.1)	15.2	0.1	0.8	646,262	637,376	7.5	(14.6)	3.0	679	1,058	1,861	362	1,670	11.7		2,316	
11/21/13 10:23	(0.2)	15.4	0.1	0.8	636,986	637,402	7.4	(14.5)	3.0	729	1,050	1,858	361	1,654	12.2		2,376	
11/21/13 10:24	(0.3)	15.0	0.1	0.8	624,034	637,391	7.6	(14.5)	3.0	701	1,030	1,864	360	1,670	12.7		2,435	
11/21/13 10:25	(0.3)	15.8	0.1	0.8	622,286	637,262	7.8	(14.6)	3.0	714	1,006	1,864	360	1,671	13.3		2,494	
11/21/13 10:26	(0.2)	15.3	0.0	0.8	640,785	637,362	7.7	(14.6)	3.0	693	993	1,866	360	1,666	13.8		2,555	
11/21/13 10:27	(0.2)	15.7	0.1	0.7	633,757	637,439	7.7	(14.6)	3.0	731	979	1,864	361	1,666	14.3		2,614	
11/21/13 10:28	(0.2)	15.2	0.1	0.7	634,720	637,394	7.5	(14.6)	3.0	703	961	1,865	361	1,652	14.9		2,673	
11/21/13 10:29	(0.3)	15.6	0.2	0.7	624,837	637,469	7.7	(14.6)	3.0	722	942	1,865	362	1,669	15.4		2,731	
11/21/13 10:30	(0.2)	15.7	0.1	0.7	640,607	637,414	7.7	(14.5)	3.0	702	929	1,864	362	1,671	15.9		2,791	
11/21/13 10:31	(0.3)	15.6	0.1	0.7	627,531	637,558	7.6	(14.6)	3.0	746	924	1,865	361	1,667	16.5		2,852	
11/21/13 10:32	(0.2)	14.7	0.1	0.8	629,725	637,605	7.5	(14.5)	3.0	705	941	1,871	360	1,649	17.0		2,911	
11/21/13 10:33	(0.2)	14.8	0.2	0.8	646,548	637,579	7.6	(14.5)	3.1	741	981	1,875	360	1,632	17.5		2,970	
11/21/13 10:34	(0.3)	14.8	0.1	0.8	632,222	637,682	7.6	(14.5)	3.1	729	1,028	1,874	360	1,658	18.0		3,030	
11/21/13 10:35	(0.3)	14.6	0.2	0.8	634,559	637,719	7.9	(14.5)	3.1	718	1,067	1,871	360	1,658	18.6		3,090	
11/21/13 10:36	(0.3)	14.8	0.1	0.8	638,823	637,669	7.7	(14.5)	3.1	728	1,091	1,868	361	1,639	19.1		3,150	
11/21/13 10:37	(0.3)	15.3	0.1	0.8	636,201	637,664	7.6	(14.5)	3.1	708	1,095	1,864	362	1,641	19.6		3,209	
11/21/13 10:38	(0.3)	15.1	0.1	0.7	642,623	637,541	7.6	(14.5)	3.1	758	1,087	1,866	362	1,666	20.2		3,269	
11/21/13 10:39	(0.3)	15.3	0.1	0.7	647,814	637,586	8.0	(14.6)	3.1	707	1,068	1,867	361	1,644	20.7		3,329	
11/21/13 10:40	(0.3)	15.7	0.1	0.7	636,522	637,646	7.8	(14.5)	3.1	701	1,048	1,865	360	1,648	21.2		3,389	
11/21/13 10:41	(0.1)	15.6	0.1	0.8	642,516	637,738	7.7	(14.5)	3.1	756	1,025	1,865	359	1,658	21.7		3,447	
11/21/13 10:42	0.1	15.3	0.1	0.8	636,522	637,676	7.8	(14.5)	3.1	702	1,004	1,867	359	1,648	22.3		3,508	
11/21/13 10:43	(0.0)	15.8	0.1	0.8	648,064	637,673	7.7	(14.5)	3.1	732	985	1,866	358	1,644	22.8		3,567	
11/21/13 10:44	(0.1)	15.7	0.1	0.8	644,246	637,755	7.6	(14.5)	3.1	728	965	1,866	358	1,668	23.3		3,626	
11/21/13 10:45	(0.1)	15.7	0.1	0.8	638,234	637,736	7.9	(14.5)	3.1	728	947	1,866	359	1,648	23.9		3,684	
11/21/13 10:46	(0.1)	15.4	0.1	0.7	633,007	637,734	7.8	(14.5)	3.0	706	932	1,869	359	1,635	24.4		3,746	
11/21/13 10:47	(0.1)	15.7	0.1	0.7	637,878	637,724	7.8	(14.5)	2.8	701	925	1,872	360	1,660	25.0		3,804	
11/21/13 10:48	(0.3)	15.4	0.1	0.7	640,571	637,776	7.9	(14.5)	2.7	662	935	1,877	361	1,664	25.5		3,865	
11/21/13 10:49	(0.2)	15.5	0.1	0.7	647,011	637,739	8.0	(14.5)	2.7	728	962	1,873	362	1,645	26.0		3,924	
11/21/13 10:50	0.0	14.7	0.1	0.7	644,335	637,842	7.5	(14.5)	2.7	718	999	1,873	362	1,646	26.5		3,984	
11/21/13 10:51	(0.1)	15.2	0.1	0.8	646,655	638,029	7.6	(14.5)	2.7	760	1,036	1,872	361	1,648	27.1		4,043	
11/21/13 10:52	(0.1)	14.7	0.2	0.8	640,482	638,030	7.5	(14.6)	3.0	762	1,067	1,874	358	1,669	27.6		4,103	
11/21/13 10:53	(0.3)	14.6	0.1	0.8	641,909	638,111	7.6	(14.5)	3.0	752	1,086	1,877	356	1,663	28.1		4,162	
11/21/13 10:54	(0.3)	15.3	0.2	0.8	636,540	638,088	7.8	(14.5)	3.0	795	1,087	1,874	354	1,681	28.7		4,222	
11/21/13 10:55	(0.2)	15.3	0.1	0.8	643,479	638,045	7.7	(14.5)	3.0	717	1,074	1,870	353	1,658	29.2		4,281	

