
PERMIT ATTACHMENT

APPENDIX V

RF-2 PERFORMANCE DEMONSTRATION TEST PLAN AND REPORT

This appendix contains the text portions of the PDT Test Plan and PDT Report. For the remainder of these documents, refer to the April 2016 Permit Application.

September 2018

APPENDIX V

RF-2 PERFORMANCE DEMONSTRATION TEST
PLAN AND REPORT

FOR

SIEMENS INDUSTRY, INC.

PARKER REACTIVATION FACILITY

PARKER, ARIZONA

Revision 1
April 2012

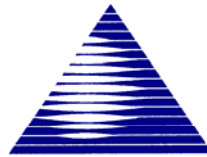
CARBON REACTIVATION FURNACE PERFORMANCE DEMONSTRATION TEST PLAN

PREPARED FOR:

**WESTATES CARBON - ARIZONA, INC.
2523 MUTAHAR STREET
PARKER, ARIZONA 85344**

**Revision: 0
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Focus Project No. 010111**

PREPARED BY:



Focus Environmental, Inc.

ENGINEERING SOLUTIONS TO ENVIRONMENTAL PROBLEMS

**FOCUS ENVIRONMENTAL, INC
9050 EXECUTIVE PARK DRIVE.,
SUITE A202
KNOXVILLE, TENNESSEE 37923
(865) 694-7517**

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ACRONYMS AND ABBREVIATIONS

acfm	Actual cubic feet per minute
APC	Air pollution control
ASTM	American Society for Testing and Materials
AWFCO	Automatic waste feed cutoff
Btu	British thermal unit
CAA	Clean Air Act
CARB	California Air Resources Board
CEM or CEMS	Continuous emission monitor or Continuous emission monitoring system
CFR	Code of Federal Regulations
cm	Centimeters
COPCs	Compounds of potential concern
cu. ft.	Cubic foot
CVAAS	Cold vapor atomic absorption spectroscopy
DC	Direct current
DRE	Destruction and removal efficiency
dscf	Dry standard cubic foot
dscfm	Dry standard cubic feet per minute
EPA	United States Environmental Protection Agency
ft	Feet
GC/FID	Gas chromatography/flame ionization detector
GC/MS	Gas chromatography/mass spectrometry
gpm	U.S. Gallons per minute
gr	Grain (equals 1/7000 pound)
HAP	Hazardous air pollutant
HPLC	High performance liquid chromatography
hr	Hour
HRGC/HRMS	High resolution gas chromatography/high resolution mass spectrometry
HWC MACT	Hazardous Waste Combustor Maximum Achievable Control Technology regulations
ICP	Inductively coupled plasma spectroscopy
in	Inch
in w.c.	Inches of water column (pressure measurement)
L	Liter
lb	Pound
mg	Milligram
ml	Milliliter
MTEC	Maximum theoretical emission concentration
NDIR	Non-dispersive infrared
ng	Nanogram
NVOC	Nonvolatile organic compound
P&ID	Piping and instrumentation diagram
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo furans
PDT	Performance Demonstration Test
PDTP	Performance Demonstration Test Plan

PFD	Process flow diagram
PIC	Product of incomplete combustion
PLC	Programmable logic controller
POHC	Principal organic hazardous constituent
ppmv	Parts per million by volume
ppmvd	Parts per million by volume, dry basis
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RF	Reactivation Furnace
scfm	Standard cubic feet per minute
sq. ft.	Square feet
SVOC	Semivolatile organic compound
TCDD	Tetrachloro dibenzo-p-dioxin
TEQ	Toxicity equivalent (related to 2,3,7,8-TCDD)
TIC	Tentatively identified compound
TOE	Total organic emissions
TSCA	Toxic Substances Control Act
ug	Microgram
VOA	Volatile organic analysis
VOC	Volatile organic compound
VOST	Volatile organic sampling train
WESP	Wet electrostatic precipitator
WCAI	Westates Carbon – Arizona, Inc.

1.0 INTRODUCTION

1.1 FACILITY AND BACKGROUND INFORMATION

Westates Carbon - Arizona, Inc. (WCAI) operates a carbon reactivation facility located in the Colorado River Indian Tribes (CRIT) Industrial Park near Parker, Arizona. The facility treats spent activated carbon that has been used by industry, state and federal government agencies, and municipalities for the removal of organic compounds from liquid and vapor phase process waste streams. Once the carbon has been used and is spent, it must be either disposed of or reactivated at a facility such as WCAI. A Carbon Reactivation Furnace (RF) is used by WCAI to reactivate the spent carbon. Some of the carbon received at the Parker facility is designated as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) regulations. Much of the carbon received at the facility is not a RCRA hazardous waste, as it is either not a characteristic or listed waste. The RF is not a hazardous waste incinerator. "Hazardous waste incinerator" is defined in 40 CFR Part 63, Subpart EEE as a "device defined as an incinerator in § 260.10 of this chapter and that burns hazardous waste at any time." (40 CFR 63.1201). "Incinerator" is defined in 40 CFR 260.10 as "any enclosed device that: (1) Uses controlled flame combustion and neither meets the criteria for classification as a boiler, sludge dryer or carbon regeneration unit, nor is listed as an industrial furnace; or (2) Meets the definition of infrared incinerator or plasma arc incinerator. (emphasis supplied)" The RF does not qualify as an incinerator and instead is designated by Subpart X of the RCRA regulations as a Miscellaneous Unit. According to 40 CFR 264.601 of the Subpart X regulations, permit terms and provisions for a Miscellaneous Unit must include appropriate requirements of 40 CFR Subparts I through O and Subparts AA through CC, 40 CFR 270, 40 CFR 63 Subpart EEE, and 40 CFR 146.

Based on 40 CFR 264.601, WCAI will test the RF to demonstrate performance in accordance with the emission standards of 40 CFR 63 Subpart EEE. These emission standards are more stringent than the RCRA hazardous waste incinerator emission standards of 40 CFR 264 Subpart O. The regulations at 40 CFR 63 Subpart EEE are often referred to as the Hazardous Waste Combustor Maximum Achievable Control Technology (HWC MACT) standards. This terminology will be used in this document.

1.2 TEST PLAN PURPOSE AND ORGANIZATION

The purpose of this Performance Demonstration Test Plan (PDTP) is to identify and document the necessary process details; sampling, analytical, and QA/QC procedures; and anticipated permit operating conditions necessary for demonstration of compliance with the applicable regulatory requirements, and for demonstration of continuing compliance with those standards.

To best address the requirements for demonstrating that the RF can operate within the parameters and limits established by the applicable regulatory requirements the PDTP has been organized into the following major sections:

- 1.0 INTRODUCTION
- 2.0 FEED STREAM DESCRIPTION
- 3.0 ENGINEERING DESCRIPTION
- 4.0 TEST DESIGN AND PROTOCOL
- 5.0 SAMPLING, ANALYSIS, AND MONITORING PROCEDURES
- 6.0 TEST SCHEDULE
- 7.0 OPERATING PERMIT OBJECTIVES
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- 9.0 DATA IN LIEU OF TESTING

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1.3 PROCESS OVERVIEW

The carbon reactivation process consists of a multiple hearth reactivation furnace, a natural gas fired afterburner used to destroy organic contaminants released from the carbon, a wet quench, venturi scrubber, packed bed scrubber, and wet electrostatic precipitator.

1.4 TEST OBJECTIVES AND APPROACH

The WCAI Performance Demonstration Test Plan has been prepared to provide comprehensive performance testing of the RF unit to demonstrate compliance with the applicable HWC MACT emission standards and to gather data for use in a site-specific risk assessment. The objectives of the PDTP are to demonstrate regulatory compliance with standards such as Destruction and Removal Efficiency (DRE) and particulate matter emission concentration, while operating at “worst case” conditions processing normal feed materials, which have been augmented with metals, chloride, etc., to establish operating conditions that will be included in the permit. More specifically, the objectives of the Performance Demonstration Test (PDT) are as follows:

1. Demonstrate Compliance with Applicable USEPA Regulatory Performance Standards (Based on HWC MACT Standards for Existing Hazardous Waste Incinerators):
 - Demonstrate a DRE of greater than or equal to 99.99% for the selected principal organic hazardous constituents (POHCs) chlorobenzene and tetrachloroethene.
 - Demonstrate stack gas carbon monoxide concentration less than or equal to 100 ppmv, dry basis, corrected to 7% oxygen.
 - Demonstrate stack gas hydrocarbon concentration of less than or equal to 10 ppmv, as propane, dry basis, corrected to 7% oxygen.
 - Demonstrate a stack gas particulate concentration less than or equal to 34 mg/dscm (0.015gr/dscf) corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of hydrogen chloride (HCl) and chlorine (Cl₂) are no greater than 77 ppmv, dry basis, corrected to 7% oxygen, expressed as HCl equivalents.
 - Demonstrate that the stack gas mercury concentration is less than or equal to 130 µg/dscm, corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of semivolatile metals (cadmium and lead, combined) is less than or equal to 240 µg/dscm, corrected to 7% oxygen.

- Demonstrate that the stack gas concentration of low volatility metals (arsenic, beryllium, and chromium, combined) is less than or equal to 97 $\mu\text{g/dscm}$, corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of dioxins and furans does not exceed 0.40 ng/dscm, corrected to 7% oxygen, expressed as toxic equivalents of 2,3,7,8-TCDD (TEQ). This is the applicable standard since the gas temperature entering the first particulate matter control device is less than 400°F.
2. Establish Permit Operating Limits
- Demonstrate maximum feed rate for spent activated carbon.
 - Demonstrate minimum afterburner gas temperature
 - Demonstrate maximum combustion gas velocity (or a suitable surrogate indicator)
 - Demonstrate maximum total chlorine/chloride feed rate
 - Establish a Maximum Theoretical Emission Concentration (MTEC) limit for mercury
 - Demonstrate system removal efficiency (SRE) for semivolatile and low volatility metals so feed rate limits can be developed by extrapolation from test results.
 - Establish appropriate operating limits for the air pollution control system components.
3. Gather Information for Use in a Site-Specific Risk Assessment
- Measure emissions of metals, including hexavalent chromium
 - Measure emissions of specific volatile and semivolatile products of incomplete combustion (PICs)
 - Measure emissions of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF)
 - Measure emissions of polychlorinated biphenyls (PCBs)
 - Measure emissions of specific organochlorine pesticides
 - Measure emissions of total volatile, semivolatile, and nonvolatile organics
 - Determine the stack gas particle size distribution.

1.5 TEST PROTOCOL SUMMARY

In order to accomplish the PDT objectives, (i.e., demonstrating that the unit will meet all applicable environmental performance standards) a single test condition representing “worst case” operations of minimum temperature, maximum combustion gas velocity (minimum residence time), and maximum waste feed rate will be performed. The test will consist of at least three replicate sampling runs.

A summary description of the testing conditions, analytical parameters, and sampling methods follows:

1.5.1 Test Condition 1 (“Worst-Case” Operations)

Sampling and monitoring protocols that will be utilized while carrying out the performance test are summarized as follows:

- Spent Activated Carbon Feed - total chlorine/chloride, elemental (C, H, N, O, S, moisture), volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Makeup Water - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Caustic feed to APC - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Cu, Co, Pb, Hg, Ag, Tl, Se, Ni, V, Zn)
- Scrubber Blowdown - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Wastewater Discharge to POTW - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Stack gas particulate, HCl, and Cl₂ using EPA Method 26A
- Stack gas target volatile organics using VOST, SW-846 Method 0030
- Stack gas target semivolatile organics and organochlorine pesticides using SW-846 Method 0010
- Stack gas PAHs and PCBs using a separate SW-846 Method 0010 sampling train
- Stack gas PCDD/PCDF using SW-846 Method 0023A
- Stack gas total volatile organics using SW-846 Method 0040
- Stack gas total semivolatile and nonvolatile organics using SW-846 Method 0010
- Stack gas metals (Al, Sb, As, Ba, Be, Cd, total Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, and Zn) using EPA Method 29
- Stack gas hexavalent chromium using SW-846 Method 0061
- Stack gas particle size distribution using a cascade impactor

- Stack gas CO and O₂ by permanently installed CEM according to the protocols in the Appendix to 40 CFR 63, Subpart EEE; Performance Specification 4B of 40 CFR 60, Appendix B.
- Stack gas total hydrocarbons (as propane) by temporary CEM according to EPA Method 25A and the protocols in the Appendix to 40 CFR 63, Subpart EEE.

1.6 DEVELOPMENT OF PERMIT LIMITS

WCAI is required to establish operating limits (applicable whenever RCRA hazardous spent activated carbon is in the reactivation furnace) in its permit to ensure that the RF system complies with the applicable USEPA environmental performance standards at all times that RCRA hazardous spent activated carbon is being treated. Under the HWC MACT, the regulations establish a comprehensive list of regulated parameters at 40 CFR 63.1209 (j) through (p) which are used to ensure continuing regulatory compliance. Other RCRA permitting guidance documents also suggest certain permit limits and means for establishing those limits. Finally, the RF has been operating since 1996 with certain limits imposed by plant operations personnel.

Considering the configuration of the RF system and the characteristics of the spent activated carbon to be fed, WCAI anticipates establishing process operational limits on the following parameters:

- Minimum afterburner gas temperature
- Maximum spent activated carbon feed rate
- Maximum total chlorine and chloride feed rate
- Maximum feed rate of mercury (based on MTEC)
- Maximum feed rate of semivolatile metals (total combined lead and cadmium)
- Maximum feed rate of low volatility metals (total combined arsenic, beryllium, and chromium)
- Minimum venturi scrubber pressure differential
- Minimum quench/venturi scrubber total liquid flow rate
- Minimum packed bed scrubber pH
- Minimum packed bed scrubber pressure differential
- Minimum packed bed scrubber liquid flow rate
- Minimum scrubber blowdown flow rate
- Minimum WESP secondary voltage

- Maximum stack gas flow rate (indicator of combustion gas velocity).

These operating limits will be established as described in Section 7.0 of this document. The approach taken for establishing operating limits generally follows the specifications of 40 CFR 63 Subpart EEE and guidance prepared for RCRA incinerator permits. However, since those regulations and guidance do not strictly apply to this unit, but are used as guidelines for the development of appropriate limits, WCAI is also proposing to establish some limits based on current operating practices and automation system capabilities, which have proven to be effective for this particular facility.

1.7 TEST PLAN DEVELOPMENT AND CONDUCT OF THE PERFORMANCE DEMONSTRATION TEST

In August 2001, USEPA requested that WCAI prepare a performance demonstration test plan and a risk assessment workplan as part of the process for completing the RCRA facility permit. In its August letter, USEPA identified a variety of general requirements for the plans. In response to USEPA's request, WCAI selected Focus Environmental, Inc. to provide permitting assistance, overall project management, and preparation of the Performance Demonstration Test Plan. Focus Environmental, Inc. is an independent engineering consulting firm headquartered in Knoxville, Tennessee, and has no affiliation with WCAI or its parent company, USFilter, other than its contract to conduct the permitting activities for the Parker facility.

WCAI will select qualified and experienced performance testing contractors and laboratories to conduct all aspects of the Performance Demonstration Test, including overall test management, stack gas sampling, laboratory analysis, data review, calculation of results, and test reporting. These firms will be independent contractors having no affiliation with WCAI, or its parent company, USFilter, other than their contract to conduct the testing services for the Parker Facility.

2.0 FEED STREAM DESCRIPTION

2.1 FEED STREAM CHARACTERISTICS

The feed streams for the WCAI RF are described in the following sections.

2.1.1 Spent Activated Carbon

An aqueous slurry of spent activated carbon is the only material treated in the RF. The facility treats spent activated carbon that has typically been used for treating industrial and municipal wastewater, groundwater, surface water, process materials, or for air pollution control. Constituents in the streams being treated are adsorbed onto the surface and into the internal pores of the activated carbon. The activated carbon is said to be "spent" when it has adsorbed a certain amount of chemicals. The amount of chemicals adsorbed will vary from site to site, but generally the organic loading is no greater than 0.3 pounds of chemicals per pound of dry activated carbon. The organic loading on an average basis is much lower than the 0.3 pounds per pound of activated carbon maximum loading. Average loading data for the period from 1997 through 2001 indicated a range of 0.0038 to 0.0071 pounds of organic per pound of dry carbon, with an overall weighted average of 0.0055 pounds of organic per pound of dry carbon.

The number of different regulated constituents adsorbed on the activated carbon from a given source depends on the composition of the stream being treated. The list of organic constituents that may be adsorbed on spent carbon is very extensive, and includes, but is not limited to, volatile organic compounds, polynuclear aromatic hydrocarbons, phthalates, amines, and pesticides. Activated carbon is not customarily used to remove metals from a waste stream, although, low concentrations may be expected in the spent carbon. Actual facility data for the spent activated carbon is included in Tables 2-1 and 2-2. The spent activated carbon will be received, stored and handled as per the Waste Analysis Plan located in the facility's RCRA Part B permit application. The facility will not accept spent carbon containing TSCA-regulated levels of PCBs, infectious wastes, regulated levels of radioactive wastes (as regulated by the Nuclear Regulatory Commission) or spent carbon exhibiting the characteristics of corrosivity or reactivity. Additionally, WCAI will not accept spent activated carbon that is classified as a dioxin-listed hazardous wastes (i.e., those carrying EPA Waste Codes F020, F021, F022, F023, F026, and F027).

2.1.2 Fuels

The only auxiliary fuel used for the RF is natural gas. Typical characteristics of natural gas are included in Table 2-3.

2.1.3 Other Feed Streams

The only other feed stream to the RF is steam. The steam is used in the RF to assist in the reactivation process of the spent carbon. The steam is not expected to contain any RCRA Appendix VIII Hazardous Constituents or Hazardous Air Pollutants (HAPs).

2.2 FEED STREAM MANAGEMENT

The feed stream management of the spent carbon is described in the following sections.

2.2.1 Storage

Spent carbon is received by truck in containers (i.e., drums, vessels, supersacks, roll-off bins, etc.) or in tank trucks. Following inspection and acceptance at the facility, containerized spent carbon is unloaded in the unloading and receiving area where it is inspected and sampled. If the load is accepted for treatment, the containerized spent carbon is either transferred into one of the four spent carbon storage tanks via a feed hopper or moved to the Container Storage Area.

Spent carbon received in large containers, such as roll-offs and slurry trailers, is typically transferred directly to the spent carbon storage tanks through a feed hopper. Spent carbon received in smaller containers, such as drums, is typically moved to the container storage area in the containers in which it was received and subsequently transferred to the spent carbon storage tanks. The containerized spent carbon is transferred to the storage tanks via a hopper because it cannot be pumped directly from the container to the storage tank. Water is added as the carbon passes through the hopper to facilitate removal of the spent carbon from the hopper via an eductor. The carbon is transferred to the storage tanks as a water-carbon slurry.

The tank trucks carrying the bulk loads are retained in the unloading and receiving area and the spent carbon is inspected and sampled. If the shipment is accepted for treatment, the spent carbon is transferred in slurry form to one of the four process storage tanks, directly or through a feed hopper. Water used in the transfer process is supplied from the recycle water system

which consists of two recycle water storage tanks and associated valves and piping. The recycle water is periodically monitored and pH-adjusted, when required, for corrosion control. From the process storage tanks, the carbon is transferred in slurry form to the Carbon Reactivation Furnace (RF).

2.2.2 Blending

Blending of the spent carbon is required to control the concentration of chlorine and chlorides present in the feed material to maintain compliance with WCAI's wastewater discharge limit for TDS.

3.0 ENGINEERING DESCRIPTION

A block flow diagram of the carbon reactivation process is shown in Figure 3-1. Spent carbon slurry is fed from the Furnace Feed Hopper into a dewatering screw where the carbon is dewatered prior to introduction into the Carbon Reactivation Furnace (RF). Water from the dewatering screw is returned to one of the two recycle water storage tanks. The RF is a multiple hearth furnace consisting of five hearths. The spent carbon is introduced into the top hearth and flows downward through the remaining four hearths. Reactivated carbon exits the bottom hearth through a cooling screw. The RF is equipped with a primary combustion air fan and two shaft cooling fans. Steam from a small boiler is introduced into the RF to complete the reactivation process. Natural gas burners are provided to ensure adequate heat input to the reactivation unit for all of the spent carbons that are reactivated at the facility. The hot gases generated in the RF flow upward through the hearths and exit from the topmost hearth and are routed to an afterburner to ensure the thermal oxidation of any organic matter that is not oxidized in the reactivation unit. The afterburner is equipped with two burners that utilize natural gas as the fuel source. From the afterburner, the gases are quenched by direct water contact and routed through a variable throat venturi scrubber for particulate matter control. From the venturi scrubber, the gases are routed to a packed bed scrubber for acid gas control. From the packed bed scrubber, the gases flow through a wet electrostatic precipitator, used for fine particulate matter and metals control. From the wet electrostatic precipitator (WESP), the gases are routed through a stack to the atmosphere. The motive force for moving the gases through the air pollution control system is supplied by an induced draft fan located between the WESP and stack.

A pH-controlled scrubbing medium (water and caustic solution) is supplied to the air pollution control system from the scrubber water system. The pH is continuously monitored to ensure efficient acid gas removal in both the quench/venturi scrubber and the packed bed scrubber. Caustic is added based on the pH of the scrubber water.

The air pollution control equipment uses a closed loop recycle water system. Periodically, a portion of the scrubber water in the system is discharged (blowdown) in order to prevent the excessive build-up of total dissolved solids in the scrubber water system.