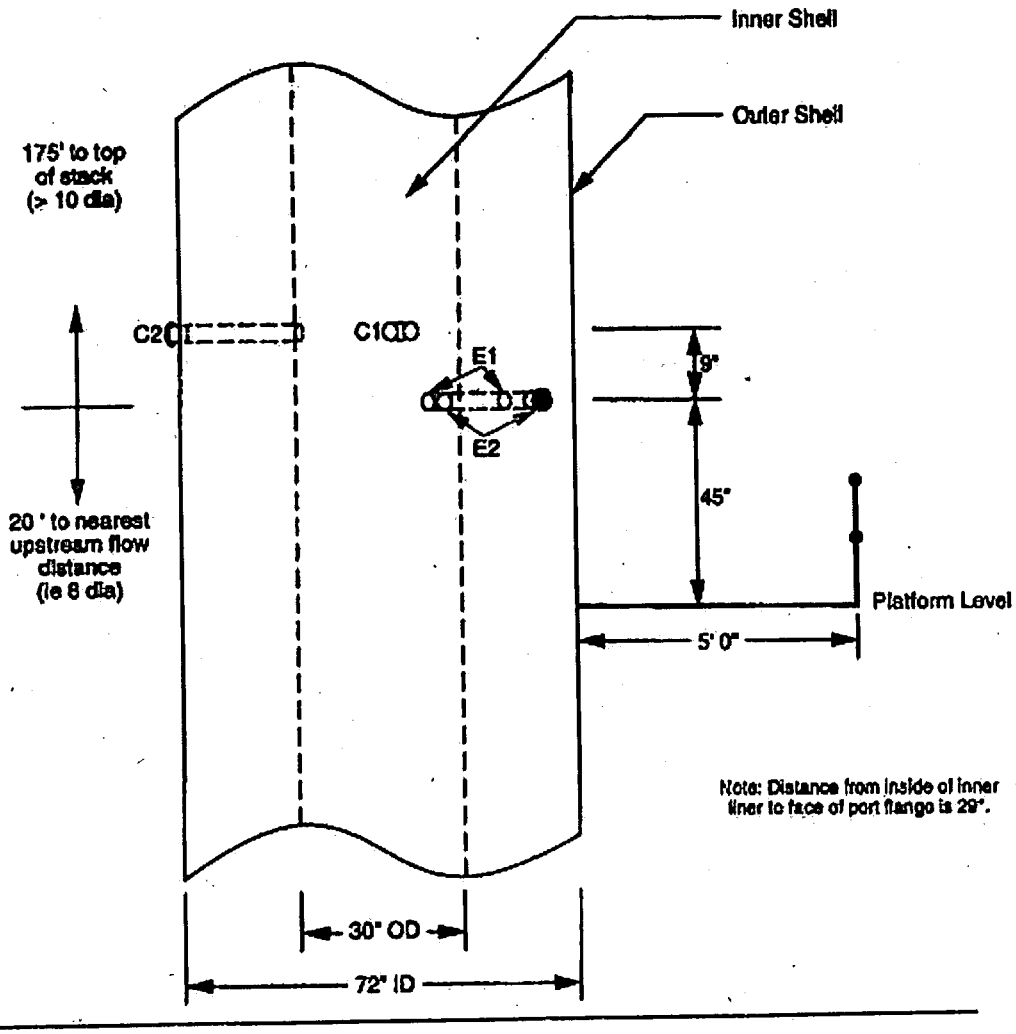
11/21/13 10:56	(0.2)	15.7	0.2	0.8	635,273	638,082	7.6	(14.5)	3.0	766	1,056	1,867	354	1,669	29.7		4,342	
11/21/13 10:57	(0.3)	15.6	0.2	0.7	639,554	638,145	7.6	(14.5)	3.0	799	1,034	1,869	356	1,685	30.3		4,400	
11/21/13 10:58	(0.2)	15.6	0.2	0.7	635,576	638,119	7.8	(14.5)	3.0	725	1,012	1,869	359	1,663	30.8		4,460	
11/21/13 10:59	(0.1)	15.7	0.2	0.7	635,005	638,105	7.9	(14.5)	3.0	757	991	1,870	360	1,663	31.3		4,518	
11/21/13 11:00	(0.2)	16.0	0.2	0.8	643,426	638,110	7.7	(14.5)	3.0	753	972	1,869	361	1,682	31.8	31.8	4,580	
11/21/13 11:01	(0.2)	15.7	0.2	0.8	628,868	638,035	7.6	(14.6)	3.2	773	956	1,870	361	1,660	0.5		4,640	
11/21/13 11:02	(0.2)	15.7	0.1	0.8	637,663	637,959	7.6	(14.6)	3.3	745	941	1,871	360	1,683	1.0		4,698	
11/21/13 11:03	(0.2)	15.8	0.2	0.7	641,874	637,929	7.6	(14.6)	3.2	754	932	1,870	358	1,664	1.6		4,758	
11/21/13 11:04	(0.2)	15.6	0.2	0.7	638,877	638,119	7.7	(14.5)	3.2	815	933	1,873	357	1,665	2.1		4,817	
11/21/13 11:05	(0.2)	15.1	0.1	0.7	638,092	638,388	7.7	(14.5)	3.3	735	953	1,876	356	1,676	2.6		4,877	
11/21/13 11:06	(0.2)	15.3	0.1	0.8	641,303	638,212	7.7	(14.5)	3.3	786	988	1,875	356	1,672	3.2		4,937	
11/21/13 11:07	(0.3)	14.9	0.1	0.8	640,839	638,233	7.9	(14.6)	3.2	741	1,025	1,875	357	1,677	3.7		4,997	
11/21/13 11:08	(0.2)	15.1	0.1	0.7	642,552	638,247	7.7	(14.5)	3.2	780	1,059	1,875	359	1,656	4.2		5,056	
11/21/13 11:09	(0.2)	14.9	0.1	0.7	644,371	638,229	7.8	(14.5)	3.3	763	1,081	1,876	360	1,658	4.7		5,115	
11/21/13 11:10	(0.3)	15.3	0.1	0.7	639,447	638,103	8.0	(14.6)	3.3	765	1,086	1,872	361	1,663	5.3		5,175	
11/21/13 11:11	(0.2)	15.5	0.2	0.8	635,255	638,207	7.8	(14.5)	3.3	755	1,075	1,867	361	1,669	5.8		5,235	
11/21/13 11:12	(0.3)	15.6	0.1	0.8	632,419	638,287	7.9	(14.5)	3.2	766	1,058	1,867	361	1,659	6.4		5,294	
11/21/13 11:13	(0.2)	15.9	0.1	0.8	636,379	638,257	7.9	(14.5)	3.3	743	1,036	1,867	359	1,661	6.9		5,354	
11/21/13 11:14	(0.2)	15.9	0.1	0.7	631,437	638,197	8.0	(14.5)	3.3	740	1,016	1,868	357	1,648	7.4		5,413	
11/21/13 11:15	(0.2)	16.1	0.0	0.8	626,531	638,306	7.6	(14.5)	3.2	712	996	1,866	356	1,648	8.0		5,473	
11/21/13 11:16	(0.2)	15.9	0.2	0.8	633,953	638,220	7.9	(14.5)	3.3	762	978	1,868	355	1,648	8.5		5,532	
11/21/13 11:17	(0.2)	15.5	0.2	0.8	638,823	638,191	7.7	(14.5)	3.2	732	962	1,873	356	1,632	9.0		5,593	
11/21/13 11:18	(0.2)	15.7	0.2	0.8	638,877	638,385	8.2	(14.5)	3.3	763	949	1,873	358	1,657	9.5		5,652	
11/21/13 11:19	(0.2)	16.2	0.1	0.7	643,354	638,390	7.8	(14.6)	3.3	765	938	1,869	359	1,655	10.1		5,712	
11/21/13 11:20	(0.2)	15.5	0.2	0.7	637,271	638,399	7.7	(14.5)	3.2	753	936	1,870	360	1,655	10.6		5,771	
11/21/13 11:21	(0.2)	15.8	0.1	0.8	640,054	638,223	7.9	(14.5)	3.3	744	950	1,870	361	1,657	11.1		5,830	
11/21/13 11:22	(0.2)	15.3	0.2	0.8	651,204	638,201	7.2	(14.5)	3.3	784	978	1,873	362	1,656	11.7		5,889	
11/21/13 11:23	(0.2)	14.9	0.1	0.7	643,675	638,346	7.4	(14.5)	3.3	773	1,010	1,875	363	1,657	12.2		5,948	
11/21/13 11:24	(0.2)	15.2	0.1	0.7	634,952	638,385	7.2	(14.6)	3.2	772	1,042	1,872	363	1,644	12.7		6,009	
11/21/13 11:25	(0.2)	14.8	0.2	0.7	630,510	638,428	7.4	(14.5)	3.2	757	1,068	1,872	362	1,665	13.3		6,068	
11/21/13 11:26	(0.3)	15.2	0.1	0.8	640,839	638,327	7.3	(14.5)	3.3	739	1,078	1,870	361	1,653	13.8		6,127	
11/21/13 11:27	(0.2)	15.4	0.2	0.8	630,563	638,240	7.5	(14.5)	3.3	793	1,073	1,869	360	1,658	14.3		6,186	
11/21/13 11:28	(0.2)	15.6	0.1	0.8	623,267	638,341	7.4	(14.5)	3.3	770	1,059	1,867	359	1,659	14.9		6,246	
11/21/13 11:29	(0.2)	15.8	0.2	0.7	632,312	638,369	7.3	(14.5)	3.2	764	1,040	1,865	358	1,642	15.4		6,307	
11/21/13 11:30	(0.2)	15.3	0.2	0.8	639,323	638,376	7.5	(14.5)	3.3	760	1,020	1,868	358	1,664	15.9		6,366	
11/21/13 11:31	(0.2)	15.9	0.2	0.8	635,487	638,372	7.2	(14.6)	3.3	789	1,001	1,869	359	1,645	16.5		6,426	
11/21/13 11:32	(0.3)	15.7	0.2	0.7	644,050	638,324	7.6	(14.6)	3.3	769	985	1,870	360	1,667	17.0		6,485	
11/21/13 11:33	(0.2)	15.7	0.2	0.7	639,091	638,343	7.6	(14.5)	3.2	756	970	1,870	361	1,687	17.5		6,545	
11/21/13 11:34	(0.2)	15.8	0.3	0.8	634,702	638,271	7.7	(14.5)	3.2	727	956	1,870	361	1,667	18.0		6,605	
11/21/13 11:35	(0.2)	16.3	0.2	0.8	643,533	638,205	7.4	(14.5)	3.3	775	944	1,867	361	1,666	18.6		6,664	
11/21/13 11:36	(0.3)	15.6	0.2	0.8	647,333	638,292	7.3	(14.6)	3.3	782	938	1,869	361	1,665	19.1		6,723	
11/21/13 11:37	(0.3)	15.4	0.2	0.8	643,765	638,314	7.9	(14.5)	3.2	757	942	1,872	360	1,686	19.6		6,783	
11/21/13 11:38	(0.2)	15.5	0.3	0.7	621,394	638,295	7.6	(14.5)	3.2	715	964	1,874	359	1,664	20.2		6,843	
11/21/13 11:39	(0.2)	15.7	0.2	0.7	643,889	638,163	7.7	(14.5)	3.2	773	996	1,874	359	1,668	20.7		6,900	
11/21/13 11:40	(0.2)	15.0	0.3	0.7	639,287	638,152	7.8	(14.5)	3.3	770	1,031	1,874	360	1,669	21.2		6,962	
11/21/13 11:41	(0.2)	15.4	0.2	0.7	646,779	638,123	7.8	(14.5)	3.3	710	1,059	1,868	362	1,649	21.8		7,020	
11/21/13 11:42	(0.2)	15.4	0.3	0.8	640,143	638,184	7.9	(14.5)	3.2	746	1,076	1,867	362	1,669	22.3		7,080	
11/21/13 11:43	(0.2)	15.5	0.3	0.7	641,909	638,129	7.7	(14.5)	3.2	798	1,078	1,869	363	1,673	22.8		7,140	
11/21/13 11:44	(0.3)	15.4	0.3	0.8	636,647	638,086	8.2	(14.5)	3.3	728	1,067	1,869	363	1,656	23.4		7,201	
11/21/13 11:45	(0.2)	15.7	0.3	0.7	645,495	638,064	7.7	(14.5)	3.3	724	1,050	1,873	362	1,657	23.9		7,259	
11/21/13 11:46	(0.2)	16.1	0.3	0.8	640,821	638,102	7.8	(14.5)	3.2	724	1,028	1,873	360	1,681	24.4		7,319	
11/21/13 11:47	(0.2)	16.2	0.3	0.8	639,519	638,159	8.0	(14.6)	3.3	777	1,004	1,868	358	1,660	25.0		7,379	
11/21/13 11:48	(0.2)	15.8	0.4	0.8	626,014	638,203	7.7	(14.5)	3.3	725	979	1,866	357	1,658	25.5		7,438	
11/21/13 11:49	(0.2)	15.9	0.3	0.7	644,460	638,130	8.0	(14.5)	3.3	763	956	1,866	357	1,673	26.0		7,497	
11/21/13 11:50	(0.2)	16.3	0.3	0.7	643,247	638,009	7.9	(14.5)	3.3	749	936	1,865	358	1,672	26.5		7,557	
11/21/13 11:51	(0.2)	15.9	0.3	0.7	649,081	637,837	7.2	(14.5)	3.2	770	918	1,865	360	1,672	27.1		7,617	
11/21/13 11:52	(0.3)	15.7	0.3	0.7	646,637	637,913	7.3	(14.5)	3.3	755	902	1,865	362	1,651	27.6		7,677	
11/21/13 11:53	(0.2)	15.9	0.3	0.8	634,417	637,813	7.3	(14.5)	3.2	737	887	1,865	363	1,658	28.1		7,736	
11/21/13 11:54	(0.2)	16.0	0.3	0.7	636,147	637,789	7.3	(14.5)	3.2	766	874	1,865	365	1,641	28.7		7,795	
11/21/13 11:55	(0.2)	16.0	0.3	0.7	631,223	637,805	7.5	(14.5)	3.2	765	861	1,865	366	1,666	29.2		7,855	
11/21/13 11:56	(0.2)	15.8	0.3	0.7	639,572	637,818	7.1	(14.6)	3.3	766	850	1,867	366	1,655	29.7		7,913	
11/21/13 11:57	(0.2)	15.9	0.3	0.8	641,802	637,878	7.1	(14.5)	3.3	733	840	1,866	363	1,639	30.3		7,973	
11/21/13 11:58	(0.2)	16.0	0.3	0.8	644,050	637,971	7.3	(14.5)	3.2	782	830	1,866	360	1,658	30.8		8,034	
11/21/13 11:59	(0.2)	15.9	0.3	0.8	638,877	637,848	7.6	(14.5)	3.3	773	821	1,867	358	1,655	31.3		8,094	
11/21/13 12:00	(0.3)	15.8	0.3	0.8	638,466	637,817	7.2	(14.5)	3.3	760	813	1,867	357	1,636	31.8	31.8	8,154	
11/21/13 12:01	(0.2)	15.9	0.3	0.7	639,679	637,861	7.4	(14.6)	3.3	801	805	1,867	358	1,657	0.5		8,213	
11/21/13 12:02	(0.3)	15.7	0.3	0.7	644,924	637,875	7.4	(14.5)	3.2	734	797	1,867	360	1,653	1.0		8,272	
11/21/13 12:03	(0.2)	16.3	0.3	0.7	633,507	637,884	7.5	(14.5)	3.2	755	790	1,863	362	1,652	1.6		8,314	
11/21/13 12:04	(0.2)	15.9	0.3	0.7	639,947	637,871	7.5	(14.5)	3.3	741	767	1,863	363	1,651	2.1		8,314	
11/21/13 12:05	(0.3)	15.9	0.3	0.8	635,737	637,646	7.5	(14.5)	3.3	753	735	1,868	364	1,662	2.6		8,314	
11/21/13 12:06	(0.2)	16.0	0.3	0.7	643,729	637,765	7.4	(14.5)	3.3	768	700	1,870	365	1,648	3.2		8,314	
11/21/13 12:07	(0.2)	15.8	0.2	0.7	631,955	637,789	7.5	(14.5)	3.3	752	669	1,868	365	1,646	3.7		8,314	
11/21/13 12:08	(0.2)	16.1	0.2	0.8	641,196	637,794	7.4	(14.5)	3.3	786	643	1,864	362	1,664	4.2		8,314	
11/21/13 12:09	(0.2)	15.9	0.3	0.8	637,967	637,789	7.5	(14.5)	3.3	778	619	1,863	360	1,663	4.8		8,314	
11/21/13 12:10	(0.2)	15.7	0.3	0.8	637,164	637,843	7.6	(14.5)	3.3	807	598	1,867	358	1,659	5.3		8,314	
11/21/13 12:11	(0.2)	15.9	0.3	0.7	642,659	637,842	7.6	(14.5)	3.2	774	580	1,869	357	1,651	5.8		8,314	
11/21/13 12:12	(0.2)	16.1	0.3	0.7	631,705	637,850	7.7	(14.5)	3.2	743	564	1,867	359	1,649	6.3		8,314	
11/21/13 12:13	(0.1)	15.9	0.3	0.8	637,895	637,864	7.6	(14.5)	3.3	745	549	1,865	360	1,652	6.9		8,314	
11/21/13 12:14	(0.2)	16.2	0.3	0.7	636,272	637,859	7.8	(14.5)	3.2	730	537	1,862	362	1,670	7.4		8,314	
11/21/13 12:15	(0.2)	16.1	0.2	0.7	638,341	637,794	7.7	(14.5)	3.2	780	525	1,862	363	1,670	7.9		8,314	
11/21/13 12:16	(0.2)	15.7	0.3	0.8	639,947	637,851	7.7	(14.5)	3.2	764	514	1,866	364	1,670	8.5		8,314	
11/21/13 12:17	(0.2)	15.8	0.2	0.8	630,617	637,875	7.8	(14.5)	3.2	768	505	1,869	364	1,684	9.0		8,314	
11/21/13 12:18	(0.3)	16.1	0.3	0.8	644,264	637,832	8.0	(14.5)	3.2	760	496	1,868	362	1,658	9.6		8,314	
11/21/13 12:19	(0.2)	16.0	0.3	0.8	634,702	637,863	7.8	(14.5)	3.2	806	487	1,866	360	1,658	10.1		8,314	
11/21/13 12:20	(0.3)	15.4	0.3	0.7	635,148	637,872	7.6	(14.5)	3.3	791	479	1,868	359	1,658	10.6		8,314	
11/21/13 12:21	(0.2)	15.8	0.3	0.7	633,953	637,893	7.7	(14.5)	3.3	823	472	1,869	358	1,674	11.1		8,314	
11/21/13 12:22	(0.2)	15.9	0.3	0.8	640,589	637,891	7.8	(14.5)	3.3	752	465	1,868	358	1,650	11.7		8,314	
11/21/13 12:23	(0.1)	15.9	0.4	0.8	635,095	637,743	7.9	(14.5)	3.2	786	458	1,866	359	1,675	12.2		8,314	
11/21/13 12:24	(0.2)	16.2	0.3	0.7	641,767	637,706	7.9	(14.5)	3.2	815	451	1,865	361	1,676	12.7	12.7	8,314	577

Schematic of the Test Location

Rotary Kiln Incinerator Exhaust Stack

General Dynamics – Carthage, MO





Particulate Traverse Point Locations for Circular Stacks

Facility: General Dynamics

Source Identification: Rotary Kiln Incinerator

Stack Diameter: 30 inches

Sampling Locations: 8.00 diameters downstream
70.0 diameters upstream

Minimum Number of Traverse points as specified by EPA Method 1: 12

Number of traverse points sampled: 12

Traverse Point Number	Percent of Stack Diameter From Inside Wall	Distance in Inches From Inside Wall*
1	4.4	1.3
2	14.6	4.4
3	29.6	8.9
4	70.4	21.1
5	85.4	25.6
6	95.6	28.7

*Traverse points located within 1.00" to the stack wall for stacks having an inside diameter greater than 24" will be relocated as well as traverse points located within 0.50 inches to the stack wall on stacks with a 24" ID or less to meet criteria.

Field Data and Calculations

Summary of Results - PCDD/PCDF
General Dynamics
Rotary Kiln Incinerator - Building 6
Carthage, Missouri

Sample Volume	96.299 dscf	Volumetric Flow Rate	6412 DSCFM
Sample Volume	2.73 m^3		

Run 2 Isomer	Sample Collected (pg)	EPA Equivalency Factor	Toxic Equivalency [a] (ng/dscm)
2378-TCDD	5.0	1	1.8E-03
12378-PeCDD	11.0	0.5	2.0E-03
123478-HxCDD	5.0	0.1	1.8E-04
123678-HxCDD	8.0	0.1	2.9E-04
123789-HxCDD	13.0	0.1	4.8E-04
1234678-HpCDD	29.0	0.01	1.1E-04
Total OCDD	67.0	0.001	2.5E-05
2378-TCDF	77	0.1	2.8E-03
12378-PeCDF	58	0.05	1.1E-03
23478-PeCDF	90	0.5	1.7E-02
123478-HxCDF	148	0.1	5.4E-03
123678-HxCDF	86	0.1	3.2E-03
234678-HxCDF	54	0.1	2.0E-03
123789-HxCDF	18	0.1	6.6E-04
1234678-HpCDF	209.0	0.01	7.7E-04
1234789-HpCDF	62	0.01	2.3E-04
Total OCDF	139	0.001	5.1E-05
TOTAL TEQs (ng/m^3)			0.038
TOTAL TEQs (ng/m^3 @ 7 % O_2)			0.096

[a] U.S EPA (1989) Toxic Equivalency Factor
[b] PCDD/PCDF Standard = 0.4 ng/dscm

O'BRIEN & GERE

Summary of Results - PCDD/PCDF
General Dynamics
Rotary Kiln Incinerator - Building 6
Carthage, Missouri

Sample Volume	95.782 dscf	Volumetric Flow Rate	6356 DSCFM
Sample Volume	2.71 m^3		

Run 3 Isomer	Sample Collected (pg)	EPA Equivalency Factor	Toxic Equivalency [a] (ng/dscm)
2378-TCDD	7.0	1	2.6E-03
12378-PeCDD	12	0.5	2.2E-03
123478-HxCDD	6	0.1	2.2E-04
123678-HxCDD	9	0.1	3.3E-04
123789-HxCDD	14	0.1	5.2E-04
1234678-HpCDD	26	0.01	9.6E-05
Total OCDD	70	0.001	2.6E-05
2378-TCDF	125	0.1	4.6E-03
12378-PeCDF	55	0.05	1.0E-03
23478-PeCDF	90	0.5	1.7E-02
123478-HxCDF	82	0.1	3.0E-03
123678-HxCDF	83	0.1	3.1E-03
234678-HxCDF	57	0.1	2.1E-03
123789-HxCDF	17	0.1	6.3E-04
1234678-HpCDF	217.0	0.01	8.0E-04
1234789-HpCDF	65	0.01	2.4E-04
Total OCDF	108	0.001	4.0E-05
TOTAL TEQs (ng/m^3)			0.038
TOTAL TEQs (ng/m^3 @ 7 % O_2)			0.099

[a] U.S EPA (1989) Toxic Equivalency Factor
[b] PCDD/PCDF Standard = 0.4 ng/dscm

O'BRIEN & GERE

Summary of Results - PCDD/PCDF
General Dynamics
Rotary Kiln Incinerator - Building 6
Carthage, Missouri

Sample Volume	96.450 dscf	Volumetric Flow Rate	6403 DSCFM
Sample Volume	2.73 m^3		

Run 33 Isomer	Sample Collected (µg)	EPA Equivalency Factor	Toxic Equivalency [a] (ng/dscm)
2378-TCDD	8.0	1	2.9E-03
12378-PeCDD	14.0	0.5	2.6E-03
123478-HxCDD	7.0	0.1	2.6E-04
123678-HxCDD	11.0	0.1	4.0E-04
123789-HxCDD	17.0	0.1	6.2E-04
1234678-HpCDD	38.0	0.01	1.4E-04
Total OCDD	62.0	0.001	2.3E-05
2378-TCDF	178	0.1	6.5E-03
12378-PeCDF	70	0.05	1.3E-03
23478-PeCDF	100	0.5	1.8E-02
123478-HxCDF	178	0.1	6.5E-03
123678-HxCDF	107	0.1	3.9E-03
234678-HxCDF	81.0	0.1	3.0E-03
123789-HxCDF	23.0	0.1	8.4E-04
1234678-HpCDF	246.0	0.01	9.0E-04
1234789-HpCDF	82.0	0.01	3.0E-04
Total OCDF	109.0	0.001	4.0E-05
TOTAL TEQs (ng/m^3)			0.049
TOTAL TEQs (ng/m^3 @ 7 % O_2)			0.126

[a] U.S EPA (1989) Toxic Equivalency Factor

[b] PCDD/PCDF Standard = 0.4 ng/dscm

O'BRIEN & GERE

Test Data Summary and Calculations
General Dynamics
Rotary Kiln Incinerator - Building 6
Carthage, Missouri

Parameter	Run 2	Run 3	Run 4
Run Date	20Nov13	20Nov13	21Nov13
Start/Stop Time	1449-1754	1818-2122	0918-1224
Duration of Run, Minutes	180	180	180
Ave. Nozzle Diameter, inches	0.265	0.265	0.265
Pitot Calibration Factor, CF	0.84	0.84	0.84
Meter Gamma	1.020	1.020	1.020
Meter Delta H, inches of H2O	1.990	1.990	1.990
Stack Diameter, inches	30	30	30
Rectangular Width, inches		0	0
Rectangular Length, inches		0	0
Stack Area, sq.ft.	4.91	4.91	4.91
Barometric Pressure, inches of Hg	28.87	28.87	29.03
Static Pressure, inches of H2O	-0.41	-0.36	-0.38
Dry Gas Meter Sample Volume, (VM)ft3			
Initial	83.319	180.474	277.932
Final	180.329	276.701	372.704
Actual Volume Collected	97.01	96.227	94.772
Ave. Stack Temperature, Ts(F)	221.7	223.3	215.2
Ave. Meter Temperature, Tm(F)	64.7	63.3	54.6
Ave. Run Delta H, inches of H2O	0.93	0.92	0.92
Ave. Square Root of Delta P	0.5656	0.5614	0.5606
Moisture Data			
Volume of water collected, mls	614.7	610.8	618.4
Silica Gel, grams	28.6	30.6	28
Total Collected, mls	643.3	641.4	646.4
ORSAT Data			
%O2	15.50	15.60	15.60
%CO2	3.78	3.60	3.50
%CO			

Calculations

Vw(std), scf =	30.280	30.191	30.426
Vm(std), dscf =	96.299	95.782	96.450
Bws=	0.239	0.240	0.240
Md=	29.22	29.20	29.18
Ms=	26.54	26.52	26.50
Vs, ft/sec =	38.3	38.1	37.7
Qs, acfm =	11,288	11,222	11,112
Qs(std), dscfm =	6,412	6,356	6,403
Isokinetic Sampling Rate, %	107.0	107.3	107.3

Where:

An = area of the nozzle
As = area of the stack
Vw(std) = volume of water vapor in gas, standard conditions = 0.04707*Vlc
Vm(std) = vol. of gas sampled, standard conditions = 17.647 x Vm x gamma x [Pb + (dH/13.6)]/Tm(R)
Bws = water vapor in gas stream, proportion by volume = Vw(std)/(Vm(std) + Vw(std))
Md = molecular weight of stack gas, dry basis = (0.44 x%CO2) + (0.32 x%O2) + [0.28 x (%N2 + %CO)]
Ms = molecular weight of stack gas, wet basis = [Md x (1-Bws)] + (18.0 x Bws)
Vs = stack gas velocity = 85.49 x Cp x (avg. Sq.Rt. dP) x [Sq.Rt. (Ts(R))/(Ms x Ps)]
Qs = stack gas flow rate = Vs x As x 60
Qs(std) = stack gas flow rate, standard conditions = Qs x (1-Bws) x (528/(Ts(R)) x (Ps/29.92)
Isokinetic sampling rate = {(Ts(R)) x [(0.00267 x Vlc) + (Vm(std)/17.647)] x 100}/(Time x vs x Ps x An x60)

Field Da[illegible]ummary
General Dynamics
Rotary Kiln Incinerator - Building 6
Carthage, Missouri

	Run 2							Run 3							Run 4					
Traverse Point	Stack Temp(F)	Delta P	Delta H	Tm(F) in	Tm(F) out	SQRT Delta P		Stack Temp(F)	Delta P	Delta H	Tm(F) in	Tm(F) out	SQRT Delta P		Stack Temp(F)	Delta P	Delta H	Tm(F) in	Tm(F) out	SQRT Delta P
A1	216	0.30	0.87	67	62	0.5477		222	0.32	0.93	64	61	0.5657		209	0.30	0.87	48	48	0.5477
1	221	0.31	0.90	66	62	0.5568		221	0.31	0.90	64	61	0.5568		209	0.30	0.87	49	48	0.5477
1	220	0.30	0.87	66	62	0.5477		220	0.32	0.93	65	61	0.5657		209	0.30	0.87	50	48	0.5477
2	222	0.33	0.96	67	62	0.5745		222	0.34	0.99	66	61	0.5831		213	0.33	0.96	52	49	0.5745
2	222	0.34	0.99	68	62	0.5831		222	0.34	0.99	66	61	0.5831		213	0.33	0.96	54	49	0.5745
2	222	0.35	1.00	68	62	0.5916		222	0.33	0.96	66	61	0.5745		213	0.34	0.99	55	50	0.5831
3	223	0.34	0.99	69	62	0.5831		222	0.32	0.93	66	61	0.5657		213	0.34	0.99	55	49	0.5831
3	224	0.35	1.00	69	63	0.5916		222	0.34	0.99	68	61	0.5831		215	0.34	0.99	56	50	0.5831
3	224	0.35	1.00	70	63	0.5916		224	0.34	0.99	66	61	0.5831		215	0.34	0.99	56	50	0.5831
4	223	0.34	0.99	70	63	0.5831		224	0.33	0.96	68	61	0.5745		215	0.34	0.99	57	50	0.5831
4	225	0.33	0.96	69	63	0.5745		225	0.33	0.96	66	60	0.5745		216	0.34	0.99	58	51	0.5831
4	225	0.33	0.96	71	63	0.5745		225	0.33	0.96	66	60	0.5745		216	0.34	0.99	57	51	0.5831
5	223	0.27	0.79	71	64	0.5196		224	0.32	0.93	66	60	0.5657		215	0.31	0.90	58	51	0.5568
5	223	0.28	0.81	70	63	0.5292		224	0.32	0.93	66	60	0.5657		216	0.31	0.90	58	52	0.5568
5	223	0.29	0.84	69	63	0.5385		224	0.32	0.93	65	60	0.5657		216	0.31	0.90	58	52	0.5568
6	220	0.24	0.70	69	63	0.4899		223	0.26	0.76	65	60	0.5099		215	0.28	0.81	58	51	0.5292
6	222	0.24	0.70	69	63	0.4899		223	0.26	0.76	65	60	0.5099		214	0.28	0.81	58	52	0.5292
6	220	0.22	0.64	68	62	0.4690		222	0.26	0.76	65	60	0.5099		214	0.27	0.79	58	52	0.5196
B1	221	0.30	0.87	61	59	0.5477		224	0.34	0.99	62	60	0.5831		213	0.32	0.93	54	52	0.5657
1	222	0.31	0.90	62	59	0.5568		224	0.33	0.96	65	60	0.5745		212	0.32	0.93	57	52	0.5657
1	222	0.31	0.90	63	59	0.5568		223	0.33	0.96	66	60	0.5745		213	0.32	0.93	58	53	0.5657
2	220	0.30	0.87	65	59	0.5477		224	0.34	0.99	66	60	0.5831		215	0.35	1.02	58	53	0.5916
2	220	0.30	0.87	65	60	0.5477		224	0.35	1.00	66	60	0.5916		215	0.35	1.02	58	53	0.5916
2	221	0.31	0.90	66	60	0.5568		223	0.35	1.00	66	61	0.5916		216	0.35	1.02	59	53	0.5916
3	223	0.39	1.10	67	60	0.6245		223	0.34	0.99	66	60	0.5831		218	0.33	0.96	60	53	0.5745
3	223	0.37	1.10	67	61	0.6083		224	0.34	0.99	67	61	0.5831		218	0.34	0.99	60	53	0.5831
3	222	0.39	1.10	68	61	0.6245		224	0.34	0.99	67	61	0.5831		218	0.35	1.02	60	54	0.5916
4	224	0.37	1.10	68	61	0.6083		224	0.33	0.96	67	61	0.5745		218	0.34	0.99	61	54	0.5831
4	224	0.37	1.10	68	62	0.6083		224	0.32	0.93	67	61	0.5657		219	0.33	0.96	61	54	0.5745
4	224	0.37	1.10	69	62	0.6083		226	0.32	0.93	67	61	0.5657		219	0.33	0.96	61	54	0.5745
5	219	0.33	0.96	69	62	0.5745		224	0.29	0.84	67	61	0.5385		219	0.30	0.87	61	55	0.5477
5	219	0.32	0.93	69	62	0.5657		224	0.29	0.84	67	61	0.5385		218	0.28	0.81	61	55	0.5292
5	220	0.33	0.96	69	62	0.5745		224	0.29	0.84	67	61	0.5385		218	0.28	0.81	61	54	0.5292
6	219	0.33	0.96	69	62	0.5745		223	0.28	0.81	67	61	0.5292		218	0.25	0.73	60	54	0.5000
6	220	0.32	0.93	69	62	0.5657		223	0.25	0.73	66	61	0.5000		217	0.25	0.73	60	55	0.5000
6	219	0.33	0.96	69	62	0.5745		223	0.25	0.73	66	61	0.5000		217	0.25	0.73	60	55	0.5000
						0.0000							0.0000							0.0000
Average	222	0.32	0.93	68	62	0.5656		223	0.32	0.92	66	61	0.5614		215	0.32	0.92	57	52	0.5606