Scrubber blowdown from the RF air pollution control equipment is either discharged directly to the Publicly Owned Treatment Works (POTW) or is treated in a RCRA-exempt wastewater treatment unit, and then discharged to the POTW. The discharge to the POTW is continuously monitored for pH, total dissolved solids, flow and temperature to ensure compliance with the discharge limitations found in the facility's industrial wastewater discharge permit.

3.1 THERMAL TREATMENT SYSTEM

The thermal treatment system is a multiple hearth furnace, consisting of five hearths followed by an afterburner. Spent carbon is introduced into the top hearth of the reactivation unit and flows downward through the remaining four hearths. The top two hearths are unfired hearths. Hot combustion gases generated in the bottom three hearths are used to complete the dewatering of the spent carbon. The bottom three hearths are fired hearths where the reactivation process occurs. Rabble arms, with teeth, each connected to a rotating center shaft, are located above each hearth. The rabble teeth plow the carbon material across the hearth surface and towards drop holes. The carbon falls through the drop holes to the next lower hearth, and eventually to the outlet of the reactivation unit. Reactivated carbon exits the bottom hearth through a cooling screw. The RF is equipped with a primary combustion air fan, and two center shaft cooling fans. Steam from a natural gas fired boiler is introduced into the RF to complete the reactivation process. Natural gas burners are provided to ensure adequate heat input to the reactivation unit for all carbons that are reactivated at the facility.

3.1.1 Type, Manufacturer's Name and Model Number

The RF is a multiple hearth furnace consisting of five hearths and an afterburner manufactured by Hankin Environmental Systems, Inc. The Hankin multiple hearth furnace is a 12'10 ³/₄" O.D. x 5 Hearths designed to nominally reactivate 2,760 lb/hr of spent carbon feed. Drawings and specifications for the multiple hearth furnace and afterburner are presented in Attachment E.

3.1.2 System Capacity

The RF unit is currently authorized to reactivate 2,760 pounds per hour of spent carbon feed.

3.1.3 Thermal Treatment and Combustion Chamber(s)

Following dewatering the spent granular carbon is fed to the top section of the multiple-hearth furnace. In the pre-drying and drying zones (the top hearths) the water retained in the pores

and on the surface of the carbon is evaporated by the counter-current flow of hot combustion gases. The temperature of the carbon is raised to approximately 210°F. Upon application of heat, water will evaporate freely when the particle temperature goes over 200°F. The adsorbed water is freed at temperatures of approximately 212°F to 230°F.

Upon the application of heat to the particles at temperatures over 600°F, the high molecular weight organic impurities will crack to produce gaseous hydrocarbons, hydrogen and water vapor which escape the pores of the granular carbon while some fixed carbon is retained in the pores of the granules. In these pre-heating and decomposition zones (middle hearths) the temperature of the carbon is increased to about 750°F in a virtually oxygen-free atmosphere. Under these conditions the adsorbed organic impurities in the pores of the carbon are pyrolyzed and all volatile materials are driven off.

The carbonaceous residue, left behind in the pore structure of the carbon by the pyrolyzation process, is oxidized in the final heat up and gasification zones (lower hearths) in a way which avoids damage to the original pore structure of the carbon. This is the most important commercial phase of the reactivation process, with the critical parameters being carbon temperature, retention time, and steam and carbon dioxide concentration in the furnace atmosphere. Carbon bed temperatures may range from 1450°F-1600°F. Combustion of natural gas provides the required heat. Carbon dioxide and some water vapor are part of the products of combustion. Steam is injected as necessary.

The afterburner is a self-supporting vertical cylindrical chamber approximately 33 feet high with an inside refractory diameter of approximately 5 feet. The design incorporates a mixing zone, choke ring and a minimum residence time at temperature of greater than one second. The afterburner shell is constructed of steel plate and is internally lined with firebrick and castable insulation. The afterburner is equipped with two low NO_x burners, which utilize heated combustion air. The afterburner chamber is fitted with a total of six air injection nozzles which are placed to provide combustion air and turbulence to promote the oxidation of organic materials in the flue gas. The afterburner is designed to thermally oxidize greater than 99.99 percent of all organic matter entering the afterburner in the furnace off gas. A cross-section of the afterburner and the specification for the afterburner can be found in Attachment E. Actual material usages will be those listed in the specification or their functional equivalent.

3.1.4 Residence Time Determination

The residence time for the solid carbon in the Carbon Reactivation Furnace is 42 minutes at a shaft speed of 1 rpm.

3.2 BURNER AND FEED SYSTEMS

Six natural gas burners are installed in the RF, two per hearth on hearths 3, 4, and 5. Two natural gas burners are installed in the afterburner.

3.2.1 Burner Description

The six burners installed in the RF are North American Manufacturing Company burners (NA 6422-6) or their functional equivalent. The two burners installed in the afterburner are North American Manufacturing Company burners (NA 6514-8-B) or their functional equivalent. Literature describing these burners can be found in Attachment E. Materials of construction of these burners are listed in the literature.

3.2.2 Spent Activated Carbon Feed System

The spent activated carbon feed system to the RF consists of a feed hopper, a dewatering screw, and a weigh belt conveyor. The spent carbon/recycle water slurry is discharged from the feed hopper to the dewatering screw via a control valve. The dewatered spent carbon is discharged from the dewatering screw on to the weigh belt conveyor, which is used to measure the feed rate to the RF.

3.2.3 Auxiliary Fuel System

The six burners in the RF and the two burners in the afterburner are fired with natural gas, supplied by the local utility company via pipeline.

3.2.4 Combustion Air

Combustion air is supplied to the six RF burners and two afterburner burners by a combustion air blower. The blower is designed to supply approximately 351,600 ACFH of preheated combustion air. Fan specifications are located in Attachment E.

3.3 REACTIVATED CARBON HANDLING SYSTEM

The reactivated carbon exiting from the RF is a product. The reactivated carbon is discharged from the RF into a screw cooler and from the screw cooler through an enclosed conveyor system into one of three reactivated carbon product storage tanks. From the reactivated carbon storage tanks, the reactivated carbon product is transported through an enclosed conveyor to a product packaging facility. At the product packaging facility, the reactivated carbon is removed from the storage tanks and placed in appropriate containers for shipment to customers.

Scrubber blowdown from the RF air pollution control equipment is treated in a RCRA-exempt wastewater treatment unit, or discharged directly to the POTW. The discharge to the POTW is continuously monitored for pH, total dissolved solids, flow and temperature to ensure compliance with the discharge limitations found in the facility's industrial wastewater discharge permit.

3.4 AIR POLLUTION CONTROL (APC) SYSTEM

The APC system for the RF includes a quench/venturi scrubber, a packed bed scrubber and a wet electrostatic precipitator. Exhaust gases from the thermal treatment system are continuously routed through the APC equipment, and cannot by-pass the APC equipment under any circumstances. The individual components of the APC equipment are described in the following sections.

3.4.1 Quench/Venturi Scrubber

The Quench/Venturi Scrubber is a dual-purpose device used to rapidly quench the hot combustion gases exiting the afterburner and to remove particulate matter. The quench section uses water sprays to cool the afterburner exit gas to the point of adiabatic saturation (approximately 170 to 190°F). The venturi scrubber has an adjustable throat, and is a low energy, vertical down flow type. The throat area is adjusted by a pneumatic cylinder actuator and an electro/pneumatic positioner. The remotely adjustable throat is automatically controlled to maintain a constant pressure differential. The venturi scrubber is located directly below the quench section and is connected by a flooded elbow to the packed bed scrubber. The elbow incorporates a water-filled gas impact section directly beneath the throat to prevent erosion of the shell. The water supply for quench and venturi irrigation is recirculated scrubber water at a total flow of approximately 7.5 gpm/1000 ACFM.

The design data and equipment descriptions for the quench/venturi scrubber as well as a description of the physical dimensions of the venturi scrubber section can be found in Attachment E. Actual material usages will be those listed therein, or their functional equivalent.

3.4.2 Packed Bed Scrubber

The packed bed scrubber consists of a vertical up flow and cylindrical disengaging section followed by a packed bed section and mist eliminator. The bottom portion of the scrubber is used to separate entrained water droplets from the gas prior to entering the packed section of the scrubber.

The packed bed scrubber is designed to remove a minimum of 99 percent of the incoming hydrogen chloride.

The design data and equipment description for the packed bed scrubber as well as a description of the physical dimensions of the packed bed scrubber can be found in Attachment E. Actual material usages will be those listed therein or their functional equivalent.

3.4.3 Wet Electrostatic Precipitator

The wet electrostatic precipitator (WESP) is a vertical hexagonal tube design with self-irrigating tubes. The WESP consists of inlet gas distribution to promote even distribution of the process gas flow entering the WESP, inlet and outlet plenums and a collecting electrode tube bundle. The WESP is equipped with outboard high voltage insulator compartments which include a purge air system, high voltage distribution-support grids, high intensity rigid tube type charging/precipitating discharge electrodes, high voltage power supply (transformer/rectifier and controller) system, ground sticks, safety key interlocks, warning labels, and electronic control logic equipment and valving.

The WESP, in conjunction with the venturi scrubber, is designed to achieve a maximum outlet particulate matter grain loading of 0.015 grains/dscf adjusted to 7 percent oxygen.

The design data and equipment description for the WESP as well as a description of the physical dimensions of the WESP can be found in Attachment E. Actual material usages are those listed therein or their functional equivalent.

3.4.4 ID Fan

A variable speed induced draft fan is provided to exhaust combustion gases from the furnace and afterburner and through the air pollution control system. Design specifications for the fan can be found in Attachment E. Actual materials of construction will be those listed in the specification or their functional equivalent.

3.4.5 Stack

The treated gas stream is exhausted to the atmosphere via a 110 foot high stack with an inside diameter of two feet and a gas outlet that is 19.75 inches in diameter. The stack is equipped with ports for continuous emissions monitoring, stack gas flow rate monitoring, and exhaust gas sampling. A stack drawing is provided in Attachment E. Actual materials of construction will be those listed in the specification or their functional equivalent. Additional sampling ports may be installed for the extensive sampling to be conducted during this Performance Demonstration Test. A stack sampling port location drawing is included in Attachment E.

3.5 PROCESS MONITORING, CONTROL, AND OPERATION

The facility is equipped with a programmable logic control (PLC) system which monitors and/or controls process variables to ensure proper facility operation. The RF system is equipped with instrumentation to monitor and control process flows, temperatures, and pressures, and to transmit signals to the main control system. The automation system has the capabilities of controlling valves, motors, pumps, and fans as well as alarming and initiating waste feed cutoff interlocks if process conditions deviate from established limits.

Figure 3-2 shows the location of pertinent instrumentation related to permit compliance. Complete Piping and Instrumentation Diagrams (P&IDs) are included in Attachment E. It is important to note that these drawings include many components of the facility that are exempt from permitting under various provisions of RCRA. These components are provided for informational purposes and ease of review only, and they are not intended to become regulated components of the facility. Information concerning the major process instruments associated with regulatory compliance is presented in Table 3-1. Instrument tag numbers correspond to the designations shown on the P&IDs. Calibration schedules are based on manufacturer's recommendations and WCAI operating experience.

Process monitoring and emissions monitoring performed for regulatory compliance is conducted on a continuous basis in accordance with USEPA definitions of continuous monitors.

A "Continuous Monitor" is a device (or series of devices) which continuously samples the regulated parameter without interruption, evaluates the detector response at least once every 15 seconds, and computes and records the average value at least every 60 seconds, except during periods of calibration or as otherwise allowed by the applicable regulations or guidelines. For many parameters, rolling averages are calculated. A "Rolling Average" is defined as the arithmetic mean of a defined number of the most recent one-minute average values calculated by the continuous monitor. For example, an hourly rolling average would incorporate the 60 most recent one-minute average values. As each new one-minute average value is computed, the least recent of the 60 values is discarded and a new hourly rolling average is calculated and recorded. 12-hour rolling averages use 720 one-minute average values rather than 60.

Two subsets of continuous monitoring systems are employed on the RF: process continuous monitoring systems (CMS) and continuous emissions monitoring systems (CEMS). The following is a discussion of each type of continuous monitoring system.

3.5.1 Process Continuous Monitoring System (CMS)

Figure 3-2 shows the general location and function of the temperature, pressure, and flow indicating and control devices for the carbon reactivation system. The specifications for these devices are shown in Table 3-1.

The following is a discussion of each type of process monitoring and control to be performed in the RF system for regulatory compliance purposes.

Spent Activated Carbon Feed Rate

The flow rate of the spent activated carbon is monitored and controlled using a weigh belt conveyor and carbon slurry feed valve. When the feed valve is open, carbon slurry drops into the dewatering screw and is then discharged onto the weight belt conveyor, which feeds the carbon to the RF. The feed rate control system consists of a weigh cell, weight transmitting element, weight indicating controller, variable timed open/closed carbon slurry feed valve, and continuous weight feed rate recorder. The desired spent activated carbon feed rate is achieved

by the control system adjusting the time that the carbon slurry feed valve is open and closed. Automatic waste feed cutoff interlocks stop the weigh belt conveyor which stops the feed of carbon to the RF.

Regulated Constituent Feed Rates

The total feed rate of mercury, semivolatile metals (the combination of cadmium plus lead), and low volatility metals (the combination of arsenic, beryllium, plus chromium) will be continuously monitored and recorded in accordance with the HWC MACT regulations. This will be accomplished by the process computer which continuously monitors the flow rate of spent activated carbon, and multiplies that flow rate by the constituent concentration, which is input to the computer whenever the feedstream characterization is updated. If a regulated constituent is believed to have the potential to be present in the spent activated carbon, but is not detected by the relevant analysis, then the detection limit for that constituent will be used in the calculation. If a constituent is not expected to have the potential to be present in the spent activated carbon, then the concentration of that constituent will be set as zero.

Afterburner Temperature

The RF afterburner combustion temperature is continuously measured by thermocouples located in the afterburner chamber. The automatic temperature controller accepts the signal from the thermocouple and manipulates the auxiliary fuel feed rate. The automatic waste feed cutoff interlock is activated during low temperature conditions.

Venturi Pressure Differential

Venturi scrubber pressure differential is measured and controlled as an indicator of the energy supplied for particulate matter removal. A minimum pressure differential is necessary for proper control efficiency. The pressure differential is continuously measured by a pressure differential indicator with pressure taps located at the inlet and outlet of the venturi. The pressure differential is controlled by changing the position of the venturi throat control valve elements.

Quench/Venturi Scrubber Liquid Flow Rate

The recycle flow rate is continuously monitored using magnetic flow meters in the recycle water lines. A minimum recycle water flow rate is maintained in order to provide sufficient cooling and

scrubbing water for particle removal. A low total recycle flow rate will initiate an automatic waste feed cutoff.

Packed Bed Scrubber pH and Flow Rate

The packed bed scrubber recycle pH and the flow rate of recycled liquid to the packed bed scrubber influence the effectiveness of acid gas removal. The pH is measured continuously by an in-line pH probe installed in the recycle liquid piping. The recycle flow rate is continuously monitored using a magnetic flow meter in the recycle water line. Either low pH or low packed bed scrubber recycle flow rate will initiate an automatic waste feed cutoff.

Packed Bed Scrubber Pressure Differential

The differential pressure across the packed bed is measured as an indicator of proper liquid and gas distribution in the tower. The pressure differential is continuously measured by a differential pressure element with taps located at the inlet and outlet of the packed bed scrubber.

WESP Secondary Voltage

Although the HWC MACT regulations, do not require monitoring of any WESP performance indicators, WCAI will monitor the secondary voltage as an indicator of proper collection of fine particles and metals. A minimum secondary voltage of 14 kVDC has been established based upon operating experience.

Scrubber Blowdown Flowrate

In order to conserve water, WCAI recycles most of the liquid from the air pollution control system. In order to prevent the buildup of dissolved solids, WCAI bleeds water from the system. As water is bled, fresh makeup water is added. The APC system blowdown flow rate is continuously monitored using a magnetic flowmeter, and a low flow rate will trigger an automatic waste feed cutoff.

Stack Gas Flow Rate

The flow rate of stack gases is used as the indicator of combustion gas velocity prescribed by the applicable regulations. A flow sensor located in the stack provides the direct flow measurement. High stack gas flow rate will initiate an automatic waste feed cutoff.

3.5.2 Continuous Emissions Monitoring System (CEMS)

The exhaust gases are continuously monitored for carbon monoxide and oxygen content as an indicator of proper operation of the combustion process. To ensure these monitors are functioning properly, they are calibrated according to the protocols specified in the Appendix to 40 CFR 63 Subpart EEE, and Performance Specification 4B of 40 CFR 60 Appendix B.

The oxygen analyzer is an Ametek FCA-Control paramagnetic analyzer. The carbon monoxide analyzer is a Thermo Environmental Model 48, non-dispersive infrared monitor having a dual range of 0-100 ppm and 0-1000 ppm.

Performance specifications for the CEMS are shown in Table 3-2. Additional specifications, as well as a drawing of the sampling system can be found in Attachment E.

3.5.3 Safety and Automatic Waste Feed Cutoffs

The control system includes an automatic waste feed cutoff (AWFCO) system that stops the feed of spent activated carbon when operating conditions are at or near limits necessary to comply with specific permit conditions. In addition, the spent activated carbon feed is automatically stopped if the range of the measurement instrument is exceeded or if there is a malfunction of the continuous monitoring system. A listing of the AWFCO parameters is provided in Table 3-3. When any of these parameters deviates from the established limit, an electronic signal from the control system will stop the carbon weigh belt feeder. Anticipated limits for these and other permit conditions are discussed in Section 7.0 of this plan.

On a monthly basis, during RF operations, the AWFCO system will be tested, without feed interruption, by running a software routine to check PLC logic functions and alarm logging associated with the AWFCO subsystem. Each of the regulatory AWFCOs will be tested by using a control system console to input a software value which corresponds to an exceedance of the permit limit. Verification will then be made that the control system, in response to the test input, sends out a signal to trigger AWFCOs. The alarm logs will be checked to verify that the appropriate alarm was recorded. It should be noted that during the brief period of time when the AWFCO parameters are being tested, regulatory AWFCOs will be precluded. A maximum time limit of one minute per test for each parameter will be imposed so as to minimize AWFCO downtime. Non-regulatory AWFCOs will not be affected by the test.

3.6 PROCEDURES TO RAPIDLY STOP WASTE FEEDS AND CONTROL EMISSIONS

3.6.1 Rapidly Stopping Spent Activated Carbon Feeds

The RF is controlled by a process control computer. WCAI has included alarms and waste feed cutoff interlock setpoints which will automatically stop the feed of spent activated carbon before any permit limits are exceeded. In the event any of these preprogrammed operating setpoints are reached, the computer will take automatic action to stop the carbon weigh belt conveyor to immediately stop spent activated carbon feed to the system. The same action to cease spent activated carbon feed can be activated from the control room by operating personnel. These actions do not necessarily constitute a shutdown of the RF; only a stoppage of spent activated carbon feed. The RF will normally operate on auxiliary fuel after spent activated carbon feed is ceased to maintain operating temperature.

3.6.2 Shutting Down the System

RF system shutdowns may occur for two reasons:

1. A loss or malfunction of systems or controllers critical to maintaining performance standards and operating requirements.
2. A scheduled shutdown for normal maintenance or other operational purposes.

In the event of a system failure, the RF system is equipped with spent activated carbon feed and fuel shutoff mechanisms which fail to the "safe" (closed or off) position. Critical automation equipment or instrumentation failures will result in automatic stoppage of spent activated carbon feed and partial or complete system shutdown, depending on the severity of the failure or malfunction. Operations personnel have the ability to initiate an emergency system shutdown manually from the control room, although a controlled shutdown is preferred. Complete shutdown of the RF system can be undertaken as required in an orderly fashion to allow for a proper rate of cooling. WCAI maintains standard operating procedures including those for normal shutdown of the RF system. Normal and emergency system shutdown procedures are summarized in Attachment E.

3.6.3 Controlling Emissions During Equipment Malfunctions

The RF system is totally sealed to prevent fugitive emissions under all operating or malfunction conditions. Equipment shells and interconnecting ductwork are free from openings or gaps. Emissions from the spent activated carbon feed point are prevented through the use of a rotary

air lock on the multiple hearth furnace feed port. Emissions from the rotating parts in the multiple hearth are prevented by a sand seal. Reactivated carbon product handling is totally enclosed. Daily inspections are conducted in accordance with the inspection procedures of the RCRA Permit Application. Process gases are always directed through the emissions control equipment, and there are no provisions to bypass the air pollution control system. In addition, the emissions control equipment is among the last equipment to be taken off-line under any circumstance. In the event of an equipment malfunction affecting RF system performance, spent activated carbon feed is automatically discontinued. Stopping the spent activated carbon feed immediately eliminates the flow of untreated material into the RF system, however since the spent activated carbon takes 42 minutes to travel through the reactivation furnace hearths, a slight potential for emissions remains during this time. To the greatest extent possible, the afterburner and emissions control equipment will continue to operate while the malfunction is corrected. Spent activated carbon feed may be resumed once operating conditions have been returned within the permit limits. If the malfunction can not be corrected in a reasonable time frame or requires the unit to be taken off line, the reactivation furnace, afterburner, and APC systems will be shut down in an orderly fashion according to standard operating procedures. Spent carbon feed will not resume until the malfunction has been corrected and the entire RF system has been returned to operating conditions within the permitted limits.

3.6.4 Emergency Safety Vent Operations

The WCAI RF design does not require or utilize an emergency safety vent. Process gases are always directed through the emissions control equipment, and there are no provisions to bypass the air pollution control system.