O'BRIEN & GERE

EPA Isokinetic Field Sheet

Methods Performed: M23

Client	General Dynamics	Run Number	2	Pitot Number	PS-A
Location	Carthage, MO	Stack Diameter	30	Pitot Coefficient	0.84
Source	Bldg 6	Barometric Pres.	28.87	Stack TC I.D.	PS-4
Date	11/28/18	Static Pressure	-0.41	Oven Box I.D.	HB-1
Operators	SMib / BGoodhde	Meter Box #	7	Impinger Out I.D.	IO-11
Start Time	1449	Meter delta H	1.99	Nozzle Size	0.265
End Time		Meter Gamma	1.022	XAD Trap I.D.	M23

Leak Check Rates	Sample Rate in.	Sample Rate cfm	Pitot +	Pitot -
Initial	10	0.007	✓	✓
Mid	8	0.007	✓	✓
Mid				
Final	6		✓	✓

Sample Point	Sample Time (min)	Velocity Head (in. H_2O)	Orifice Setting (in. H_2O)	Meter Volume (ft^3)	Temperature Readings in Degrees Farenheit: Stack	Probe	Oven Box	Impinger	Aux	Meter Inlet	Meter Outlet	Vacuum (in. hg)	Comments/Notes
B1	0	0.30	0.87	83.319	221	233	250	53	50	61	59	4.0	Kc = 2.91
1	5	0.31	0.90	85.95	222	230	253	52	50	62	59	4.0	
1	10	0.31	0.90	88.61	222	232	255	50	49	63	59	4.5	
2	15	0.30	0.87	91.25	220	260	253	49	50	65	59	4.5	
2	20	0.30	0.87	93.845	220	259	252	50	51	65	60	4.5	
2	25	0.31	0.90	96.43	221	258	252	51	51	66	60	4.5	
3	30	0.39	1.1	99.06	223	257	251	52	52	67	60	5.5	
3	35	0.37	1.1	102.02	223	259	250	52	49	67	61	5.5	
3	40	0.39	1.1	104.96	222	259	252	51	49	68	61	5.5	
4	45	0.37	1.1	107.92	224	256	251	51	48	68	61	5.5	
4	50	0.37	1.1	110.86	224	249	252	51	48	68	62	5.5	
4	55	0.37	1.1	113.80	224	251	251	51	49	69	62	5.5	
5	1:00	0.33	0.96	116.95	219	249	249	53	53	69	62	5.0	
5	1:05	0.32	0.93	119.50	219	251	250	55	54	69	62	5.0	
5	1:10	0.33	0.96	122.20	220	244	248	56	56	69	62	5.0	
6	1:15	0.33	0.96	124.93	219	239	251	57	58	69	62	5.0	
6	1:20	0.32	0.93	127.86	220	242	252	60	60	69	62	5.0	
6	1:25	0.33	0.96	130.37	219	235	252	61	62	69	62	5.0	Stop 1619
	1:30			133.071									Restart 1624
A1	1:30	0.30	0.87	133.149	216	245	250	58	55	67	62	4.0	
1	1:35	0.31	0.90	135.76	221	256	251	55	48	66	62	4.5	
1	1:40	0.30	0.87	138.39	220	259	252	52	47	66	62	4.5	
2	1:45	0.33	0.96	140.01	222	254	252	51	48	67	62	4.5	
2	1:50	0.34	0.99	143.74	222	239	251	50	49	68	62	5.0	
2	1:55	0.35	1.0	146.8	222	242	251	50	48	68	62	5.0	
3	2:00	0.34	0.99	149.27	223	245	251	50	49	69	62	5.0	
3	2:05	0.35	1.0	152.04	224	250	251	50	51	69	63	5.0	
3	2:10	0.35	1.0	154.83	224	258	250	52	52	70	63	5.0	
4	2:15	0.34	0.99	157.62	223	251	249	54	55	70	63	5.5	

Impinger Data (vol) #	Initial	Final
1	0	
2	100	
3	100	
4	0	
5	SG	
6		

Silica Gel Data (gm) #	Initial	Final
1		
2		

Moisture Gain

_____ ml.

_____ gm

_____ Total

Filter Data #	Number	Tare
1		
2		
3		

Molecular Weight Data (%) #	O_2	CO_2
1	15.5	3.78
2		
3		
Avg		

O'BRIEN & GERE

EPA Isokinetic Field Sheet

Methods Performed M23

Client	General Dynamics	Run Number	2	Pitot Number	PS-A
Location	Carthage, MO	Stack Diameter		Pitot Coefficient	0.84
Source	Bldg 6	Barometric Pres.	28.87	Stack TC I.D.	PS-A
Date	11/28/13	Static Pressure	-0.41	Oven Box I.D.	HB-1
Operators	SMile / BGoodlike	Meter Box #	7	Impinger Out I.D.	IO-11
Start Time	1449	Meter delta H	1.99	Nozzle Size	0.265
End Time	1754	Meter Gamma	1.022	XAD Trap I.D.	M23

Leak Check Rates	Sample Rate in.	Sample Rate cfm	Pitot +	Pitot -
Initial	10	0.007	✓	✓
Mid	8	0.007		
Mid				
Final	6	0.002	✓	✓

Sample Point	Sample Time (min)	Velocity Head (in. H_2O)	Orifice Setting (in. H_2O)	Meter Volume (ft³)	Temperature Readings in Degrees Farenheit: Stack	Probe	Oven Box	Impinger	Aux	Meter Inlet	Meter Outlet	Vacuum (in. hg)	Comments/Notes
4	220	0.33	0.96	160.38	225	247	252	55	57	69	63	5.5	
4	225	0.33	0.96	163.27	225	245	251	55	48	71	63	5.5	
5	230	0.27	0.79	165.87	223	234	251	51	45	71	64	4.0	
5	235	0.28	0.81	168.58	223	227	251	50	45	70	63	4.0	
5	240	0.29	0.84	170.86	223	231	251	47	45	69	63	4.0	
6	245	0.24	0.70	173.38	220	228	251	48	46	69	63	3.5	
6	250	0.24	0.70	175.9	222	231	251	48	46	69	63	3.5	
6	255	0.22	0.64	178.2	220	234	251	50	48	68	62	3.5	
	5:00	-	-	180.329	-	-	-	-	-	-	-	-	

Impinger Data (vol) #	Initial	Final
1	0	
2	100	
3	100	
4	0	
5	SG	
6		

Silica Gel Data (gm) #	Initial	Final
1		
2		

Moisture Gain

_____ ml.

_____ gm

_____ Total

Filter Data #	Number	Tare
1		
2		
3		

Molecular Weight Data (%) #	O_2	CO_2
1	15.5	3.78
2		
3		
Avg		

O'BRIEN & GE

EPA Isokinetic Field Sheet

Mathods Performed: M23

Clierit	General Dynamics	Run Number	3	Pitot Number	P5-A
Location	Carthage, MO	Stack Diameter	30"	Pitot Coefficient	0.84
Source	Bldg 6	Barometric Pres.	28.87	Stack TC I.D.	P5-A
Date	11/20/13	Static Pressure	-0.36	Oven Box I.D.	HB-1
Operators	SMilo / B Gaethke	Meter Box #	7	Impinger Out I.D.	IO-11
Start Time	1818	Meter delta H	1.99	Nozzle Size	0.265
End Time		Meter Gamma	1.022	XAD Trap I.D.	M23

Leak Check Rates	Sample Rate in.	Sample Rate cfm	Pitot +	Pitot -
Initial	10	0.005	✓	✓
Mid				
Mid				
Final				

Sample Point	Sample Time (min)	Velocity Head (in. H_2O)	Orifice Setting (in. H_2O)	Meter Volume (ft^3)	Stack	Probe	Oven Box	Impinger	Aux	Meter Inlet	Meter Outlet	Vacuum (in. hg)	Comments/Notes
					Temperature Readings in Degrees Farenheit								
A1	0	0.32	0.93	180.474	222	227	256	52	40	64	61	8.0	K=.291
1	5	0.31	0.90	183.15	221	238	255	47	40	64	61	8.0	
1	10	0.32	0.93	185.83	220	252	254	45	40	65	61	8.0	
2	15	0.34	0.99	188.46	222	243	252	47	42	66	61	9.0	Paused @
2	20	0.34	0.99	191.23	222	240	252	47	42	66	61	9.0	1848
2	25	0.33	0.96	194.01	222	235	251	48	42	66	61	9.0	
3	30	0.32	0.93	196.73	222	234	252	48	41	68	61	8.5	Restart
3	35	0.34	0.99	199.41	222	232	252	49	43	66	61	9.0	@ 1952
3	40	0.34	0.99	202.16	224	227	252	50	46	68	61	9.0	
4	45	0.33	0.96	204.939	224	232	250	52	47	66	61	9.0	
4	50	0.33	0.96	207.703	225	231	251	54	47	66	60	9.0	
4	55	0.33	0.96	210.499	225	230	249	55	50	66	60	9.0	
5	1:00	0.32	0.93	213.154	224	241	251	57	51	66	60	9.0	
5	1:05	0.32	0.93	215.575	224	250	251	55	49	65	60	9.0	
5	1:10	0.32	0.93	218.579	224	251	251	58	45	65	60	9.0	
6	1:15	0.26	0.76	221.2 —	223	252	250	55	45	65	60	8.0	
6	1:20	0.26	0.76	224 —	223	248	251	54	46	65	60	8.0	
6	1:25	0.26	0.76	226.4 —	222	249	250	55	47	65	60	8.0	
	130			228.767									
B1	130	0.34	0.99	228.767	224	251	251	53	50	62	60	9.0	
1	135	0.33	0.96	231.435	224	249	251	53	48	65	60	9.0	
1	140	0.33	0.96	234.175	223	250	252	54	48	66	60	9.5	
2	145	0.34	0.99	236.88	224	249	250	54	47	66	60	9.5	
2	150	0.35	1.0	239.64	224	250	251	55	47	66	60	9.5	
2	155	0.35	1.0	242.41	223	250	252	53	49	66	61	9.5	
3	200	0.34	0.99	245.17	223	251	251	54	49	66	60	9.5	
3	205	0.34	0.99	247.95	224	250	249	50	46	67	61	9.5	
3	210	0.34	0.99	250.726	224	250	251	50	46	67	61	9.5	

Impinger Data (vol) #	Initial	Final
1	0	
2	100	
3	100	
4	0	
5	56	
6		

Silica Gel Data (gm) #	Initial	Final
1		
2		

Moisture Gain	
	ml.
	gm
	Total

Filter Data #	Number	Tare
1		
2		
3		

Molecular Weight Data (%) #	O_2	CO_2
1	15.6	3.6
2		
3		
Avg		

EPA Isokinetic Field Sheet

Methods Performed: M23

Client	General Dynamics	Run Number	3	Pitot Number	DS A
Location	Carthage, MO	Stack Diameter	30"	Pitot Coefficient	0.84
Source	Building 6	Barometric Pres.	28.87	Stack TC I.D.	DS A
Date	11-20-13	Static Pressure	-0.36	Oven Box I.D.	43 1
Operators	CW/SH/BG	Meter Box #	7	Impinger Out I.D.	50 11
Start Time	1518	Meter delta H	1.99	Nozzle Size	0.265
End Time	2122	Meter Gamma	1.022	XAD Trap I.D.	

Leak Check Rates	Sample Rate in.	Sample Rate cfm	Pitot +	Pitot -
Initial	10	0.005	✓	✓
Mid				
Mid				
Final	10	0.010		

Sample Point	Sample Time (min)	Velocity Head (in. H_2O)	Orifice Setting (in. H_2O)	Meter Volume (ft³)	Temperature Readings in Degrees Farenheit: Stack	Probe	Oven Box	Impinger	Aux	Meter Inlet	Meter Outlet	Vacuum (in. hg)	Comments/Notes
4	215	0.33	0.96	253.56	224	249	250	49	47	67	61	9.0	
4	220	0.32	0.93	256.244	224	249	250	50	47	67	61	9.0	
4	225	0.32	0.93	258.949	226	250	250	50	48	67	61	9.0	
5	230	0.29	0.84	261.7 -	224	252	251	52	52	67	61	9.0	
5	235	0.29	0.84	264.300	224	249	252	54	52	67	61	9.0	
5	240	0.29	0.84	266.85	224	251	251	55	53	67	61	9.0	Paused
6	245	0.28	0.81	269.350	223	250	250	57	57	67	61	8.0	1948
6	250	0.25	0.73	271.926	223	251	249	57	56	66	61	8.0	
6	255	0.25	0.73	274.318	223	248	251	54	57	66	61	8.0	Restart
													@ 1952
	300			276.761									

Impinger Data (vol) #	Initial	Final
1	0	
2	100	
3	100	
4	0	
5	56	
6		

Silica Gel Data (gm) #	Initial	Final
1		
2		

Moisture Gain	
	ml.
	gm
	Total

Filter Data #	Number	Tare
1		
2		
3		

Molecular Weight Data (%) #	O_2	CO_2
1	15.6	3.6
2		
3		
Avg		

O'BRIEN & GERE

EPA Isokinetic Field Sheet

Methods Performed: Method 23

Client	General Dynamics	Run Number	4	Pitot Number	PS A
Location	Carthage, MO	Stack Diameter	30"	Pitot Coefficient	0.84
Source	Building 6	Barometric Pres.	~~30.03~~ 29.03	Stack TC I.D.	PS A
Date	11-21-2013	Static Pressure	-0.38	Oven Box I.D.	OB 1
Operators	CW/SM/BG	Meter Box #	MB 7	Impinger Out I.D.	FO 11
Start Time	0918	Meter delta H	1.99	Nozzle Size	0.265
End Time	1224	Meter Gamma	1.022	XAD Trap I.D.	

K = 2.91

Leak Check Rates	Sample Rate in.	Sample Rate cfm	Pitot +	Pitot -
Initial	13	0.002	✓	✓
Mid				
Mid				
Final	10	0.001	✓	✓

Sample Point	Sample Time (min)	Velocity Head (in. H_2O)	Orifice Setting (in. H_2O)	Meter Volume (ft³)	Temperature Readings in Degrees Farenheit: Stack	Probe	Oven Box	Impinger	Aux	Meter Inlet	Meter Outlet	Vacuum (in. hg)	Comments/Notes
A 1	0	0.30	0.87	277.932	209	241	253	43	39	48	48	2	
1	5	0.30	0.87	280.3—	209	251	255	42	40	49	48	4	
1	10	0.30	0.87	283.002	209	250	252	41	41	50	48	5	
2	15	0.33	0.96	285.549	213	252	253	42	43	52	49	5	Paused @
2	20	0.33	0.96	288.238	213	250	252	43	45	54	49	5	1048 for
3	25	0.34	0.99	290.914	213	251	251	44	45	55	50	5	port change
3	30	0.34	0.99	293.653	213	250	251	45	46	55	49	5	
3	35	0.34	0.99	296.402	215	250	251	47	46	56	50	5	Restart "B"
3	40	0.34	0.99	299.144	215	248	249	48	47	56	50	5	@ 1054
4	45	0.34	0.99	301.878	215	249	251	49	47	57	50	5	
4	50	0.34	0.99	304.599	216	250	252	51	51	58	51	5	
4	55	0.34	0.99	307.328	216	250	251	52	52	57	51	5	
5	60	0.31	0.90	310.027	215	251	252	52	54	53	51	5	
5	1:05	0.31	0.90	312.645	216	250	249	55	57	58	52	5	
5	1:10	0.31	0.90	315.299	216	250	253	56	58	58	52	5	
6	1:15	0.28	0.81	317.700	215	251	252	56	58	58	51	4.5	
6	1:20	0.28	0.81	322.355	214	250	250	58	58	58	52	4.5	
6	1:25	0.27	0.79	322.515	214	250	252	59	60	58	52		
	1:30			325.354									
B 1	1:30	0.32	0.93	325.354	213	245	251	52	43	54	52	5	
1	1:35	0.32	0.93	328.009	212	250	253	47	43	57	52	5	
1	1:40	0.32	0.93	330.647	213	250	251	46	43	58	53	5	Points 2
2	1:45												through 6
2	1:50												of "B" run
2	1:55												purge 2
3	2:00												
3	2:05												Data sheet
3	2:10												got wet.

Impinger Data (vol) #	Initial	Final
1	0	
2	100	
3	100	
4	0	
5	56	
6		

Silica Gel Data (gm) #	Initial	Final
1		
2		

Moisture Gain

_____ ml.
_____ gm
_____ Total

Filter Data #	Number	Tare
1		
2		
3		

Molecular Weight Data (%) #	O_2	CO_2
1	15.6	3.5
2		
3		
Avg		

O'BRIEN & GERE

EPA Isokinetic Field Sheet

Methods Performed Method 27

Client	General Dynamics	Run Number	4	Pitot Number	P5A
Location	Carthage, MO	Steck Diameter	36" (16)	Pitot Coefficient	0.84
Source	Building 6	Barometric Pres.	~~29.03~~ 29.03	Stack TC I.D.	P5A
Date	11-21-2013	Static Pressure	-0.38	Oven Box I.D.	031
Operators	CW/SM/RC	Meter Box #	MB-7	Impinger Out I.D.	20 "
Start Time	0918	Meter delta H	1.99	Nozzle Size	0.265
End Time	1224	Meter Gamma	1.022	XAD Trap I.D.	

K = 2.91

Leak Check Rates	Sample Rate in.	Sample Rate cfm	Pitot +	Pitot -
Initial	13	0.002	✓	✓
Mid				
Mid				
Final	10	0.001	✓	✓

Sample Point	Sample Time (min)	Velocity Head (in. H_2O)	Orifice Setting (in. H_2O)	Meter Volume (ft^3)	Temperature Readings in Degrees Farenheit: Stack	Probe	Oven Box	Impinger	Aux	Meter Inlet	Meter Outlet	Vacuum (in. hg)	Comments/Notes
B 2	1:45	0.35	1.02	333.269	215	249	251	47	44	54	53	5	
2	1:50	0.35	1.02	335.972	215	250	250	47	45	54	53	5	
2	1:55	0.35	1.02	338.742	216	249	250	47	45	54	53	5	
3	2:00	0.33	0.96	341.502	218	249	251	48	47	60	53	5	
3	2:05	0.34	0.99	344.246	218	249	252	49	48	60	53	5	Paused @
3	2:10	0.35	1.02	346.919	218	249	250	48	50	60	54	5.5	1048 for
4	2:15	0.34	0.99	349.704	218	250	251	52	52	61	54	5.5	port change
4	2:20	0.33	0.96	352.477	219	247	250	52	53	61	54	5.5	
4	2:25	0.33	0.96	355.2	219	249	251	49	50	61	54	5.5	Restart
5	2:30	0.30	0.87	357-	219	250	251	49	47	61	55	5	1054
5	2:35	0.28	0.81	360.200	218	249	251	49	47	61	55	5	
5	2:40	0.28	0.81	363.113	218	250	250	49	47	61	54	4.5	
6	2:45	0.25	0.73	365.663	218	250	251	50	50	60	54	4	
6	2:50	0.25	0.73	367.953	217	249	252	49	50	60	55	4	
6	2:55	0.25	0.73	370.0	217	250	251	51	51	60	55	4	
	3:00		End	372.704									

Impinger Data (vol) #	Initial	Final
1	0	
2	100	
3	100	
4	0	
5	30	
6		

Silica Gel Data (gm) #	Initial	Final
1		
2		

Moisture Gain	
	ml.
	gm
	Total

Filter Data #	Number	Tare
1		
2		
3		

Molecular Weight Data (%) #	O_2	CO_2
1	15.6	3.5
2		
3		
Avg		

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Sample Train Recovery Data Sheet

Client GENERAL PHARMA Location CARTHAGE, NC Source BLDG #6 EXHAUST Method M23 Date 11/20/2013

Run # 1

	Final ml or gm	Initial ml or gm	Net Gain
Impinger #1		519.2	
Impinger #2		769.4	
Impinger #3		756.0	
Impinger #4		624.6	
Impinger #5		897.0	
Impinger #6			
Impinger #7			
Impinger #8			
		Total Gain	VOID ml/gm

Filter #1 D/F
Filter #2
Filter #3
XAD # 8
Run Start Time
Run End Time
Recovery Technician BAG

Run # 2

	Final ml or gm	Initial ml or gm	Net Gain
Impinger #1	1115.4	503.0	612.4
Impinger #2	786.6	786.2	0.4
Impinger #3	755.2	754.8	0.4
Impinger #4	673.4	(06) ~~642.6~~ 671.9	1.5
Impinger #5	864.0	835.4	28.6
Impinger #6			
Impinger #7			
Impinger #8			
		Total Gain	643.3 ml/gm

Filter #1 D/F
Filter #2
Filter #3
XAD # 6
Run Start Time
Run End Time
Recovery Technician

Run #

	Final ml or gm	Initial ml or gm	Net Gain
Impinger #1	1129.6	519.2	610.4
Impinger #2	769.4	770.8	-1.4
Impinger #3	757.0	757.4	-0.4
Impinger #4	627.4	625.2	2.2
Impinger #5	932.4	901.8	30.6
Impinger #6			
Impinger #7			
Impinger #8			
		Total Gain	641.4 ml/gm

Filter #1 D/F
Filter #2
Filter #3
XAD #5
Run Start Time
Run End Time
Recovery Technician

O'BRIEN & GERE

Sample Train Recovery Data Sheet

Client GENERAL DYNAMICS Location CARTHAGE, MO Source BLDG #6 EXHAUST Method M23 Date 11/21/13

Run # 4

	Final ml or gm	Initial ml or gm	Net Gain
Impinger #1	1120.2	503.8	616.4
Impinger #2	783.4	782.6	0.8
Impinger #3	758.2	758.2	0.0
Impinger #4	674.0	672.8	1.2
Impinger #5	865.9	835.4	28.0
Impinger #6			
Impinger #7			
Impinger #8			
		Total Gain	646.4 ml/gm

Filter #1 D/F

Filter #2

Filter #3

XAD #4

Run Start Time

Run End Time

Recovery Technician

Run #

	Final ml or gm	Initial ml or gm	Net Gain
Impinger #1			
Impinger #2			
Impinger #3			
Impinger #4			
Impinger #5			
Impinger #6			
Impinger #7			
Impinger #8			
		Total Gain	ml/gm

Filter #1

Filter #2

Filter #3

Run Start Time

Run End Time

Recovery Technician

Run #

	Final ml or gm	Initial ml or gm	Net Gain
Impinger #1			
Impinger #2			
Impinger #3			
Impinger #4			
Impinger #5			
Impinger #6			
Impinger #7			
Impinger #8			
		Total Gain	ml/gm

Filter #1

Filter #2

Filter #3

Run Start Time

Run End Time

Recovery Technician

Equipment Calibration Data

Reference Method Manual Equipment
Pretest Calibrations, Verifications, and Checks

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at tested vacuum (from Orifice Calibration Report), for a period of time necessary to achieve a minimum total volume of 5 cubic feet.
4) Record data and information in the GREEN cells, YELLOW cells are calculated.

					INITIAL	FINAL	AVG (P_{bar})
DATE:	1/4/2013	METER SERIAL #:	7	BAROMETRIC PRESSURE (in Hg):	29.2	29.2	29.2
METER PART #:	MB-7	CRITICAL ORIFICE SET SERIAL #:	1393				

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y % Diff to Average Y	Y % Diff with other orifices	$\Delta H_@$
11	1	0.306				.0						0								
	2	0.306	20	205.413	210.483	5.070	69	60	64	60	62	61.5	13.00	0.51	5.0171	5.0518	1.007			1.88
	3	0.306				.0						0								
																AVG =	1.007	-1.44	-1.01	
16	1	0.4268				.0						0								
	2	0.4268	19	210.483	217.503	7.020	69	64	65	62	64	63.75	13.00	1.1	6.9271	7.0461	1.017			2.08
	3	0.4268				.0						0								
																AVG =	1.017	-0.43	1.02	
18	1	0.4961				.0						0								
	2	0.4961	18	217.503	225.556	8.053	69	66	67	64	65	65.5	13.00	1.4	7.9259	8.1902	1.033			1.95
	3	0.4961				.0						0								
																AVG =	1.033	1.15	1.59	
26	1	0.7131				.0						0								
	2	0.7131	17	225.556	237.255	11.699	69	67	69	65	65	66.75	13.00	3	11.5332	11.7727	1.021			2.03
	3	0.7131				.0						0								
																AVG =	1.021	-0.08	-0.88	
31	1	0.8358				.0						0								
	2	0.8358	16	237.255	250.835	13.580	69	69	69	66	67	67.75	13.00	4.1	13.3989	13.7984	1.030			2.02
	3	0.8358				.0						0								
																AVG =	1.030	0.80	0.89	

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

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **1.022**

AVERAGE $\Delta H_@$ = **1.99**

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

= Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $$Vcr_{(std)} = K' \cdot \frac{Pbar \cdot \Theta}{\sqrt{Tamb}}$$

= Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration.