4.0 TEST DESIGN AND PROTOCOL

4.1 REGULATORY REQUIREMENTS

A Carbon Reactivation Furnace is used by WCAI to reactivate spent activated carbon. Some of the carbon received at the Parker Facility is designated as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) regulations. Much of the carbon received at the facility is not a RCRA hazardous waste, as it is either not a characteristic or listed waste. The RF is not a hazardous waste incinerator. "Hazardous waste incinerator" is defined in 40 CFR 63, Subpart EEE, as a "device defined as an incinerator in §260.10 of this chapter and that burns hazardous waste at any time." (40 CFR 63.1201). "Incinerator" is defined in 40 CFR 260.10 as "any enclosed device that: (1) Uses controlled flame combustion and neither meets the criteria for classification as a boiler, sludge dryer or carbon regeneration unit, nor is listed as an industrial furnace; or (2) Meets the definition of infrared incinerator or plasma arc incinerator. (emphasis supplied)" The RF does not qualify as an incinerator and instead is designated by Subpart X of the RCRA regulations as a Miscellaneous Unit. According to 40 CFR 264.601 of the Subpart X regulations, permit terms and provisions for a Miscellaneous Unit must include appropriate requirements of 40 CFR Subparts I through O and Subparts AA through CC, 40 CFR 270, 40 CFR 63 Subpart EEE, and 40 CFR 146.

Based on 40 CFR 264.601, WCAI will test the RF to demonstrate performance in accordance with the emission standards of 40 CFR 63 Subpart EEE applicable to existing incinerators. These emission standards are more stringent than the RCRA hazardous waste incinerator emission standards of 40 CFR 264 Subpart O. WCAI is proposing to establish operating limits to ensure continuing compliance with its permit using an approach which generally follows the specifications of 40 CFR 63 Subpart EEE and guidance prepared for RCRA incinerator permits. However, since those regulations and guidance do not strictly apply to this unit, but may be used as guidelines for the development of appropriate limits, WCAI is also proposing to establish some limits based on current operating practices and automation system capabilities, which have proven to be effective for this particular facility.

4.1.1 40 CFR 60 Subpart EEE CAA Requirements

As stated above, WCAI will test the RF to demonstrate performance in accordance with the emission standards of 40 CFR 63 Subpart EEE applicable to existing incinerators. According to

40 CFR 63.1201, an existing source under Subpart EEE is any affected source, the construction or reconstruction of which commenced on or before April 19, 1996. Part 63, Subpart A, defines "commenced", with respect to construction or reconstruction, as either (a) undertaking a continuous program of construction or reconstruction, or (b) entering into a contractual obligation to undertake and complete, within a reasonable time, a continuous program of construction or reconstruction.

WCAI signed a Trade Contract (No. 21-4527-AF) with Hankin Environmental Systems, dated October 17, 1995, to construct RF-2 (the currently operating RF unit). The contract was signed by Stephen McDonough (Hankin) and Mark Hepp (WCAI). A Purchase Order was written on December 27, 1995 to construct the concrete pad for RF-2, with actual pad construction beginning on December 29, 1995. The multiple hearth was erected in January 1996. WCAI has dated pictures showing the construction process. Startup occurred July 11, 1996. Consequently, WCAI had clearly entered into a contractual obligation to undertake the construction of RF-2 well before April 19, 1996, and under a continuous program of construction, the unit was completed within a reasonable period of time.

Since this RF system would qualify as an existing unit if it were subject to Subpart EEE, the appropriate emission standards for this unit are the standards for existing incinerators under the Hazardous Waste Combustor Maximum Achievable Control Technology (HWC MACT) regulations of 40 CFR 63, Subpart EEE. Specific requirements are summarized as follows:

- Demonstrate a DRE of greater than or equal to 99.99% for the selected POHCs chlorobenzene and tetrachloroethene.
- Demonstrate stack gas carbon monoxide concentration less than or equal to 100 ppmv, dry basis, corrected to 7% oxygen.
- Demonstrate stack gas hydrocarbon concentration of less than or equal to 10 ppmv, as propane, dry basis, corrected to 7% oxygen.
- Demonstrate a stack gas particulate concentration less than or equal to 34 mg/dscm (0.015 gr/dscf), corrected to 7% oxygen.
- Demonstrate that the stack gas concentration of hydrogen chloride (HCl) and chlorine (Cl₂) are no greater than 77 ppmv, dry basis, corrected to 7% oxygen, expressed as HCl equivalents..
- Demonstrate that the stack gas mercury concentration is less than or equal to 130 µg/dscm, corrected to 7% oxygen.

- Demonstrate that the stack gas concentration of semivolatile metals (cadmium and lead, combined) is less than or equal to 240 µg/dscm, corrected to 7% oxygen.
- Demonstrate that the stack gas concentration of low volatility metals (arsenic, beryllium, and chromium, combined) is less than or equal to 97 µg/dscm, corrected to 7% oxygen.
- Demonstrate that the stack gas concentration of dioxins and furans does not exceed 0.40 ng/dscm, corrected to 7% oxygen, expressed as toxic equivalents of 2,3,7,8-TCDD (TEQ). This standard is applicable since the gas temperature entering the first particulate matter control device is less than 400°F.

4.1.2 Regulatory Policy Requirements

In addition to the specific regulatory requirements, WCAI has been requested to perform both a human health and an ecological risk assessment, in accordance with EPA policy. As such, the performance test must include specific data gathering activities for use in the risk assessments.

For this facility, those risk assessment data gathering activities are:

- Measure emissions of metals, including hexavalent chromium
- Measure emissions of specific volatile and semivolatile products of incomplete combustion (PICs)
- Measure emissions of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF)
- Measure emissions of polychlorinated biphenyls (PCBs)
- Measure emissions of specific organochlorine pesticides
- Measure emissions of total volatile, semivolatile, and nonvolatile organics
- Determine the stack gas particle size distribution.

4.2 TEST OBJECTIVES AND APPROACH

The WCAI Performance Demonstration Test Plan has been prepared to provide comprehensive performance testing of the RF unit to demonstrate compliance with the applicable HWC MACT emission standards and to gather data for use in a site-specific risk assessment. The objectives of the PDTP are to demonstrate regulatory compliance with standards such as Destruction and Removal Efficiency (DRE) and particulate matter emission concentration (described above), while operating at “worst case” conditions processing normal feed materials, which have been augmented with metals, chloride, etc., to establish operating conditions that will be included in the permit.

4.3 TEST PROTOCOL

In order to accomplish the PDT objectives, (i.e., demonstrating that the unit will meet all applicable environmental performance standards) a single test condition representing “worst case” operations of minimum temperature, maximum combustion gas velocity (minimum residence time), and maximum spent activated carbon feed rate will be performed. The test will consist of at least three replicate sampling runs.

A summary description of the testing conditions, analytical parameters, and sampling methods follows:

4.3.1 Test Condition 1 (“Worst-Case” Operations)

Sampling and monitoring protocols that will be utilized while carrying out the performance test are summarized as follows:

- Spent Activated Carbon Feed - total chlorine/chloride, elemental (C, H, N, O, S, moisture), volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Makeup Water - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Caustic feed to APC - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Cu, Co, Pb, Hg, Ag, Tl, Se, Ni, V, Zn)
- Scrubber Blowdown - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Wastewater Discharge to POTW - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Stack gas particulate, HCl, and Cl₂ using EPA Method 26A
- Stack gas target volatile organics using VOST, SW-846 Method 0030
- Stack gas target semivolatile organics and organochlorine pesticides using SW-846 Method 0010
- Stack gas PAHs and PCBs using a separate SW-846 Method 0010 sampling train
- Stack gas PCDD/PCDF using SW-846 Method 0023A
- Stack gas total volatile organics using SW-846 Method 0040
- Stack gas total semivolatile and nonvolatile organics using SW-846 Method 0010
- Stack gas metals (Al, Sb, As, Ba, Be, Cd, total Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, and Zn) using EPA Method 29
- Stack gas hexavalent chromium using SW-846 Method 0061
- Stack gas particle size distribution using a cascade impactor

- Stack gas CO and O₂ by permanently installed CEM according to the protocols in the Appendix to 40 CFR 63, Subpart EEE; Performance Specification 4B of 40 CFR 60, Appendix B.
- Stack gas total hydrocarbons (as propane) by temporary CEM according to EPA Method 25A and the protocols in the Appendix to 40 CFR 63, Subpart EEE.

4.4 FEED MATERIAL CHARACTERISTICS

4.4.1 Description and Composition of Spent Activated Carbon

Spent activated carbon is the only material treated in the RF. The current spent activated carbon profile data is presented in Tables 2-1 and 2-2. Actual spent activated carbon will be treated during the performance test. The spent activated carbon will be augmented, as discussed below, by the addition of POHCs (principle organic hazardous constituents), other organic surrogates, chlorine/chloride, and metals, as needed to achieve the test objectives. The expected composition of the spent activated carbon, as fed to the RF during the PDT, is summarized in Table 4-1.

4.4.2 Expected Constituent Levels in Natural Gas, Process Air, & Other Feed Streams

In addition to the spent activated carbon, WCAI feeds natural gas to the burners in the multiple hearth furnace and afterburner, ambient air for combustion, and steam to assist in the reactivation process. Neither the ambient air, nor the steam are expected to contain regulated constituents. Natural gas may contain low concentrations of metals, as shown in Table 2-3. These metals concentrations are so low that their contribution to emissions is negligible, and will not be considered further.

4.4.3 POHC Selection Rationale

The RF system exclusively treats spent activated carbon. A wide variety of organic contaminants may be present on the carbon, thus WCAI needs flexibility to treat carbon containing any RCRA Appendix VIII Hazardous Constituent or CAA HAP except for carbons classified as dioxin wastes (EPA Waste Codes F020, F021, F022, F023, F026, or F027) or containing TSCA-regulated levels of PCBs. The compounds to be used as POHCs during the PDT were selected for their ability to demonstrate the effectiveness of the unit in destroying compounds that are equal or more thermally stable, and are thus equal or more challenging to treat, than those currently found on the spent activated carbon. This provides assurance that the unit will be effective for all of the spent carbon contaminants.

EPA has developed a thermal stability ranking system based on laboratory studies conducted under low oxygen conditions in a non-flame environment. The EPA's thermal stability ranking system has divided organic compounds into seven thermal stability classes, with Class 1 compounds being the most stable, and Class 7 compounds being the least thermally stable. The EPA thermal stability ranking system is structured on the principle that if a combustion system is successful in destroying compounds in a particular class, it is appropriate to assume that other compounds within the same and lower classes will be destroyed at efficiencies equal to or greater than the efficiencies demonstrated.

A review of WCAI's spent activated carbon characterization information shows that compounds from several thermal stability classes, including Class 1, may be present on the spent activated carbon. WCAI has chosen to demonstrate the DRE of chlorobenzene (a Class 1 compound) and tetrachloroethene (a Class 2 compound) as the Principal Organic Hazardous Constituents during the Performance Demonstration Test. Chlorobenzene was chosen since it is a compound sometimes present on spent activated carbon received at the Parker Facility, thus its use is representative of normal operations. It is also relatively available and less hazardous to handle than other Class 1 compounds for spiking into the furnace during the PDT. Chlorobenzene is an aromatic compound and will also provide a source of organic chlorine to challenge the system during the performance test. WCAI believes that its choice of chlorobenzene as a POHC represents the most significant challenge possible to the thermal destruction capabilities of the RF unit.

Tetrachloroethene is a per-chlorinated aliphatic compound that is also sometimes present on spent activated carbon received at the Parker Facility. It represents a significant source of organic chlorine to the system, and was chosen as a POHC so the test would include both an aromatic and an aliphatic compound.

Since the selected POHC compounds rank among the most difficult to destroy on the thermal stability ranking system and represent a variety of aromatic and aliphatic compounds, successful DRE demonstration should allow WCAI to treat spent activated carbon represented by the waste codes in the facility's most current RCRA Part A permit application. WCAI will

spike chlorobenzene and tetrachloroethene, as needed for both DRE demonstration and as sources of organic chlorine.

Samples of the spent activated carbon, collected before spiking, will be analyzed for POHC content. The spent activated carbon feed POHC analyses and carbon feed rates will be used to determine the feed rate of native POHC, if any. WCAI will utilize the services of a spiking contractor to provide additional POHC spiking. The spiked POHC will be prepared by the contractor for spiking directly into the furnace. The contractor's certification of composition of the spiking material and the spiking logs will be used to determine the POHC spike rate. Samples of the spiking material will be collected and archived. For the DRE calculation, the POHC feed rates will include the native POHC in the spent activated carbon feed and the spiked POHC.

4.4.4 Feed Material Specifications for the Test

While a wide variety of organic compounds can be on the spent activated carbon, and the specific constituents and concentrations vary over time according to the generator, the actual material fed to the RF is quite homogeneous. As stated earlier, organic compounds can account for up to 0.3 pounds per pound of dry carbon from a given generator. However, when added to other more lightly loaded carbons, and processed for feeding, the actual feed material is typically low in organics. Based on actual feed data from 1997 to 2002, the feed stream is predominantly carbon granules (~56 to 57 wt%, wet basis) which are wet from the slurring and subsequent de-watering process (~43 wt% water). Average loading data indicated a range of 0.0038 to 0.0071 pounds of organic per pound of dry carbon, with an overall weighted average of 0.0055 pounds of organic per pound of dry carbon. On a wet (as fed) basis, the organic loading accounts for only about 0.2 to 0.4 wt% of the total feed. The variability in the feed is thus restricted to only this 0.2 to 0.4% of the total material.

For purposes of this test, the feed materials must support WCAI's need to demonstrate DRE for selected POHCs, demonstrate system removal efficiency (SRE) for representative metals, demonstrate maximum total chlorine/chloride feed rate, and gather emissions data for the risk assessment which are reasonably representative of the long-term operation of the RF system. The most desirable situation would be if carbon could be received and stockpiled from a number of sources such that the test feeds would contain sufficient quantities of POHCs, metals,

chlorine, and other organics for use during the test. Unfortunately WCAI has limited capacity for stockpiling materials, and cannot control when various generators send spent activated carbon for treatment. In light of this situation, WCAI will feed actual spent activated carbon available on-site, but will supplement it with POHCs, metals, chlorine, and other organics to meet the test objectives. Feed composition targets for the Performance Demonstration Test are shown in Table 4-1. Constituent feed rates and target process operating conditions for all three runs of the Performance Demonstration Test are shown in Table 4-2.

The POHCs, chlorobenzene and tetrachloroethene, will be spiked into the reactivation furnace in sufficient quantities for DRE demonstration and to add chlorine to the feed.

Lead will be spiked as a representative metal for the determination of semivolatile metal SRE. Spiking will be sufficient to ensure detection in the stack gas sample, and so that metal feed rate extrapolation can be reliably accomplished.

Chromium will be spiked as a representative metal for the determination of low volatility metal SRE. Spiking will be sufficient to ensure detection in the stack gas sample, and so that metal feed rate extrapolation can be reliably accomplished.

Based on a review of the organic constituents commonly found on the spent activated carbon routinely treated at WCAI, and based on the relative availability and handling safety considerations of these materials, WCAI will spike a mixture of organic compounds into the reactivation furnace to act as surrogates for the various classes of compounds routinely treated. This will ensure that the carbon fed during the test contains representative types, and higher than normal quantities, of organic compounds, in addition to those native to the spent carbon, and gives the feed materials the potential to produce a range of representative combustion products so that the risk assessment emissions data from the Performance Demonstration Test will be appropriate. In order to meet this objective, the following organic surrogates will be added to the furnace, in addition to the POHCs:

- Toluene
- 1,1,1-Trichloroethane
- Naphthalene

- Ethylene glycol.

These compounds represent aromatics, aliphatics, chlorinated compounds, non-chlorinated compounds, oxygenated compounds, as well as both volatile and semivolatile organics.

The spiked materials will be pumped into the reactivation furnace at the point where spent activated carbon enters the furnace. This location will ensure that all spiked materials enter the RF with the carbon. An injection manifold will be constructed to accommodate the spike material feed lines.

As shown on Table 4-1, and discussed above, the typical spent activated carbon metals concentration ranges from about 13 to 19 mg/kg. Spiking during the test will increase this concentration to between 240 to 280 mg/kg (over a fifteen-fold increase). Similarly, the total organic concentration of typical spent activated carbon is between 0.2 to 0.4 wt%, while the carbon used for the test will have the total organic concentration increased to approximately 3.5 to 5 wt% (over a ten-fold increase). The use of actual spent activated carbon will provide a variety of compounds which will produce representative emissions, and these compounds and their relative concentration may vary during the test (just as in normal operations) due to the limited ability to stockpile and blend. However, the addition of metals and organic surrogates is so much in excess of the expected native concentrations on the carbon, that any variability will be overshadowed by the spiking. Thus the overall composition of the carbon feed will be quite homogeneous during the three runs of the Performance Demonstration Test. Further, WCAI expects no significant variation in process operating conditions due to variability of the native carbon constituents, thus providing appropriate data for permitting decisions.

4.4.4.1 Chloride Content

The data presented in Table 4-1 include the target total chlorine/chloride content for the performance test carbon feed stream. The typical spent activated carbon contains varying amounts of organic chlorine associated with chlorinated organics adsorbed onto the carbon.

To demonstrate maximum total chlorine/chloride feed rate during the performance test, WCAI intends to spike chloride sources into the reactivation furnace. The chloride will be provided by the POHCs (chlorobenzene and tetrachloroethene), as well as the other chlorinated organic surrogates.

4.4.4.2 Metals Content

The data presented in Table 4-1 includes target performance test metal feed rates for the spiked and native metals.

Two approaches will be used in establishing the metals operating limits, based on a review of expected spent activated carbon compounds and the HWC MACT provisions for establishing metals feed rate limits:

WCAI will meet mercury limits which utilize the "Maximum Theoretical Emission Concentration" (MTEC) concept, where it is conservatively assumed that all feed mercury is emitted from the system. Based on the results of the performance test, WCAI will calculate a maximum mercury feed rate which will ensure compliance with the MTEC, and will continuously monitor the mercury feed rate to ensure that the limit is complied with. Since this approach does not take credit for actual removal across the APC system, it is the most conservative assumption for the low levels of mercury in the feeds.

Lead will be spiked during the test to determine the system removal efficiency (SRE) for semivolatile metals. Chromium will be spiked during the test to determine the SRE for low volatility metals. These SRE values will be used as the basis for establishing permit feed rate limits for the semivolatile and low volatility metals. The native metals content of the spent activated carbon feed is expected to be similar to that shown in Table 2-1.

4.4.5 POHC, Organic Surrogate, and Metal Spiking

A spiking system will be used for POHC, organic surrogate, and metals addition to the spent activated carbon feed. Three separate spiking systems will be used: one for the mixture of POHCs, one for the organic surrogate mixture, and one for the metals dispersion. Each spiking system will consist of a variable speed, positive displacement pump, (or equivalent system) that will transfer the spiking materials from containers onto the spent activated carbon just as it enters the RF. An electronic scale will be provided for each spiking material system so that a weighed amount of material will be metered into the RF and quantified for each test run. Technical grade POHCs and organic surrogates will be used as needed. Lead will be spiked as a dispersion of lead oxide, while chromium will be added as a dispersion of strontium chromate (a solid hexavalent chromium compound). Specifications for the spiking materials will be

provided by the spiking contractor. Calculations showing that the planned POHC feed rates are adequate to demonstrate the required DRE are presented in Attachment D. Metals spiking rates have been selected to allow for detection in the stack gas so that a rational SRE value can be determined. Based on the SRE, the metal feed rates will be extrapolated upwards to attain metals feed rate limits for the permit. Metal spiking rate calculations and anticipated permit feed rate limits, derived from extrapolation are shown in Attachment D.

WCAI will utilize the services of a spiking contractor to provide each of the spiking materials and to perform spiking operations during the test. The contractor's certification of composition of the spiking materials and the spiking logs will be used to determine the respective spike rates. Samples of the spiking materials will be collected and archived.

4.5 OPERATING CONDITIONS

Planned process operating conditions and feed rates are summarized in Table 4-2.

4.5.1 System Operation to Achieve Steady State Conditions

Carbon in the multiple hearth section of the RF has a residence time of 42 minutes. Test materials must be fed to the system for at least one residence time to ensure that the system is operating on test material only. There is no other "hold up" of feeds in the system and there is little in the way of "surge capacity" in the APC system, thus there is little "conditioning" necessary to bring the system to steady state conditions. However, since most process parameters are being monitored on an hourly rolling average basis, the process should be operated at test conditions (including spiking) for at least one hour prior to beginning a test run in order to allow the rolling averages to be established.

"Steady State" conditions will be achieved by bringing the system to the desired test conditions, and then operating the system at the desired test conditions (including any spiking operations) for a period of at least one hour prior to the beginning of each test run. Normal process fluctuations are expected during the test periods, just as during normal operations. Typically fluctuations of 10 to 20 percent of the "steady state" process value are considered normal for thermal treatment systems, however some parameters may experience even greater fluctuations while still being considered acceptable. WCAI operations personnel and the test

manager will closely monitor operations during the test periods and will make any necessary determinations regarding the acceptability of process fluctuations.

5.0 SAMPLING, ANALYSIS, AND MONITORING PROCEDURES

The following paragraphs discuss the planned sampling and analyses during the Performance Demonstration Test. The sampling procedures to be used during the performance test are located in Attachment A. Analytical methods are described in Attachment B. Quality Assurance and Quality Control procedures are described in the Quality Assurance Project Plan (QAPP) located in Attachment C.