(3) $$Y = \frac{Vcr_{(std)}}{Vm_{(std)}}$$

= DGM calibration factor

$$\Delta H_@ = \left(\frac{0.75\,\theta}{V_{cr}(std)}\right)^2 \Delta H \left(\frac{V_m(std)}{V_m}\right)$$

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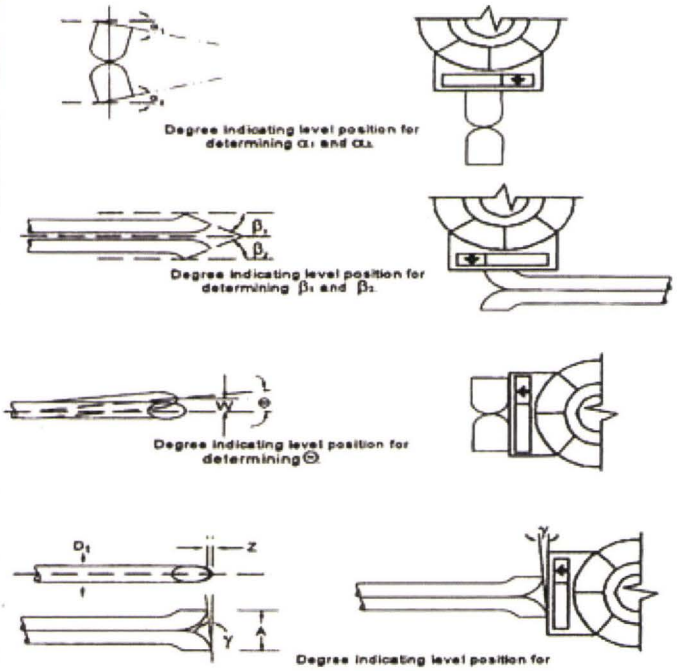
Initial Sample Probe Calibration Form

Probe ID: P5-A Date: 01/13/13 Technician: BPG

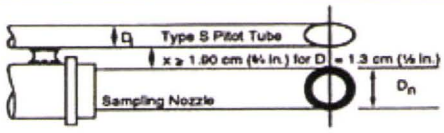
"S" Type Pitot Calibration

Is the Pitot Level and Perpindicular?	Yes
Is There any Obstruction?	No
Is the Pitot Damaged	No
α_1 ($-10^\circ = a_1 = +10^\circ$)	2
α_2 ($-10^\circ = a_2 = +10^\circ$)	1
β_1 ($-5^\circ = \beta_1 = +5^\circ$)	0
β_2 ($-5^\circ = \beta_2 = +5^\circ$)	1
γ	0
Θ	0
z = A Tan γ (< 0.125")	0
W = A Tan Θ (< 0.03125")	0
D_t (3/16 = D_t = 3/8")	0.375
A	0.843
$A/2D_t$ (1.05 = P_A/D_t = 1.5)	1.124

Source: Quality Assurance Handbook for Air Pollution Measurement Systems. Volume III. Stationary Source-Specific Methods. EPA/600/R-94/038c. September 30, 1994



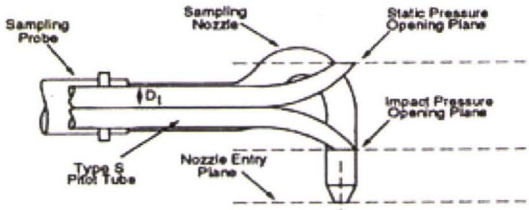
Verification of "S" Type Pitot, Thermocouple and Nozzle Placement



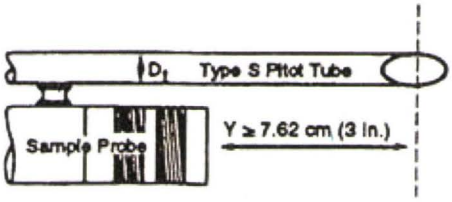
A. Bottom View; showing minimum pitot tube-nozzle separation.

Does X Exceed 0.75 inches? Yes

Does Y Exceed 3 inches? Yes



B. Side View; to prevent pitot tube from interfering with gas flow streamlines approaching the nozzle, the impact pressure opening plane of the pitot tube shall be even with or above the nozzle entry plane.



Thermocouple Calibration

	Ice Bath °R			Ambient °R			Boiling Water °R		
	1	2	3	1	2	3	1	2	3
Reference Temp	491	492	492	542	542	542	669	669	668
Thermocouple Temp	493	493	493	541	541	541	669	669	669
Difference (%)	0.4	0.2	0.2	-0.2	-0.2	-0.2	0.0	0.0	0.1

Temperature values must be within 1.5% of reference temperature

I certify that the probe ID P5-A meets or exceeds all specifications, criteria and/or applicable design features and is herby assigned a pitot tube calibration factor C_p of 0.84

Certified By: BPG Date: 01/13/13

O'BRIEN & GERE

Initial Oven Box Thermocouple Calibration

ID Number	Ice Bath			Ambient			Hot Water Bath			Technician	Date Performed
	Reference Temperature (°R)	Thermocouple Temperature (°R)	Deviation*	Reference Temperature (°R)	Thermocouple Temperature (°R)	Deviation*	Reference Temperature (°R)	Thermocouple Temperature (°R)	Deviation*		
OB-1	493	493	0.0%	515	515	0.0%	672	672	0.0%	JLS	02/09/11
OB-2	492	492	0.0%	515	515	0.0%	672	670	-0.3%	JLS	02/22/11
OB-3	492	491	-0.2%	515	514	-0.2%	672	670	-0.3%	JLS	02/22/11
OB-4	492	488	-0.8%	515	512	-0.6%	672	672	0.0%	JLS	02/22/11
OB-A	492	492	0.0%	515	515	0.0%	672	672	0.0%	JLS	02/22/11
OB-B	492	492	0.0%	533	534	0.2%	671	668	-0.4%	NAG	05/19/07
OB-5	492	488	-0.8%	515	515	0.0%	672	670	-0.3%	JLS	02/22/11
OB-C	492	492	0.0%	533	530	-0.6%	670	670	0.0%	NAG	05/19/07
OB-6	492	493	0.2%	536	535	-0.2%	670	670	0.0%	BPG	12/13/05
OB-7	492	492	0.0%	536	536	0.0%	670	670	0.0%	BPG	12/13/05
OB-D	492	492	0.1%	524	525	0.1%	668	668	0.0%	BAG	04/27/06

Reference Thermocouple: Fluke S/N: 83450033 or S/N 90460057 traceable to the Untied States National Institute of Standards and Technology
*Acceptable Deviation: 1.5%

O'BRIEN & GERE

Initial Impinger Outlet Thermocouple Calibration

ID Number	Ice Bath			Ambient			Hot Water Bath			Technician	Date Performed
	Reference Temperature (°Rk	Thermocouple Temperature (°Rk	Deviation*	Reference Temperature (°Rk	Thermocouple Temperature (°Rk	Deviation*	Reference Temperature (°Rk	Thermocouple Temperature (°Rk	Deviation*		
IO-1	492	493	0.2%	524	525	0.2%	669	668	-0.1%	BPG	01/08/13
IO-2	492	493	0.2%	524	524	0.0%	669	669	0.0%	BPG	01/08/13
IO-3	492	493	0.2%	524	525	0.2%	669	669	0.0%	BPG	01/08/13
IO-4	492	493	0.2%	524	525	0.2%	669	670	0.1%	BPG	01/08/13
IO-5	492	493	0.2%	524	526	0.4%	669	668	-0.1%	BPG	01/08/13
IO-6	493	493	0.0%	524	525	0.2%	669	669	0.0%	BPG	01/08/13
IO-8	492	493	0.2%	524	526	0.4%	669	669	0.0%	BPG	01/08/13
IO-10	492	493	0.2%	524	526	0.4%	669	669	0.0%	BPG	01/08/13
IO-11	493	493	0.0%	524	527	0.6%	669	669	0.0%	BPG	01/08/13
IO-12											
IO-15	493	493	0.0%	524	526	0.4%	669	670	0.1%	BPG	01/08/13
G-5	493	493	0.0%	524	526	0.4%	669	670	0.1%	BPG	01/08/13

Reference Thermocouple: Fluke S/N: 83450033 or S/N 90460057 traceable to the United States National Institute of Standards and Technology
*Acceptable Deviation: 1.5%

Reference Method Manual Equipment
Post-Test Calibration Checks

POST TEST DRY GAS METER CALIBRATION

DATE:	12/24/2013	METER BOX #:	7	BAROMETRIC PRESSURE (in Hg):	INITIAL 29.7 / FINAL 29.7 / AVG (P_{bar}) 29.7
TECHNICIAN:	JM	CRITICAL ORIFICE SET SERIAL #:	1393		

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	$\Delta H_@$
	1					.0						0							
	2					.0						0							
	3					.0						0							
																AVG =			
18	1	0.4961	18	527.211	535.694	8.483	69.9	61	65	59	61	61.5	13.00	1.3	8.5547	8.3234	0.973		1.80
	2	0.4961	18	535.694	544.042	8.348	69.9	65	67	61	63	64	13.00	1.3	8.3784	8.3234	0.993		1.79
	3	0.4961	18	544.042	552.476	8.434	69.9	67	68	63	63	65.25	13.00	1.3	8.4445	8.3234	0.986		1.79
																AVG =	0.984	0.00	
	1					.0						0							
	2					.0						0							
	3					.0						0							
																AVG =			

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.984

PRE-DETERMINED DRY GAS METER CALIBRATION FACTOR, Y = 1.022

PERCENT DIFFERENCE = -3.7

O'BRIEN & GERE

Post-Test Sample Probe Calibration Form

Probe ID P5-A

Visual Inspection

Do pilot tips appear to be damaged?	N
Do thermocouple wires appear broken or shorted?	N
Do all components appear to be in good condition?	Y

Post-Test Thermocouple Calibration

Reference Temperature °F	Thermocouple Temperature °F	Difference °F
67.4	67.8	0.4

Reference Thermocouple: Fluke S/N: 83450033 traceable to the United States National Institute of Standards and Technology

Accepatable Deviation +/- 2 °F

X Acceptable

____ Unacceptable

Date 12/10/13

Technician JTG

Laboratory Reports

Maxxam

Success Through Science®

Your Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

Attention: Jeff Gorman
O'Brien & Gere Engineers Inc
7600 Morgan Rd.
Liverpool, NY
USA 13090

Report Date: 2013/12/16

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B3K3387
Received: 2013/11/24, 17:25

Sample Matrix: Stack Sampling Train
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
2,3,7,8-TCDF Confirmation (M23)	2	N/A	2013/12/09	BRL SOP-00404	EPA M23/23A
2,3,7,8-TCDF Confirmation (M23)	1	N/A	2013/12/11	BRL SOP-00404	EPA M23/23A
Dioxins/Furans in Air (Method 23)	3	2013/12/03	2013/12/07	BRL SOP-00404	EPA M23/23A
Dioxins/Furans in Air (Method 23)	1	2013/12/03	2013/12/09	BRL SOP-00404	EPA M23/23A

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905) 817-5769

==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel (905) 817-5700 Toll-Free 800-563-6266 Fax (905) 817-5777 www.maxxam.ca

Maxxam Job #: B3K3387
Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA7865						
Sampling Date		2013/11/20 00:01			TOXIC EQUIVALENCY		# of	
	Units	RUN 2-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDD *	pg	5 (1)	2.0	20	1.00	5.00	N/A	3448859
1,2,3,7,8-Penta CDD	pg	11	2.0	20	1.00	11.0	N/A	3448859
1,2,3,4,7,8-Hexa CDD	pg	5	2.0	20	0.100	0.500	N/A	3448859
1,2,3,6,7,8-Hexa CDD	pg	8	2.1	20	0.100	0.800	N/A	3448859
1,2,3,7,8,9-Hexa CDD	pg	13 (2)	1.9	20	0.100	1.30	N/A	3448859
1,2,3,4,6,7,8-Hepta CDD	pg	29	2.2	20	0.0100	0.290	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDD	pg	67	4.1	200	0.000300	0.0201	N/A	3448859
Total Tetra CDD	pg	29	2.0	20	N/A	N/A	N/A	3448859
Total Penta CDD	pg	111	2.0	20	N/A	N/A	N/A	3448859
Total Hexa CDD	pg	79	2.0	20	N/A	N/A	N/A	3448859
Total Hepta CDD	pg	62	2.2	20	N/A	N/A	N/A	3448859
2,3,7,8-Tetra CDF **	pg	107	2.0	20	0.100	10.7	N/A	3448859
1,2,3,7,8-Penta CDF	pg	58	2.1	20	0.0300	1.74	N/A	3448859
2,3,4,7,8-Penta CDF	pg	<90 (3)	90	20	0.300	27.0	N/A	3448859
1,2,3,4,7,8-Hexa CDF	pg	148 (2)	2.0	20	0.100	14.8	N/A	3448859
1,2,3,6,7,8-Hexa CDF	pg	86	1.9	20	0.100	8.60	N/A	3448859
2,3,4,6,7,8-Hexa CDF	pg	<54 (3)	54	20	0.100	5.40	N/A	3448859
1,2,3,7,8,9-Hexa CDF	pg	18	2.2	20	0.100	1.80	N/A	3448859
1,2,3,4,6,7,8-Hepta CDF	pg	209	1.8	20	0.0100	2.09	N/A	3448859
1,2,3,4,7,8,9-Hepta CDF	pg	62	2.4	20	0.0100	0.620	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDF	pg	136	4.2	200	0.000300	0.0408	N/A	3448859
Total Tetra CDF	pg	515	2.0	20	N/A	N/A	N/A	3448859
Total Penta CDF	pg	736	2.1	20	N/A	N/A	N/A	3448859
Total Hexa CDF	pg	822	2.1	20	N/A	N/A	N/A	3448859
Total Hepta CDF	pg	492	2.1	20	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
(1) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical
(2) EMPC / Merged Peak
(3) EMPC / DPE - Diphenylether interference present caused dibenzofuran detected to become a "non-detect" with an elevated detection limit.