5.1 SAMPLING LOCATIONS AND PROCEDURES

Sample collection points are shown on Figure 5-1. Sample collection locations, equipment, methods, and frequency are summarized in Table 5-1. The types of analyses planned for the performance test samples are outlined on Table 5-2. Analytical methods and procedures to be used for each sample are summarized in Table 5-3. Alternative methods may be used with the prior approval of the EPA.

5.1.1 Spent Activated Carbon Feed

Spent activated carbon feed samples will be collected during each test run as described in Attachment A. Spent carbon samples will be collected every 15 minutes and composited over the run. The feed samples collected will be analyzed for the parameters as indicated in Tables 5-2 and 5-3. Volatile organic analysis (VOA) samples will be collected from the run composite at the end of each run, and placed into a separate jar with minimum headspace. Analytical methods are presented in Attachment B.

5.1.2 Spiking Materials

POHC, Organic Surrogate, and Metals Spiking Feedstock Samples

POHC material will be pumped from portable containers into the RF, using metering pumps. The POHC injection point will be downstream of the point where spent activated carbon feed samples are collected. The POHC spiking rate will be determined using either flow meters or digital scales and logs of the differential weights at 10-minute intervals.

In addition to the POHCs, other organic surrogates will be spiked separately into the RF. These materials are being added to ensure that the test is conducted with a variety of organic compounds which have the potential to produce a wide variety of combustion products,

indicative of the range of materials to be treated at the WCAI Parker Facility. The organic surrogate spiking rate will be determined using either flow meters or digital scales and logs of the differential weights at 10-minute intervals.

Metals will be metered as necessary into the RF at an adjacent location to the POHC and organic surrogate spiking points. The metals will be supplied as aqueous solutions or as dispersions (aqueous or organic). The metal solution/dispersion injection point will be downstream of the ports where spent activated carbon feed samples are collected. The amount of each metal solution/dispersion spiked will be determined using either flow meters or digital scales and logs of the differential weights at 10-minute intervals.

WCAI will utilize the services of a spiking contractor to provide the POHCs, organic surrogates, and metals spiking materials and to conduct the spiking. The manufacturer's certification of composition of the spiking materials and the contractor's spiking logs will be used to determine the respective spike rates. Samples of the spiking materials will be collected once during the test and archived for analysis if required. The sampling procedure will be as described in Attachment A.

5.1.3 Process Makeup and Residue Streams

Makeup Water, Caustic, Scrubber Blowdown, and POTW Discharge Samples

Samples of the makeup water, caustic, scrubber blowdown, and POTW discharge streams will be collected during each test run as described in Attachment A. Samples of the makeup water and caustic will be collected once during the test. Samples of the scrubber blowdown and POTW discharge will be collected every 30 minutes during each test run. VOA samples of wet scrubber blowdown and POTW discharge will be collected and handled as discrete samples. VOA samples will be composited in the laboratory immediately prior to analysis. Grab samples of the scrubber blowdown and POTW discharge for the other analyses will be composited in the field to form one sample per run. Analytical methods are presented in Attachment B.

5.1.4 Stack Gas

5.1.4.1 Stack Gas Volatile Organics

A Volatile Organic Sampling Train (VOST) (SW-846 Method 0030), will be used to determine the stack gas emissions of the POHCs (chlorobenzene and tetrachloroethene) for DRE determination. Four pairs of VOST tubes will be collected during each sampling run, but only

three will be analyzed. The fourth tube pair will serve as an archive set in the case of breakage during shipment or laboratory handling. Attachment A presents a description of the stack gas VOST sampling method. The VOST tubes will be analyzed using SW-846 Method 8260.

In addition to the POHCs, the VOST samples will be analyzed for other volatile organic compounds. These analyses will be used to assess the emissions of volatile organic compounds for use in the risk assessment. The target volatile organic compounds are listed in Table 5-4. Analyses will be performed using SW-846 Method 8260. In addition to the target analyte list, analyses will include identifying non-target analyte peaks, which are referred to as tentatively identified compounds (TICs). A discussion of TIC identification and quantitation is presented in the QAPP (Attachment C). Analytical methods are presented in Attachment B.

5.1.4.2 Stack Gas Particulate, HCl, and Cl₂

The stack gas will be sampled for particulate, HCl, and Cl₂ according to EPA Method 26A. The sampling procedure is described in Attachment A. Particulate filters will be analyzed per EPA Method 5 procedures. Impinger solutions will be analyzed for chloride ion per SW-846 Method 9057 to determine the emissions of HCl and Cl₂. Analytical methods are presented in Attachment B.

5.1.4.3 Stack Gas Multiple Metals

Stack gas multiple metals will be collected using an EPA Method 29 sampling train according to the procedure in Attachment B. Metals will be analyzed by Inductively Coupled Plasma Spectroscopy/Mass Spectroscopy (ICP-MS) using SW-846 Method 6020. Mercury will be analyzed using Cold Vapor Atomic Absorption Spectroscopy (CVAAS) using SW-846 Method 7470. Target metal analytes are shown in Table 5-5.

5.1.4.4 Stack Gas Hexavalent Chromium

Stack gas hexavalent chromium samples will be collected using an SW-846 Method 0061 sampling train, as described in Attachment A. Analysis is according to SW-846 Method 7199, as described in Attachment B.

5.1.4.5 Stack Gas Semivolatile Organics, PAHs, Organochlorine Pesticides, and PCBs

The stack gas will be sampled to determine the emissions of the semivolatile organic compounds, for use in the risk assessment. Stack gas will be sampled for target semivolatile organic compounds (SVOCs), semivolatile TICs, polyaromatic hydrocarbons (PAHs),

organochlorine pesticides, and polychlorinated biphenyls (PCBs) using two separate SW-846 Method 0010 sampling trains. The extract from the analytical preparation of each Method 0010 sampling train will be split for analysis as follows:

Train 1: one portion for SVOC analysis by SW-846 Method 8270 [gas chromatograph/mass spectrometry (GCMS)], a second portion for organochlorine pesticides analysis by SW-846 Method 8081 (GC), and a final portion retained as an archive in case any of the analyses need to be repeated.

Train 2: one portion for high resolution gas chromatograph/high resolution mass spectrometry (HRGC/HRMS) PAH analysis, a second fraction for HRGC/HRMS analysis of PCBs, and a final portion retained as an archive in case any of the analyses need to be repeated.

Prior to testing, the XAD-2 resin of each train will be spiked with sampling surrogates of each target analyte group, as an added QC step. The sampling procedure is described in Attachment A.

The respective target SVOC, PAH, OC Pesticide, and PCB analytes for the Method 0010 samples are presented in Tables 5-6, 5-7, 5-8, and 5-9. In addition to the SVOC target analyte list, analyses will include identifying non-target analyte peaks (TICs) based on the nearest internal standard and library search.

5.1.4.6 Stack Gas Method 0023A (Dioxins and Furans)

Stack gas samples will be collected for PCDD/PCDF using a SW-846 Method 0023A sampling train. The sampling procedure is described in Attachment A. Analysis of PCDD/PCDF is conducted by high resolution GC/MS according to SW-846 Method 8290, and described in Attachment B. PCDD/PCDF target analytes are shown in Table 5-10.

5.1.4.7 Stack Gas Total Semivolatile and Nonvolatile Organics

For the risk assessment analysis, the performance test program includes determining the Total Organic Emissions (TOE) using the procedures in "Guidance for Total Organics" EPA/600/R-96/036, March 1996. The stack gas will be sampled for total semivolatile organic compounds (Boiling Points from 100°C to 300°C) and nonvolatile organic compounds (Boiling Points greater than 300°C) using a separate SW-846 Method 0010 sampling train. The sampling method is

described in Attachment A. No isotopically labeled sampling surrogates will be spiked to the XAD-2 resin used in this sampling train. The dichloromethane extracts of the pooled components of the sampling train will be used to determine the Total Chromatographable Organics (TCO) using Gas Chromatography/Flame Ionization Detector (GC/FID). The marker compounds are n-heptane and n-heptadecane because their boiling points are 98°C and 302°C, respectively.

The nonvolatile organics will be determined by a gravimetric procedure known as GRAV from the same pooled dichloromethane extract of the Method 0010 train components as the semivolatile organic components. The analytical methods are described in greater detail in Attachment B.

5.1.4.8 Stack Gas Total Volatile Organics

For the risk assessment analysis, stack gas will be sampled for total volatile organic compounds (Boiling Points <100°C). Tedlar bag samples of stack gas will be collected and measured for total volatile organics by field gas chromatograph (GC) according to SW-846 Method 0040. The SW-846 Method 0040 sampling procedure is described in Attachment A. Emphasis will be made on the identification of n-C₁ - C₇ hydrocarbons. In addition, the volatile organics collected in the condensate trap of the SW-846 Method 0040 will be analyzed by purge and trap GC/FID. The analytical procedure is described in Attachment B.

5.1.4.9 Particle Size Distribution

The risk assessment analysis requires the collection of particle size distribution data on the stack gas particulate emissions. A cascade impactor will be used to determine the particle size distribution. The cascade impactor will be operated at a single point of average velocity within the stack. The procedure to be used is described in Attachment A. Analysis of the cascade impactor filter substrates is the same as that used for particulate matter determination in Method 5.

WCAI has previously collected PSD information and is submitting this data set in lieu of testing. Refer to Section 9.0 and Attachment G for the PSD data.

5.2 ANALYTICAL PROCEDURES

Attachment B presents a description of the analytical methods to be used during the performance test.

5.3 MONITORING PROCEDURES

During the performance test, the stack gas will be continuously monitored by installed CEMS using the following procedures:

- Stack gas carbon monoxide by non-dispersive infrared (NDIR) analyzer
- Stack gas oxygen by paramagnetic analyzer

CEMS performance testing will be completed prior to conducting the PDT. Stack gas CO and O₂ monitors will be operated during the PDT according to the protocols of the Appendix to 40 CFR 63 Subpart EEE, and Performance Specification 4B of 40 CFR 60 Appendix B. The stack gas monitors will be checked daily during the performance test for calibration stability in accordance with WCAI's standard operating procedures.

Also during the performance test, the stack gas will be continuously monitored for total hydrocarbons, as propane (EPA Method 25A) using a portable monitor supplied by the stack testing contractor.

5.4 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

Attachment C contains a Quality Assurance Project Plan for the Performance Demonstration Test.

5.5 EMISSION VALUES FOR USE IN RISK ASSESSMENTS

Many of the emissions determinations being made during the PDT are for risk assessment purposes rather than to demonstrate compliance with specific regulatory performance standards. WCAI suggests that the average emission rate determined from the PDT data be used for assessing risks, since the RF will be operated at "worst case" conditions during the PDT. It should also be noted that while the target analyte lists are extensive, approved and validated stack gas sampling and analytical methods are not currently available for several compounds identified as COPCs (Compounds of Potential Concern) in the risk assessment.

WCAI will estimate the emission rate of these compounds, by assuming that they are present in the spent activated carbon fed during the PDT at the “typical” concentration shown in the feedstream characterization (Table 2-2), and applying the average DRE determined for the test.

6.0 TEST SCHEDULE

6.1 PLANNED TEST DATE

Following approval of the test plan, WCAI needs to accumulate carbon necessary for conducting the test, and needs to schedule the delivery of spiking materials, and consider the availability of sampling and analytical contractors. The RF unit is currently operating, thus no startup or shakedown period is required, however WCAI may conduct limited preliminary testing prior to conducting the formal PDT. The pre-test will involve operating the RF system at the same conditions proposed for the PDT. The scope of any pre-test sampling and analysis will be a subset of the PDT sampling and analyses. Depending on the results of the initial pretest, additional pretests may be performed. The preliminary testing will be used to confirm that the proposed PDT conditions are attainable and appropriate for meeting the objectives of the testing program. Preliminary testing will also allow WCAI and its contractors to identify and correct any difficulties with the sampling, analytical, or QA/QC procedures specified in this test plan.

Currently WCAI believes that, depending on contractor and consultant schedules, it can be ready to conduct preliminary testing within 8 to 10 weeks of PDTP approval, and to conduct the PDT within 5 to 6 weeks after completion of the pre-test. WCAI will notify EPA at least 30 days before the planned date for starting the Performance Demonstration Test. The performance testing will be conducted over a period of approximately 5 consecutive days.

Day 1 – Equipment setup and system readiness confirmation

Day 2 – Test Run 1

Day 3 – Test Run 2

Day 4 – Test Run 3

Day 5 – Contingency/equipment demobilization.

Each of the three test run days are planned to be identical. A detailed daily schedule for these three days is presented in Table 6-1.

6.2 DURATION OF EACH TEST

The performance test will consist of three replicate sampling runs at a single test condition. The RF will be fed test materials 1 to 2 hours before a sampling run, and will be stabilized at test

conditions at least 1 hour before a sampling run. This will establish steady operation at process test conditions. Each test run is anticipated to have a duration of 4 to 6 hours, including port changes.

6.3 QUANTITY OF SPENT CARBON TO BE REACTIVATED

Spent activated carbon will be fed to the RF for up to an estimated 6 to 9 hours per day over a period of 3 testing days, assuming no interruptions. Allowing for 12 hours of spent activated carbon feed each test day (as a contingency), plus one extra contingency day (12 additional hours), the approximate amount of spent activated carbon used for testing purposes is 144,000 pounds.

6.4 DETAILED SCHEDULE OF PLANNED TEST ACTIVITIES

A planned schedule for a typical testing day is presented in Table 6-1.

6.5 PRELIMINARY TESTING

WCAI may conduct preliminary testing prior to the formal Performance Demonstration Test. The purpose of any such preliminary testing will be to verify that the planned Performance Demonstration Test operating conditions, as well as the planned spiking, sampling, and/or analytical methods are appropriate and yield acceptable results. A further goal of preliminary testing is to ensure that any test team interaction, coordination, or logistics issues are addressed prior to conducting the formal test.

Tables 4-1 and 4-2 show the anticipated feed materials, compositions, feed rates, and operating conditions planned for the test. Preliminary testing, if conducted, will be targeted to achieve the same conditions as shown in Tables 4-1 and 4-2. Process and emissions sampling and analysis for the Performance Demonstration Test are summarized in Tables 5-1, 5-2, and 5-3. Preliminary testing, if conducted, will utilize all, or a portion, of these same sampling and analytical methods.

7.0 OPERATING PERMIT OBJECTIVES

Based on the results of the performance test, WCAI will propose operating limits for the RF system that assure continuing compliant performance. Parameters will be established from the operating conditions demonstrated during the test; established regulatory requirements; manufacturer's recommendations; good operating practice, or on the results of the risk assessments. If the required performance objectives of the test are achieved, the RF system should be allowed to operate under the conditions proposed in this section.

Table 7-1 summarizes the anticipated operating limits. In order to achieve the desired conditions and demonstrate operations at the limits shown in Table 7-1, the interlock setpoints for certain operating parameters must be set somewhat wider during testing periods. The recommended interlock setpoints during testing periods are presented in Table 7-2. The following sections present a discussion of each parameter.

7.1 CONTROL PARAMETERS

WCAI anticipates limits on a number of operational control parameters which must be maintained as an indication that the RF system will continue to operate in compliance with all regulatory standards. Control parameters are grouped into categories:

- Group A1 parameters are continuously monitored and recorded, and are interlocked with the automatic waste feed cutoff system. Group A1 parameter limits are established from test operating data, and are used to ensure that system operating conditions are equal to or are more rigorous than those demonstrated during the test. During the test periods (pretest and performance test), interlocks for Group A1 parameters will be operational, but will be set at values which will allow the desired operating limits to be demonstrated.
- Group A2 parameters are continuously monitored and recorded, and are interlocked with the automatic waste feed cutoff system. Group A2 parameter limits are established based on regulatory requirements rather than on the test operating conditions, e.g., the maximum stack CO concentration. Interlocks for Group A2 parameters will be operational during the test periods, without modification to the interlock setpoints.
- Group B parameters are continuously monitored and recorded, but are not required to be interlocked with the automatic waste feed cutoff system. Operating records are required to ensure that established limits for these parameters are not exceeded. The Group B parameter limits are established based on the operation of the system during the test.

- Group C parameters are continuously monitored and recorded, but are not required to be interlocked with the automatic waste feed cutoff system. Group C parameter limits are based on manufacturer's recommendations, operational safety, and good operating practice considerations rather than on the test operating conditions, e.g., the minimum packed bed scrubber pressure differential.

7.2 DEVELOPMENT OF PERMIT LIMITS

The following sections describe how each control parameter limit will be established.

In addition to establishing specific operating limits, WCAI has limits on the types of waste which can be accepted in the RF. Since WCAI will demonstrate performance while treating a Class 1 (most thermally stable) compound, it is expected that WCAI will be permitted to treat spent activated carbon having EPA waste codes as represented in the facility's most recent RCRA Part A permit application. Specific prohibitions are expected for wastes containing greater than 50 mg/kg of PCBs and those wastes listed with the waste codes F020, F021, F022, F023, F026 or F027.

7.2.1 Group A1 Parameters

Group A1 parameter limits are based on the results of the performance test. The following parameters are proposed as Group A1 parameters for the RF system.

7.2.1.1 Maximum Spent Carbon Feed Rate

The performance test will be conducted in order to demonstrate the maximum feed rate of spent activated carbon. The spent activated carbon feed rate will be monitored on a continuous basis. The maximum allowable spent activated carbon feed rate will be established from the mean of the average feed rates demonstrated during each run of the performance test. The feed rate limit will be monitored as 1-hour block average.

7.2.1.2 Minimum Afterburner Temperature

The performance test will be conducted to demonstrate the minimum afterburner temperature with maximized combustion gas flow (minimum residence time), since these conditions are least favorable for DRE. Organic emissions are also being measured for risk assessment purposes since it is expected to represent worst case conditions for organic emissions. Combustion gas temperature will be monitored in the afterburner on a continuous basis. Based on successful

demonstration of DRE during the performance test, the minimum temperature limit will be based on the average of the minimum hourly rolling average temperature values demonstrated during each run of the performance test. The permit limit is expected to be administered as an hourly rolling average.

7.2.1.3 Minimum Venturi Scrubber Differential Pressure

The performance test will be conducted to demonstrate the minimum venturi scrubber differential pressure. Venturi scrubber differential pressure will be monitored on a continuous basis. Based on successful demonstration of particulate control during the performance test, the minimum venturi scrubber differential pressure limit will be based on the mean of the minimum hourly rolling average values demonstrated during each run of the performance test. The permit limit is also expected to be an hourly rolling average value.

7.2.1.4 Minimum Quench/Venturi Scrubber Recycle Liquid Flow Rate

The performance test will be conducted to demonstrate the minimum quench/venturi scrubber recycle flow and maximum stack gas flow, thus establishing a *de facto* minimum liquid to gas ratio. Quench/Venturi scrubber flow and stack gas flow will both be monitored on a continuous basis. Based on successful demonstration during the performance test, the minimum quench/venturi scrubber recycle liquid flow rate limit will be based on the mean of the hourly rolling average values demonstrated during each run of the performance test.

7.2.1.5 Minimum Packed Bed Scrubber pH

The performance test will be conducted to demonstrate the minimum packed bed scrubber pH at maximum total chlorine/chloride feed rate. Scrubber pH will be monitored on a continuous basis. Based on successful demonstration of HCl and Cl₂ control during the performance test, the minimum packed bed scrubber pH limit will be based on the mean of the minimum hourly rolling average pH values demonstrated during each run of the performance test. The permit limit will be administered as an hourly rolling average.

7.2.1.6 Minimum Packed Bed Scrubber Recycle Liquid Flow Rate

The performance test will be conducted to demonstrate the minimum packed bed scrubber recycle flow rate and maximum stack gas flow, thus establishing a *de facto* minimum liquid to gas ratio. Packed bed scrubber recycle flow and stack gas flow will both be monitored on a continuous basis. Based on successful demonstration of HCl and Cl₂ control during the performance test, the minimum packed bed scrubber recycle liquid flow rate limit will be based

on the mean of the hourly rolling average values demonstrated during each run of the performance test.

7.2.1.7 Minimum Scrubber Blowdown Flow Rate

The performance test will demonstrate minimum scrubber blowdown flow rate, in order to demonstrate worst case conditions for solids buildup in the scrubbing system. In order to conserve water, WCAI recycles most of the liquid from the air pollution control system. However, in order to prevent the buildup of dissolved solids in the recycled water, a certain amount of the water must be purged (or blown down) from the system. As water is purged from the system, fresh makeup water is added. The minimum scrubber blowdown flow rate limit will be based on the mean of the hourly rolling average values demonstrated during each run of the performance test.

7.2.1.8 Minimum WESP Secondary Voltage

Although the HWC MACT regulations do not require any indicator of performance in an electrically enhanced emissions control device, WCAI believes that it is appropriate to establish a performance indicator. Accordingly, WESP secondary voltage (expressed as KVDC) will be used as the indicator of continuing WESP performance. The minimum value will be established from the mean of the minimum hourly rolling average secondary voltage values demonstrated during each run of the performance test. The secondary voltage value will be based on an hourly rolling average.

7.2.1.9 Maximum Combustion Gas Velocity (Stack Gas Flow Rate)

The stack gas flow rate (expressed as actual cubic feet per minute) will be used as the indicator of combustion gas velocity. The maximum stack gas flow rate will be established from the mean of the maximum hourly rolling average stack gas flow rates demonstrated during each run of the performance test. The combustion gas velocity is proposed as an hourly rolling average limit to dampen normal variations in flow.