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Maxxam Job #: B3K3387
Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA7865						
Sampling Date		2013/11/20 00:01			TOXIC EQUIVALENCY		# of	
	Units	RUN 2-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Confirmation 2,3,7,8-Tetra CDF **	pg	33	1.9	20	0.100	3.30	N/A	3451957
TOTAL TOXIC EQUIVALENCY	pg	N/A	N/A	N/A	N/A	84.3	N/A	N/A
Surrogate Recovery (%)								
Confirmation C13-2378 TetraCDF	%	48	N/A	N/A	N/A	N/A	N/A	3451957
C13-1234678 HeptaCDD *	%	116	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234678 HeptaCDF	%	89	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDD	%	102	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDF	%	108	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234789 HeptaCDF	%	102	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDD	%	100	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDF	%	91	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDD	%	118	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDF	%	128	N/A	N/A	N/A	N/A	N/A	3448859
C13-123789 HexaCDF	%	122	N/A	N/A	N/A	N/A	N/A	3448859
C13-23478 PentaCDF	%	101	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDD	%	89	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDF	%	65	N/A	N/A	N/A	N/A	N/A	3448859
C13-Octachlorodibenzo-p-Dioxin	%	66	N/A	N/A	N/A	N/A	N/A	3448859
Cl37-2378 TetraCDD	%	106	N/A	N/A	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

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Maxxam Job #: B3K3387
Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA7866						
Sampling Date		2013/11/20 00:01			TOXIC EQUIVALENCY		# of	
	Units	RUN 3-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDD *	pg	7 (1)	3.3	20	1.00	7.00	N/A	3448859
1,2,3,7,8-Penta CDD	pg	12	3.2	20	1.00	12.0	N/A	3448859
1,2,3,4,7,8-Hexa CDD	pg	6	2.1	20	0.100	0.600	N/A	3448859
1,2,3,6,7,8-Hexa CDD	pg	9	2.2	20	0.100	0.900	N/A	3448859
1,2,3,7,8,9-Hexa CDD	pg	14 (2)	1.9	20	0.100	1.40	N/A	3448859
1,2,3,4,6,7,8-Hepta CDD	pg	26	1.6	20	0.0100	0.260	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDD	pg	70	4.3	200	0.000300	0.0210	N/A	3448859
Total Tetra CDD	pg	79	3.3	20	N/A	N/A	N/A	3448859
Total Penta CDD	pg	80	3.2	20	N/A	N/A	N/A	3448859
Total Hexa CDD	pg	123	2.1	20	N/A	N/A	N/A	3448859
Total Hepta CDD	pg	52	1.6	20	N/A	N/A	N/A	3448859
2,3,7,8-Tetra CDF **	pg	<210 (3)	210	20	0.100	21.0	N/A	3448859
1,2,3,7,8-Penta CDF	pg	55	2.3	20	0.0300	1.65	N/A	3448859
2,3,4,7,8-Penta CDF	pg	90	2.4	20	0.300	27.0	N/A	3448859
1,2,3,4,7,8-Hexa CDF	pg	82	1.9	20	0.100	8.20	N/A	3448859
1,2,3,6,7,8-Hexa CDF	pg	83	1.8	20	0.100	8.30	N/A	3448859
2,3,4,6,7,8-Hexa CDF	pg	57	2.1	20	0.100	5.70	N/A	3448859
1,2,3,7,8,9-Hexa CDF	pg	17	2.1	20	0.100	1.70	N/A	3448859
1,2,3,4,6,7,8-Hepta CDF	pg	217	2.1	20	0.0100	2.17	N/A	3448859
1,2,3,4,7,8,9-Hepta CDF	pg	65	2.7	20	0.0100	0.650	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDF	pg	106	3.6	200	0.000300	0.0318	N/A	3448859
Total Tetra CDF	pg	1110	3.4	20	N/A	N/A	N/A	3448859
Total Penta CDF	pg	753	2.4	20	N/A	N/A	N/A	3448859
Total Hexa CDF	pg	890	2.0	20	N/A	N/A	N/A	3448859
Total Hepta CDF	pg	509	2.4	20	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
(1) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical
(2) EMPC / Merged Peak
(3) RT > 3 seconds - PCDD/DF analysis - Peak detected exceeds expected retention time (from internal standard) by greater than 3 seconds.

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Maxxam Job #: B3K3387
Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA7866						
Sampling Date		2013/11/20 00:01			TOXIC EQUIVALENCY		# of	
	Units	RUN 3-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Confirmation 2,3,7,8-Tetra CDF **	pg	38	1.5	20	0.100	3.80	N/A	3451957
TOTAL TOXIC EQUIVALENCY	pg	N/A	N/A	N/A	N/A	81.4	N/A	N/A
Surrogate Recovery (%)								
Confirmation C13-2378 TetraCDF	%	57	N/A	N/A	N/A	N/A	N/A	3451957
C13-1234678 HeptaCDD *	%	117	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234678 HeptaCDF	%	71	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDD	%	100	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDF	%	103	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234789 HeptaCDF	%	100	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDD	%	78	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDF	%	72	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDD	%	72	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDF	%	89	N/A	N/A	N/A	N/A	N/A	3448859
C13-123789 HexaCDF	%	98	N/A	N/A	N/A	N/A	N/A	3448859
C13-23478 PentaCDF	%	97	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDD	%	58	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDF	%	55	N/A	N/A	N/A	N/A	N/A	3448859
C13-Octachlorodibenzo-p-Dioxin	%	66	N/A	N/A	N/A	N/A	N/A	3448859
Cl37-2378 TetraCDD	%	108	N/A	N/A	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

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O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA7867						
Sampling Date		2013/11/21 00:01			TOXIC EQUIVALENCY		# of	
	Units	RUN 4-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDD *	pg	8 (1)	2.1	20	1.00	8.00	N/A	3448859
1,2,3,7,8-Penta CDD	pg	14	2.2	20	1.00	14.0	N/A	3448859
1,2,3,4,7,8-Hexa CDD	pg	7	2.1	20	0.100	0.700	N/A	3448859
1,2,3,6,7,8-Hexa CDD	pg	11	2.2	20	0.100	1.10	N/A	3448859
1,2,3,7,8,9-Hexa CDD	pg	17 (2)	2.0	20	0.100	1.70	N/A	3448859
1,2,3,4,6,7,8-Hepta CDD	pg	38	2.1	20	0.0100	0.380	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDD	pg	62	4.2	200	0.000300	0.0186	N/A	3448859
Total Tetra CDD	pg	49	2.1	20	N/A	N/A	N/A	3448859
Total Penta CDD	pg	137	2.2	20	N/A	N/A	N/A	3448859
Total Hexa CDD	pg	134	2.1	20	N/A	N/A	N/A	3448859
Total Hepta CDD	pg	75	2.1	20	N/A	N/A	N/A	3448859
2,3,7,8-Tetra CDF **	pg	178	2.0	20	0.100	17.8	N/A	3448859
1,2,3,7,8-Penta CDF	pg	70	2.1	20	0.0300	2.10	N/A	3448859
2,3,4,7,8-Penta CDF	pg	<100 (3)	100	20	0.300	30.0	N/A	3448859
1,2,3,4,7,8-Hexa CDF	pg	178 (2)	2.1	20	0.100	17.8	N/A	3448859
1,2,3,6,7,8-Hexa CDF	pg	107	2.0	20	0.100	10.7	N/A	3448859
2,3,4,6,7,8-Hexa CDF	pg	81	2.3	20	0.100	8.10	N/A	3448859
1,2,3,7,8,9-Hexa CDF	pg	23	2.3	20	0.100	2.30	N/A	3448859
1,2,3,4,6,7,8-Hepta CDF	pg	246 (1)	1.9	20	0.0100	2.46	N/A	3448859
1,2,3,4,7,8,9-Hepta CDF	pg	82	2.5	20	0.0100	0.820	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDF	pg	109	4.1	200	0.000300	0.0327	N/A	3448859
Total Tetra CDF	pg	836	2.0	20	N/A	N/A	N/A	3448859
Total Penta CDF	pg	549	2.2	20	N/A	N/A	N/A	3448859
Total Hexa CDF	pg	997	2.2	20	N/A	N/A	N/A	3448859
Total Hepta CDF	pg	580	2.2	20	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
(1) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical
(2) EMPC / Merged Peak
(3) EMPC / DPE - Diphenylether interference present caused dibenzofuran detected to become a "non-detect" with an elevated detection limit.

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Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA7867						
Sampling Date		2013/11/21 00:01			TOXIC EQUIVALENCY		# of	
	Units	RUN 4-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Confirmation 2,3,7,8-Tetra CDF **	pg	42	1.5	20	0.100	4.20	N/A	3451957
TOTAL TOXIC EQUIVALENCY	pg	N/A	N/A	N/A	N/A	104	N/A	N/A
Surrogate Recovery (%)								
Confirmation C13-2378 TetraCDF	%	53	N/A	N/A	N/A	N/A	N/A	3451957
C13-1234678 HeptaCDD *	%	115	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234678 HeptaCDF	%	75	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDD	%	101	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDF	%	104	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234789 HeptaCDF	%	115	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDD	%	101	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDF	%	82	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDD	%	98	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDF	%	123	N/A	N/A	N/A	N/A	N/A	3448859
C13-123789 HexaCDF	%	116	N/A	N/A	N/A	N/A	N/A	3448859
C13-23478 PentaCDF	%	95	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDD	%	78	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDF	%	69	N/A	N/A	N/A	N/A	N/A	3448859
C13-Octachlorodibenzo-p-Dioxin	%	70	N/A	N/A	N/A	N/A	N/A	3448859
Cl37-2378 TetraCDD	%	110	N/A	N/A	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

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Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA9381						
Sampling Date		2013/11/21 00:01			TOXIC EQUIVALENCY		# of	
	Units	RB-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
2,3,7,8-Tetra CDD *	pg	<2.1	2.1	20	1.00	2.10	N/A	3448859
1,2,3,7,8-Penta CDD	pg	<2.0	2.0	20	1.00	2.00	N/A	3448859
1,2,3,4,7,8-Hexa CDD	pg	<2.1	2.1	20	0.100	0.210	N/A	3448859
1,2,3,6,7,8-Hexa CDD	pg	<2.2	2.2	20	0.100	0.220	N/A	3448859
1,2,3,7,8,9-Hexa CDD	pg	<1.9	1.9	20	0.100	0.190	N/A	3448859
1,2,3,4,6,7,8-Hepta CDD	pg	4 (1)	2.0	20	0.0100	0.0400	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDD	pg	62	4.1	200	0.000300	0.0186	N/A	3448859
Total Tetra CDD	pg	<2.1	2.1	20	N/A	N/A	N/A	3448859
Total Penta CDD	pg	<2.0	2.0	20	N/A	N/A	N/A	3448859
Total Hexa CDD	pg	<2.1	2.1	20	N/A	N/A	N/A	3448859
Total Hepta CDD	pg	7	2.0	20	N/A	N/A	N/A	3448859
2,3,7,8-Tetra CDF **	pg	<2.2	2.2	20	0.100	0.220	N/A	3448859
1,2,3,7,8-Penta CDF	pg	<2.1	2.1	20	0.0300	0.0630	N/A	3448859
2,3,4,7,8-Penta CDF	pg	<2.1	2.1	20	0.300	0.630	N/A	3448859
1,2,3,4,7,8-Hexa CDF	pg	<2.0	2.0	20	0.100	0.200	N/A	3448859
1,2,3,6,7,8-Hexa CDF	pg	<1.9	1.9	20	0.100	0.190	N/A	3448859
2,3,4,6,7,8-Hexa CDF	pg	<2.1	2.1	20	0.100	0.210	N/A	3448859
1,2,3,7,8,9-Hexa CDF	pg	<2.2	2.2	20	0.100	0.220	N/A	3448859
1,2,3,4,6,7,8-Hepta CDF	pg	3 (1)	1.9	20	0.0100	0.0300	N/A	3448859
1,2,3,4,7,8,9-Hepta CDF	pg	<2.4	2.4	20	0.0100	0.0240	N/A	3448859
1,2,3,4,6,7,8,9-Octa CDF	pg	7	4.1	200	0.000300	0.00210	N/A	3448859
Total Tetra CDF	pg	<2.2	2.2	20	N/A	N/A	N/A	3448859
Total Penta CDF	pg	<2.1	2.1	20	N/A	N/A	N/A	3448859
Total Hexa CDF	pg	<2.0	2.0	20	N/A	N/A	N/A	3448859
Total Hepta CDF	pg	6	2.1	20	N/A	N/A	N/A	3448859
TOTAL TOXIC EQUIVALENCY	pg	N/A	N/A	N/A	N/A	6.57	N/A	N/A
Surrogate Recovery (%)								
C13-1234678 HeptaCDD	%	114	N/A	N/A	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds
(1) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical

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O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		UA9381						
Sampling Date		2013/11/21 00:01			TOXIC EQUIVALENCY		# of	
	Units	RB-M23	EDL	RDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
C13-1234678 HeptaCDF **	%	78	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDD *	%	103	N/A	N/A	N/A	N/A	N/A	3448859
C13-123478 HexaCDF	%	113	N/A	N/A	N/A	N/A	N/A	3448859
C13-1234789 HeptaCDF	%	118	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDD	%	100	N/A	N/A	N/A	N/A	N/A	3448859
C13-123678 HexaCDF	%	78	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDD	%	114	N/A	N/A	N/A	N/A	N/A	3448859
C13-12378 PentaCDF	%	127	N/A	N/A	N/A	N/A	N/A	3448859
C13-123789 HexaCDF	%	125	N/A	N/A	N/A	N/A	N/A	3448859
C13-23478 PentaCDF	%	104	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDD	%	84	N/A	N/A	N/A	N/A	N/A	3448859
C13-2378 TetraCDF	%	82	N/A	N/A	N/A	N/A	N/A	3448859
C13-Octachlorodibenzo-p-Dioxin	%	70	N/A	N/A	N/A	N/A	N/A	3448859
Cl37-2378 TetraCDD	%	108	N/A	N/A	N/A	N/A	N/A	3448859

N/A = Not Applicable
RDL = Reportable Detection Limit
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
* CDD = Chloro Dibenzo-p-Dioxin, ** CDF = Chloro Dibenzo-p-Furan
TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.
WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

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Maxxam Job #: B3K3387
Report Date: 2013/12/16

O'Brien & Gere Engineers Inc
Client Project #: 51076
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

Test Summary

Maxxam ID UA7865 **Collected** 2013/11/20
Sample ID RUN 2-M23 **Shipped**
Matrix Stack Sampling Train **Received** 2013/11/24

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	3451957	N/A	2013/12/09	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	3448859	2013/12/03	2013/12/07	Owen Cosby

Maxxam ID UA7866 **Collected** 2013/11/20
Sample ID RUN 3-M23 **Shipped**
Matrix Stack Sampling Train **Received** 2013/11/24

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	3451957	N/A	2013/12/11	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	3448859	2013/12/03	2013/12/09	Owen Cosby

Maxxam ID UA7867 **Collected** 2013/11/21
Sample ID RUN 4-M23 **Shipped**
Matrix Stack Sampling Train **Received** 2013/11/24

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	3451957	N/A	2013/12/09	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	3448859	2013/12/03	2013/12/07	Owen Cosby

Maxxam ID UA9381 **Collected** 2013/11/21
Sample ID RB-M23 **Shipped**
Matrix Stack Sampling Train **Received** 2013/11/24

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Dioxins/Furans in Air (Method 23)	HRMS/MS	3448859	2013/12/03	2013/12/07	Owen Cosby

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GENERAL COMMENTS

Results relate only to the items tested.

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Attention: Jeff Gorman
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P.O. #:
Site Location: GENERAL DYNAMICS - CARTHAGE, MO

Quality Assurance Report

Maxxam Job Number: GB3K3387

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3448859 OBC	Spiked Blank	C13-1234678 HeptaCDD	2013/12/06		149 (1)	%	25 - 130
	Spiked Blank DUP	C13-1234678 HeptaCDD	2013/12/06		120	%	25 - 130
	Spiked Blank	C13-1234678 HeptaCDF	2013/12/06		111	%	25 - 130
	Spiked Blank DUP	C13-1234678 HeptaCDF	2013/12/06		79	%	25 - 130
	Spiked Blank	C13-123678 HexaCDD	2013/12/06		103	%	40 - 130
	Spiked Blank DUP	C13-123678 HexaCDD	2013/12/06		99	%	40 - 130
	Spiked Blank	C13-123678 HexaCDF	2013/12/06		99	%	40 - 130
	Spiked Blank DUP	C13-123678 HexaCDF	2013/12/06		79	%	40 - 130
	Spiked Blank	C13-12378 PentaCDD	2013/12/06		91	%	40 - 130
	Spiked Blank DUP	C13-12378 PentaCDD	2013/12/06		111	%	40 - 130
	Spiked Blank	C13-12378 PentaCDF	2013/12/06		118	%	40 - 130
	Spiked Blank DUP	C13-12378 PentaCDF	2013/12/06		124	%	40 - 130
	Spiked Blank	C13-123789 HexaCDF	2013/12/06		105	%	40 - 130
	Spiked Blank DUP	C13-123789 HexaCDF	2013/12/06		107	%	40 - 130
	Spiked Blank	C13-2378 TetraCDD	2013/12/06		71	%	40 - 130
	Spiked Blank DUP	C13-2378 TetraCDD	2013/12/06		67	%	40 - 130
	Spiked Blank	C13-2378 TetraCDF	2013/12/06		70	%	40 - 130
	Spiked Blank DUP	C13-2378 TetraCDF	2013/12/06		66	%	40 - 130
	Spiked Blank	C13-Octachlorodibenzo-p-Dioxin	2013/12/06		83	%	25 - 130
	Spiked Blank DUP	C13-Octachlorodibenzo-p-Dioxin	2013/12/06		76	%	25 - 130
	Spiked Blank	2,3,7,8-Tetra CDD	2013/12/06		108	%	80 - 140
	Spiked Blank DUP	2,3,7,8-Tetra CDD	2013/12/06		110	%	80 - 140
	RPD	2,3,7,8-Tetra CDD	2013/12/06	1.8		%	20
	Spiked Blank	1,2,3,7,8-Penta CDD	2013/12/06		108	%	80 - 140
	Spiked Blank DUP	1,2,3,7,8-Penta CDD	2013/12/06		106	%	80 - 140
	RPD	1,2,3,7,8-Penta CDD	2013/12/06	1.9		%	20
	Spiked Blank	1,2,3,4,7,8-Hexa CDD	2013/12/06		111	%	80 - 140
	Spiked Blank DUP	1,2,3,4,7,8-Hexa CDD	2013/12/06		112	%	80 - 140
	RPD	1,2,3,4,7,8-Hexa CDD	2013/12/06	0.9		%	20
	Spiked Blank	1,2,3,6,7,8-Hexa CDD	2013/12/06		103	%	80 - 140
	Spiked Blank DUP	1,2,3,6,7,8-Hexa CDD	2013/12/06		105	%	80 - 140
	RPD	1,2,3,6,7,8-Hexa CDD	2013/12/06	1.9		%	20
	Spiked Blank	1,2,3,7,8,9-Hexa CDD	2013/12/06		110	%	80 - 140
	Spiked Blank DUP	1,2,3,7,8,9-Hexa CDD	2013/12/06		112	%	80 - 140
	RPD	1,2,3,7,8,9-Hexa CDD	2013/12/06	1.8		%	20
	Spiked Blank	1,2,3,4,6,7,8-Hepta CDD	2013/12/06		97	%	80 - 140
	Spiked Blank DUP	1,2,3,4,6,7,8-Hepta CDD	2013/12/06		131	%	80 - 140
	RPD	1,2,3,4,6,7,8-Hepta CDD	2013/12/06	NC		%	20
	Spiked Blank	1,2,3,4,6,7,8,9-Octa CDD	2013/12/06		108	%	80 - 140
	Spiked Blank DUP	1,2,3,4,6,7,8,9-Octa CDD	2013/12/06		110	%	80 - 140
	RPD	1,2,3,4,6,7,8,9-Octa CDD	2013/12/06	NC		%	20
	Spiked Blank	2,3,7,8-Tetra CDF	2013/12/06		95	%	80 - 140
	Spiked Blank DUP	2,3,7,8-Tetra CDF	2013/12/06		105	%	80 - 140
	RPD	2,3,7,8-Tetra CDF	2013/12/06	NC		%	20
	Spiked Blank	1,2,3,7,8-Penta CDF	2013/12/06		108	%	80 - 140
	Spiked Blank DUP	1,2,3,7,8-Penta CDF	2013/12/06		109	%	80 - 140
	RPD	1,2,3,7,8-Penta CDF	2013/12/06	0.9		%	20
	Spiked Blank	2,3,4,7,8-Penta CDF	2013/12/06		112	%	80 - 140
	Spiked Blank DUP	2,3,4,7,8-Penta CDF	2013/12/06		118	%	80 - 140
	RPD	2,3,4,7,8-Penta CDF	2013/12/06	5.2		%	20
	Spiked Blank	1,2,3,4,7,8-Hexa CDF	2013/12/06		111	%	80 - 140
	Spiked Blank DUP	1,2,3,4,7,8-Hexa CDF	2013/12/06		118	%	80 - 140
	RPD	1,2,3,4,7,8-Hexa CDF	2013/12/06	6.1		%	20
	Spiked Blank	1,2,3,6,7,8-Hexa CDF	2013/12/06		101	%	80 - 140
	Spiked Blank DUP	1,2,3,6,7,8-Hexa CDF	2013/12/06		110	%	80 - 140

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Quality Assurance Report (Continued)

Maxxam Job Number: GB3K3387

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3448859 OBC	RPD	1,2,3,6,7,8-Hexa CDF	2013/12/06	8.5		%	20
	Spiked Blank	2,3,4,6,7,8-Hexa CDF	2013/12/06		105	%	80 - 140
	Spiked Blank DUP	2,3,4,6,7,8-Hexa CDF	2013/12/06		129	%	80 - 140
	RPD	2,3,4,6,7,8-Hexa CDF	2013/12/06	20.5 (2)		%	20
	Spiked Blank	1,2,3,7,8,9-Hexa CDF	2013/12/06		122	%	80 - 140
	Spiked Blank DUP	1,2,3,7,8,9-Hexa CDF	2013/12/06		138	%	80 - 140
	RPD	1,2,3,7,8,9-Hexa CDF	2013/12/06	12.3		%	20
	Spiked Blank	1,2,3,4,6,7,8-Hepta CDF	2013/12/06		95	%	80 - 140
	Spiked Blank DUP	1,2,3,4,6,7,8-Hepta CDF	2013/12/06		108	%	80 - 140
	RPD	1,2,3,4,6,7,8-Hepta CDF	2013/12/06	NC		%	20
	Spiked Blank	1,2,3,4,7,8,9-Hepta CDF	2013/12/06		94	%	80 - 140
	Spiked Blank DUP	1,2,3,4,7,8,9-Hepta CDF	2013/12/06		126	%	80 - 140
	RPD	1,2,3,4,7,8,9-Hepta CDF	2013/12/06	NC		%	20
	Spiked Blank	1,2,3,4,6,7,8,9-Octa CDF	2013/12/06		103	%	80 - 140
	Spiked Blank DUP	1,2,3,4,6,7,8,9-Octa CDF	2013/12/06		107	%	80 - 140
	RPD	1,2,3,4,6,7,8,9-Octa CDF	2013/12/06	NC		%	20
	Method Blank	C13-1234678 HeptaCDD	2013/12/07		128	%	25 - 130
		C13-1234678 HeptaCDF	2013/12/07		106	%	25 - 130
		C13-123678 HexaCDD	2013/12/07		112	%	40 - 130
		C13-123678 HexaCDF	2013/12/07		105	%	40 - 130
		C13-12378 PentaCDD	2013/12/07		106	%	40 - 130
		C13-12378 PentaCDF	2013/12/07		116	%	40 - 130
		C13-123789 HexaCDF	2013/12/07		119	%	40 - 130
		C13-2378 TetraCDD	2013/12/07		61	%	40 - 130
		C13-2378 TetraCDF	2013/12/07		61	%	40 - 130
		C13-Octachlorodibenzo-p-Dioxin	2013/12/07		87	%	25 - 130
		2,3,7,8-Tetra CDD	2013/12/07	<2.1, EDL=2.1		pg	
		1,2,3,7,8-Penta CDD	2013/12/07	<2.2, EDL=2.2		pg	
		1,2,3,4,7,8-Hexa CDD	2013/12/07	<2.2, EDL=2.2		pg	
		1,2,3,6,7,8-Hexa CDD	2013/12/07	<2.3, EDL=2.3		pg	
		1,2,3,7,8,9-Hexa CDD	2013/12/07	<2.0, EDL=2.0		pg	
		1,2,3,4,6,7,8-Hepta CDD	2013/12/07	2, EDL=1.9		pg	
		1,2,3,4,6,7,8,9-Octa CDD	2013/12/07	8, EDL=4.2		pg	
		Total Tetra CDD	2013/12/07	<2.1, EDL=2.1		pg	
		Total Penta CDD	2013/12/07	<2.2, EDL=2.2		pg	
		Total Hexa CDD	2013/12/07	<2.2, EDL=2.2		pg	
		Total Hepta CDD	2013/12/07	2, EDL=1.9		pg	
		2,3,7,8-Tetra CDF	2013/12/07	<2.1, EDL=2.1		pg	
		1,2,3,7,8-Penta CDF	2013/12/07	<2.0, EDL=2.0		pg	
		2,3,4,7,8-Penta CDF	2013/12/07	<2.1, EDL=2.1		pg	
		1,2,3,4,7,8-Hexa CDF	2013/12/07	<2.0, EDL=2.0		pg	
		1,2,3,6,7,8-Hexa CDF	2013/12/07	<1.8, EDL=1.8		pg	
		2,3,4,6,7,8-Hexa CDF	2013/12/07	<2.1, EDL=2.1		pg	
		1,2,3,7,8,9-Hexa CDF	2013/12/07	<2.1, EDL=2.1		pg	
		1,2,3,4,6,7,8-Hepta CDF	2013/12/07	<1.8, EDL=1.8		pg	
		1,2,3,4,7,8,9-Hepta CDF	2013/12/07	<2.3, EDL=2.3		pg	
		1,2,3,4,6,7,8,9-Octa CDF	2013/12/07	<4.1, EDL=4.1		pg	
		Total Tetra CDF	2013/12/07	<68, EDL=68 (3)		pg	
		Total Penta CDF	2013/12/07	<2.1, EDL=2.1		pg	
		Total Hexa CDF	2013/12/07	<2.0, EDL=2.0		pg	
		Total Hepta CDF	2013/12/07	<2.0, EDL=2.0		pg	
3451957 VCI	Method Blank	Confirmation C13-2378 TetraCDF	2013/12/09		45	%	40 - 135
		Confirmation 2,3,7,8-Tetra CDF	2013/12/09	<1.9, EDL=1.9		pg	

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method

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Quality Assurance Report (Continued)

Maxxam Job Number: GB3K3387

accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) Recovery above method criteria 40% - 130%

No impact on data
(2) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.
(3) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

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Validation Signature Page

Maxxam Job #: B3K3387

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Owen Cosby, BSc.C.Chem, Supervisor, HRMS Services

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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