7.2.2 Group A2 Parameters

Group A2 parameter limits are interlocked with the automatic waste feed cutoff system, but are not based on the results of the performance test. The following parameters are proposed as Group A2 parameters for the RF system.

7.2.2.1 Maximum Stack Gas CO Concentration

The maximum hourly rolling average stack gas CO concentration will be maintained at or below 100 ppmv corrected to 7% oxygen (dry basis) during the PDT. WCAI expects to obtain a permit limit specifying a maximum allowable stack gas carbon monoxide concentration of 100 ppmv hourly rolling average corrected to 7% oxygen, dry basis, based on the regulatory limit.

7.2.3 Group B Parameters

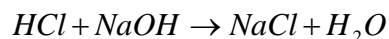
7.2.3.1 Maximum Chlorine/Chloride Feed Rate

WCAI will feed chlorine/chloride at the maximum anticipated rate during the performance test. Assuming that the stack gas HCl/Cl₂ concentration meets the applicable standard, the final limit for total chlorine/chloride feed rate should be expressed as a 12-hour average based on the mean of the chlorine/chloride feed rate values demonstrated during each run of the test.

During routine operations, WCAI has found the chlorine feed rate to be somewhat variable based on observed caustic use in the scrubbing system. Further, accurate chlorine feed concentration data on spent activated carbon is difficult to obtain and relate to a "real time" measure of chlorine feed rate. WCAI therefore proposes to demonstrate continuing compliance with the chlorine feed rate limit by monitoring the change in total dissolved solids in the RF scrubber blowdown.

WCAI has performed an evaluation of the total amount of chlorine feed as it relates to TDS in the scrubber blowdown. This evaluation demonstrates that compliance with the facility's existing wastewater discharge limit of delta 1400 mg/L for the rise in total dissolved solids (TDS) can be used to ensure compliance with the facility's proposed 12-hour rolling average limit for the feed rate of total chlorine and chloride. Attachment F contains a summary of the evaluation of chlorine feed rate versus TDS, and presents calculations to support the conclusions. The following presents a brief summary of the evaluation.

Sodium hydroxide (NaOH) is added to the recirculated scrubber solutions for the quench/venturi and packed bed scrubbers to neutralize and control the emissions of hydrogen chloride (HCl) from the carbon reactivation furnace. HCl is readily dissolved in water, where chloride ions react with sodium ions to form salt.



The NaCl formed as a result of this reaction manifests itself as dissolved solids in the scrubber liquid. The pH of the recirculated scrubber solutions for the quench/venturi and packed bed scrubbers are controlled to make sure a sufficient amount of sodium hydroxide is continuously added to the scrubber water for reaction with the hydrogen chloride.

The amount of sodium chloride formed is dependent upon the chloride content and the feed rate of the spent activated carbon. At a chloride feed rate equal to that proposed as the permit limit (and as will be demonstrated during the test) the increase in TDS in WCAI's water discharge is slightly in excess of its waste water discharge limit. Thus, compliance with the waste water TDS discharge restrictions ensures compliance with the proposed chlorine feed rate limit.

7.2.3.2 Maximum Mercury Feed Rate

Due to the low amounts of mercury expected in the spent activated carbon, WCAI will comply with the mercury standard by calculating and complying with a 12-hour rolling average Maximum Theoretical Emission Concentration (MTEC), conservatively assuming no mercury removal across the APC system. The MTEC is complied with as a maximum mercury feed rate limit. This limit will be calculated from the performance test data by using the stack gas flow rate and oxygen concentration, and the maximum allowable stack gas mercury concentration based on the HWC MACT regulations. The feed rate limit is determined assuming that all mercury is emitted.

7.2.3.3 Maximum Semivolatile Metals Feed Rate

WCAI will determine the feed rate and emission rate of the semivolatile metals cadmium and lead during the performance test. A maximum semivolatile metal feed rate will be established for the total combined cadmium and lead feed rates as a 12-hour rolling average. This limit will be based on the mean of the average semivolatile metals feed rates, and the emission rate of semivolatile metals, demonstrated during each run. The total semivolatile metal feed rate during the test will be supplemented by spiking of lead as needed. The test results will be extrapolated upwards to the allowable HWC MACT limit, using the equations presented in Section 7.2.5 below.

7.2.3.4 Maximum Low Volatility Metals Feed Rate

WCAI will determine the feed rate and emission rate of the low volatility metals arsenic, beryllium, and chromium during the performance test. A maximum low volatility metal feed rate will be established for the total combined arsenic, beryllium, and chromium feed rates as a 12-hour rolling average. This limit will be based on the mean of the average low volatility metals feed rates, and the emission rate of low volatility metals, demonstrated during each run. The total low volatility metal feed rate during the test will be supplemented by spiking of chromium as needed. The test results will be extrapolated upwards to the allowable HWC MACT limit, using the equations presented in Section 7.2.5 below.

7.2.4 Group C Parameters

Group C parameters are determined from information other than the test results. These parameters and how the limits are to be established are described below.

7.2.4.1 Minimum Packed Bed Scrubber Pressure Differential

A minimum pressure drop across the packed bed scrubber will be established as a limit, based on past operating experience.

7.2.5 Extrapolation of Metals Feed Rate Limits

As allowed by the HWC MACT regulations, WCAI wishes to feed representative metals to the RF system during the PDT and to establish feed rate limits by extrapolating upward from the test results. WCAI proposes to feed lead and chromium at only a fraction of the maximum desired permit feed rates during the test. These metals are representative of the semivolatile and low volatility metal groups, respectively. Since these metals are representative of the metal volatility groups, the test data can be used to calculate a system removal efficiency (SRE) for each of these metals which can then be applied to their respective metal volatility group. System removal efficiency will be calculated using the following equation:

$$SRE = \left[1 - \frac{\dot{m}_{i,out}}{\dot{m}_{i,in}} \right] \times 100\%$$

where:

$\dot{m}_{i,in}$ = mass feed rate of metal i.

$\dot{m}_{i,out}$ = mass emission rate of metal i.

The calculated system removal efficiency for each metal volatility class can be used to establish feed rate limits for each group using the following equation:

$$\dot{m}_{i,in,max} = \frac{\dot{m}_{i,out,MACT}}{\left(1 - \frac{SRE}{100}\right)}$$

where:

$\dot{m}_{i,in,max}$ = maximum allowable feed rate of metal i.

$\dot{m}_{i,out,MACT}$ = mass emission rate of metal i at MACT regulatory limit.

If necessary, the test data can also be used to establish appropriate risk-based feed rate limits for other individual metals of concern based on their volatility and risk-based emission limits.

Metals will be added to the spent activated carbon feed as a stable dispersion of finely divided metal-containing solids. Lead will be fed in its oxide form. Chromium will be fed in the form of strontium chromate, which is a solid hexavalent chromium compound. Metals or their oxides are the most common form of the metals expected to be fed to the process, and were thus chosen as the feed form for the test. Chromium is being fed in a hexavalent form to produce a worst case feed for the risk assessment testing.

The purpose of feeding only two metals, and for upward extrapolation from the test results, is to minimize the number and quantity of metals added to the RF solely for the purpose of demonstrating the maximum desired feed rate. WCAI has examined its spent activated carbon characterization data (shown in Table 2-1) and has determined a desired feed rate limit for each metal volatility group. The proposed metal feed rates for the PDT are approximately one third to one half of these limits. This level of spiking was chosen for the following reasons:

- Spiking at less than the maximum desired feed rate decreases the emissions associated solely with the PDT.
- Spiking at approximately one third to one half of the desired feed rate minimizes the degree to which test results will need to be extrapolated, thus eliminating inaccuracies which might be associated with a larger degree of extrapolation.

- The anticipated emissions resulting from the planned spiking rates should be detectable using the specified sampling and analytical methods so that an accurate system removal efficiency for both metals can be determined. (See calculations in Attachment D).

8.0 TEST REPORT

The final Performance Demonstration Test report will be submitted to EPA within 90 days after completion of the test. The final report will be a comprehensive test report that contains a discussion of the test objectives; sampling, analysis, and QA/QC activities performed; summaries of process operating conditions; the results of the test determinations; and proposed permit conditions. The planned outline of the report is shown in Figure 8-1.

Specific determinations to be made based on the test results include, but are not limited to the following:

8.1 REGULATORY COMPLIANCE DETERMINATIONS

8.1.1 Destruction and Removal Efficiency for the Designated POHCs.

The DRE determination will be made using the following equation:

$$DRE = \left[1 - \frac{W_{out}}{W_{in}} \right] \times 100$$

where:

DRE = Destruction and Removal Efficiency (%)

W_{in} = Mass feed rate of POHC

W_{out} = Stack gas mass emission rate of POHC.

8.1.2 Particulate Matter Emission Concentration

The particulate matter emission concentration will be determined in terms of milligrams of filterable particulate matter per dry standard cubic meter of stack gas, corrected to 7 percent oxygen by volume, dry basis.

8.1.3 Metal Emission Concentrations

The stack gas emission concentration of mercury, semivolatile metals (total combined cadmium and lead), and low volatility metals (total combined arsenic, beryllium, and chromium) will be

determined in terms of micrograms of metal per dry standard cubic meter of stack gas, corrected to 7 percent oxygen by volume, dry basis.

8.1.4 System Removal Efficiency for Specific Metal Groups

In addition to determining the metal emission concentrations, for purposes of extrapolating metal emission rates and feed rates upwards to determine the appropriate metal feed rate limits, WCAI will determine the System Removal Efficiency (SRE) of Semivolatile Metals (lead and cadmium combined) and of Low Volatility Metals (arsenic, beryllium, and chromium combined). The formula for SRE is analogous to that used for DRE:

$$SRE = \left[1 - \frac{M_{out}}{M_{in}} \right] \times 100$$

where:

SRE = System Removal Efficiency (%)

M_{in} = Mass feed rate of metal (or metal group)

M_{out} = Stack gas mass emission rate of metal (or metal group).

8.1.5 Hydrogen Chloride and Chlorine Emission Concentration

The total combined stack gas emission concentration of hydrogen chloride and chlorine will be determined in terms of parts per million hydrogen chloride equivalents by volume, corrected to 7 percent oxygen by volume, dry basis.

8.1.6 Polychlorinated Dibenzo-p-Dioxin and Polychlorinated Dibenzofuran Emission Concentration

The stack gas emission concentration of PCDD/PCDF will be determined in terms of nanograms of 2,3,7,8-TCDD toxic equivalents (TEQ) per dry standard cubic meter of stack gas, corrected to 7 percent oxygen by volume, dry basis.

8.1.7 Carbon Monoxide Emission Concentration

The concentration of carbon monoxide in the stack gas will be continuously monitored and reported in terms of parts per million by volume, corrected to 7 percent oxygen by volume, dry basis.

8.1.8 Total Hydrocarbon Emission Concentration

During each test run where DRE is being determined, the stack gas total hydrocarbon emission concentration will also be determined in terms of parts per million propane by volume, corrected to 7 percent oxygen by volume, dry basis.

8.2 OTHER STACK GAS EMISSION DETERMINATIONS

In addition to the regulatory compliance emission determinations, the following stack gas emission determinations will be made:

Stack Gas Parameter	Units
Stack gas flow rate	dscfm, dscm/min
Stack gas velocity	ft/s, m/s
Stack gas temperature	°F, °C
Stack gas moisture content	vol%
Stack gas oxygen concentration	vol%, dry
Stack gas carbon dioxide concentration	vol%, dry
Stack gas dry molecular weight	lb/lb-mol
Particulate matter emission rate	lb/h, g/s
Hydrogen chloride emission rate	lb/h, g/s
Chlorine emission rate	lb/h, g/s
Metals emission rates (Al, Sb, As, Ba, Be, Cd, Cr (total), Cr (VI), Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	lb/h, g/s
PCDD/PCDF emission rate (each 2,3,7,8-substituted congener, and total TEQ)	lb/h, g/s
Speciated volatile organic compound emission rate (each target analyte plus each TIC)	lb/h, g/s
Speciated semivolatile organic compound emission rate (each target analyte plus each TIC)	lb/h, g/s
Total volatile organics emission rate (subset of TOE)	lb/h, g/s
Total semivolatile organics emission rate (subset of TOE)	lb/h, g/s
Total nonvolatile organics emission rate (subset of TOE)	lb/h, g/s
PCB emission rate (each target analyte)	lb/h, g/s
Organochlorine pesticides emission rate (each target analyte)	lb/h, g/s
PAH emission rate (each target analyte)	lb/h, g/s
Particle size distribution	Mass fraction of various particle size ranges

8.3 FEED AND EFFLUENT DETERMINATIONS

The following feed material and effluent determination will be made:

Feed Parameter	Units
Spent carbon feed rate	lb/h, kg/h
Spent carbon chlorine/chloride concentration	mg/kg
Spent carbon metals concentration (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	mg/kg
Spent carbon POHC concentration	mg/kg
Spent carbon volatile organic concentration	ug/kg
Spent carbon semivolatile organic concentration	ug/kg
Makeup water metals concentration (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	mg/l
Makeup water volatile organic concentration	ug/l
Makeup water semivolatile organic concentration	ug/l
Caustic solution metals concentration (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	mg/l
Caustic solution volatile organic concentration	ug/l
Caustic solution semivolatile organic concentration	ug/l
Total feed rate of chlorine/chloride	lb/h
Total feed rate of metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	lb/h
Total feed rate of each POHC	lb/h

Effluent Parameter	Units
Scrubber blowdown volatile organic concentration	ug/kg
Scrubber blowdown semivolatile organic concentration	ug/kg
Scrubber blowdown metals concentration (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	mg/l
POTW discharge volatile organic concentration	ug/l
POTW discharge semivolatile organic concentration	ug/l
POTW discharge metals concentration (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)	mg/l

8.4 PROCESS DATA

The following process data points will be continuously monitored and recorded. One minute values for each parameter listed will be presented in an appendix to the report, while the average, minimum, and maximum values recorded during each run will be summarized within the body of the report.

Process Parameter	Units
Spent carbon feed rate	lb/h
Afterburner temperature	°F
Venturi scrubber pressure differential	in. w.c.
Quench/Venturi scrubber liquid flow rate	gpm
Packed bed scrubber pH	pH
Packed bed scrubber liquid flow rate	gpm
Packed bed scrubber pressure differential	in. w.c.

Process Parameter	Units
Scrubber blowdown flow rate	gpm
WESP secondary voltage	kVDC
Stack gas flow rate	acfm

8.5 REPORTING OF INTERMEDIATE RESULTS

EPA has requested that WCAI report certain intermediate data to EPA during the test and prior to submittal of the final test report. WCAI will comply with those requests as follows.

8.5.1 Daily Process Data

WCAI will provide EPA's on-site observer with either computer disks or hard copy printouts (at the option of the EPA observer) representing the one-minute updated process operating data for the parameters described in Table 7-1. These data, from the previous day's test activities, will be provided at the beginning of the following day. Prior to the first day of testing, WCAI will provide the previous day's data for these same monitors, as well as their most recent calibration results.

8.5.2 Unfavorable Performance Demonstration Test Results

If WCAI determines, during the course of compiling the Performance Demonstration Test data, that any of the test emission targets were not met, or if other unfavorable results have occurred, EPA will be notified as soon as practical following WCAI's confirmation of such an occurrence. WCAI and EPA will work together to develop appropriate corrective actions to resolve any such situation.

8.5.3 Modification of Planned Performance Test Operating Conditions

Should preliminary testing of the RF system, or other information lead WCAI to propose a change of target process operating conditions or to modify the test protocol after approval of the test plan, WCAI will implement such changes through the use of a Corrective Action Request (CAR) as described in Section 14.2 of the QAPP (Attachment C). Such CAR will require approval of WCAI, the test manager, and EPA.

9.0 DATA IN LIEU OF TESTING

WCAI has conducted a number of previous tests on the carbon reactivation furnace and is confident in its ability to meet all emission requirements, however most of those tests were not conducted under conditions which would support all of the desired permit conditions as described in this test plan. Thus, data from those previous tests is not being submitted in lieu of the currently planned compliance testing. WCAI does however have particle size distribution data collected in November 2001, which it believes is appropriate for use during the risk assessment, and has included in Attachment G.

WCAI believes that it is appropriate to utilize the existing particle size distribution (PSD) data in lieu of gathering the same data during the Performance Demonstration Test, since PSD data is used for risk assessment modeling of long-term impacts from the facility. This data set was generated under typical operating conditions without spiking of metals or ash, thus the size distribution data in Attachment G is representative of normal operations. It is possible that spiking of finely divided metals during the Performance Demonstration Test could alter the size distribution of the emitted particles compared to normal operations. Further, use of the current PSD data set will also eliminate one sampling train during the Performance Demonstration Test, which is already extremely complex.

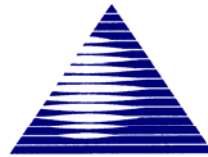
CARBON REACTIVATION FURNACE RF-2 PERFORMANCE DEMONSTRATION TEST REPORT

PREPARED FOR:

**SIEMENS WATER TECHNOLOGIES, CORP.
2523 MUTAHAR STREET
PARKER, ARIZONA 85344**

**Revision: 0
June 30, 2006
Focus Project No. 010111**

PREPARED BY:



Focus Environmental, Inc.

ENGINEERING SOLUTIONS TO ENVIRONMENTAL PROBLEMS

**FOCUS ENVIRONMENTAL, INC
9050 EXECUTIVE PARK DRIVE.,
SUITE A202
KNOXVILLE, TENNESSEE 37923
(865) 694-7517**

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VOLUME II (on CD)

- I. Airtech, Inc. Stack Sampling Report (Includes particulate matter, M0040 Bag analytical data, and THC CEMS data)
- J. ESS, Spiking Report and Certificate of Composition for Spiking Materials
- K. CEMS Performance Specification Test Report
- L. Process Instrument Calibration Data

VOLUME III (on CD)

Feed and Process Data Packages

	File Name
A. Feed Ultimate Analysis	H6D040101 Carbon Ultimate.pdf
B. Feed Total Chlorine	H6D040102 Carbon Total Chlorine.pdf
C. Feed and Process Volatiles	H6D030205 Carbon & Process VOC.pdf
D. Feed and Process Semivolatiles	H6D030246 Carbon & Process SVOC.pdf
E. Feed and Process Metals	H6D040213 Carbon & Process Metals.pdf

Stack Gas Data Packages

	File Name
A. M5 Particle Size Distribution	142541 M5 PSD.pdf
B. M0030 VOST and First VOST Audit	H6D030169 M0030 VOST & 1 st VOST Audit.pdf
C. M0040 Total Volatile Organic Condensate	H6D030177 M0040 CON.pdf
D. M0061 Hexavalent Chromium	H6D030194 M0061 Hex Cr.pdf
E. M29 Metals	H6D030224 M29 Metals.pdf
F. M0010 Total Semivolatile and Nonvolatile Organics	H6D030231 M0010 TCO Grav.pdf
G. M0023A Dioxin and Furans	H6D030236 M0023A D-F.pdf
H. M0010 PCBs and PAHs	H6D030241 M0010 PCB PAH.pdf
I. M0010 SVOCs and OCPs	H6D030245 M0010 SVOC OCP.pdf
J. M26A Chlorine and Hydrogen Chloride	H6D040103 M26A HCl Cl.pdf
K. Second VOST Audit	H6D120117 2 nd VOST Audit.pdf

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ACRONYMS AND ABBREVIATIONS

acfm	Actual cubic feet per minute
APC	Air pollution control
ASTM	American Society for Testing and Materials
AWFCO	Automatic waste feed cutoff
B.P.	Boiling point
Btu	British thermal unit
CAR	Corrective Action Request
CAA	Clean Air Act
CARB	California Air Resources Board
CEM or CEMS	Continuous emission monitor or Continuous emission monitoring system
CFR	Code of Federal Regulations
cm	Centimeters
CO	Carbon monoxide
COPCs	Compounds of potential concern
CRIT	Colorado River Indian Tribes
cu. ft.	Cubic foot
CVAAS	Cold vapor atomic absorption spectroscopy
DC	Direct current
DOT	Department of Transportation
DQO	Data Quality Objective
DRE	Destruction and removal efficiency
dscf	Dry standard cubic foot
dscfm	Dry standard cubic feet per minute
dscm	Dry standard cubic meters
EPA	United States Environmental Protection Agency
FID	Flame ionization detector
ft	Feet
g	Gram
GC/FID	Gas chromatography/flame ionization detector
GC/MS	Gas chromatography/mass spectrometry
gpm	U.S. Gallons per minute
gr	Grain (equals 1/7000 pound)
GRAV	Gravimetric
HAP	Hazardous air pollutant
HCl	Hydrogen chloride
HPLC	High performance liquid chromatography
hr	Hour
HRGC/HRMS	High resolution gas chromatography/high resolution mass spectrometry
HWC MACT	Hazardous Waste Combustor Maximum Achievable Control Technology regulations
ICP	Inductively coupled plasma spectroscopy
in	Inch
in w.c.	Inches of water column (pressure measurement)
kg	Kilogram
L	Liter
lb	Pound
lpm	Liters per minute
m	Meter
mg	Milligram
ml	Milliliter
MTEC	Maximum theoretical emission concentration
NDIR	Non-dispersive infrared

ng	Nanogram
NVOC	Nonvolatile organic compound
P&ID	Piping and instrumentation diagram
PAH	Polyaromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCDD/PCDF	Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo furans
PDT	Performance Demonstration Test
PDTP	Performance Demonstration Test Plan
PFD	Process flow diagram
PIC	Product of incomplete combustion
PLC	Programmable logic controller
POHC	Principal organic hazardous constituent
POTW	Publicly owned treatment works
ppm	Parts per million
ppmv	Parts per million by volume
ppmvd	Parts per million by volume, dry basis
psig	Pounds per square inch, gauge
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RF	Reactivation Furnace
s	Second
scfm	Standard cubic feet per minute
SOP	Standard operating procedure
sq. ft.	Square feet
SQL	Sample quantitation limit
SVOC	Semivolatile organic compound
TCDD	Tetrachloro dibenzo-p-dioxin
TCO	Total chromatographable organics
TEQ	Toxicity equivalent (related to 2,3,7,8-TCDD)
THC	Total hydrocarbons
TIC	Tentatively identified compound
TOE	Total organic emissions
TSCA	Toxic Substances Control Act
ug	Microgram
VOA	Volatile organic analysis
VOC	Volatile organic compound
VOST	Volatile organic sampling train
WESP	Wet electrostatic precipitator
w.c.	Water column
XAD	Brand name for Amberlite XAD-2 adsorbent resin

1.0 EXECUTIVE SUMMARY

A Performance Demonstration Test (PDT) of the Carbon Reactivation Furnace RF-2 at the Siemens Water Technologies Corp. (formerly known as U.S. Filter Westates) Facility located in the Colorado River Indian Tribes (CRIT) Industrial Park near Parker, Arizona was conducted in March 2006.

The facility treats spent activated carbon that has been used by industry, state and federal government agencies, and municipalities for the removal of organic compounds from liquid and vapor phase process waste streams. Once the carbon has been used and is spent, it must be either disposed of or reactivated at a facility such as Siemens Water Technologies Corp.. A Carbon Reactivation Furnace (designated as RF-2) is used by Siemens Water Technologies Corp. to reactivate the spent carbon. Some of the carbon received at the Parker facility is designated as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) regulations. Much of the carbon received at the facility is not a RCRA hazardous waste, as it is either not a characteristic or listed waste. The RF is not a hazardous waste incinerator. "Hazardous waste incinerator" is defined in 40 CFR Part 63, Subpart EEE as a "device defined as an incinerator in § 260.10 of this chapter and that burns hazardous waste at any time." (40 CFR 63.1201). "Incinerator" is defined in 40 CFR 260.10 as "any enclosed device that: (1) Uses controlled flame combustion and neither meets the criteria for classification as a boiler, sludge dryer or carbon regeneration unit, nor is listed as an industrial furnace; or (2) Meets the definition of infrared incinerator or plasma arc incinerator. (emphasis supplied)" The RF-2 unit does not qualify as an incinerator and instead is designated by Subpart X of the RCRA regulations as a Miscellaneous Unit. According to 40 CFR 264.601 of the Subpart X regulations, permit terms and provisions for a Miscellaneous Unit must include appropriate requirements of 40 CFR Subparts I through O and Subparts AA through CC, 40 CFR 270, 40 CFR 63 Subpart EEE, and 40 CFR 146.

Based on 40 CFR 264.601, Siemens Water Technologies Corp. tested the RF-2 unit to demonstrate performance and to establish operating parameter limits in accordance with the standards of 40 CFR 63 Subpart EEE. The emission standards of 40 CFR 63 Subpart EEE are more stringent than the RCRA hazardous waste incinerator emission standards of 40 CFR 264 Subpart O. The regulations at 40 CFR 63 Subpart EEE are often referred to as the Hazardous Waste Combustor Maximum Achievable Control Technology (HWC MACT) standards. This terminology will be used in this document.

The testing was conducted in accordance with the requirements of the HWC MACT standards and the approved PDT plan. The testing consisted of a Performance Demonstration Test of the RF-2 unit and a Continuous Emissions Monitoring Systems (CEMS) test. The CEMS testing was conducted just prior to the RF-2 PDT. The formal PDT was conducted on March 27 through March 30, 2006.

The carbon reactivation process consists of a multiple hearth reactivation furnace, a natural gas fired afterburner used to destroy organic contaminants released from the carbon, a wet quench, venturi scrubber, packed bed scrubber, and wet electrostatic precipitator.

The purpose of the PDT was to:

1. Demonstrate Compliance with Applicable USEPA Regulatory Performance Standards (Based on HWC MACT Standards for Existing Hazardous Waste Incinerators):
 - Demonstrate a DRE of greater than or equal to 99.99% for the selected principal organic hazardous constituents (POHCs) chlorobenzene and tetrachloroethene.
 - Demonstrate stack gas carbon monoxide concentration less than or equal to 100 ppmv, dry basis, corrected to 7% oxygen.
 - Demonstrate stack gas hydrocarbon concentration of less than or equal to 10 ppmv, as propane, dry basis, corrected to 7% oxygen.
 - Demonstrate a stack gas particulate concentration less than or equal to 34 mg/dscm (0.015 gr/dscf) corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of hydrogen chloride (HCl) and chlorine (Cl₂) are no greater than 77 ppmv, dry basis, corrected to 7% oxygen, expressed as HCl equivalents.
 - Demonstrate that the stack gas mercury concentration is less than or equal to 130 µg/dscm, corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of semivolatile metals (cadmium and lead, combined) is less than or equal to 240 µg/dscm, corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of low volatility metals (arsenic, beryllium, and chromium, combined) is less than or equal to 97 µg/dscm, corrected to 7% oxygen.
 - Demonstrate that the stack gas concentration of dioxins and furans does not exceed 0.40 ng/dscm, corrected to 7% oxygen, expressed as toxic equivalents of 2,3,7,8-TCDD (TEQ). This is the applicable standard since the gas temperature entering the first particulate matter control device is less than 400°F.
2. Establish Permit Operating Limits
 - Demonstrate maximum feed rate for spent activated carbon.
 - Demonstrate minimum afterburner gas temperature
 - Demonstrate maximum combustion gas velocity (or a suitable surrogate indicator)
 - Demonstrate maximum total chlorine/chloride feed rate
 - Establish a Maximum Theoretical Emission Concentration (MTEC) limit for mercury
 - Demonstrate system removal efficiency (SRE) for semivolatile and low volatility metals so feed rate limits can be developed by extrapolation from test results.
 - Establish appropriate operating limits for the air pollution control system components.

3. Gather Information for Use in a Site-Specific Risk Assessment
 - Measure emissions of metals, including hexavalent chromium
 - Measure emissions of specific volatile and semivolatile products of incomplete combustion (PICs)
 - Measure emissions of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF)
 - Measure emissions of polychlorinated biphenyls (PCBs)
 - Measure emissions of specific organochlorine pesticides
 - Measure emissions of total volatile, semivolatile, and nonvolatile organics
 - Determine the stack gas particle size distribution.

A summary of the PDT performance and emission results is presented in Table 1-1. A summary of the process operating conditions for each run is presented in Table 1-2.

The PDT results indicate that the RF-2 unit meets the applicable performance requirements. Specific conclusions drawn from the PDT are as follows:

- The RF-2 system operated reliably during each PDT run, and was able to maintain operating conditions which were consistent with the target values stated in the PDT Plan. The test results are suitable for establishing operating parameter limits.
- DRE requirements of 99.99% or greater were met for both POHCs (monochlorobenzene and tetrachloroethene). Minimum temperature limits and maximum flue gas flow rate limits can be appropriately established from the test results.
- PCDD/PCDF emission standards were met.
- Particulate matter emission standards were met.
- Metal emission standards were met for mercury, semivolatile metals, and low volatility metals. Maximum metal feed rates can be reliably determined using the test results.
- Stack gas CO and THC concentration standards were met in all test runs.
- Stack gas HCl/Cl₂ emission requirements were met. Maximum total chlorine and chloride feed rate limits can be appropriately established from the test results.
- Emissions data to support the estimates of risk in a site-specific multi-pathway human health and ecological risk assessment were gathered successfully.

Continued operation of the Siemens Water Technologies Corp. Carbon Reactivation Furnace RF-2 under the conditions established by the PDT will result in effective destruction of organic compounds, and control of emissions in accordance with the applicable performance requirements.

2.0 TEST PROGRAM SUMMARY

2.1 SUMMARY OF TEST PLAN AND OBJECTIVES

In order to accomplish the PDT objectives, (i.e., demonstrating that the unit will meet all applicable environmental performance standards) a single test condition representing “worst case” operations of minimum temperature, maximum combustion gas velocity (minimum residence time), and maximum spent activated carbon feed rate was performed. The test consisted of three replicate sampling runs.

A summary description of the planned testing conditions, analytical parameters, and sampling methods follows:

Test Condition 1 (“Worst-Case” Operations)

Sampling and monitoring protocols that were planned for the performance test are summarized as follows:

- Spent Activated Carbon Feed - total chlorine/chloride, elemental (C, H, N, O, S, moisture), volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Makeup Water - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Caustic feed to APC - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Cu, Co, Pb, Hg, Ag, Tl, Se, Ni, V, Zn)
- Scrubber Blowdown - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Wastewater Discharge to POTW - volatile organics, semivolatile organics, and total metals (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, Zn)
- Stack gas particulate, HCl, and Cl₂ using EPA Method 26A
- Stack gas target volatile organics using VOST, SW-846 Method 0030
- Stack gas target semivolatile organics and organochlorine pesticides using SW-846 Method 0010
- Stack gas PAHs and PCBs using a separate SW-846 Method 0010 sampling train
- Stack gas PCDD/PCDF using SW-846 Method 0023A
- Stack gas total volatile organics using SW-846 Method 0040
- Stack gas total semivolatile and nonvolatile organics using SW-846 Method 0010
- Stack gas metals (Al, Sb, As, Ba, Be, Cd, total Cr, Co, Cu, Pb, Hg, Ni, Se, Ag, Tl, V, and Zn) using EPA Method 29
- Stack gas hexavalent chromium using SW-846 Method 0061
- Stack gas particle size distribution using a cascade impactor

- Stack gas CO and O₂ by permanently installed CEM according to the protocols in the Appendix to 40 CFR 63, Subpart EEE; Performance Specification 4B of 40 CFR 60, Appendix B.
- Stack gas total hydrocarbons (as propane) by temporary CEM according to EPA Method 25A and the protocols in the Appendix to 40 CFR 63, Subpart EEE.

Tables 2-1 and 2-2 present the planned PDT sampling and analytical protocol in greater detail. Figure 2-1 shows the location of sampling points in the RF-2 system.

2.2 DEVELOPMENT OF PERMIT LIMITS

Siemens Water Technologies Corp. is required to establish operating limits (applicable whenever hazardous waste is in the combustion chamber) in its permit to ensure that the RF-2 system complies with the applicable USEPA environmental performance standards at all times. Under the HWC MACT, the regulations establish a comprehensive list of regulated parameters at 40 CFR 63.1209 (j) through (p) which are used to ensure continuing regulatory compliance.

Considering the configuration of the RF-2 system and the characteristics of the spent activated carbon to be fed, Siemens Water Technologies Corp. anticipated establishing process operational limits on the following parameters, and operated the system accordingly during the PDT:

- Minimum afterburner gas temperature
- Maximum spent activated carbon feed rate
- Maximum total chlorine and chloride feed rate
- Maximum feed rate of mercury (based on MTEC)
- Maximum feed rate of semivolatile metals (total combined lead and cadmium)
- Maximum feed rate of low volatility metals (total combined arsenic, beryllium, and chromium)
- Minimum venturi scrubber pressure differential
- Minimum quench/venturi scrubber total liquid flow rate
- Minimum packed bed scrubber pH
- Minimum packed bed scrubber pressure differential
- Minimum packed bed scrubber liquid flow rate
- Minimum scrubber blowdown flow rate
- Minimum WESP secondary voltage
- Maximum stack gas flow rate (indicator of combustion gas velocity).

These operating limits have been established as described in the HWC MACT regulations and in the approved Performance Demonstration Test Plan, and are more fully described in Section 7.0 of this test report.

As part of EPA's approval of the PDT Plan, Siemens Water Technologies Corp. was also required to establish both a minimum and maximum temperature limit for Hearth #5 of the reactivation furnace. Since both a minimum and maximum temperature could not be demonstrated in the single test condition approved for the test, Siemens Water Technologies Corp. operated Hearth #5 at a maximum temperature during the PDT and will conduct a separate minimum temperature test outside of the formal PDT period.

2.3 TEST IMPLEMENTATION SUMMARY

Overall, the PDT was executed in substantial conformance with the approved protocols contained in the PDT Plan and Quality Assurance Project Plan (QAPP). This section presents an account of the PDT implementation.

The Performance Demonstration Test of the Siemens Water Technologies Corp. carbon reactivation furnace RF-2 located in the Colorado River Indian Tribes Industrial Park near Parker, Arizona was conducted during the week of March 27 - 31, 2006. Actual emissions sampling was conducted on March 28 through March 30. All planned testing for the PDT was completed.

All process operating conditions were within the operating envelope defined by the specifications provided in the PDT Plan. All sampling and analysis was performed as described in the PDT Plan and QAPP, with minor deviations as described in Section 2.3.2 below.

The PDT was conducted in compliance with the PDT Plan approved by the US Environmental Protection Agency (EPA) and CRIT. The PDT program was conducted under the overall direction of Siemens Water Technologies Corp. personnel. Mr. Monte McCue was the overall CPT Manager for Siemens Water Technologies Corp. Mr. Willard (Drew) Bolyard of Siemens Water Technologies Corp. oversaw plant personnel and operations during the PDT. Ms. Mary Blevins, Ms. Stacy Braye, Mr. Steven Arman, Mr. Robert Fitzgerald, Mr. Michael Svizzero, and Ms. Karen Scheuerman of USEPA were on-site to observe portions of the PDT. Mr. Hector Duran observed the PDT as a representative of CRIT. Mr. Marty Jones and Mr. Chase McLaughlin of Arcadis also observed the PDT as consultants to CRIT. Process operations were conducted by Siemens Water Technologies Corp. personnel, with the assistance of Mr. Karl Monninger of Chavond Barry Engineering. Mr. Anthony Eicher, of Focus Environmental, Inc. (Focus), coordinated and oversaw all technical aspects of the test program, and acted as the PDT

Manager. Mr. Eicher was also responsible for the preparation of this report, and provided overall QA/QC for the project. Ms. Teresa White, of Focus, acted as the on-site sample coordinator for the test. She also served as the Quality Assurance Officer for the PDT analytical activities, and performed data validation of the process sample and emissions results. Process samples were collected by Focus and Siemens Water Technologies Corp. personnel, under the direction of Focus. A number of process samples were provided as split samples to Ms. Kathy Baylor of EPA, who was on site to coordinate the collection and packaging of the split samples. All stack gas samples were collected by Airtech Environmental Services, Inc. (Airtech), under the direction of Mr. Pat Clark. Waste feed spiking services were provided by Engineered Spiking Solutions, Inc. (ESS), under the direction of Dr. William Schofield, with field spiking services provided by Mr. Scott Neal. PDT sample analyses were performed by the following laboratories:

1. Airtech conducted the analysis of stack gas particulate matter samples and provided on-site analytical services for the determination of total volatile organics. Airtech also operated a temporary CEM systems for THC during the PDT.
2. Severn-Trent Laboratories of Knoxville, Tennessee, under the direction of Dr. William Anderson, performed the analyses for all process and stack gas samples, with the exception of the stack gas particulate matter and particle size distribution.
3. MVA, Inc. of Atlanta, Georgia, conducted the stack gas particle size determination, under sub-contract to Severn-Trent Laboratories.

2.3.1 Test Run Chronology

The test team arrived on-site and set up equipment for the test on March 27, 2006. Coordination meetings were held between the test team members to ensure that all were familiar with the test protocols and that operators understood the desired test conditions.

During the initial meetings with the test team, a number of minor modifications to the test plan were discussed based on comments received from EPA after approval of the plan, and based on input from the other test team members based on observations during preliminary testing and subsequent sample analysis. The majority of these items have been documented through the use of Corrective Action Requests (CARs) as provided for in the approved Quality Assurance Project Plan (QAPP) and are discussed in detail in later section of this report. CARs were reviewed and approved by appropriate members of the team during the course of the PDT.

The test team arrived on site at or before 07:00 on March 28, 2006. The RF-2 system was near the target operating conditions when the team arrived. POHC spiking was started at 07:30 and spiking of the organic surrogate mixture and metals started at 07:50. The entire RF-2 unit experienced a shutdown at

07:56 due to over-amperage of the ID fan. All spiking was stopped immediately. The plant recovered quickly from the shutdown and spiking operations were re-started at 08:59. Preliminary stack gas flow traverses were conducted and final preparations were made for the beginning of testing.

PDT Run 1 was started at 12:10 on March 28, 2006.

PDT Run 1 was completed at 16:44 on March 28, 2006, without interruption. All stack gas sampling trains were successfully leak checked prior to the start of sampling, during port changes, and upon completion of sampling and were recovered once the run was complete.

On March 29, 2006, the testing crew arrived on-site at 08:00 and began setting up for PDT Run 2. Spiking operations were started at 08:58. Plant personnel made a number of adjustments to the furnace in order to maintain the stack gas flow rate near the desired conditions.

PDT Run 2 was started at 11:15 on March 29, 2006.

As the Method 0023A sampling train was being moved to the last traverse point in the first half of the run, the glass probe liner broke. The sampling team and regulatory observers noticed the break immediately when it occurred, and the sampling team shut down the sample pump. Since it was known when the break occurred and sampling was immediately stopped, it was decided to recover both parts of the broken probe liner, replace the probe, and continue sampling. All parties were aware of the situation and approved of the action taken.

PDT Run 2 was completed at 17:00 on March 29, 2006, without further sampling difficulties. All stack gas sampling trains were successfully leak checked prior to the start of sampling, during port changes, and upon completion of sampling and were recovered once the run was complete. There were no process interruptions during the run.

On March 30, 2006, the testing team arrived at or before 08:00 and began setting up for PDT Run 3. All process conditions were at their target values, and spiking started at 08:50.

At 08:58 a weld on the nipple attached to the carbon feed chute used for spiking material injection was noticed to be cracked. Spiking was immediately stopped and the weld was repaired. Spiking resumed at 10:13 on March 30, 2006.

PDT Run 3 was started at 11:50 on March 30, 2006.

All sampling activities were placed on hold at 12:39 when it was noted that the organic surrogate mixture was not flowing correctly through the spiking system. The other spiking systems continued to operate and process conditions were maintained while the problem with the organic surrogate mixture spiking system was identified and corrected.

Organic surrogate spiking was resumed at 14:43 and all sampling was resumed at 15:30 on March 30, 2006.

PDT Run 3 was completed at 19:16 on March 30, 2006. As the PSD sampling train was being recovered it was noted that the filter had gotten wet, thus potentially compromising the sample. Another PSD sample was collected as quickly as possible and finished at 19:59. Since all other samples had finished at 19:16, all parties involved in testing decided to designate 19:16 as the official run completion time. All stack gas sampling trains were successfully leak checked prior to the start of sampling, during port changes, and upon completion of sampling and were recovered once the run was complete. There were no process interruptions during the run.

On March 31, 2006 the test team dismantled all testing and spiking equipment, packaged samples for shipment to the laboratory, and departed the site. Sample packaging and shipping were handled by Focus and Airtech personnel.

2.3.2 Deviations from the Test Plan

Siemens Water Technologies Corp. conducted preliminary testing prior to the formal PDT in order to ensure that all process, spiking, sampling, and analytical systems and procedures were appropriate, and that the test team could identify and resolve any major issues prior to the formal PDT. During the preliminary testing and subsequent planning activities, several items were identified and corrective actions were initiated. These were documented through Corrective Action Requests (CARs) as provided for in the QAPP. Additionally, EPA provided Siemens Water Technologies Corp. with certain data submittal requests in the test plan approval letter, and also required Siemens Water Technologies Corp. to establish additional operating parameters (Hearth #5 minimum and maximum temperature) that were not addressed in the approved test plan. Additionally, conditions during the test dictated that several field directives be given; some of which warranted documentation through the CAR process.

A total of eight CARs were generated during the PDT and are shown in Appendix C. Additional verbal directives were given in the field and to the laboratory during the course of the PDT program. Each corrective action and verbal directive is discussed fully in Section 5.0, and is summarized below:

1. The selected laboratory for the performance test has a slightly different target analyte list compared to those presented in the original test plan. Revised target analyte lists were presented to EPA and were approved for use in the test. This is documented as CAR-001.
2. The original test plan calls for an organic surrogate mixture to be added to the spent activated carbon feed. That mixture was specified to contain 1,1,1-Trichloroethane, however the compound is not available because it is an ozone depleting substance. Methylene chloride was substituted for 1,1,1-trichloroethane. This is documented as CAR-002.
3. Based on observations made during preliminary testing, it was believed that the high stack gas moisture content and low particulate matter concentration would not be conducive to the use of a Cascade Impactor, which was originally planned for collection of particle size distribution data. Therefore, a Method 5 train, employing a smooth filter media was used to collect particulate matter samples, followed by scanning electron microscope examination of the particles to determine the particle size distribution. This is documented as CAR-003.
4. Prior to the test, the analytical laboratory expressed concern that analytical surrogate compounds placed onto the adsorbent resin in some of the sampling trains might be stripped off unless sampling is conducted at very low sampling rates. In order to address this concern, all semivolatile organic sampling trains were operated for a nominal sampling run time of 4 hours instead of the planned nominal sampling time of three hours. The same nominal volume of sample was collected over the four hour period that would have been collected in three hours. This represents a very conservative approach to the issue, and is documented as CAR-004.
5. EPA indicated that a minimum temperature limit must be established for Hearth #5 in the reactivation furnace. This condition was not anticipated, nor was it addressed in the Performance Demonstration Test Plan. After discussions with EPA, it was decided that a separate test will be conducted outside the formal PDT test period where a minimum Hearth #5 temperature will be maintained and the resulting reactivated carbon will be analyzed for organics. This is documented as CAR-005.
6. Several modifications to the target operating conditions and anticipated permit limits were made after approval of the Performance Demonstration Test Plan. Most of these changes were made as a result of preliminary testing. Additionally, EPA included with their test plan approval letter a table of information and process data that they wanted included in the test report. Revised operating condition targets and the list of data requested by EPA are documented as CAR-006.
7. During Run 2 of the PDT, the glass probe liner on the M0023A train was broken due to high winds swinging the sampling train as it was being moved from one traverse point to another. The stack sampling crew and regulatory observers noted the break and immediately stopped sampling. Upon investigation, it was found that both pieces of the broken probe liner could be retrieved and that the sampling train leak-checked from the break through the remainder of the train. All parties agreed that there was no impact on sample integrity, so the broken probe liner pieces were capped, taken to the recovery area and rinsed. The probe liner was replaced and the train was used to complete the sampling run. The rinse of the broken probe liner pieces was combined with the final train rinse to capture the entire sample. This is documented as CAR-007.

8. In order to maximize the stack gas flow rate (minimize the gas residence time) for the performance test, a source of additional air was needed beyond what is normally supplied by the combustion air fan. The access door on Hearth #1 was opened to allow additional air to be drawn into the system and to pass through the combustion and air pollution control portions of the system. This is documented as CAR-008.
9. Makeup water samples were planned to be collected only once, at the beginning of the test. Siemens Water Technologies Corp. personnel were concerned however, that the quality of the makeup water could change significantly over time, thus makeup water samples were collected at the beginning of each test run. This modification increased the number and frequency of makeup water samples.
10. In order to keep any water droplets and particulate matter from entering the M0040 sampling train, a glass wool plug was inserted into the sample probe. This was not described in the test plan, but was deemed to be a good operating practice for this train.
11. At the end of Run 1, the Test Manager noticed that the silica gel in the M0061 train was quite wet. The sampling team was directed to add an additional silica gel impinger to the M0061 train to prevent this situation from occurring again. A check of the moisture determination from the M0061 train used in Run 1 was compared to the moisture determinations from the other Run 1 trains, and found to be consistent. Thus there was no adverse impact on the Run 1 M0061 sample.
12. It was noted that Siemens Water Technologies Corp.'s installed stack gas flow rate monitor was not corresponding with the Pitot tube readings of the stack sampling team. Further investigation indicated that some type of fault in the stack gas flow rate monitor was being experienced, however it was not able to be corrected during the course of the PDT. All parties were informed of the situation, and a decision was made to complete the PDT and to use the average of the stack gas sampling train flow rate determinations from each run to set the maximum stack gas flow rate operating limit for the system. Siemens Water Technologies Corp. will need to correct the fault in the stack gas flow rate monitoring system in order to demonstrate continuing compliance with the operating limit.

All other testing and process operations were conducted in conformance with the approved PDT Plan and QAPP. EPA also requested that split samples of the process feed materials and effluents be provided. Additional sample volume was collected accordingly, and samples were split with EPA.

A few analytical quality control determinations showed non-conformances with the target data quality objectives. However, none of these non-conformances are deemed to have had a significant negative impact on the PDT results or conclusions. These items are discussed in Section 5.0 of the report and in the Data Validation Report in Appendix H.

3.0 PROCESS OPERATIONS

3.1 PROCESS OPERATING CONDITIONS

Key process operating parameters were continuously monitored and recorded during each test run by the process computer system. Process operating data were stored on magnetic disk at one-minute intervals during each test run. Appendix A presents complete printouts of the process operating data from each test run.

Manual logs were kept during the PDT to record the times when sampling runs were started, stopped, and/or interrupted. The PDT Manager's manual log is included in Appendix B. Tables 3-1 through 3-3 summarize key operating data collected during each PDT run.

Key process instruments were calibrated prior to the PDT. The CEM system underwent a Performance Specification Test prior to the PDT, and underwent daily calibration checks during the PDT. The Performance Specification Test and each daily calibration check showed the CEM system to be operating within specifications. A copy of the CEMS Performance Specification Test Report is included in Appendix K. Process instrument calibration data is presented in Appendix L.

3.2 FEED MATERIAL CHARACTERISTICS AND CONSTITUENT FEED RATES

The spent activated carbon feed to RF-2 was sampled at 15-minute intervals and composited during each PDT run. Makeup water samples were collected at the beginning of each run. Caustic used in the APC system was sampled once for the PDT program. Feed sampling logs, as well as other sampling information, are summarized in Appendix D. A list of samples is presented in Appendix E. Analyses of the feed samples, as well as summaries of all CPT analytical results are shown in Appendix F. Feed material physical/chemical characteristics are presented in Table 3-4. Constituent feed rate information (e.g., total chlorine/chloride, metals, and each POHC) is presented in Table 3-5. Table 3-6 presents volatile organic feed data. Semivolatile organic feed data are presented in Table 3-7. Example calculations are presented in Appendix G. (Note that the complete sampling report and full analytical data packages have been submitted as separate volumes.)

3.3 SPENT ACTIVATED CARBON FEED SPIKING

Monochlorobenzene and tetrachloroethene (perchloroethylene) were the designated POHCs, and were spiked onto the spent activated carbon feed in all PDT runs. Lead and chromium were spiked onto the spent activated carbon feed during each run to represent semivolatile, and low volatility metals, respectively. Additionally an organic surrogate mixture of methylene chloride, toluene, naphthalene, and ethylene glycol was added to the spent activated carbon to increase the organic loading and to provide a variety of compounds for the formation of a broad array of emission products. Spiking was conducted downstream of the feed sampling point, using metering pumps and mass flow meters, backed up by calibrated electronic scales. Spiking rates are summarized in Table 3-8. A complete spiking report is presented in Appendix J. The spiking report contains copies of all field data sheets, calibrations and spiking material composition certifications.

3.4 MAKEUP AND EFFLUENT CHARACTERISTICS

Makeup water and caustic solution are added to the scrubbing system. Effluent streams are the scrubber blowdown water and POTW discharge. Results of the makeup and effluent material analyses are summarized in Table 3-9. Summaries of all analyses are presented in Appendix F. Complete analytical data packages have been submitted as separate volumes.

4.0 COMPLIANCE RESULTS

Using the process operating data and analytical results from the PDT program, the performance of the Siemens Water Technologies Corp. Carbon Reactivation Furnace RF-2 system was determined and compared to the performance requirements specified for the facility. The PDT demonstrated the RF-2 unit's ability to meet all regulatory requirements. Table 4-1 presents performance results for each key parameter during the PDT, and compares the performance results with target criteria. Example calculations for each performance determination are shown in Appendix G.

Stack gas sampling was conducted by Airtech Environmental Services, Inc. Summaries of the sampling conditions are presented in each table of stack emission results. A complete report of Airtech's sampling results, including all field data sheets, calibration records, and calculations is presented in Appendix I. Example calculations for each PDT determination are presented in Appendix G. Analytical summaries are presented in Appendix F. Complete analytical data packages are presented in separate volumes.

4.1 POHC DESTRUCTION AND REMOVAL EFFICIENCY

Monochlorobenzene and tetrachloroethene were designated as the POHCs for the test. DRE results are summarized in Table 4-2. The PDT demonstrated that the RF-2 unit achieved a DRE of greater than 99.99% for each POHC in all runs.

4.2 DIOXIN AND FURAN EMISSIONS

Dioxin and furan sampling results and emission concentrations are presented in Tables 4-3 through 4-5. The data presented show the PCDD/PCDF emissions are in compliance with the HWC MACT standard of 0.40 ng TEQ/dscm corrected to 7% O₂ applicable to existing systems with a temperature at the entrance to the primary particulate matter control device of 400°F or less. [40 CFR 63.1203(a)(1)(ii)].

4.3 PARTICULATE EMISSIONS

Particulate matter sampling results and emission concentrations are shown in Tables 4-6 through 4-8. Particulate matter concentrations met the regulatory requirement for the PDT in all runs.

4.4 HYDROGEN CHLORIDE AND CHLORINE EMISSIONS

Tables 4-6 through 4-8 presents the results of HCl and Cl₂ emissions determinations during the PDT. HCl/Cl₂ emission concentrations were significantly below the performance criteria in all runs.

4.5 METALS EMISSIONS

Metal sampling and emissions results are presented in Tables 4-9 through 4-11. The results indicate that the system met the applicable emission standards for volatile metals (mercury), semivolatile metals (the sum of lead and cadmium emissions), and low volatility metals (the sum of arsenic, beryllium, and chromium emissions).

Further, data from the test were used to develop a system removal efficiency (SRE) for the low volatility metal group. These values are used along with the feed rates of spiked low volatility metal during the test to develop an extrapolated low volatility metals feed rate limit in accordance with 40 CFR 63.1209(n)(2)(ii) and the approved PDT Plan. The actual feed rate of mercury and semivolatile metals demonstrated during the test were used to establish feed rate limits for these metals, without extrapolation. Detailed information regarding the establishment of metals feed rate limits and other process operating limits is presented in Section 6.0 of the report.

4.6 STACK GAS OXYGEN, CARBON MONOXIDE, AND TOTAL HYDROCARBONS

Siemens Water Technologies Corp.'s CEM system was used to monitor the stack gas O₂, and CO concentrations during the PDT. A temporary CEM was operated by Airtech during the PDT for THC measurements. These CEM readings were used to demonstrate regulatory compliance and to make corrections to specific stack gas concentration values that are reported on a 7% O₂ corrected basis. Both the carbon monoxide and total hydrocarbon concentrations met the regulatory requirements in all test runs as indicated in Table 4-1. The CEM data are summarized with the process operating data in Tables 3-1 through 3-3, and in Appendix A. In addition, Airtech used CEM oxygen and carbon dioxide data to determine the stack gas molecular weight for use in emissions calculations. The oxygen and carbon dioxide data results are shown in the summary tables for each sampling train and are presented in Airtech's Stack Sampling Report in Appendix I.

5.0 QUALITY ASSURANCE/QUALITY CONTROL RESULTS

The PDT QAPP specifies procedures to be followed to assure the quality of data generated from the test program. Target data quality objectives (DQOs) and specific QA/QC procedures are presented in the QAPP for the following:

- Sample collection
- Sample analysis
- Process instrument calibration
- Stack sampling equipment calibration
- Laboratory analytical instrument calibration.

This section presents an overview of the QA/QC activities implemented during the PDT to ensure and assess the quality of the data gathered. This section also presents the QA/QC results for the PDT, and an assessment of the quality of the data gathered.

5.1 QA/QC ACTIVITIES AND IMPLEMENTATION

Siemens Water Technologies Corp. personnel were involved in all phases of project planning including the development of Data Quality Objectives (DQOs), the selection of sampling and analysis methods, the selection of contractors, and the development and review of project controlling documents. Primary references for the selection of methods and setting DQOs included:

- USEPA SW-846, Test Methods for Evaluating Solid Waste
- 40 CFR 266 Appendix IX and the Appendix to 40 CFR 63, Subpart EEE, Performance Specifications for Continuous Emission Monitoring Systems
- USEPA QAMS-005/80, Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans
- EPA/625/6-89/023, Quality Assurance/Quality Control (QA/QC) Procedures for Hazardous Waste Incineration
- EPA/600/4-77-027b, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods
- 40 CFR 60 Appendix A, Test Methods and Procedures, New Source Performance Standards
- 40 CFR 61 Appendix B, Test Methods.

5.1.1 QA Surveillance

Part of the overall program QA/QC is the coordination of process operations and sampling activities during the test. This coordination effort is intended to identify potential operating upsets or sampling problems in the field, and to institute corrective actions as required. These field actions include holding, stopping, and/or repeating test runs as needed to ensure the collection of adequate and representative data. A log is kept by the PDT Manager to document performance test activities and noteworthy occurrences that may be beneficial to the reconstruction of events or to the evaluation of PDT results. Appendix B contains a copy of the PDT Manager's manual log.

During the PDT, there were no process-related interruptions to sampling activities. There were two interruptions in sampling which occurred due to other causes.

During Run 2 as the Method 0023A sampling train was being moved to the last traverse point in the first half of the run, the glass probe liner broke. The sampling team and regulatory observers noticed the break immediately when it occurred, and the sampling team shut down the sample pump. Since it was known when the break occurred and sampling was immediately stopped, it was decided to recover both parts of the broken probe liner, replace the probe, and continue sampling. All parties were aware of the situation and approved of the action taken.

During Run 3, a problem developed with the organic surrogate mixture spiking system. All sampling was placed on hold while the problem was corrected. All process operations and other spiking activities continued without interruption. Once the organic surrogate mixture spiking system was returned to service, all sampling was resumed, and the run finished without further interruption.

No negative impact on sampling or analysis occurred as a result of these interruptions, nor were there any other occurrences noted that would impact the PDT results or conclusions.

Several items were identified throughout the course of the PDT program (including preliminary testing conducted by Siemens Water Technologies Corp. in preparation for the formal PDT) which could either be classified as nonconformances with the test methods or specifications of the project controlling documents, or as potential areas for improvement. Where modifications to the protocols or field activities were necessary, they were implemented through field directives and/or the issuance of a Corrective Action Request (CAR). Copies of each CAR are included in Appendix C. The sections below discuss the PDT activities and include a description of any QA/QC observations, procedural modifications, or CARs issued.

5.1.2 Sample Collection

Feed, effluent, and stack gas samples were collected and analyzed as part of the PDT program. Sampling QA/QC objectives are considered to be met if sampling activities follow the standard methods described in the PDT Plan and QAPP. During this test, sampling activities followed the prescribed procedures of the PDT Plan and QAPP, with the following exceptions:

1. Based on observations made during preliminary testing, it was believed that the high stack gas moisture content and low particulate matter concentration would not be conducive to the use of a Cascade Impactor, which was originally planned for collection of particle size distribution data. Therefore, a Method 5 train, employing a smooth filter media was used to collect particulate matter samples, followed by scanning electron microscope examination of the particles to determine the particle size distribution. This is documented as CAR-003.
2. Prior to the test, the analytical laboratory expressed concern that analytical surrogate compounds placed onto the adsorbent resin in some of the sampling trains might be stripped off unless sampling is conducted at very low sampling rates. In order to address this concern, all semivolatile organic sampling trains were operated for a nominal sampling run time of 4 hours instead of the planned nominal sampling time of three hours. The same nominal volume of sample was collected over the four hour period that would have been collected in three hours. This represents a very conservative approach to the issue, and is documented as CAR-004.
3. During Run 2 of the PDT, the glass probe liner on the M0023A train was broken due to high winds swinging the sampling train as it was being moved from one traverse point to another. The stack sampling crew and regulatory observers noted the break and immediately stopped sampling. Upon investigation, it was found that both pieces of the broken probe liner could be retrieved and that the sampling train leak-checked from the break through the remainder of the train. All parties agreed that there was no impact on sample integrity, so the broken probe liner pieces were capped, taken to the recovery area and rinsed. The probe liner was replaced and the train was used to complete the sampling run. The rinse of the broken probe liner pieces was combined with the final train rinse to capture the entire sample. This is documented as CAR-007.
4. Makeup water samples were collected at the beginning of each run rather than being collected only once at the beginning of the test program. This change was made based on plant personnel's recommendations and concerns that the makeup water quality could potentially change over time. This modification is viewed as an improvement to the original test protocol.
5. In order to keep any water droplets and particulate matter from entering the M0040 sampling train, a glass wool plug was inserted into the sample probe. This was not described in the test plan, but was deemed to be a good operating practice for this train.
6. At the end of Run 1, the Test Manager noticed that the silica gel in the M0061 train was quite wet. The sampling team was directed to add an additional silica gel impinger to the M0061 train to prevent this situation from occurring again. A check of the moisture determination from the M0061 train used in Run 1 was compared to the moisture determinations from the other Run 1 trains, and found to be consistent. Thus there was no adverse impact on the Run 1 M0061 sample.

7. EPA requested that split samples of the process feed materials and effluents be provided. Additional sample volume was collected accordingly, and samples were split with EPA.

Prior to the CPT, a database of all expected field samples was developed and cross-referenced with the analyses planned for each sample. A master list of samples generated from the database was used as a field QC checklist to help ensure that all samples were collected and shipped to the laboratory. Sample collection activities were recorded on log sheets, samples were labeled, packaged, and shipped to the analytical laboratory using traceability procedures described in the QAPP. Included with the samples were request-for-analysis forms specifying the required analyses for each sample. Copies of the process sample collection logs are included in Appendix D. Copies of the chain-of-custody records, and an index of sample numbers and identifications are included in the analytical data packages. Stack gas sample collection sheets are included with the full stack sampling report in Appendix I of this report. A review of the sample collection log sheets indicates that samples were collected as required, all applicable data were recorded, and sampling equipment conditions and operating parameters (particularly applicable to stack sampling activities) were within the requirements of the applicable methods.

5.1.3 Sample Analysis

Analytical data quality was determined through the analysis of blanks, duplicates, spiked samples, and reference materials, as prescribed by the QAPP. In large measure, the analytical data quality objectives for the PDT program were met. Section 5.2, below, and the data validation report in Appendix H, present more detailed results for each analytical data quality determination. Other observations and notes regarding sample analysis are provided in the next several paragraphs.

1. The selected laboratory for the performance test has a slightly different target analyte list compared to those presented in the original test plan. Revised target analyte lists were presented to EPA and were approved for use in the test. This is documented as CAR-001.
2. Several analytical results for the POHCs in the stack gas were above the upper calibration range of the analytical instrument. Since these analyses totally consume the sample, there was no opportunity to conduct a dilution and reanalyze the samples. The laboratory therefore reported estimated values. When this situation came to the attention of the PDT Manager and QA Manager, the laboratory was asked if anything could be done to qualify these estimates to ensure that they were valid. The laboratory set up an extended calibration curve for the affected compounds and requantified the samples as discussed in the case narrative of the VOST analytical data package. The requantified results were all less than the original reported results, therefore the original results are considered to be biased high. In order to be conservative in the use of these data, the original high emission values were used for calculating Destruction and Removal Efficiency, thus resulting in a conservatively low DRE.

5.1.4 Operations and Process Instrumentation

Process monitoring systems were calibrated prior to the PDT. Calibration data is presented in Appendix L. All process instrumentation met the performance criteria, and were deemed to produce reliable data, with one exception. While the stack gas flow rate monitoring system showed acceptable calibration results prior to the test, it was noted during the course of the PDT, that Siemens Water Technologies Corp.'s installed stack gas flow rate monitor was not corresponding with the Pitot tube readings of the stack sampling team. Further investigation indicated that some type of fault in the stack gas flow rate monitor was being experienced, however it was not able to be corrected during the course of the PDT. All parties were informed of the situation, and a decision was made to complete the PDT and to use the average of the stack gas sampling train flow rate determinations from each run to set the maximum stack gas flow rate operating limit for the system. Siemens Water Technologies Corp. will need to correct the fault in the stack gas flow rate monitoring system in order to demonstrate continuing compliance with the operating limit.

A CEMS Performance Specification Test was conducted prior to the PDT, and the emissions monitors met the applicable performance requirements. A CEMS Performance Specification Test Report is presented in Appendix K. Daily calibration of stack gas continuous emissions monitoring systems was conducted during the PDT. Each monitor met the calibration criteria during each day of testing.

The original test plan calls for an organic surrogate mixture to be added to the spent activated carbon feed. That mixture was specified to contain 1,1,1-Trichloroethane, however the compound is not available because it is an ozone depleting substance. Methylene chloride was substituted for 1,1,1-trichloroethane. This is documented as CAR-002.

Several modifications to the target operating conditions and anticipated permit limits were made after approval of the Performance Demonstration Test Plan. Most of these changes were made as a result of preliminary testing. Additionally, EPA included with their test plan approval letter a table of information and process data that they wanted included in the test report. Revised operating condition targets and the list of data requested by EPA are documented as CAR-006.

In order to maximize the stack gas flow rate (minimize the gas residence time) for the performance test, a source of additional air was needed beyond what is normally supplied by the combustion air fan. The access door on Hearth #1 was opened to allow additional air to be drawn into the system and to pass through the combustion and air pollution control portions of the system. This is documented as CAR-008.

5.1.5 Stack Sampling Equipment

All stack sampling equipment was calibrated according to the protocols given in the applicable sampling methods. Each sampling system passed the calibration criteria. Stack sampling equipment calibration records are included in the Stack Sampling Report in Appendix I, of this report.

5.1.6 Laboratory Analytical Instrumentation

QA/QC procedures, as specified by the analytical methods and summarized in the PDT Plan and QAPP, were conducted and documented during the test. Analytical instrument calibration records and all raw analytical data are presented in the analytical data packages, submitted as separate volumes. No calibration problems were identified by the laboratories.

5.2 AUDITS AND DATA VALIDATION

The following audits were provided for in the QAPP:

- Field audits
- Performance Evaluations
- Office Audits
- Laboratory Audits.

A field audit was used to ensure that work was performed in accordance with the various project controlling documents and associated standard operating procedures. This audit was conducted throughout the test by the PDT Manager through observation of process operations and sample collection. It is the opinion of the PDT Manager, based on field observations, that all work was performed in substantial compliance with the specifications contained in the PDT Plan and QAPP.

VOST audit samples (spiked Tenax resin) were provided by the regulatory agencies. An initial set of VOST audit tubes were received from EPA's contract laboratory and were analyzed with the samples from the PDT. These initial audit samples, however were received without proper documentation and preservation, and were thus deemed to be of suspect validity. EPA was informed of the issue and another set of VOST audit tubes were received from EPA's contract laboratory (this time with proper documentation and preservation). These audit samples were submitted to the laboratory for analysis, but the timing was such that they were not analyzed with the actual PDT samples. Results for all of the audit sample received are presented in Table 5-1. The test team participants do not know the true value of the audit samples, so the analytical results are reported here for review by the regulatory agencies.

The preparation of this report was conducted under the office QA/QC program in place at Focus. All records, correspondence, calculations, data, and reports are maintained in designated files for future reference. Reports, numerical tabulations, drawings, and calculations are checked for completeness and technical correctness, and documented prior to release in final form to the client.

Laboratory audits were provided for in the PDT Plan and the QAPP as an option to be exercised, if necessary, during the test program. No situations arose through the course of the test program which suggested the need for a laboratory audit.

Data validation consisted of a thorough check of all calculations involved in reducing sampling and analysis data. Subsequently, the data were compared to expected values and were investigated for consistency within and between test runs. For example, comparisons were made of stack gas flow rates, process operating temperatures, and sampling equipment operating conditions. Analytical data were reviewed to identify variations between duplicate measurements of the same parameter, either from multiple analyses of the same sample or from analyses between replicate test runs. Finally, QA/QC results were compared to the target data quality objectives defined in the QAPP and in the laboratory standard operating procedures (SOPs). During the project, 12,491 analytical data quality indicators were evaluated. Over 93 percent of the data quality objectives were completed and met. The data compare well within and between runs, and the measurements agree well with the expected values. The data are technically sound and are usable for their intended purpose. A data validation report is presented in Appendix H.

5.3 CALCULATIONS

Where applicable, the RF-2 system's performance and/or emissions were calculated using formulas presented in appropriate regulations. Other calculations followed generally accepted practice for thermal treatment process operations and performance test reporting. Many calculations were made using spreadsheets specifically designed by Focus for performance test data reduction and reporting, while other calculations were made by hand. Appendix G documents how all calculations were made for performance determination during this test program.

5.4 CONCLUSIONS

Overall, the PDT was executed in substantial conformance to the requirements and specifications of the project controlling documents. Any anomalies observed have been documented and corrective actions have been implemented as necessary. The impact of these anomalies has been thoroughly reviewed and assessed. In the judgment of the PDT Manager, those anomalies do not have a discernible negative impact on data quality or the utility of the data gathered to serve their intended purpose as defined in the PDT Plan and QAPP.

6.0 OPERATING PARAMETER LIMITS

The Siemens Water Technologies Corp. Carbon Reactivation Furnace RF-2 system demonstrated compliance with all applicable regulatory requirements during the PDT program. Operating parameter limits and associated automatic waste feed cutoff setpoints (as applicable) will be established as described in the approved PDT Plan and in the appropriate regulations of 40 CFR 63 Subpart EEE. Most operating parameter limits are based on demonstrations made during the PDT. For some parameters, such as maximum stack gas CO concentration, and minimum packed bed scrubber pressure differential, either regulation, guidance, or equipment manufacturer's recommendations (rather than the PDT demonstrated values) are used as the basis for the limit.

6.1 DEVELOPMENT OF OPERATING LIMITS

Limits on a number of operational control parameters must be maintained as an indication that the RF-2 system continues to operate in compliance with the applicable emission standards. Table 6-1 summarizes the discussion of the operational parameter limits for the RF-2 unit. To facilitate review, the operating parameters are grouped into the following categories:

- Group A1 parameters are continuously monitored and recorded, and are interlocked with the automatic waste feed cutoff system. Group A1 parameter limits are established from test operating data, and are used to ensure that system operating conditions are equal to or are more rigorous than those demonstrated during the test.
- Group A2 parameters are continuously monitored and recorded, and are interlocked with the automatic waste feed cutoff system. Group A2 parameter limits are established based on regulatory requirements rather than on the test operating conditions, e.g., the maximum stack CO concentration.
- Group B parameters are continuously monitored and recorded, but are not required to be interlocked with the automatic waste feed cutoff system. Operating records are required to ensure that established limits for these parameters are not exceeded. The Group B parameter limits are established based on the operation of the system during the test.
- Group C parameters are continuously monitored and recorded, but are not required to be interlocked with the automatic waste feed cutoff system. Group C parameter limits are based on manufacturer's recommendations, operational safety, and good operating practice considerations rather than on the test operating conditions, e.g., the minimum packed bed scrubber pressure differential.

6.2 SPECIFIC OPERATING PARAMETERS

Operating parameter limits for each of the control parameters have been established as specified in the HWC MACT regulations given in 40 CFR 63.1209 and the approved PDT plan. The following sections describe how each operating parameter limit has been established.

In addition to establishing specific operating limits, Siemens Water Technologies Corp. anticipates having limits on the types of waste that can be treated in RF-2. Since Siemens Water Technologies Corp. has demonstrated greater than 99.99% DRE during the PDT while treating chlorobenzene, a Class 1 (most thermally stable) compound, it is expected that Siemens Water Technologies Corp. will be permitted to treat all of the materials represented by the waste codes in the facility's most recent RCRA Part A permit application. Specific prohibitions are anticipated in the site's permit, for feed materials containing greater than 50 ppm of PCBs and those listed with the waste codes F020, F021, F022, F023, F026 or F027.

6.2.1 Parameters Demonstrated During the Test (Group A1 Limits)

Group A1 parameter limits are based on the results of the testing. The following operating parameters will be established as Group A1 parameters for the RF-2 system.

6.2.1.1 Maximum Spent Carbon Feed Rate

The PDT was conducted in order to demonstrate the maximum feed rate of spent carbon. The spent carbon feed rate is monitored on a continuous basis. The maximum allowable spent carbon feed rate has been established as a block hour average limit from the average of feed rates demonstrated during each of the three runs of the PDT.

6.2.1.2 Minimum Afterburner Temperature

The PDT was conducted at the minimum afterburner temperature with maximized combustion gas flow rate (minimum residence time), since these are the conditions least favorable for DRE. Organic emissions were also measured under these conditions for risk assessment purposes. Based on successful demonstration of DRE during the PDT, the minimum temperature limit has been established as an hourly rolling average equal to the average of the demonstrated test run average values.

6.2.1.3 Minimum and Maximum Hearth #5 Temperature

As part of EPA's approval of the PDT Plan, Siemens Water Technologies Corp. was required to establish both a minimum and maximum temperature limit for Hearth #5 of the reactivation furnace. Since both a minimum and maximum temperature could not be demonstrated in the single test condition approved for

the test, Siemens Water Technologies Corp. operated Hearth #5 at a maximum temperature during the PDT and will conduct a separate minimum temperature test outside of the formal PDT period.

The maximum Hearth #5 temperature limit has been established as an hourly rolling average equal to the average of the demonstrated test run averages.

6.2.1.4 Minimum Venturi Scrubber Differential Pressure

The performance test was conducted to demonstrate the minimum venturi scrubber differential pressure. Venturi scrubber differential pressure is monitored on a continuous basis. Based on successful demonstration of particulate and metals control during the performance test, the minimum venturi scrubber differential pressure limit has been established as the average of the hourly rolling average values demonstrated during each run of the performance test. The permit limit is also expected to be an hourly rolling average value.

6.2.1.5 Minimum Quench/Venturi Scrubber Recycle Liquid Flow Rate

The performance test was conducted to demonstrate the minimum quench/venturi scrubber recycle flow and maximum stack gas flow, thus establishing a *de facto* minimum liquid to gas ratio. Quench/Venturi scrubber flow and stack gas flow are both monitored on a continuous basis. Based on successful demonstration during the performance test, the minimum quench/venturi scrubber recycle liquid flow rate limit has been established based on the average of the hourly rolling average values demonstrated during each run of the performance test. This limit will be established as an hourly rolling average.

6.2.1.6 Minimum Packed Bed Scrubber pH

The performance test was conducted to demonstrate the minimum packed bed scrubber pH at maximum total chlorine/chloride feed rate. Scrubber pH is monitored on a continuous basis. Based on successful demonstration of HCl and Cl₂ control during the performance test, the minimum packed bed scrubber pH limit has been established as the average of the hourly rolling average pH values demonstrated during each run of the performance test. The permit limit will be administered as an hourly rolling average.

6.2.1.7 Minimum Packed Bed Scrubber Recycle Liquid Flow Rate

The performance test was conducted to demonstrate the minimum packed bed scrubber recycle flow rate and maximum stack gas flow, thus establishing a *de facto* minimum liquid to gas ratio. Packed bed scrubber recycle flow and stack gas flow are both monitored on a continuous basis. Based on successful demonstration of HCl and Cl₂ control during the performance test, the minimum packed bed scrubber recycle liquid flow rate limit has been established as the average of the hourly rolling average values demonstrated during each run of the performance test. This limit will also be administered on an hourly rolling average basis.

6.2.1.8 Minimum Scrubber Blowdown Flow Rate

The performance test demonstrated a minimum scrubber blowdown flow rate, in order to demonstrate worst case conditions for solids buildup in the scrubbing system. In order to conserve water, Siemens Water Technologies Corp. recycles most of the liquid from the air pollution control system. However, in order to prevent the buildup of dissolved solids in the recycled water, a certain amount of the water must be purged (or blown down) from the system. As water is purged from the system, fresh makeup water is added. The minimum scrubber blowdown flow rate limit has been based on the average of the hourly rolling average values demonstrated during each run of the performance test. This limit will be administered as an hourly rolling average.

6.2.1.9 Minimum WESP Secondary Voltage

Although the HWC MACT regulations do not require any indicator of performance in an electrically enhanced emissions control device, Siemens Water Technologies Corp. believes that it is appropriate to establish a performance indicator. Accordingly, WESP secondary voltage (expressed as KVDC) is used as the indicator of continuing WESP performance. The minimum value has been established as the average of the minimum hourly rolling average secondary voltage values demonstrated during each run of the performance test. The secondary voltage limit will be based on an hourly rolling average.

6.2.1.10 Maximum Combustion Gas Velocity (Stack Gas Flow Rate)

The stack gas flow rate (expressed as actual cubic feet per minute) is used as the indicator of combustion gas velocity. The maximum stack gas flow rate was planned to be established from the mean of the maximum hourly rolling average stack gas flow rates measured by Siemens Water Technologies Corp.'s stack gas flow rate monitor during each run of the performance test. As stated in earlier sections of this report, the stack gas flow rate monitor experienced difficulties during the PDT such that the measurements were not reliable. Each isokinetic sampling system used for stack gas emissions measurements during the PDT also included the measurement of stack gas flow rate. Thus, the average stack gas flow rate determinations for each run, derived from the stack gas sampling systems, has been used to establish a maximum stack gas flow rate limit. The maximum stack gas flow rate limit will be administered as an hourly rolling average.

6.2.2 Group A2 Parameters

6.2.2.1 Maximum Stack Gas CO Concentration

The maximum hourly rolling average stack gas CO concentration was maintained at or below 100 ppmv corrected to 7% oxygen (dry basis) during the test. An operating parameter limit for maximum stack gas

carbon monoxide concentration of 100 ppmv hourly rolling average corrected to 7% oxygen will be established.

6.2.2.2 Fugitive Emissions Control

The HWC MACT regulations require controlling combustion system leaks. By design (no open feed systems), the combustion chamber constitutes a sealed system. There are no locations for combustion system leaks to occur. Therefore, the RF-2 system is in compliance with 40 CFR 63.1206(c)(5)(i)(A).

6.2.3 Group B Parameters

6.2.3.1 Maximum Total Chlorine/Chloride Feed Rate

During the PDT, Siemens Water Technologies Corp. maximized the feed rate of total chlorine/chloride through the spiking of tetrachloroethene and other chlorinated organic compounds. Since the HCl and Cl₂ emissions measured during the PDT were less than the applicable standard, the limit for total chlorine/chloride feed rate has been set as a 12-hour rolling average, equal to the average of the average total chlorine/chloride feed rate during the three runs of the PDT. Total chlorine/chloride includes the native chlorine/chloride in the spent activated carbon feed plus the spiked chlorine/chloride. Records of feed analyses, and the calculated 12-hour rolling average total chlorine/chloride feed rate values will be maintained to demonstrate compliance with the chlorine/chloride feed rate limit.

6.2.3.2 Maximum Mercury Feed Rate

Due to the low amounts of mercury expected in the spent activated carbon, Siemens Water Technologies Corp. has elected to comply with the mercury standard by calculating and complying with a 12-hour rolling average Maximum Theoretical Emission Concentration (MTEC), conservatively assuming no mercury removal across the APC system. The MTEC is complied with as a maximum mercury feed rate limit. This limit has been calculated from the performance test data by using the stack gas flow rate and oxygen concentration, and the maximum allowable stack gas mercury concentration based on the HWC MACT regulations. The feed rate limit is determined assuming that all mercury is emitted, and is complied with as a maximum 12-hour rolling average mercury feed rate limit.

6.2.3.3 Maximum Semivolatile Metals Feed Rate

Siemens Water Technologies Corp. demonstrated compliance with the semivolatile metal emission standard while spiking lead during the test. Therefore, the permitted feed rate limit for semivolatile metals (total cadmium plus lead) has been set as a 12-hour rolling average value equal to the average semivolatile metal feed rate demonstrated during the three runs of the PDT. Records of feed analyses, and the calculated 12-hour rolling average semivolatile metal feed rate values will be maintained to demonstrate compliance with the semivolatile metal feed rate limit.

6.2.3.4 Maximum Low Volatility Metals Feed Rate

Siemens Water Technologies Corp. demonstrated compliance with the low volatility metal emission standard while spiking chromium during the test. The emissions measured during the test were significantly lower than the allowable limit. Therefore, the permitted feed rate limit for low volatility metals (total arsenic, plus beryllium, plus chromium) will be set as a 12-hour rolling average extrapolated upward to the HWC MACT standard based on the average low volatility metal feed rate and the average low volatility metal System removal Efficiency (SRE) during the three runs of the CPT. Extrapolation has been conducted as described in the approved PDT Plan. Records of feed analyses, and the calculated 12-hour rolling average low volatility metal feed rate values will be maintained to demonstrate compliance with the low volatility metal feed rate limit.

6.2.4 Group C3 Parameters

Group C parameter limits are based on manufacturer's recommendations, operational safety and good operating practice considerations. The following parameters are proposed as Group C parameters.

6.2.4.1 Minimum Packed bed Scrubber Pressure Differential

The minimum packed bed scrubber pressure differential is based on past operating experience. This limit has been established as an hourly rolling average limit.

6.3 EXTRAPOLATION OF METALS FEED RATE LIMITS

Siemens Water Technologies Corp. spiked lead and chromium into RF-2 during the PDT. Lead and chromium are representative of the semivolatile and low volatility metal groups, respectively. Since the lead emissions were very close to the applicable standard during the PDT, Siemens Water Technologies Corp. has established the maximum semivolatile metal feed rate as the average feed rate that was demonstrated during the three runs of the PDT. The emissions of low volatility metals however, were substantially below the standard during the PDT, thus Siemens Water Technologies Corp. has extrapolated the test results upward to establish a low volatility metals feed rate limit. PDT data has been used to calculate a system removal efficiency (SRE) for chromium, which can then be applied to the LVM metal volatility group. System removal efficiency is shown in Table 6-2, and was calculated using the following equation:

$$SRE_i = \left[1 - \frac{\dot{m}_{i,out}}{\dot{m}_{i,in}} \right] \times 100\%$$

where:

$\dot{m}_{i,in}$ = mass feed rate of metal i.

$\dot{m}_{i,out}$ = mass emission rate of metal i.

SRE_i = demonstrated system removal efficiency of metal i.

The demonstrated system removal efficiency for chromium can be used to establish a mass feed rate limit for low volatility metals using the following equation:

$$\dot{m}_{g,in,max} = \frac{\dot{m}_{g,out,MACT}}{\left(1 - \frac{SRE_i}{100}\right)}$$

where:

$\dot{m}_{g,in,max}$ = maximum allowable mass feed rate of metal group g

$\dot{m}_{g,out,MACT}$ = maximum allowable mass emission rate of metal group g based on the MTEC analysis

SRE_i = demonstrated system removal efficiency of metal i designated to be the metal representative of metal group g.

7.0 EMISSIONS DATA TO SUPPORT THE SITE SPECIFIC RISK ASSESSMENT

Siemens Water Technologies Corp. collected emissions data to support the site specific risk assessment under “worst-case” conditions rather than conducting a separate “risk burn” under less aggressive “typical” conditions. Siemens Water Technologies Corp. therefore believes that the emissions presented represent conservative values which are higher than during typical operation. The following section presents the emission data and discusses interpretation of the data where appropriate.

7.1 DETECTION LIMITS

Method detection limits (MDLs) were determined for each of the stack gas analyses conducted. MDLs were determined statistically for non-isotope dilution methods following the requirements of 40 CFR Part 136, Appendix B. MDLs for isotope dilution methods were determined following the promulgated method requirements. Isotope dilution method MDLs were calculated based on 2.5 times the background noise. All reported MDLs, including condensate analyses, are matrix specific and reflect any dilutions, splits, or concentrations applied during the extraction or analysis of the samples. As such, laboratory-supplied MDL's for these stack gas analyses appear to meet the definition of sample quantitation limit (SQL) referenced in several sources of risk assessment guidance.

7.2 METALS

EPA Method 29 was used to sample stack gas multiple-metals emissions during the PDT. Metals emission data were collected in addition to the metals feed rate data, and are presented with the compliance data in Section 4.0. Emission results for the multiple-metals trains are repeated here in Tables 7-1 through 7-3. Mercury speciation data for the risk assessment are presented in Table 7-4.

A separate SW-846 Method 0061 sampling train was operated during each run of the PDT to determine the emission of hexavalent chromium. Sampling conditions and emission results for hexavalent chromium are presented in Tables 7-5 through 7-7.

7.3 HYDROGEN CHLORIDE AND CHLORINE

HCl and Cl₂ emissions were determined using EPA Method 26A during the PDT and are presented with the compliance results in Section 4.0. They are repeated here in Tables 7-8 through 7-10.

7.4 PARTICLE SIZE DISTRIBUTION

Particle size distribution data were collected using EPA Method 5 followed by scanning electron microscope evaluation of the particles collected on the filters. Particle size distribution results are presented in Table 7-11.

7.5 SPECIATED VOLATILE ORGANICS

Stack gas volatile organic samples were collected using SW-846 Method 0030, and analyzed for a list of target analytes, as specified in the PDT Plan, as well as for tentatively identified compounds (TICs). Sampling conditions and results are presented in Tables 7-12 through 7-14.

7.6 SPECIATED SEMIVOLATILE ORGANICS

An SW-846 Method 0010 sampling train was used to sample the stack gases for a list of target semivolatile organics, as specified in the PDT Plan, as well as for tentatively identified compounds (TICs). The sampling conditions and results are summarized in Tables 7-15 through 7-17.

7.7 TOTAL VOLATILE ORGANICS, SEMIVOLATILE ORGANICS, AND NONVOLATILE ORGANICS

Determination of these emissions was conducted according to the procedures presented in EPA/600/R-96/036, and are reported in three fractions:

- 1 Total volatile organics, expressed as total mass of C₁ through C₇ n-alkanes (Tables 7-18 through 7-20).
- 2 Total chromatographable organics (TCO), representing compounds with a boiling point range of 100°C to 300°C (Tables 7-21 through 7-23).
- 3 Total nonvolatile organics (GRAV), representing compounds with a boiling point above 300°C (Tables 7-21 through 7-23).

7.8 DIOXINS AND FURANS

Stack gases were sampled using SW-846 Method 0023A for PCDD/PCDF emissions during each PDT run. Analyses were performed to identify the total mass of the tetra- through octa-chlorinated PCDD and

PCDF congeners, as well as the mass of each individual 2,3,7,8-substituted PCDD and PCDF congener. In order to evaluate the potential risk posed by emissions of a variety of PCDD/PCDF compounds, each 2,3,7,8-substituted isomer is assigned a "toxic equivalence factor" which is used to equate the toxicity of that compound to the toxicity of 2,3,7,8-TCDD. A summary of the sampling conditions and emission results is provided with the compliance results in Section 4.0, and are repeated here as Tables 7-24 through 7-26. Analytical results for each of the 2,3,7,8-substituted PCDD and PCDF isomers, and their corresponding emissions, expressed as 2,3,7,8-TCDD toxic equivalents are presented in Tables 7-27 through 7-29.

7.9 SPECIATED PAHS

Polyaromatic hydrocarbons were analyzed on the same sampling train used for speciated semivolatile organic compound determinations. Analyses for PAHs followed CARB Method 429. Sampling conditions and emission results are presented in Tables 7-30 through 7-32.

7.10 POLYCHLORINATED BIPHENYLS (PCBS)

PCBs were analyzed on the same sampling train used for speciated semivolatile organic compound determinations. Analyses for PCBs followed EPA Method 1668. Sampling conditions and emission results are presented in Tables 7-33 through 7-35.

7.11 ORGANOCHLORINE PESTICIDES

Organochlorine pesticide compounds were sampled using SW-846 Method 0010. Sampling conditions and emission results are presented in Tables 7-36 through 7-38.